FINAL DRAFT REPORT
The Feasibility and Constructability Study of the Replacement/Rehabilitation of the Brent Spence Bridge

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I. BACKGROUND

The Feasibility and Constructability Study of the Replacement/Rehabilitation of the Brent Spence Bridge (the Study), contracted in 2003 by the Kentucky Transportation Cabinet (KYTC), was overseen by a Bi-State Management Team (BSMT) that included the Ohio Department of Transportation (ODOT), and the Federal Highway Administration's (FHWA) offices from both states.

The Brent Spence Bridge carries both Interstate 71 and Interstate 75 (I-71 and I-75)over the Ohio River and is a vital link of the interstate, regional, and local transportation system. It opened to traffic in 1963 and was designed to carry three 12-foot travel lanes on two decks in each direction. The northbound traffic is carried on the lower deck and the southbound traffic is carried on the upper deck. To accommodate increasing traffic levels, the lane configuration of the bridge was modified in 1985 to provide four 11-foot travel lanes in each directing. The re-configuration provides only minimal shoulders on the left and right sides.

The bridge currently operates at Level of Service F during peak travel periods. High traffic volumes and substandard design have resulted in a very high accident rate on the bridge and approaches. The total accident rate on the bridge is 8.5 times the Kentucky interstate rate.

Based on FHWA criteria for the National Bridge Inventory, the bridge is classified as functionally obsolete. This rating is due primarily to the substandard width of the lanes and shoulders which are below the minimums acceptable for interstate highways. A Bridge Condition Report completed in 1996 concluded that the calculated remaining fatigue life was less than 12 years.

The genesis of this Study was two Major Investment Studies (MIS) commissioned by the Ohio – Kentucky – Indiana Regional Council of Governments (OKI) for the I-71 and I-75 corridors. A Scoping Study to address problems with the bridge was conducted by Burgess & Niple, Ltd. (B&N) and supported by subconsultant American Consulting Engineers, PLC (American) in 1998. This was a part of a larger major investment study for the I-71 corridor from the Cincinnati/Northern Kentucky International Airport to Kings Island. The scope of service included exploration of various strategies and analysis of the fatigue life. A series of alternatives was developed including No-Build, Rehabilitation, and various Build Alternatives. Alternatives were evaluated by a local stakeholder committee.

A second analysis of the remaining fatigue life was done as an addendum for the study. Both analyses were calculated using the procedures in the AASHTO *Guide Specification for Fatigue Evaluation of Steel Bridges*. The addendum, as provided for in the Guide Specifications, calculated the remaining fatigue life as 16 years using a procedure put forth in a Transportation Research Board report

(*Fatigue Evaluation Procedures for Steel Bridges* – National Cooperative Highway Research Program Report 299 dated 1987).

A subsequent MIS for the I-75 corridor from Piqua, Ohio to the I-71/I-75 interchange in northern Kentucky known as the North South Transportation Initiative (NSTI) commenced in 2001. An early strategy resulting from this MIS process was the advancement of a replacement/rehabilitation analysis of the Brent Spence Bridge under KYTC and ODOT guidance. Because limited engineering was performed in the MISs and the complex urban setting of the project, KYTC and ODOT decided to explore the feasibility and constructability of this project prior to embarking into a potentially expensive and arduous National Environmental Protection Act (NEPA) and Preliminary Engineering (PE) process. A Congressional appropriation was secured in 2002 for the Study. After a qualification-based selection process the B&N/American/Parsons team was authorized to commence work on a 30 month Feasibility and Constructability Study of the Replacement/Rehabilitation of the Brent Spence Bridge in May 2003.

The scope of the Study included:

- Limited analysis of restricting trucks on the bridge
- Limited analysis of a new crossing near Anderson Ferry
- Field testing critical truss members to determine fatigue life
- Development of the replacement/rehabilitation concepts for five and seven lane crossings

Analysis of restricting trucks on the bridge yielded the conclusion that this concept was not a viable alternative worth developing because of unfavorable regional implications on a number of travel corridors and increased users' cost.

Analysis of a new crossing linking I-275 to U.S. 50 at Anderson Ferry concluded that a new crossing was not a viable alternative worth developing because of the limited number of trips it diverted from the Brent Spence Bridge.

The field testing of critical truss members to determine fatigue life yielded the conclusion that the previous calculations did not reflect what these members were actually experiencing and that they have infinite fatigue life. This task was undertaken concurrent with the development of replacement/rehabilitation concepts for the bridge.

The development of replacement/rehabilitation concepts to accommodate initially five lanes of traffic in each direction began with the identification of parameters that included: avoidance of environmental red flags, maintenance of traffic, keeping access to Cincinnati and Covington, and additional engineering criteria. Upon the completion of the environmental red flag mapping task six feasible concepts were identified that met the parameters. Upon review with the BSMT team one concept was dropped due to large community impacts and perceived high cost of construction. Based on an initial review of traffic projections the BSMT requested the investigation of seven lanes in each direction using the same conceptual alignments. All five replacement/rehabilitation concepts with some modification proved feasible. They range in cost from $901 million to $1.555 billion.

Because the feasibility question was answered early in the Study and given continuing regional support for the project, the BSMT elected to accelerate completion of the feasibility study and advance into the official NEPA and PE process.

II. PROBLEM STATEMENT

At the outset of the Study, a problem statement was drafted, reviewed, and commented on by the BSMT and revised accordingly (June 2003). The following narrative was the statement developed to guide the Study.

The Brent Spence Bridge (BSB), opened in 1963, carries two interstate highways (I-75 and I-71) over the Ohio River between Cincinnati, Ohio and Covington, Kentucky. I-75 is one of the nation's busiest north-south interstate routes, beginning in Miami/Dade County, Florida and extending northward through Detroit, Michigan where it connects with Canadian Highway 401, a major highway linking Detroit with Toronto and Montreal. The highway serves as one of the busiest and longest continuous interstate trade corridors in North America. I-71 begins in Louisville, Kentucky, where it connects to I-64 (which runs to the west to St. Louis, Missouri) and I-65 (terminating at Mobile, Alabama), and continues northeast to Cincinnati, Columbus, and Cleveland. I-71 and I-75 share the same alignment for approximately 18 miles in Northern Kentucky, including the BSB.

The double-deck truss structure originally was designed for three 12-foot traffic lanes in both directions. In 1985, in response to increasing traffic and congestion, the shoulders were eliminated and the lanes were narrowed to create a fourth lane. This effectively increased capacity 25 percent to 100,000 vehicles per day (VPD). However, the lane widths do not meet desired standards and the lack of shoulders does not provide space for disabled vehicles.

Today, traffic totals approximately 150,000 VPD, which includes upwards of 30,000 trucks. Traffic projections indicate the bridge will be carrying approximately 200,000 VPD in 20 years. The bridge currently operates at Level of Service F during peak hours. Thus, the length of delays while traveling I-71 and I-75 across the river will continue to worsen. Since these freeways carry national, regional, and local traffic, the increasing congestion will also cause negative economic consequences.

With the increasing traffic demands, especially truck freight caused by the "just-in-time" method of production, there are concerns relating to the structure's condition. In 1996, an analysis of the bridge's theoretical fatigue life indicated a remaining useful fatigue life of 12 to 16 years. The National Bridge Inventory listed the BSB as functionally obsolete. A central concern of any rehabilitation strategy would be the issue of increased life versus the capacity of the facility (both during the rehabilitation and afterward).

The latest analysis of accidents occurring on the bridge is also a cause of concern. For the period between January 1992 and October 1997, the accident rates for both injuries/fatalities and property damage only accidents were 954.4 accidents per 100 millions of vehicles miles of travel (MVMT). This is in comparison to the 112 accidents per MVMT for Kentucky's interstates. Thus, any reconstruction/ replacement of the BSB should minimize any geometric design exceptions relating to speed, lane/shoulder width, merge/taper rates, etc.

This Study is undertaken to answer the following questions:

- Is it feasible to replace the Brent Spence Bridge at or near its existing location?
- Can the existing Brent Spence Bridge be rehabilitated to provide additional service life and/or capacity?
- How could traffic be maintained while the I-71/I-75 Brent Spence Bridge is being replaced or rehabilitated?
- What are the limits of the approach work under various replacement/rehabilitation scenarios?
- What are the costs of the various rehabilitation or replacement scenarios and the associated approach work?
- Are there any environmental "fatal flaws" that preclude certain options from advancing?
- What are the type, size, location and costs of recommended alternatives?

III. CONSIDERATIONS AND OBJECTIVES

In addition to the 1998 Scoping Study and subsequent problem statement, the following considerations and objectives guided the development of concepts:

- Avoiding potential environmental "Fatal Flaws"
  - Potentially lengthy time to resolve disposition of Longworth Hall
  - UST/HazMat likely will be an issue since the project is located in major urban area
- Maintenance of traffic

- Relative costs (i.e. High, Moderate, Low)
- Operations
- Access to Cincinnati and Covington
- Impacts on existing buildings
- Utility impacts
- Minimize design exceptions
- Eliminate left-hand exits
- Minimize weaves
- Five through lanes with full shoulders

IV. TRUCK DIVERSION STUDY

The original scope for the Study included a separate Truck Diversion Study to evaluate the traffic impacts and costs of prohibiting all through trucks on the Brent Spence Bridge. The Ohio-Kentucky-Indiana Regional Council of Governments' (OKI) 2030 Travel Demand Model and the ITS Deployment Analysis System (IDAS) software were used to perform the analyses.

The Study methodology was an iterative process that, as each model run was made, the data was reviewed to determine if the truck shift would create additional unacceptable problems. The scenarios modeled were as follows:

- Initially, trucks were prohibited on only the Brent Spence Bridge. Using this scenario, approximately 86 percent of the trucks that had been using Brent Spence switched to using the Clay Wade Bailey Bridge. The remaining 14 percent dispersed among the other Ohio River bridges.
- Next, truck trips were prohibited from using both the Brent Spence and Clay Wade Bailey bridges. This shifted slightly less than 44,000, or 97 percent, of the Brent Spence and Clay Wade Bailey truck trips onto the Roebling Suspension Bridge.
- In the third iteration, trucks were prohibited from the Brent Spence, Clay Wade Bailey, and Roebling Suspension bridges. Truck trips again shifted to the next Ohio River crossings. In this scenario, the Taylor Southgate Bridge carried 74 percent, or 35,000 truck trips and I-471 had an additional 9,900 truck trips, or 21 percent, of what had originally been crossing the Ohio River on one of the three prohibited bridges.
- At this point, it appeared that trucks were using the Taylor Southgate Bridge to cross the Ohio River and then the 4^{th}/5^{th} Street and 12^{th} Street bridges in Kentucky to cross the Licking River. Trucks were prohibited from using the Taylor Southgate Bridge in addition to the three that were already prohibited. The 35,000 truck trips went to the Interstate bridges (I-471, Combs-Hehl, and I-275 West), eliminating problems on the Ohio River bridges but barely affecting the two Licking River bridges.

- Since prohibiting the trucks on the Taylor Southgate Bridge still created problems for the two Licking River bridges, truck trips were then prohibited from the $4^{th}/5^{th}$ Street Bridge and the 12^{th} Street Bridge and allowed access to Taylor Southgate.

The final numbers and prohibitions used in the Study were compared to the 2030 Base in the Truck Diversion Study documentation. (See Appendix B)

To calculate costs, the trip tables were imported into the IDAS software and runs were completed for the 2030 Base and truck diversion alternatives. IDAS outputs provided information concerning in-vehicle travel time, travel time reliability, fuel consumption, and number of accidents. The results are incorporated in Appendix B.

The conclusions that can be reached from this Study are: 1) the issue of banning trucks from the Brent Spence Bridge has regional implications on a number of travel corridors, and; 2) such prohibitions will increase costs to the users.

The banning of trucks on the Brent Spence Bridge will move existing truck traffic to the adjacent bridges which will affect the vehicular traffic already using those bridges. The banning of trucks will require enforcement that will be hard to maintain. The removal of truck traffic will have a short-term reduction in vehicles on the Brent Spence Bridge, but by the year 2030 the non-truck traffic volumes will exceed the current total traffic volume if the percent of trucks remains constant at 20 percent of the total traffic. The removal of the trucks will not address the problems identified for lane width, number of lanes based on traffic volumes, no shoulders, the ramp configuration, and the bridge's useful life. As the number of vehicles increases the safety issues will continue. Therefore the BSMT concluded that this option was feasible, but not a prudent solution because it did not address volume, safety, and bridge condition issues.

V. ANDERSON FERRY CROSSING

The purpose of this work element was to perform a preliminary study of a new Ohio River crossing approximately six miles west of the existing Brent Spence Bridge and near the Cincinnati/Northern Kentucky International Airport (CVG). The Study was to evaluate traffic ramifications and construction costs of the potential new transportation facility.

Two alternative alignments were studied—one that connected near to the KY 3076 (Mineola Pike) interchange with I-275 east of CVG and one that connected to the KY 212 interchange (CVG Interchange) with I-275. Both alignments terminated at the same location on U.S. 50 just west of Anderson Ferry and included an interchange with U.S. 50. The estimated construction cost of the alternatives (not including any right of way or utility relocations) ranged from $80 million to $95 million.

The traffic impacts were determined by utilizing the OKI 2030 transportation model to compare a 2030 network that was modified to include a new crossing with the results of the 2030 baseline model. The results show that by 2030, the Anderson Ferry crossing would carry slightly more than 35,000 vehicles trips in a 24-hour period, diverting only 16,000 vehicle trips from the Brent Spence Bridge. Of the total vehicle trips on the new crossing, 4,000 were truck trips with half of that amount diverting from the Brent Spence Bridge. As with the truck safety study, the new bridge to the west will divert only a portion of the traffic necessary to allow the Brent Spence Bridge to handle traffic based on its current configuration. The safety, geometrics, and the bridge's useful life will not be addressed by construction of a new bridge 6 miles to the west. With the model predicting most traffic on the Brent Spence Bridge is national and regional, the new bridge does not address the through interstate traffic volume.

It was concluded by the BSMT that this option while feasible did not address the Brent Spence Bridge problems. Appendix C contains the Anderson Ferry Study.

VI. LOAD RATING AND FATIGUE STUDY

A critical element of the Study was to perform a load capacity rating and fatigue life analysis of the main truss members of the bridge. The bridge was designed in 1961 and erection was completed in 1963. The truss and approach structures originally were configured to carry six lanes of traffic which was changed in 1985 when the Kentucky approach spans were widened and the roadway reconfigured to carry an additional lane of traffic on both decks. Some truss members were also strengthened based on a structural rating and fatigue analysis performed in 1983. This analysis was performed in accordance with the fatigue specification applying to new bridges and was prior to the 1990 issuance of the *AASHTO Guide Specification for Fatigue Evaluations of Existing Steel Bridges*.

The 1983 analysis indicated that six truss members in each anchor span (24 total due to symmetry) had the highest live load-stress ranges and, using the methodology available at the time, exceeded the allowable stress ranges for riveted members. It was recommended that these members be closely inspected and that the rivets in one member be replaced with high-strength bolts. The rivets were replaced with bolts in 1985. This member was also instrumented with strain gages with results reported in early 1985. The results of the instrumentation were considered inconclusive due to equipment problems during field measurement.

In light of the above factors and concerns about the remaining fatigue life of the structure, a load capacity rating and fatigue life analysis was performed from

March 2004 to June 2004. (During this period the development of the alternatives described below continued.) Using the mathematical model for load capacity rating, truss members with the highest stress ranges were identified. The electronic strain gages were installed on these members and calibration load tests were preformed using two trucks of known weight while the bridge was closed to other traffic. Strain gage readings were then collected for a two-week period under normal traffic conditions.

The results of the load rating indicated that the primary truss members are suitable for safely carrying four lanes of HS 20-44 (i.e. 72,000 pound truck) loading on each deck. Results of the instrumentation and fatigue analysis indicate that the primary truss members have an infinite fatigue life. The full report can be found in Appendix E.

VII. DESCRIPTIONS OF CONCEPTUAL ALTERNATIVES

The following is a description of each conceptual alternative studied.

The alternatives were initially developed during a day-long workshop including personnel from the BSMT and consultant team (See Appendix F). Alternative 3 (New West and New Interchange) was dropped by the BSMT from further consideration after initial development because of its potential impacts, costs, and its failure to address the problem statement and parameters developed for the Study. A cursory review indicated that maintenance of traffic, impacts to existing buildings, and its relative costs were substantially greater than the other alternatives. Additionally, this concept presents greater potential impacts associated with hazardous materials sites, wetlands, low-income housing, and community cohesion in the historic neighborhood of Lewisburg in Covington, Kentucky. The schematics of the five alternatives developed for the Study are located in Appendix F.

The initial conceptual alternatives were developed to carry five lanes of traffic in both directions across the river. Satisfied that these concepts were possible and after reviewing the initial 2030 traffic being developed during the late summer of 2004, KYTC and ODOT decided to expedite the completion of the study and to explore seven lanes in both directions. The initial alternatives were adjusted accordingly and are described in the following narrative.

The descriptions of the conceptual alternatives also include a discussion of the strategy for the maintenance of traffic (MOT). The following guiding principals were used when developing conceptual MOT strategies for each alternative. Mainline interstate highway and auxiliary road (ramp) traffic flow will be maintained using the following general steps:

- Build all proposed driving lane pavements (with supporting structure or grade and drain construction) which lie outside the boundaries of the existing roadway pavement and shoulder area.
- By using transitional pavement links, which could be either proposed improvements or temporary construction, connect most or all of the driving lane surfaces of the existing pavements to the newly constructed proposed roadway pavements. These transitional links, if temporary, should occupy area not in conflict with proposed improvement areas remaining to be constructed.
- Divert traffic from the "existing pavement to remain" to the improvements outlined in step one via the transitional links.
- Construct permanent pavement and other proposed improvements in the general area of the transitional links.
- Reroute traffic to the newly completed permanent roadway pavement portion of the improvements in the area of the transitional links.
- Remove the remaining transitional links and complete the construction of any remaining roadway construction items that lie outside of the permanent roadway pavement.

Alternate No. 1 Rehab + I-75 West

The preliminary concept known as "Rehab + I-75 West" consists of the construction of new approach bridges and a 1,800+/- foot-long span bridge across the Ohio River located from 700 to 900 feet west of the existing Brent Spence Bridge. The existing Brent Spence Bridge would also be structurally rehabilitated and reconfigured to facilitate only residual local traffic and I-71 through traffic via Fort Washington Way. The numbers of traffic lanes on the rehabilitated bridge would be reduced from the four lanes currently in service. The rehabilitated Brent Spence Bridge would also maintain the connections required to indirectly accommodate through I-75 traffic north and south bound across the Ohio River.

The new bridge and roadway would be sized adequately to carry I-75 through traffic and connected, without constrictions, to the existing I-75/I-71 roadway near 12th Street in Kentucky and Liberty Street in Ohio. Local connection infrastructure to surface streets on both sides of the river would be maintained; however, I-75 through traffic volumes would be absent from the traffic volume currently experienced at these local connection areas. The existing southern approaches to the proposed bridge would be widened to allow for seven lanes in each direction with full shoulders on either side. Five lanes would carry I-75 traffic across the proposed bridge and two lanes would continue to carry I-71 and local traffic across on the existing Brent Spence Bridge.

Alternate 1 generally leaves the existing facility in place and provides an alternative for I-75 traffic to avoid the existing Ohio River crossing and the southern-most access points to Cincinnati. The relocated I-75 crosses west of the existing bridge and ties in with I-75 just north of Ezzard Charles Drive in Ohio.

The confined nature of the existing facility, when combined with the additional lanes provided by Alternate 1, affects the ability to keep all existing ramp movements open for the ultimate configuration.

In Ohio, the southbound exit ramp to Gest Street, in the vicinity of Ezzard Charles Drive would be closed. This impact, however, may be mitigated by widening the exit ramp to Western Avenue, just north of Ezzard Charles Drive. Additionally, some intersection re-configuration may be justified to connect Western Avenue and Freeman Avenue at Gest Street, since this ramp is the southbound I-75 connection to U.S. 50.

Also in Ohio, the existing Freeman Avenue to northbound I-75/Winchell Avenue ramp would be closed with Alternate 1; however, this movement would be maintained by constructing a new ramp from Freeman Avenue

The last closure anticipated by Alternate 1 is related to subdivision impact, just south of 12th Street in Kentucky. An existing alley that fronts the interstate would be impacted by a relocated ramp and would be relocated or closed.

In order to construct Alternate 1, some traffic movements would be impacted during various construction phases. Many movements would suffer short-term impacts required for setting overpass bridge beams; however, the only long-term impact would affect Crescent Avenue in Kentucky. It would be closed to allow reconstruction at a lower grade.

In Ohio, reconstruction of the Freeman Avenue to northbound I-75/Winchell Avenue tie-in (relocated northbound I-75 would pass through the area) would probably require a shorter term closure.

The position of Alternate 1, being relocated from the existing facility, minimizes traffic impacts during construction. The majority of the facility, including most of the bridges, could be constructed while traffic remains in the existing configuration.

In Kentucky, the northbound exit ramp to 12th Street and the connector to Pike Street would be constructed to allow room for the new northbound I-75 construction. The southbound side, similarly, requires the southbound exit to Pike Street, the connector to 12th Street and the southbound entrance ramp to I-75 be completed prior to other southbound construction.

The remaining I-71/I-75 construction could be accomplished with minimal impact. A lane reduction would probably be required to complete the tie-ins.

In Ohio, reconstruction of the dual Ezzard Charles Drive bridges over I-75 must be reconstructed early in the process. Traffic could be maintained either by reconstructing both bridges part-width, or by shifting two-way traffic to either bridge, while replacing the other. That construction could accompany any widening of the southbound exit ramp to Western Avenue and other modifications of the local street network in the area.

With the preliminary construction accomplished, the tie-ins would be completed. The Freeman Avenue to northbound I-75/Winchell Avenue area could be phase constructed to minimize traffic disruption. The I-75 tie-ins would probably require a reduction in travel lanes to allow for completion.

Alternate No. 2 New East + I-75 West

The concept known as “New East + I-75 West” consists of the construction of new approach bridges and a 1,800+/- foot long span bridge across the Ohio River located from 700 to 900 feet west of the existing Brent Spence Bridge. The existing Brent Spence Bridge would be replaced with a new structure able to facilitate the residual local traffic and I-71 through traffic via Fort Washington Way. This new long span replacement structure for the Brent Spence Bridge would be approximately 1600 feet long located immediately east of the existing bridge. The number of traffic lanes on the New East Bridge could be less than the four lanes currently in service on the Brent Spence.

The New East Bridge would also maintain the connections required to indirectly accommodate through I-75 traffic north and south bound across the Ohio River. Surface street connections on the Kentucky side would have to be rebuilt and the approach roadway structures located at either end of the New East Bridge would have to be modified to suit the shifted alignment. The new I-75 West Bridge and roadway would be sized adequately to carry I-75 through traffic and connected, without constrictions, to the existing I-75/I-71 roadway near 12th Street in Kentucky and Liberty Street in Ohio. Local connection infrastructure to surface streets on both sides of the river, although rebuilt on the Kentucky side, would be maintained; however, I-75 through traffic volumes would be absent from the traffic volume currently experienced at these local connection areas. The existing southern approaches to the bridges would be widened to allow for seven lanes in each direction with full shoulders on either side. Just south of the proposed bridges, the roadway would split into five lanes carrying I-75 traffic across the west bridge and a minimum of two lanes carrying I-71 and local traffic across the east bridge.

Alternate 2 could be described as Alternate 1 “plus.” It provides the same relocated I-75, to the west as Alternate 1, but also includes replacement of the

Brent Spence Bridge. The replacement bridge is to the east of the existing and would re-connect to the existing ramps.

The only ultimate closures required for Alternate 2 are the same as noted for Alternate 1. They are repeated below.

The temporary closures noted for Alternate 1 will also apply to Alternate 2. An additional temporary closure that applies to Alternate 2 is expected for the southbound I-71 connection to 5th Street in Covington. While the southbound I-75 (through downtown Cincinnati) exiting traffic could be maintained from the existing Brent Spence Bridge, the I-71 traffic cannot. The closure would be required during removal of the existing approach structure and construction of a new bridge to connect southbound I-71 to the existing ramp. The southbound I-71 exit to Pike Street should remain open.

The Alternate 2 construction phasing is based on the likely circumstance of the Alternate 1 portion being constructed first. The two facilities can be constructed independently, but construction of the Alternate 1 portion first would minimize the traffic volumes on the existing facility. This reduction in traffic volume would improve the maintenance of traffic for replacement of the Brent Spence Bridge.

The phasing required for the I-75 portion of Alternate 2 would be as discussed for Alternate 1, except for that work required for the replacement of the Brent Spence Bridge.

The new bridge is to be constructed on the east side of the existing bridge, and ramps re-connected with the minimum modification possible. Construction would begin with the eastern-most lanes on the northbound side, and proceed westward until the southbound tie-ins are completed.

Alternate No. 3 New West + New Interchange (Dropped from further consideration)

The concept known as "New West + New Interchange" consists of the construction of new approach bridges and a 1,800+/- foot-long span bridge across the Ohio River. The new bridge would be located from 700 to 900 feet west of the existing Brent Spence Bridge. The existing Brent Spence Bridge, and its attendant approach bridges and access ramps would be removed.

The number of traffic lanes on the "New West" bridge would probably be five lanes north bound and five lanes south bound, in order to carry I-75, I-71, and local traffic across the river. Immediately north of the northern end of the bridge, a directional split would carry I-71 traffic over and eastward to a connection to I-71 via Fort Washington Way. The New West Bridge would also require new surface street connections (ramps). Surface street connections on the Kentucky side would have to be built generally in the same configuration as what currently exists. The approach roadway structures located at either end of the New West Bridge would be removed.

Local connection infrastructure to surface streets on the Ohio side would be replaced using a massive interchange located on the "New West" alignment in the Queensgate area approximately 2,500 to 4,500 feet north of the riverbank. This interchange would replace many of the existing local access connections along I-75 from the western end of Fort Washington Way to the Freeman Avenue overpass. The existing I-75 freeway, ramp, and overpass area would be abandoned and allowed to change to other uses. The existing freeway approaches to the project area would be widened to allow for five lanes in each direction with full shoulders on either side.

This concept was eliminated by the project team during the course of this evaluation for a variety of reasons. These reasons included concerns related to existing infrastructure in Cincinnati, as well as factors associated with bridge capacity and projected travel demand through the study area. However, cursory environmental findings further support the elimination of this alternative. Alternative 3 presents greater potential impacts associated with hazardous materials sites, wetlands, low-income housing, and community cohesion in the historic neighborhood of Lewisburg in Covington, Kentucky. Direct impacts would have included approximately five Resource Conservation and Recovery Act (RCRA) sites, 12 Underground Storage Tanks (USTS), two Emergency and Remedial Response sites, seven potential wetlands locations, and potential impacts to a Housing and Urban Development (HUD) -assisted housing project known as Union Baptists Page Towers. While it may be possible to avoid directly impacting some of these resources, local infrastructure concerns coupled with cost and environmental impacts was enough justification to disregard this alternative as part of the overall engineering feasibility study.

Alternate No. 4 Single Bridge Replacement (I-75 widening in Ohio)

The concept known as "Single Bridge Replacement" consists of the construction of a new long span bridge approximately 1,600 feet long located immediately adjacent to and east of the existing Brent Spence Bridge. This new structure would be able to facilitate I-75, I-71 and local traffic, using seven lanes both north and south bound. The Single Bridge Replacement would require much of the existing approach structure to be modified or rebuilt. Surface street connections on the Kentucky side would have to be rebuilt and the approach roadway structures at either end of the Single Bridge would have to be modified to suit the shifted alignment. Local connection infrastructure to surface streets on both sides of the river, although rebuilt on the Kentucky side, would be located where they are now. The existing southern approaches to the proposed bridge would be widened to allow for seven lanes in each direction with full shoulders on either side. At the northern end of the proposed bridge the roadway would split into five lanes carrying I-75 and local traffic north and two lanes carrying I-71 and local traffic east into Fort Washington Way.

This alternate generally calls for the widening of the existing Kentucky and Ohio approach roadways to the Brent Spence Bridge and the replacement of the Brent Spence Bridge with a new bridge carrying seven lanes north and south bound across the Ohio River.

While maintaining existing interstate traffic patterns, construction of the proposed river crossing bridge would commence. During that construction, temporary bridges intended to carry traffic crossing over I-75 north of the Ohio River would also be constructed. These crossing bridges include 6th Street, 7th Street, 9th Street, Lynn Street, Freeman Avenue, Ezzard Charles Drive, Liberty Street, and Findlay Street. Temporary decrease or loss of capacity on these crossing roads would be expected.

As traffic on these cross roads is maintained on temporary bridges, the main and approach spans of these existing cross road bridges would be removed, then possibly elevated and lengthened to accommodate the proposed widening of I-75 beneath. This cross road bridge reconstruction would intermittently slow traffic and/or restrict numbers of lanes of through traffic on I-75 and local access ramps.

All other construction of proposed mainline and auxiliary road structure, grade, drainage, and partial width pavements lying outside of the existing road pavements would be constructed. This type of construction would include the elevated I-71 approach bridges connecting the proposed Ohio River Bridge to Fort Washington Way.

Any other relocated or widened roadway alignment that is proposed to be built at, or close to, the same grade as adjacent existing pavements would also be constructed at this time. These include most of the “at grade” (not elevated on bridges) mainline I-71 and I-75 pavements in Ohio and Kentucky, the Pike Street, 12th Street and 5th Street ramps in Kentucky and 6th Street, Western Avenue, and Freeman Avenue ramps in Ohio. Short term and temporary shutdown or restriction of these ramps would be expected

The transitional ties between the proposed Ohio River Bridge and the elevated approach bridges in Kentucky and Ohio would call for the “one lane at a time” type of stage construction of these structures. This type of MOT scenario would cause minor delays and congestion for the duration of the link construction period.

Various constrictions and delays along the mainline route is expected, but at no time is the mainline I-75/I-71 through route expected to be shut down as a result of normal construction operations.

Alternate No. 5 Double Bridge Replacement (Elevated I-75 Roadways in Ohio)

The concept known as "Double Bridge Replacement" consists of the construction of two new long span bridges approximately 1,600 feet long each, located immediately adjacent to and east of the existing Brent Spence Bridge. The western bridge would carry I-71 and local traffic. The eastern-most bridge would carry I-75 traffic only. On the Ohio side, the I-75 alignment would be extended via elevated roadway along, and above, the existing I-75 alignment and tie to existing I-75 near Liberty Street. Each elevated roadway would likely use four lanes north and south bound.

This alternate would require much of the existing approach structure to be modified or rebuilt. I-71/I-75 on the Kentucky side would be widened to the east, minimizing impact on the west side and keeping the surface network intact. Surface street connections on the Kentucky side, east of the interstate, would have to be rebuilt. The approach roadway structures located at either end of the bridge would have to be modified to suit the shifted main bridge alignments. The existing freeway approaches to the project area would be widened to allow for seven lanes in each direction with full shoulders on either side.

Alternate 5 provides a replacement bridge to the east of the existing Brent Spence Bridge, on the existing corridor. In Kentucky, it generally shifts the facility to the east side, minimizing impacts to the west. In Ohio, it follows the existing corridor and maintains the connections with I-75 and downtown Cincinnati. It then uses separate elevated northbound and southbound roadways to carry the additional traffic volumes to just north of Ezzard Charles Drive where it merges with existing I-75.

The only permanent ramp closure anticipated with Alternate 5 is the southbound I-75 exit ramp to Western Avenue, just north of Ezzard Charles Drive. The proximity of the elevated roadway limits the available vertical clearance at that location. The impact of this ramp closure could be mitigated by widening the exit ramp just north of this location and Western Avenue, if deemed necessary.

A temporary closure that applies to Alternate 5 is expected for the southbound I-71 connection to 5th Street in Covington. While the southbound I-75 exiting traffic could be maintained from the existing Brent Spence Bridge, the I-71 traffic cannot. The closure would be required during removal of the existing approach structure and construction of a new bridge to connect relocated southbound I-71/I-75 to the existing ramp. The southbound I-71 exit to Pike Street should remain open.

In Kentucky, Alternate 5 provides a similar facility as presently exists, only wider. The widening is to occur on the east side, while leaving the west side intact. This design dictates that the improvements on the east side be constructed first, beginning with the ramps and the 12th Street – Pike Street connector. The new northbound lanes would be constructed next, part-width, until the northbound is complete. The southbound lanes would then be reconstructed, also part-width, until complete.

In Ohio, much of the elevated roadway construction could be completed independently of the Kentucky phasing, with minimal impact on traffic. The tie-ins at I-75 should begin with the northbound I-75 to northbound I-71 (eastern most) ramp and proceed westward. The I-75 tie-ins at the northern project terminus must be coordinated with the Kentucky tie-in phasing.

Alternate No. 6 Rehab + I-75/I-71 West

The concept known as "Rehab + I-75/I-71 West" consists of the construction of new approach bridges and a 1,800+/- foot-long span bridge across the Ohio River located from 700 to 900 feet west of the existing Brent Spence Bridge. The existing Brent Spence Bridge would also be structurally rehabilitated and reconfigured to facilitate residual local traffic. The number of traffic lanes on the rehabilitated bridge would probably be reduced from the four lanes currently in service. The rehabilitated Brent Spence Bridge would also maintain the connections required to indirectly accommodate I-75 traffic north- and south-bound across the Ohio River.

The new bridge and roadway would be sized adequately to carry both I-75 and I-71 through traffic and connected, without constrictions, to the existing I-75/ I-71 roadway near 12th Street in Kentucky. Immediately north of the northern end of the bridge, a directional split would carry I-71 traffic over and eastward to a connection to I-71 via Fort Washington Way.

Local connection infrastructure to surface streets on both sides of the river would be maintained; however, I-75 and I-71 through traffic volumes would be absent from the traffic volume currently experienced at these local connection areas. The existing southern approaches to the proposed bridge would be widened to allow for seven lanes in each direction with full shoulders on either side. The proposed bridge would carry five lanes across the river and split just at the northern end of the proposed bridge, with three lanes carrying I-75 traffic north and two lanes carrying I-71 traffic eastward toward Fort Washington Way. At least three lanes, capable of carrying I-75, I-71, and local traffic, will be maintained on the existing Brent Spence Bridge.

Since the majority of new roadway construction would be located over existing roadways, and/or away from the existing I-75/I-71 corridor, and the existing Brent Spence Bridge is to remain in service, MOT for this alternative should be relatively easy to implement. All roadway and bridge construction over and/or outside of existing roadways may take place without major influence on surface streets or current interstate traffic flow. Required approach roadway bridges to be built over the existing surface streets and interstate corridor may cause minor delays or temporary reduction in numbers of lanes.

After these non-conflicting roadways are constructed, transitional links from existing to newly constructed mainline roadways (I-75 and I-71) may be added. The preliminary design of this alternative is such that these transitional links would be simply at-grade extensions of both the existing and proposed pavements. The existing pavements would be widened at grade to connect seamlessly to the proposed roadways. Once the connection is made and pavement remarked, traffic would be re-routed to the new alignments.

The local access ramps to 12th Street, Pike Street and 5th Street would be constructed in a similar way. These ramps would be constructed independent of the existing ramp traffic and then widened at grade to make a connection to the existing ramps. Since the existing I-75/I-71 corridor is not being altered in Ohio, local access to surface streets there would not be disturbed.

Due to the redundant nature of this alternate mainline travel would be expected to continue nearly uninterrupted and undiminished during construction. Minor delays of short duration could be expected during the mainline transitional link tie-in process. No existing surface street access should be permanently lost or diminished and only short duration of loss or disruption of through and local access travel is expected during the construction process.

VIII. ENVIRONMENTAL OVERVIEW

As part of this Study, a desktop review of available community demographics, cultural and natural resources - related information was compiled from a variety of sources for the study area. The study area is approximately 4,000 feet wide, centered on I-75, and extends from Harrison Avenue and Hopple Street on the north and to just west of the Kyles Lane on the south. Other critical factors such as potential navigational challenges and permitting issues were cursorily reviewed relative to the conceptual alternatives.

A relative comparison of the five conceptual alternatives shows that Alternatives 4 and 5 (Single Bridge Replacement and Double Bridge Replacement (Elevated I-75 Roadways in Ohio)) have the lowest overall potential environmental impacts. Table 3 is a relative comparison between the conceptual alternatives. The affected resource categories are not weighted by their value; thus; “low,” “moderate,” and “high” express the same significance across resources categories. “Low” represents the fewest impacts to a given resources when compared to all other conceptual alternatives. “Moderate” indicates that the amount of impacts associated with a given alternative falls between the amount of impacts associated with other conceptual alternatives. “High” represents the greatest possible impacts to a given resource category when compared to all other conceptual alternatives. “High” does not imply significant or severe impacts relative to a threshold value or regulatory interpretation.

Table 1: Summary of Environmental Impacts**

Resource Category	**Relative Rating of Potential Impacts**				
	Alternative 1	**Alternative 2**	**Alternative 4**	**Alternative 5**	**Alternative 6**
Cultural Resources	Moderate	Moderate	Low	Moderate	Moderate
Hazardous Material Sites	Moderate	Moderate	Low	Moderate	Moderate
Parks	Moderate	Moderate	Low	Moderate	Moderate
Wetlands	Moderate	Moderate	Low	Low	Moderate
Community Cohesion	Low	Low	Low	Low	Low
Environmental Justice	Low	Low	Low	Moderate	Low
Noise and Air	N/A*	N/A	N/A	N/A	N/A
Navigation/Permits	Moderate	Moderate	Low	Low	Moderate

* N/A indicates no discernable difference in the level of impacts as no data was available or analyzed

** Based on secondary source data and no regulatory agencies coordination other than that indicated in Appendix A

All five conceptual alternatives are viable from a planning standpoint. While some of the conceptual alternatives incur varying levels of impacts to different environmental resources, it is the conclusion of this evaluation that no major “show stoppers” exist based on secondary source data. However, primary research and data collection related to threatened and endangered species may warrant a different conclusion upon further investigation.

The complete environmental overview is included in Appendix A.

IX. ESTIMATED COSTS

Construction Costs

The Consultant Team took a two-pronged approach to the construction cost estimating task. This approach was taken in recognition that the conceptual alternatives are very preliminary and that this would give KYTC and ODOT a range of costs. All estimates were developed to reflect costs in the year 2004.

One approach, using national cost data, assessed the project from a constructability (that is, contractor's) perspective. This approach developed conceptual quantities of work and/or allowances for the conceptual cost estimate. Where quantities of work were developed, unit prices were used for the individual items. Where quantities of work could not be developed at this stage (a major portion of the estimate), allowances as a lump sum or percentages of total cost were used. The allowances are based upon broad experience in complex highway and major over-water bridge projects. After an initial review of the Alternatives, Alternative Four was used as a "baseline" for the assessment of alternatives from a cost and constructability standpoint.

The second approach, from the development of the conceptual alternatives, used local (Kentucky and Ohio) cost data applied to quantities developed similar to approach one. For example, estimated pavement costs were developed by taking the area of new pavement in square yards and applying a unit cost to cover all pavement and subgrade costs, guardrail, markings, signage, lighting, and underdrains. Also, utility relocation costs were given a "place-holder" of $100 per square yard of right-of-way in recognition that many underground issues may arise given the age of the city and many industries existed prior to the construction of the Interstates. For the "bypass" alternates (One, Two, and Five), $4 million was included for electrical transmission tower relocations.

The following table presents only the construction costs of the five conceptual alternatives. The variation in Alternates One, Two and Five reflects assumptions made on portions of the approaches to the main span being primarily fill or bridges. This was done to represent "worst case" scenarios in regard to potential environmental and site constraints that may affect the final design solution. The consultant team was also requested to develop cost estimates for the five-lane solutions explored earlier in the study. Additional costs for the total construction program are described later in this section.

Construction Cost Range ($ Millions in 2004)		
Alternate	**Seven Lanes**	**Five Lanes**
Alternate #1 – Rehab and I-75 West	$667.5 - $721	$474 – $541
Alternate #2 – New East & I-75 West	$750 - $923	$578 - $702
Alternate #4 – Single Bridge Replacement	$553.4 - $560	$426 - $431
Alternate #5 – Double Bridge Replacement	$747.9 - $909	$577 - $692
Alternate #6 – Rehab & I-75/I-71 West	$707 - $729	$535 - $557

Real Estate and Relocation Cost Development

The real property values utilized for this estimate are the most recent “appraised value” indications from the Auditor’s and Property Valuation Administrator’s records in the appropriate jurisdictions. The procedures utilized by the appraisers in the development of these values are considerably less detailed than those prescribed for appraisals utilized for acquisition by a public agency. Absent the detail and the lack of multiple approaches to valuation found in a tax appraisal, one could logically conclude that the values derived from auditors’ records are not reflective of market value. This is particularly true of specialty use properties such as hotels.

As a contingency, increasing the tax value of the properties, other than the hotels, by 30% should approximate market value. In valuing the hotel properties one would have to factor in occupancy rates and other market driven measures. Utilizing a rule of thumb of $100,000 per room, it appears that the hotels are largely under-valued from what is shown in the public record.

Relocation Assistance estimates for the residential properties utilized the current statutory limit for replacement housing and an allowance for move cost. The nonresidential move costs were derived by a variety of methods ranging from personal experience to budgeting guidance provided by a commercial mover. The smaller commercial establishments could likely qualify for the statutory limit on income in lieu of moving cost. Where photographs were available of the buildings, a judgment was made regarding the potential applicability of this payment or if a larger move cost would be incurred. For office buildings, the budgeting factor of $1.50/sq ft of floor space was used to estimate move cost. For hotels, the commercial moving company’s budget factor is $400/room. The average cost to relocate an auto dealership of any size and sophistication seems to be $100,000. Without the ability to go on site, much of the other move cost estimation relies on the professional judgment of an individual experienced in Relocation Assistance. As directed by KYTC and ODOT these estimates were increased by 15%.

Finally, as per ODOT Guidelines, a factor of 12.9% (derived from the Consumers Price Index [CPI]) was added to the right-of-way costs to reflect future costs when acquisition occurs.

The following table gives the range of right-of-way plus relocation costs for each alternative. Where only one number is given, that alternate did not impact any of the "unique properties" (e.g., hotels) whose valuation is questionable given current market conditions.

Real Estate and Relocation Costs ($ Millions in 2004)		
Alternate	**Initial Valuation**	**Valuation with CPI**
Alternate #1 – Rehab & I-75 West	$28.8	$32.3
Alternate #2 – New East & I-75 West	$53.4 - $82.7	$60.29 - $93.37
Alternate #4 – Single Bridge Replacement	$23.5 - $52.8	$26.53 – $59.61
Alternate #5 – Double Bridge Replacement	$58.84- $108.24	$66.43 - $122.2
Alternate #6 – Rehab & I-75/I-71 West	$26.5	$29.92

Contingencies and Reserves

Because of the preliminary nature of the engineering of the alternatives a contingency factor of 30 percent of the construction cost was selected to reflect this fact. It was also determined that an estimate for construction reserves should be included in the estimate to account for additional work required (e.g., differing site conditions, material price increases, etc.) while the project is under construction. The table below summarizes these costs.

Contingencies Cost Range (7 Lane Solution) ($ Millions in 2004)		
Alternate	**Contingencies**	**Construction Reserve**
Alternate #1 – Rehab & I-75 West	$200- $216	$33
Alternate #2 – New East & I-75 West	$225 - $277	$37
Alternate #4 – Single Bridge Replacement	$166 - $168	$28
Alternate #5 – Double Bridge Replacement	$224 - $273	$37
Alternate #6 – Rehab & I-75/I-71 West	$212 - $219	$35

Project Development

Project development costs (environmental documentation and engineering, KYTC and ODOT construction management, and third-party construction management costs) were estimated based on recent experience on other "mega projects." The following table summarizes these additional costs, and a table showing the range of total estimated costs follows the development costs.

Project Development Costs (7 Lane Solution) ($ Millions in 2004)				
Alternate	**Environmental And Engineering**	**KYTC/ODOT Construction Management**	**Third Party Construction Management**	**Total**
Alternate #1 – Rehab & I-75 West	$63.4 - $68.5	$40.1 - $43.3	$53.4 - $57.7	$156.9 - $169.5
Alternate #2 – New East & I-75 West	$71.3 - $87.7	$45 - $55.4	$60 - $73.8	$176.3 - $216.9
Alternate #4 – Single Bridge Replacement	$52.6 - $53.2	$33.2 - $33.6	$44.3 - $44.8	$130.1 - $131.6
Alternate #5 – Double Bridge Replacement	$71.1 - $86.4	$44.9 - $54.5	$59.8 - $72.7	$175.8 - $213.6
Alternate #6 – Rehab & I-75/I-71 West	$67.2 - $69.3	$42.4 - $43.7	$56.6 - $58.3	$166.2 - $171.3

Total Cost Estimate (7 Lane Solution) ($ Millions in 2004)	
Alternate #1 – Rehab & I-75 West	$1,058 - $1,172
Alternate #2 – New East & I-75 West	$1,242 - $1,547
Alternate #4 – Single Bridge Replacement	$901 - $947
Alternate #5 – Double Bridge Replacement	$1,244 - $1,555
Alternate #6 – Rehab & I-75/I-71 West	$1,156 - $1,193

Finally, an estimate of the escalation of construction costs due to inflation was developed. This assumed that the midpoint of construction would be in the year 2017. The escalation of costs range from approximately $183 million to $305 million.

APPENDIX A
ENVIRONMENTAL OVERVIEW

I. OVERVIEW

Feasibility and Constructability Study for the Replacement / Rehabilitation of the Brent Spence Bridge

Environmental Overview

Hamilton County, Ohio and Kenton County, Kentucky

prepared for

BURGESS & NIPLE

parsons

October 2004

FEASIBILITY AND CONSTRUCTABILITY STUDY FOR THE REPLACEMENT / REHABILITATION OF THE BRENT SPENCE BRIDGE - HAMILTON COUNTY, OHIO, AND KENTON COUNTY, KENTUCKY

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FEASIBILITY AND CONSTRUCTABILITY STUDY FOR THE REPLACEMENT / REHABILITATION OF THE BRENT SPENCE BRIDGE - HAMILTON COUNTY, OHIO, AND KENTON COUNTY, KENTUCKY

1.0 INTRODUCTION

As part of the Feasibility and Constructability Study for the Replacement/Rehabilitation of Brent Spence Bridge a desktop review of available cultural and natural resource-related information was compiled from a variety of sources for the study area. Concurrently, six conceptual engineering alternatives were drafted as potential solutions to the current traffic and safety concerns associated with the existing Brent Spence Bridge. The alternatives, which appear as conceptual corridors, have varying environmental effects. Cultural resources, community demographics, and natural resources were inventoried via secondary source data within the study area. This study area encompassed a broader area than would be impacted by any of the six conceptual alternatives under consideration. Results of this environmental review, as well as other considerations, are intended to assist in the screening of proposed alternatives for 'fatal flaws' or 'red flags' as they may relate to the feasibility of a given alternative.

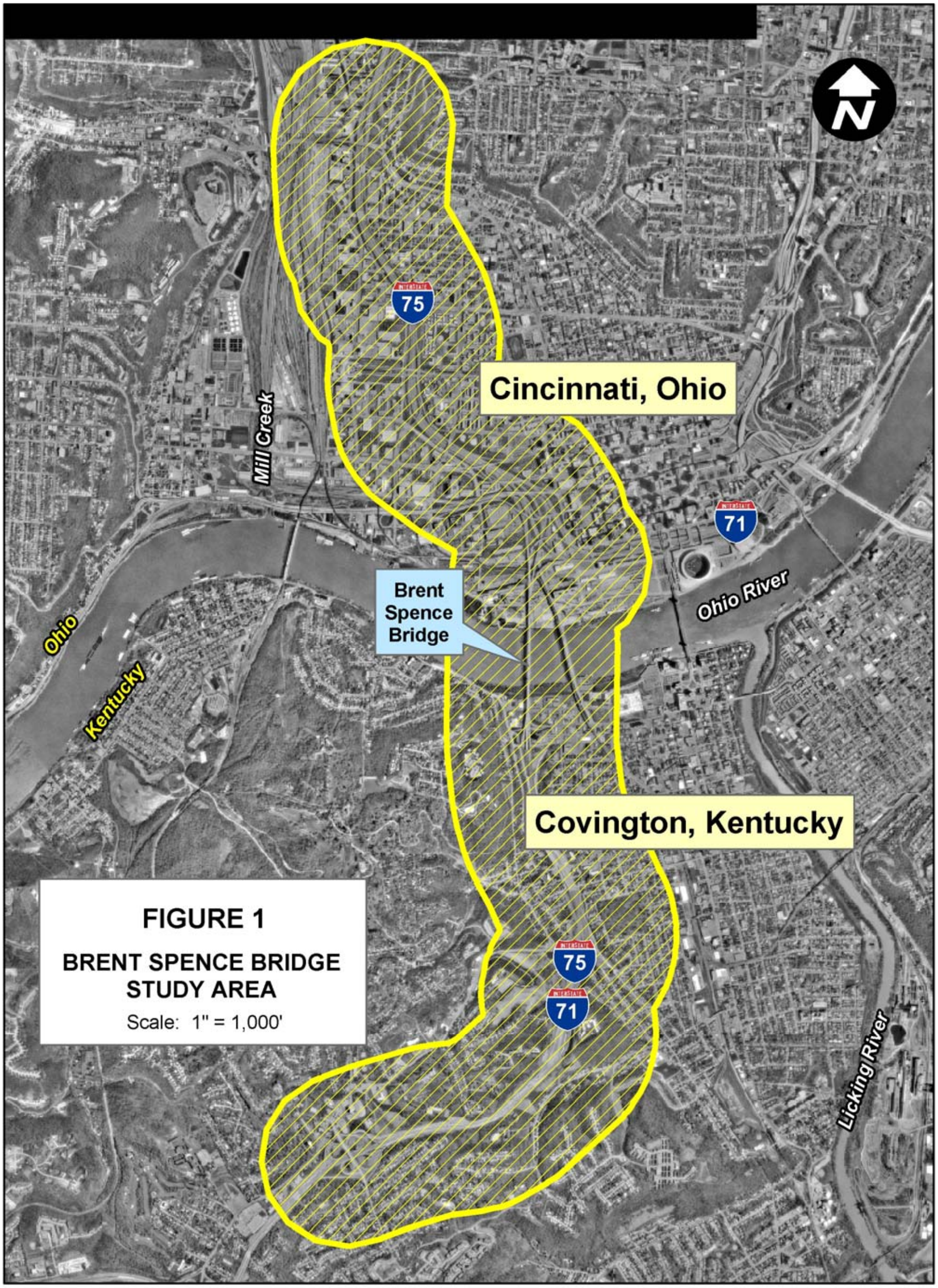
The Brent Spence Bridge study area is approximately 4,000 feet (1, 219 meters) wide and extends from Harrison Avenue and Hopple Street on the north (in Ohio) to just west of Kyles Lane on the south (in Kentucky). North of the Ohio River, the study area is bounded on the west by the Mill Creek channel. On the east, it parallels I-75 approximately 2,000 feet from the interstate. South of the Ohio River, the area is shown as extending to the top of Kenton/Park Hills on the west and the Covington rail yards on the east (Figure 1).

In addition to cultural and natural resource considerations within the study area, other critical factors such as potential navigational challenges and permitting obstacles were cursorily reviewed. Data related to such items was evaluated relative to the six conceptual alternatives under consideration.

The six conceptual alternatives include:

- *Alternative 1 - Rehab + I-75 West*
- *Alternative 2 - New East + I-75 West*
- *Alternative 3 - New West with New Interchange*
- *Alternative 4 - Single Bridge Replacement*
- *Alternative 5 –Double Bridge Replacement (Elevated I-75 Roadways in Ohio)*
- *Alternative 6 - Rehab + I-75 West / I-71 West*

Alternative 3 (*New West with New Interchange*) was eliminated by the project team during the course of this environmental evaluation for a variety of reasons. These reasons included concerns related to existing infrastructure in Cincinnati, as well as factors associated with bridge capacity and projected travel demand through the study area. However, cursory environmental findings further support the elimination of this alternative. Alternative 3 presents greater potential impacts associated with hazardous materials sites, wetlands, low-income housing, and community cohesion in the historic neighborhood of Lewisburg in Covington, Kentucky (Figures


75
Cincinnati, Ohio
Mill Creek
71
Ohio River
Brent
Spence
Bridge
Ohio
Kentucky
Covington, Kentucky
FIGURE 1
BRENT SPENCE BRIDGE
STUDY AREA
Scale: 1" = 1,000'
75
71
Licking River

2-1 and 2-2). Direct impacts would have included approximately five Resource Conservation and Recovery Act (RCRA) sites, twelve Underground Storage Tanks (USTs), two Emergency and Remedial Response sites, seven potential wetlands locations, and potential impacts to a Housing and Urban Development (HUD)-assisted housing project known as the Union Baptist Page Towers. While it may be possible to avoid directly impacting some of these resources, local infrastructure concerns coupled with cost and environmental impacts was enough justification to disregard the *New West with New Interchange Alternative* as part of the overall engineering feasibility study. Therefore, the following environmental analysis of conceptual alternatives included only the five remaining alternatives (Alternatives 1, 2, 4, 5, and 6). Although ramp configurations may differ, Alternative 1, 2, and 6 generally share similar routes and therefore are grouped together for discussion purposes throughout the analysis. These conceptual alternatives are rehabilitation and/or new bridge alternatives. They specifically include:

- ***Alternative 1 - Rehab + I-75 West***
- ***Alternative 2 - New East + I-75 West***
- ***Alternative 6 – Rehab + I-75 West / I-71 West***

Alternatives 4 and 5 are bridge replacement alternatives with varying degrees of impacts. The conceptual footprints of these alternatives are notably different; therefore, Alternatives 4 and 5 are discussed independently throughout most of the analysis. These conceptual alternatives specially include:

- ***Alternative 4 - Single Bridge Replacement*** – includes the construction of one replacement bridge carrying I-75, I-71, and local traffic

While Alternative 5 also aims to replace the existing bridge, it consists of two new bridges: one carrying I-71 and local traffic, and one carrying I-75 traffic only.

- ***Alternative 5 – Double Bridge Replacement (Elevated I-75 Roadways in Ohio)***

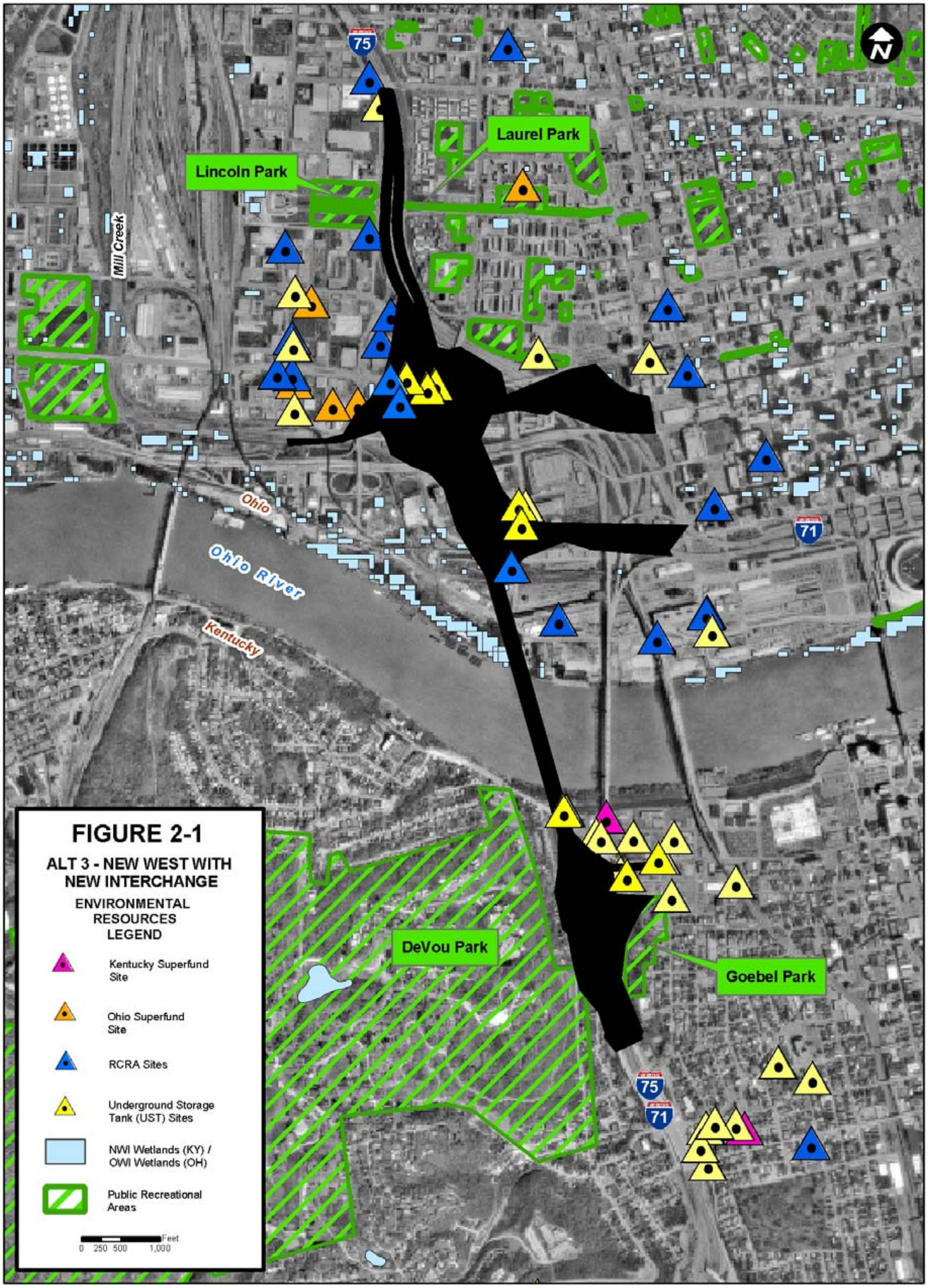
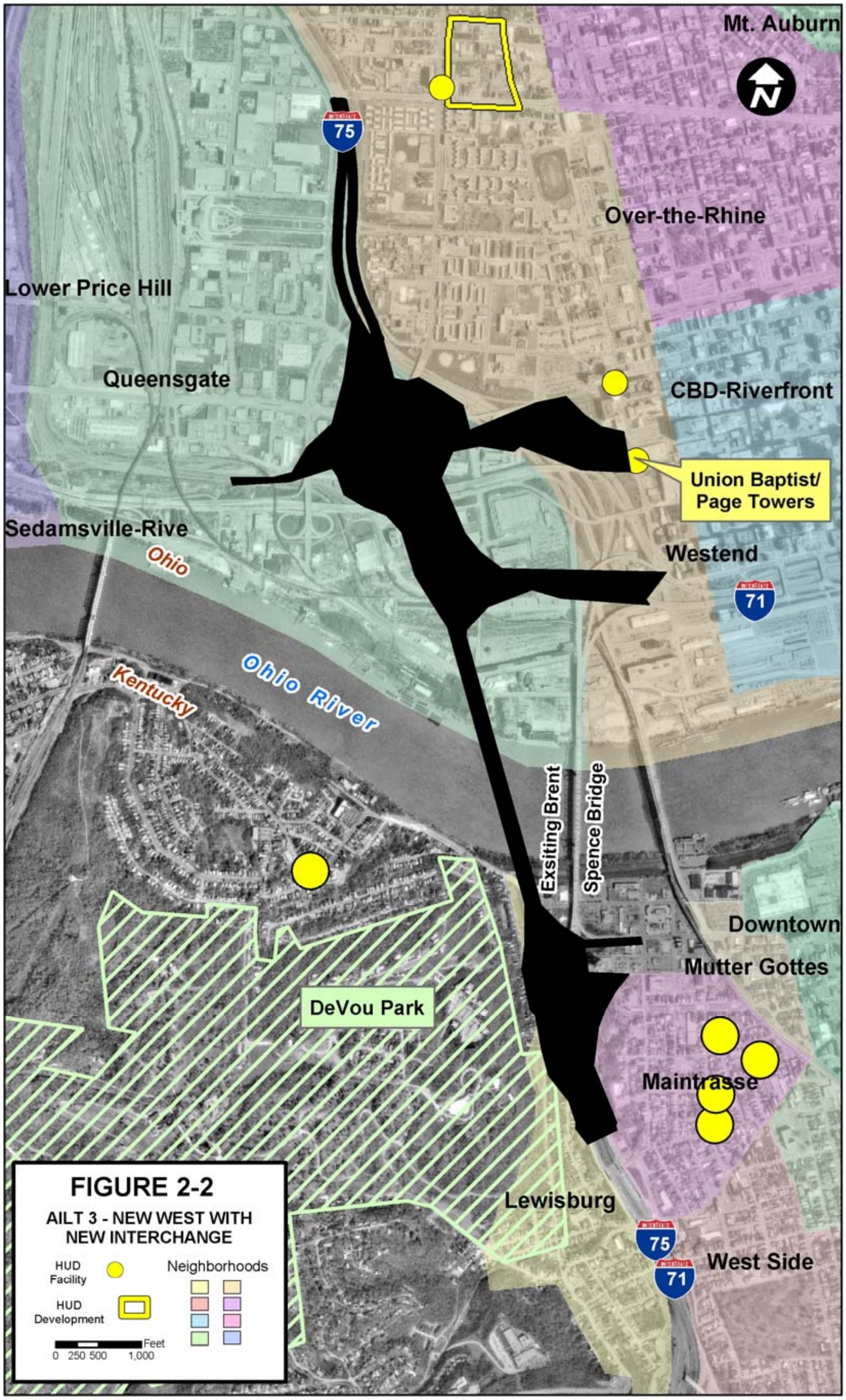


FIGURE 2-1
ALT 3 - NEW WEST WITH NEW INTERCHANGE
ENVIRONMENTAL RESOURCES LEGEND
Kentucky Superfund Site
Ohio Superfund Site
RCRA Sites
Underground Storage Tank (UST) Sites
NWI Wetlands (KY) / OWI Wetlands (OH)
Public Recreational Areas
Feet
0 250 500 1,000
Laurel Park
Lincoln Park
Mill Creek
Ohio
Ohio River
Kentucky
DeVou Park
Goebel Park
75
71
N


Mt. Auburn
N
75
Over-the-Rhine
Lower Price Hill
Queensgate
CBD-Riverfront
Union Baptist/
Page Towers
Sedamsville-Rive
Ohio
Westend
71
Ohio River
Kentucky
Exsiting Brent
Spence Bridge
Downtown
Mutter Gottes
DeVou Park
Maintrasse
FIGURE 2-2
AILT 3 - NEW WEST WITH
NEW INTERCHANGE
HUD
Facility
HUD
Development
Neighborhoods
Feet
0 250 500 1,000
Lewisburg
75
71
West Side

2.0 CULTURAL RESOURCES

The following cultural resources discussion is divided into five categories: Variables Affecting Preservation; Architectural Resources; Archaeological Resources; Key Cultural Resource Issues; and Analysis of Alternatives. It is noted that this is a preliminary planning document that should be refined as the planning and design tasks for the Brent Spence Bridge move forward. Many of the cultural resources discussed herein may not be impacted since the conceptual alternatives and eventual preferred alignment will have significantly narrower footprints than the study area, as well as unknown impacts on noise and viewsheds.

2.1 VARIABLES AFFECTING PRESERVATION

The study area lies within the bounds of three active river valleys: Mill Creek on the Ohio side; the Ohio River proper; and Licking Creek on the Kentucky side. Also, a now-channelized stream, Willow Run, was historically present in west Covington. The stream was channelized and covered when I-75 was constructed (Kornilowicz-Weldon 1993). Further, for over 200 years, the study area portion of the four stream valleys has been the scene of increasingly intense industrial and urban development. Thus, certain natural and cultural factors have affected the preservation of cultural resources within the study area.

Three natural factors are known to or may have affected cultural resources preservation in the study area. These are alluviation, flood displacement and scouring, and colluviation. Alluviation, resulting from overbank deposition along all three rivers, is persistent across the study area. According to the *Soil Survey for Hamilton County, Ohio* (Lerch et al. 1982) and the *Soil Survey for Boone, Campbell, and Kenton Counties, Kentucky* (Weisenberger et al. 1989), the soils of both the floodplain and first and second terraces are alluvial in origin. In the historic period, both the floodplain and the first terrace have been subject to overbank flooding and the soil profiles suggest that this condition has been common through the Holocene period. Thus, surface burial has occurred in all three settings and archaeological sites can be expected at depth.

Flooding routinely results in the movement and even eradication of buildings and other surface features. Flooding also can result in displacement of items resulting in redeposition and loss of context. While displacement and redeposition is likely to be relatively common in the study area, intensive and wide-spread scouring which results in the removal of soil matrix and, in some cases underlying parent rock, is uncommon. Such scouring tends to result from catastrophic floods, similar to those that scoured the Norwood lateral valley, or from the movement of glaciers across the landscape. In the study area, the removal of cultural features due to scouring is considered unlikely, while the displacement and redeposition of artifacts from flooding should be considered likely.

Colluviation resulting from the downslope migration of rock and/or soil is noted in the soil surveys as present in both the Kentucky and Ohio study areas. The colluvial deposition, in either area, does not appear to be massive. While prehistoric sites may have been affected by colluvial events over the past 10,000 years, there is no indication that large-scale burial of cultural features or sites has occurred.

The cultural factors that have affected archaeological and architectural resources in the area are redevelopment and abandonment. Initial building in an area usually results in alteration to the existing topography. In urban settings, the period of initial historic development literally lays the foundations upon which subsequent development occurs. Thus, each succeeding period of development constructs its foundations upon the fill and foundations of the preceding period (Sullebarger Associates 1991). Development and subsequent redevelopment in all sections of the study area has resulted in feature burial. The abandonment of features, in particular privies, wells, and cisterns, also has resulted in their burial. Subsequent development in an area also masks such features from view. Based on the results of excavations conducted by Purtill et al. (2003), Miller et al. (2000), and others, it is considered likely that buried archaeological features or deposits would be encountered in areas now hosting buildings, parking lots, roads, railroads, or other elements of the built environment.

2.2 ARCHITECTURAL RESOURCES

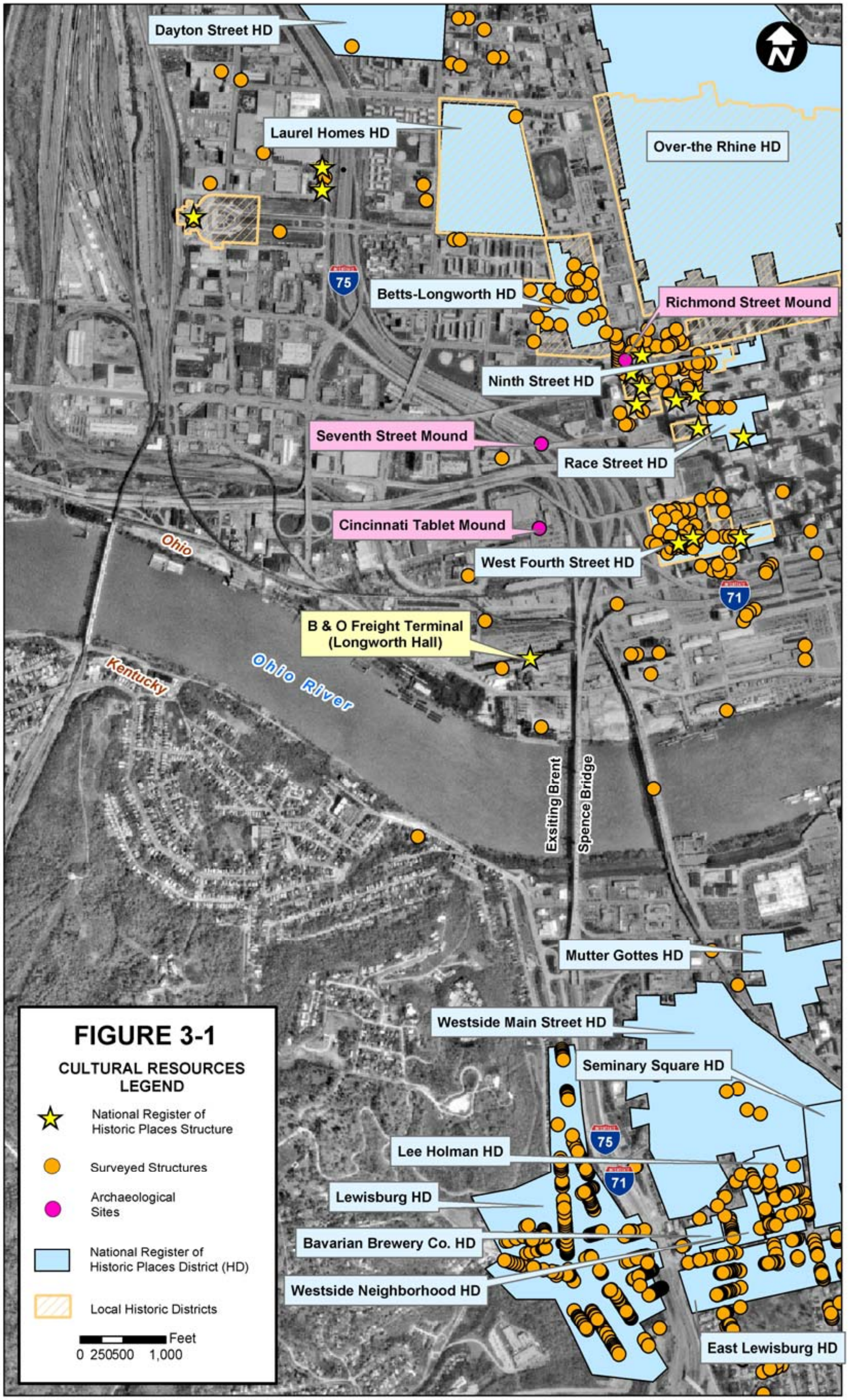
Previously recorded architectural properties are present in the study area on both sides of the Ohio River. The Ohio Historic Inventory (OHI) and Kentucky's William S. Webb Museum of Anthropology and Office of State Archaeology (OSA) files contain reference to over 1,000 structures. Cultural resource surveys, including previously assigned inventory numbers, show only individual properties that lie outside of the National Register districts, as the number of properties inside the districts is quite high (Appendix A). The known architectural resources and districts are briefly discussed below.

2.2.1 OHIO

The Ohio State Historic Preservation Office (OHPO) database contains information on 231 individual buildings or features which have been assigned OHI numbers within the study area. Of this grouping, 17 individual properties have been determined eligible for the National Register of Historic Places (NRHP) or are listed on the NHRP. Of these, 2 individual properties also are designated National Historic Landmarks (Plum Street Temple and Union Terminal).

In addition to the individual properties, eight areas have been recommended or are listed as National Register (NR) Districts. These NR Districts lie partially within or abut the study area as do 16 additional properties or locations which have been designated as Local Historic Districts (LHDs).

The 231 properties listed on the OHI are shown on Figure 3-1 and in more detail in Appendix A. The location plottings on the figure are based on Universal Transverse Mercator (UTM) information provided in various OHPO databases. The exact locations of the 231 properties have not been field confirmed. The most notable known error in the existing OHPO GIS property plottings are those of Carew Tower. The building is plotted in different locations in the OHPO National Register and OHI files. Both plottings are shown in Appendix A. The building is located at the easternmost location.


Dayton Street HD
Laurel Homes HD
Over-the Rhine HD
Betts-Longworth HD
Richmond Street Mound
Ninth Street HD
Seventh Street Mound
Race Street HD
Cincinnati Tablet Mound
West Fourth Street HD
Ohio
B & O Freight Terminal (Longworth Hall)
Ohio River
Kentucky
Exsiting Brent
Spence Bridge
75
71
Mutter Gottes HD
Westside Main Street HD
Seminary Square HD
Lee Holman HD
Lewisburg HD
Bavarian Brewery Co. HD
Westside Neighborhood HD
East Lewisburg HD
FIGURE 3-1
CULTURAL RESOURCES LEGEND
National Register of Historic Places Structure
Surveyed Structures
Archaeological Sites
National Register of Historic Places District (HD)
Local Historic Districts
Feet
0 250500 1,000

The NRHP individual properties include 17 buildings. Of these, the one currently closest to the existing bridge approach corridor is the B&O Freight Terminal building (now locally called Longworth Hall and Design Center). Located between 2nd and 3rd Streets, Longworth Hall lies adjacent to the west side of the bridge approach (Mitchell 1986) (Figure 3-1). The individual NRHP properties range in age from 1810 (Betts House) to 1933 (Cincinnati Union Terminal) and include both secular and religious structures.

Longworth Hall

The eight NRHP Districts include: Betts-Longworth, Dayton Street, Laurel Homes, Ninth Street, Over-the-Rhine, Race Street, West Fourth Street, and West Fourth Street Amendment. As shown on Figure 3-1 and in Appendix A, the districts are concentrated east of I-75 where they encompass significant tracts within downtown Cincinnati. The districts were listed between 1973 (Dayton Street) and 1995 (Race Street) and there are currently 1,646 buildings included within district boundaries. Unlike the NRHP districts on the Kentucky side which are dominated by residential buildings, many of the Ohio-side districts are comprised of commercial buildings or buildings now undergoing conversion from commercial to residential uses.

2.2.2 KENTUCKY

The Kentucky Heritage Council (KHC) databases contain information on 879 individual buildings or features which have been assigned Kentucky OSA designations within the study area (Figure 3-1). Of this grouping, 141 properties have been determined not eligible for the NRHP, 174 are listed on or determined eligible for the NRHP and lie outside for NR District boundaries, and 564 are within NR Districts and listed on or determined eligible for the NRHP. All or parts of nine NR Districts are present in the study area.

The Kentucky OSA properties include both residential and commercial buildings. As was the case on the Ohio side of the study area, both secular and religious buildings are included as individual properties and as contributing elements to the NR Districts. The buildings date predominately to the nineteenth century within the commercial districts. In particular, the Covington Downtown District, just outside the study area, contains a variety of pre-World War II, twentieth-century buildings as well. For reasons related to the historic period settlement pattern, the majority of the buildings in the study area, however, are residential. Initial settlement of the Covington/Newport area began to either side of the Licking River. Residential development spread east-to-west from the Licking River to Willow Run which lay at the base of Kenton/Park Hills. Thus, buildings within the West Side/Mainstrasse, Lewisburg, and Westside Neighborhood NR Districts, in particular, tend to be residential rather than commercial (Sahrbacker 1991; Kornilowicz-Weldon 1993).

The nine NR Districts include: Bavarian Brewery Co., East Lewisburg, Fort Mitchell Heights, Lee Holman, Lewisburg, Mutter Goettes, Seminary Square, West Side/Mainstrasse, and

Westside Neighborhood. As shown on Figure 3-1 and in Appendix A, the districts are located on both the east and west sides of existing I-75 and encompass large areas of the study area. Unlike the Ohio side, the Covington, Kentucky-area NR Districts are dominated by residential buildings (Anonymous n.d.; Henderson 1980; Langsam 1983; Sahrbacker 1991; Kornilowicz-Weldon 1993).

2.3 ARCHAEOLOGICAL RESOURCES

Terrestrial archaeological sites are known to exist in the study area on both sides of the river. There are currently five recorded sites listed in either the Ohio Archaeological Inventory (OAI) or Kentucky's OSA files. No underwater shipwrecks are listed in either site and, as far as can be determined, no systematic underwater survey has been conducted of the Cincinnati – Covington – Newport stretch of the Ohio River. The known archaeological resources in each state are briefly discussed below as are the expected archaeological resources.

2.3.1 OHIO

According to the OHPO files, there are four archaeological sites recorded within the study area (Figure 3-1). All of the sites are prehistoric and all of them were disturbed in the historic period. The sites are 33Ha1 (Cincinnati Tablet Mound), 33Ha242, 33Ha311 (Seventh Street Mound), and 33Ha312 (Richmond Street Mound). Although Site 33Ha242 is unnamed, it, like the other three sites, is noted as a prehistoric mound site (Appendix A).

Site 33Ha312 is unassigned to a specific Woodland period and its mound characteristics are unspecified. Similarly, the construction characteristics of the mound at the Middle Woodland Seventh Street Mound (Site 33Ha311) also are unspecified. In contrast, Site 33Ha1 is an earthen mound assigned to the Early Woodland period and Site 33Ha242 is reported as a Middle Woodland stone mound.

Both Adena and Hopewell mound sites are known to have functioned as both mortuary and residential loci. In the case of Sites 33Ha1 and 33Ha311, mortuary use was identified. All of the sites, however, yielded lithics, ceramics, floral, and faunal remains. The presence of these artifact classes suggests residential use within the site boundaries though likely not of the mounds proper.

In all cases, the prehistoric sites are on the first and second terraces above the main stream Ohio and Mill Creek valleys. Historic development on both terraces and on the active floodplain has impacted any prehistoric deposits except possibly those buried at depth. Prehistoric sites, however, are identified in all of these settings when even a limited systematic Phase I survey is conducted (Purtill et al. 2003).

Although no historic archaeological sites are recorded within the Ohio side of the study area, historic archaeological sites do exist. The most prominent of these is the Cincinnati & White Water Canal, which is shown on early maps (Bowman and Scroggs 1978). The then-abandoned canal between Cincinnati and Valley Junction, Ohio, was purchased in 1863 by the Cincinnati & Indiana Railroad Company. The Cincinnati & Indiana used the existing canal bed in which to construct a new rail bed (Anonymous 1899:12-13). Today, the canal tow path and bed are obvious north of the B&O Freight Terminal building between 2nd and 3rd Streets.

During recent construction for the Paul Brown Stadium, its associated facility field, and Fort Washington Way, historic features in the form of foundations and shaft features were observed in the areas northeast of I-75 and the Brent Spence Bridge approach lanes and the Clay Wade Bailey Bridge. Historic maps illustrating this area and the zone northwest of the approach lanes in the vicinity of the B&O Freight Terminal Building show increasingly dense commercial and industrial buildup of the area between 1815 and 1908 (Anonymous 1815; Robinson & Fairbank 1829; Barnum 1831; Rickey 1846; Mendenhall 1908). Buildings dating to all nineteenth and twentieth century decades, except the period 1800 to 1840, still exist in this portion of the study area; others were removed to make way for new development. Based on excavations conducted elsewhere in the urban core of Cincinnati and along its riverfront (Anonymous 1988), it is likely that building remnants and intact features such as privies, cisterns, and wells, remain. As noted above in the redevelopment discussion, these features are now buried or otherwise obscured.

2.3.2 KENTUCKY

The single previously recorded archaeological site on the Kentucky side is Site 15Ke122 and is located in the southern most part of the study area (Appendix A). This historic scatter with associated feature provides little insight into the types of archaeological sites likely to occur in the Kentucky portion of the study area. Based on features revealed, however, during the redevelopment of the area immediately east of the bridge between the Internal Revenue Service Center and the bridge approach lanes, it is likely that possible resources will duplicate those of the Ohio side. During the redevelopment, historic features in the form of foundations, privies, wells, and cisterns were observed. This was expected, as the area was dominated by small industry and residential buildings in the nineteenth and early twentieth centuries (Anonymous n.d.; Henderson 1980; Langsam 1983; Sahrbacker 1991; Kornilowicz-Weldon 1993).

2.4 KEY CULTURAL RESOURCES ISSUES

Any proposed modification to the Brent Spence Bridge location and its approaches will have an impact on previously recorded cultural properties and will likely impact presently unrecorded terrestrial archaeological resources. In addition, the possibility exists that presently unrecorded underwater archaeological resources are present within the study area as currently defined. Based on the research conducted in the development of this technical memorandum, the key cultural resource issues from north to south in the study area are:

- Eastward expansion of I-75 north of Liberty Street would impact the Dayton Street Historic District and might impact the NRHP-listed Police Station No. 5. In addition, there is a high likelihood that archaeological features would be present.

- Westward expansion of I-75 immediately north of Lincoln Park may impact two NRHP-listed properties (Ohio National Guard Armory and Our Lady of Mercy High School).

- Eastward expansion of I-75 between 4th and 5th Streets north of the I-75/Fort Washington Way interchange would impact the West Fourth Street and West Fourth Street Amendment NR Historic Districts. In addition, there is a high likelihood that archaeological features would be present.

- Westward expansion or new construction of I-75 west of existing I-75 between the river and 3rd Street would likely impact the National Register-listed B&O Freight Terminal Building. This building is currently covered by a preservation easement managed by the Cincinnati Preservation Association (CPA). Construction or expansion might also affect remnants of the now-abandoned and converted Cincinnati & White Water Canal. Finally, there is a high likelihood that archaeological features would be present.

- Potential submerged cultural resources including shipwrecks may exist in the Ohio River on either riverfront and in the channel.

- Westward expansion or new construction of I-75/I-71 west of existing I-75/I-71 between the riverfront and the Euclid Avenue interchange could impact the Lewisburg NR Historic District and its individually listed elements. In addition, there is a high likelihood that archaeological features would be present.

- Eastward expansion or new construction of I-75/I-71 east of existing I-75/I-71 between the riverfront and the Euclid Avenue interchange could immediately impact the West Side /Mainstrasse, Westside Neighborhood, Bavarian Brewery Co., and East Lewisburg NR Historic Districts and their individually listed elements. In addition, there is a high likelihood that archaeological features would be present.

- In general, sites that are eligible or listed in the NRHP are also protected under section 4(f) of the United States Department of Transportation Act of 1966 (49 USC 303); therefore, potential impacts to above detailed properties would require further investigation.

- Further, potential impacts to noted cultural resources will also initiate the Section 106 process associated with the National Historic Preservation Act of 1966.

2.5 ANALYSIS OF ALTERNATIVES

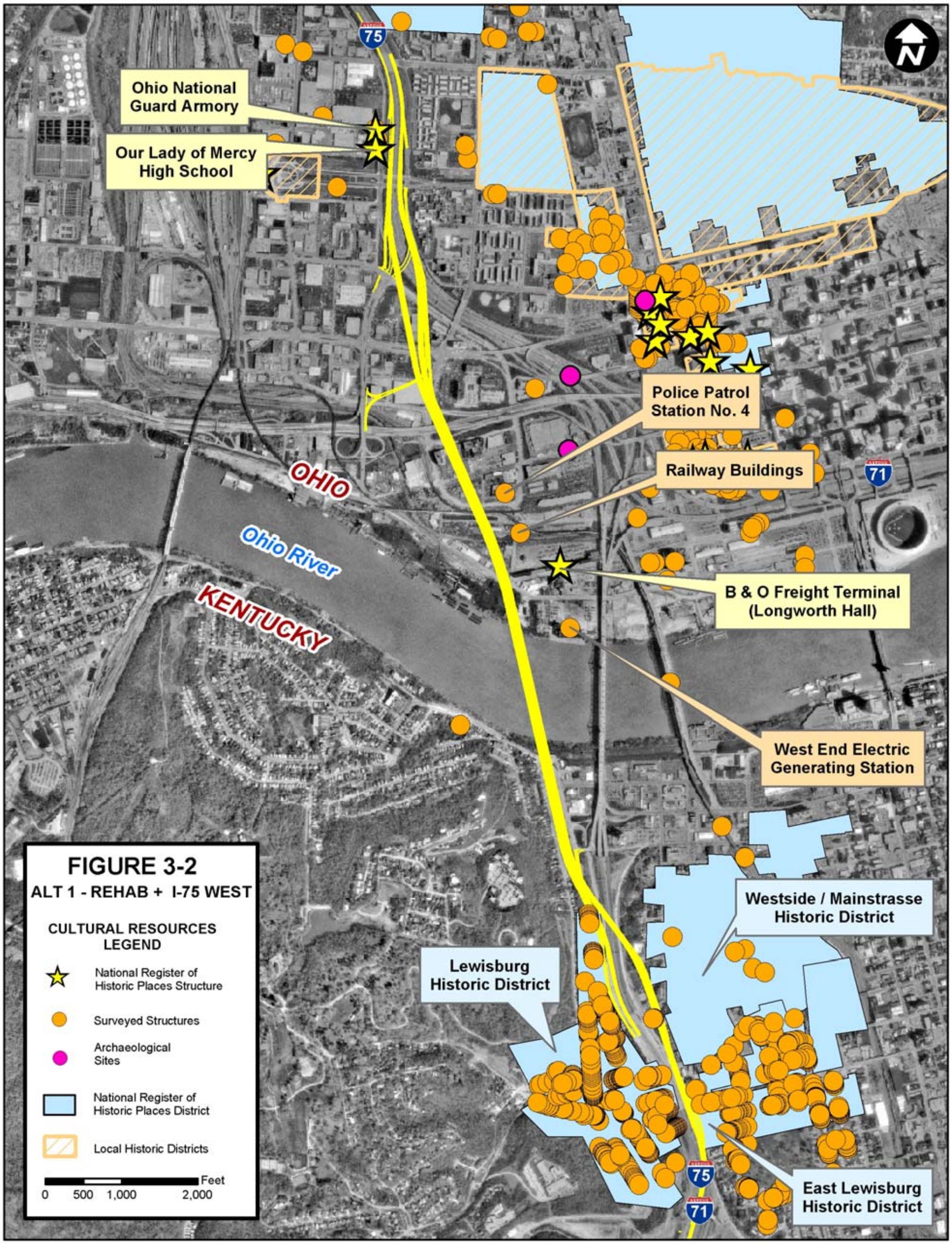
Analysis of the conceptual alternatives was conducted by reviewing the corridor that defines the individual alternatives, as well as immediately adjacent properties that may be impacted by the resultant right-of-way acquisition.

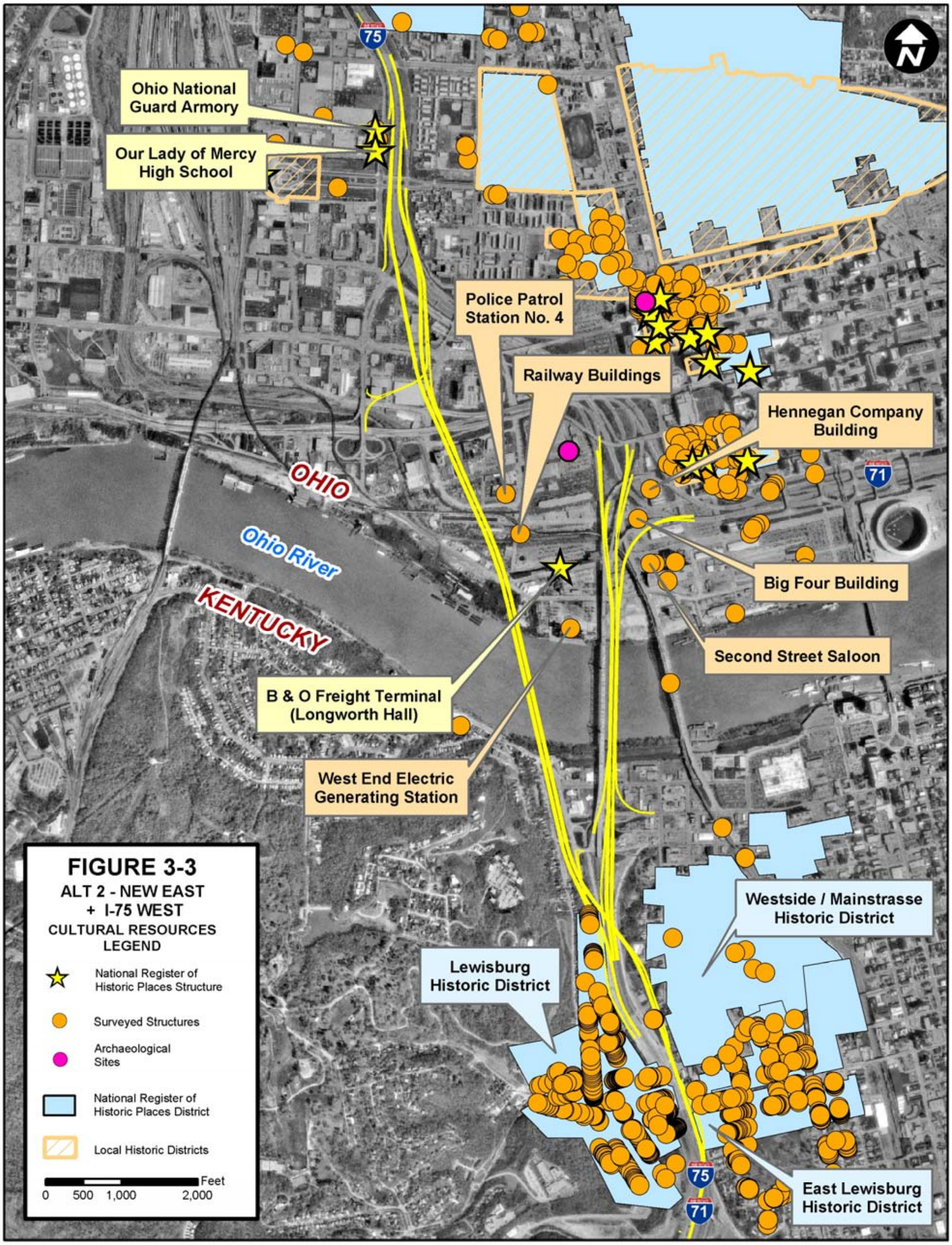
The five remaining conceptual alternatives carry differing potential impacts to architectural and archeological resources. Alternative 1, 2, and 6 (*Rehab plus I-75 West, New East plus I-75 West, and Rehab plus I-75 / I-71 West)* contain a new road segment that is in close proximity to three historic structures listed on the NRHP (Ohio National Guard Armory, Our Lady of Mercy High School, and the B & O Freight Terminal), as well as three potentially eligible structures (Police Patrol Station No. 4, Railway Buildings, and the West End Electric Generating Station). In addition, Alternative 2 includes a ramp structure that could result in noise and viewshed impacts to a cluster of eligible properties including the Second Street Saloon, the Hennegan Company Building, and the Big Four Building. The previously listed structures are located on the Ohio side of the study area. Alternative 1, 2, and 6 also may have some impacts on potentially eligible structures on the Kentucky side. These include a variety of properties in the Lewisburg Historic District (Figures 3-2, 3-3, and 3-4).

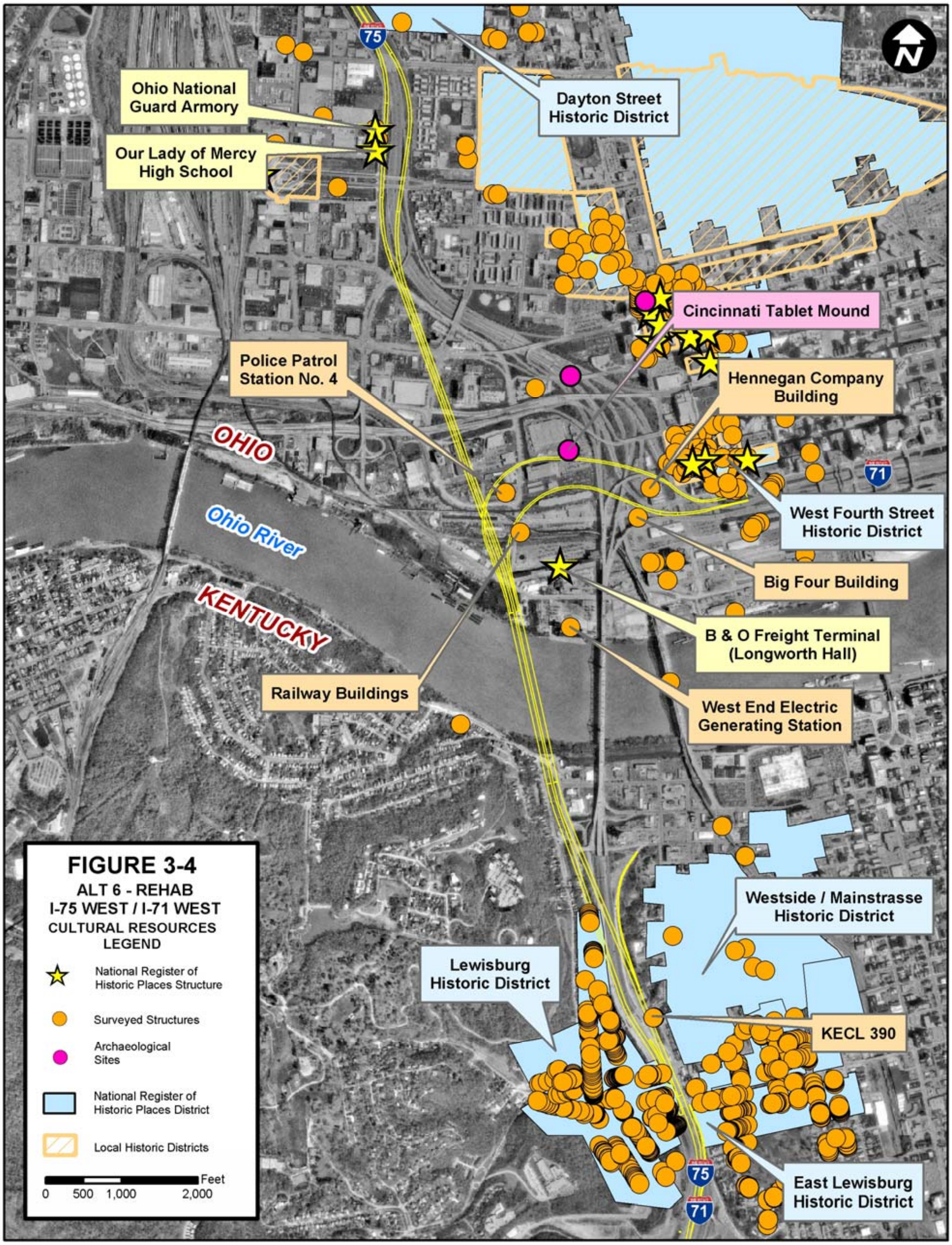
Furthermore, Alternative 6 (*Rehab plus I-75 West / I-71 West*) also potentially impacts eligible structures known as the Hennegan Company Building and the Big Four Building, and the nearby West Fourth Street Historic District. The ramps associated with Alternative 6 will also likely present greater adverse impacts to the Police Patrol Station No. 4 and the Railway Buildings than Alternatives 1 and 2. Finally, while the archeological site known as the Cincinnati Tablet Mound currently appears to be paved over with roadway or parking lot, it may be further impacted or disturbed by Alternative 6 as well (Figure 3-4). Therefore, Alternative 6 carries the highest potential impacts to cultural resources while Alternatives 1 and 2 carry moderate impacts to said resources.

Alternative 5 (*Double Bridge Replacement [Elevated I-75 Roadways in Ohio]*) also runs adjacent to NRHP sites such as the Ohio National Guard Armory, Our Lady of Mercy High School, and the B & O Freight Terminal (Figure 3-5). This alternative may have direct impacts (physical, noise, and/or visual) on the Hennegan Company Building, the Big Four Building, the Second Street Saloon, and the Seventh Street Mound archaeological site. However, a refined engineering footprint may reduce or avoid physical impacts to the structures and/or the structures may be deemed ineligible upon field observation. In addition, the West Fourth Street Historic District is located immediately east of the proposed approach for Alternative 5. The Hennegan Company Building, the Big Four Building, the West Fourth Street Historic District, the Second Street Saloon, and the Seventh Street Mound archaeological site should be evaluated as the *Double Bridge Replacement (Elevated I-75 Roadways in Ohio)* is further considered. According to aerial photography, both archaeological sites in or near the alignment (Cincinnati Tablet Mound and Seventh Street Mound) currently appear to be paved over with roadway or parking lot. Alternative 5 bears moderate impacts to cultural resources.

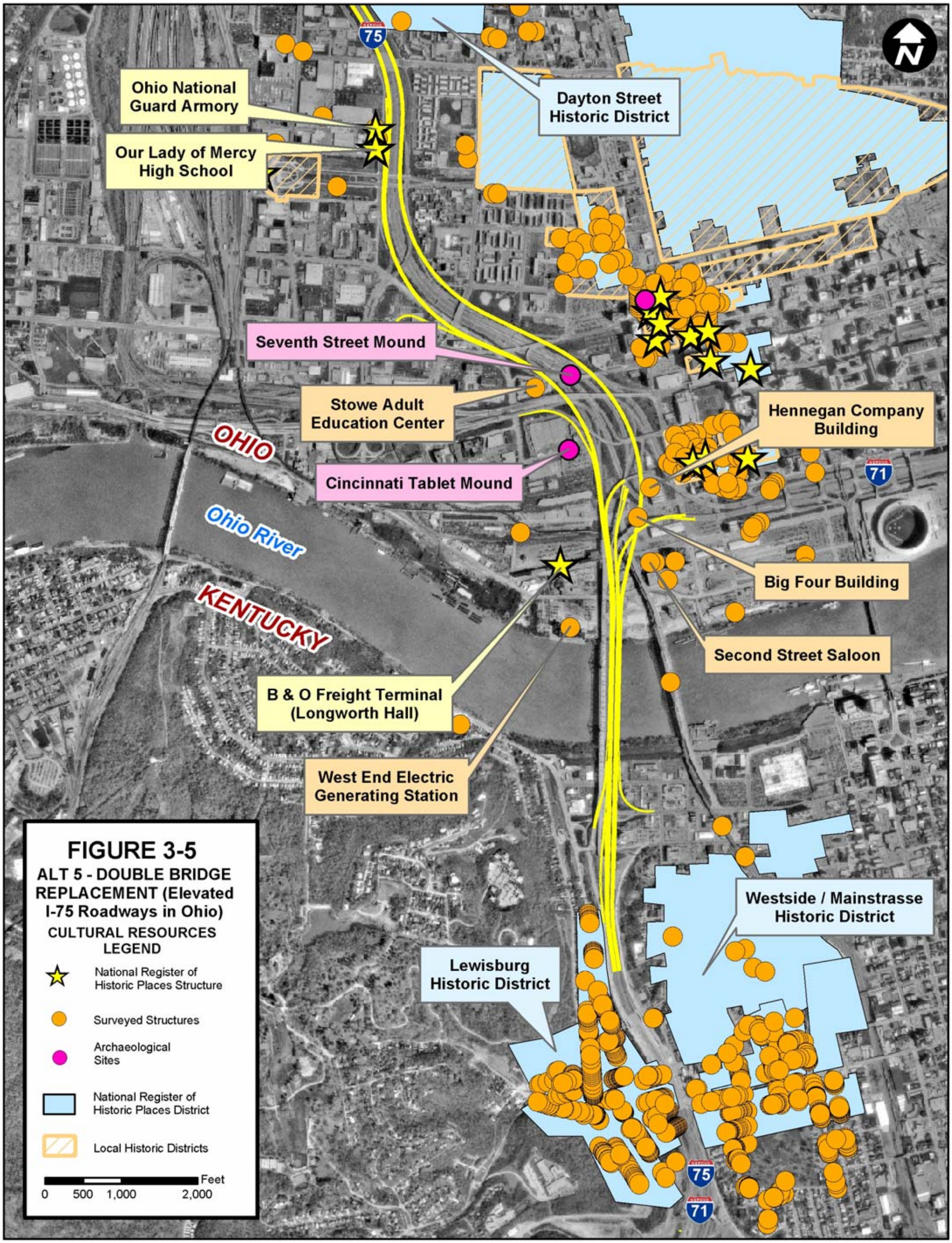
Alternative 4 (*Single Bridge Replacement*) carries the lowest potential impacts to cultural resources. The only nearby structures of concern are a cluster of eligible properties including the Second Street Saloon, the Hennegan Company Building, and the Big Four Building. A ramp structure associated with I-71 on the Ohio side could result in noise and viewshed impacts to these structures (Figure 3-6). Cultural resources on the Kentucky side appear not to be impacted by Alternative 4; however, a more detailed survey of eligible properties, as well as more precise engineering designs, is necessary before impacts to cultural resources can be confirmed.


Ohio National Guard Armory
Our Lady of Mercy High School
Police Patrol Station No. 4
Railway Buildings
OHIO
Ohio River
KENTUCKY
B & O Freight Terminal (Longworth Hall)
West End Electric Generating Station
Westside / Mainstrasse Historic District
Lewisburg Historic District
East Lewisburg Historic District
75
71
FIGURE 3-2
ALT 1 - REHAB + I-75 WEST
CULTURAL RESOURCES LEGEND
National Register of Historic Places Structure
Surveyed Structures
Archaeological Sites
National Register of Historic Places District
Local Historic Districts
Feet
0 500 1,000 2,000

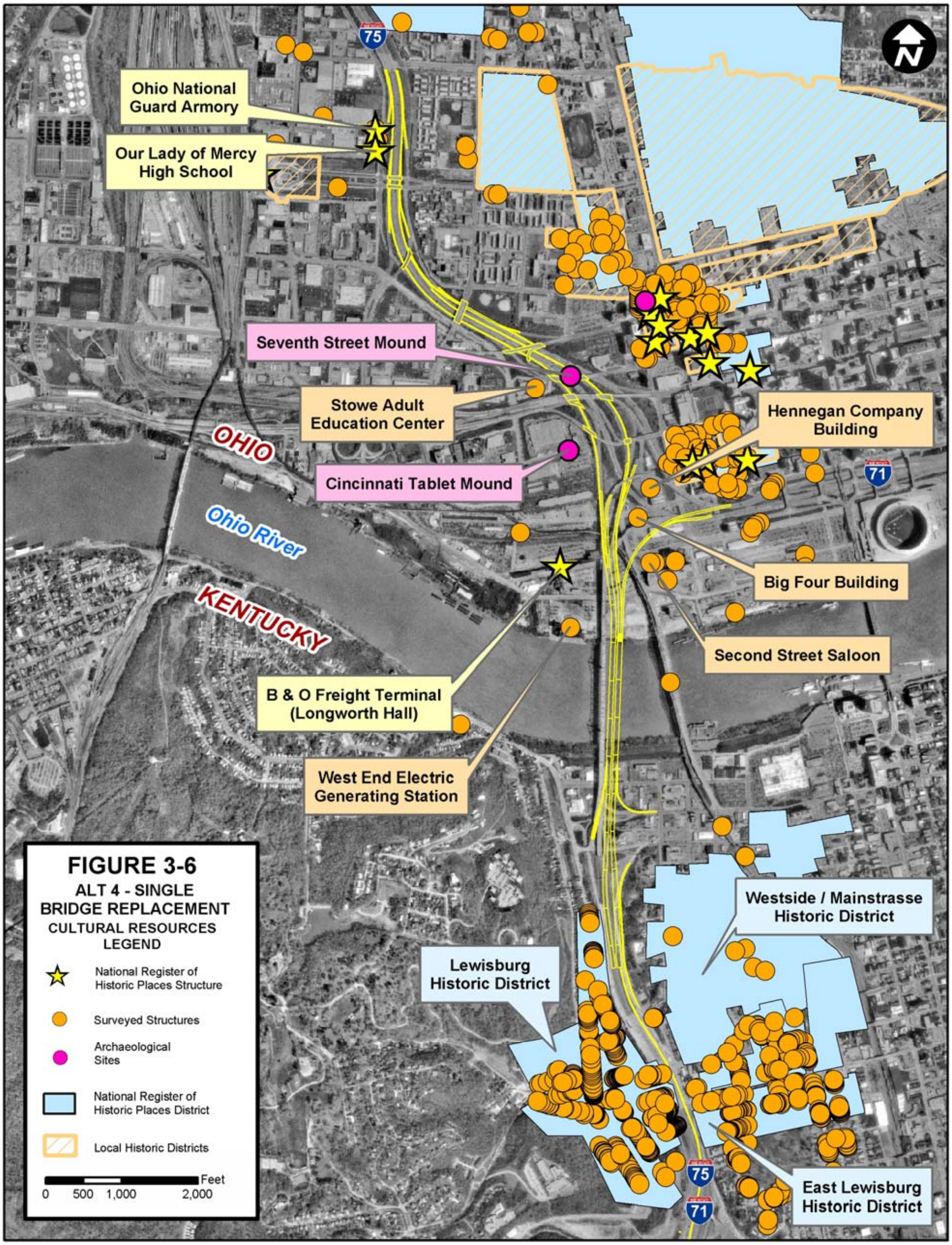

75
Ohio National Guard Armory
Our Lady of Mercy High School
Police Patrol Station No. 4
Railway Buildings
Hennegan Company Building
71
OHIO
Ohio River
KENTUCKY
Big Four Building
Second Street Saloon
B & O Freight Terminal (Longworth Hall)
West End Electric Generating Station
FIGURE 3-3
ALT 2 - NEW EAST + I-75 WEST
CULTURAL RESOURCES LEGEND
National Register of Historic Places Structure
Surveyed Structures
Archaeological Sites
National Register of Historic Places District
Local Historic Districts
Feet
0 500 1,000 2,000
Westside / Mainstrasse Historic District
Lewisburg Historic District
East Lewisburg Historic District
75
71



Ohio National Guard Armory
Our Lady of Mercy High School
Dayton Street Historic District
Cincinnati Tablet Mound
Police Patrol Station No. 4
Hennegan Company Building
OHIO
Ohio River
West Fourth Street Historic District
Big Four Building
KENTUCKY
B & O Freight Terminal (Longworth Hall)
Railway Buildings
West End Electric Generating Station
FIGURE 3-4
ALT 6 - REHAB
I-75 WEST / I-71 WEST
CULTURAL RESOURCES
LEGEND
National Register of Historic Places Structure
Surveyed Structures
Archaeological Sites
National Register of Historic Places District
Local Historic Districts
Feet
0 500 1,000 2,000
Westside / Mainstrasse Historic District
Lewisburg Historic District
KECL 390
East Lewisburg Historic District
75
71



Ohio National Guard Armory
Our Lady of Mercy High School
Dayton Street Historic District
Seventh Street Mound
Stowe Adult Education Center
Cincinnati Tablet Mound
Hennegan Company Building
Big Four Building
Second Street Saloon
B & O Freight Terminal (Longworth Hall)
West End Electric Generating Station
OHIO
Ohio River
KENTUCKY
Westside / Mainstrasse Historic District
Lewisburg Historic District
75
71
FIGURE 3-5
ALT 5 - DOUBLE BRIDGE REPLACEMENT (Elevated I-75 Roadways in Ohio)
CULTURAL RESOURCES LEGEND
National Register of Historic Places Structure
Surveyed Structures
Archaeological Sites
National Register of Historic Places District
Local Historic Districts
Feet
0 500 1,000 2,000
N



75
Ohio National Guard Armory
Our Lady of Mercy High School
Seventh Street Mound
Stowe Adult Education Center
Cincinnati Tablet Mound
OHIO
Ohio River
KENTUCKY
B & O Freight Terminal (Longworth Hall)
West End Electric Generating Station
Hennegan Company Building
71
Big Four Building
Second Street Saloon
Westside / Mainstrasse Historic District
Lewisburg Historic District
East Lewisburg Historic District
FIGURE 3-6
ALT 4 - SINGLE BRIDGE REPLACEMENT
CULTURAL RESOURCES LEGEND
National Register of Historic Places Structure
Surveyed Structures
Archaeological Sites
National Register of Historic Places District
Local Historic Districts
Feet
0 500 1,000 2,000

3.0 ENVIRONMENTAL RESOURCES

A desktop review of available Underground Storage Tank/Hazardous materials (UST/Hazmat) records and natural environment information was completed for the study area. Data from a variety of sources were compiled to evaluate the study area. Several agencies were contacted to acquire data pertaining to the human and natural environment of the study area. Those data sources are listed below.

- United States Environmental Protection Agency (EPA)
- United States Fish and Wildlife Service (USFWS) Region 3
- United States Army Corps of Engineers (USACE)
- Ohio EPA
- Ohio Department of Natural Resources (DNR)
- Ohio Bureau of Underground Storage Tank (UST) Regulations (BUSTR)
- Kentucky Department of Fish and Wildlife Resources (KDFWR)
- Kentucky Natural Resources and Environmental Protection Cabinet (KNREPC)
- Kentucky Division of Waste Management (KDWM)

3.1 HAZARDOUS MATERIALS

The significance of any specific UST/Hazmat record is unknown without completing a more detailed assessment, such as an agency hard copy file review typically conducted during a Phase I environmental site assessment. Some records may strongly suggest a significant liability to the project such as the presence of a federal Superfund site, municipal landfill, or a major abandoned industrial facility. No such records were identified for obvious red flag sites in the study area that would require special consideration by the project team when assessing the conceptual alternatives. It should be noted, however, that considering this project is located in a major urban area, UST/Hazmat concerns should be expected along any proposed alternative.

The large quantity hazardous waste generators (LQG), small quantity hazardous waste generators (SQG), treatment/storage/disposal facilities (TSD) and hazardous waste transporters (Transporter) data were downloaded from the EPA Envirofacts Data Warehouse. The downloaded data contained 421 records for hazardous waste generators and handlers in specified zip codes. The zip codes searched for Cincinnati were 45202, 45203, 45204, 45214, 45219, 45220, 45221, and 45225, and those searched for Covington were 41011, 41014, and 41016. All sites were overlaid on the study area and then were deemed inside or outside of the study area. Sites outside the study area were eliminated. Of the 421 total records, 37 are located within the study area. (Appendix B).

One hazardous waste site is specifically related to the Brent Spence Bridge. This site is related to the previous painting operation of the bridge. Sandblasting grit was not properly controlled and resulted in lead contamination in the soil below the bridge on the Kentucky side. The Kentucky Transportation Cabinet has completed partial corrective action, and additional work is anticipated.

UST data was obtained from two sources. The Kentucky Division of Waste Management (KDWM) maintains the UST database for the Commonwealth of Kentucky. UST data for Ohio was obtained from the Ohio Bureau of Underground Storage Tank Regulations (BUSTR), which is housed in the State Fire Marshal's Office of the Ohio Department of Commerce. Sites within the study area were identified using the zip code and address information, and plotted using geocoding software. There are 26 UST sites on the Kentucky side of the study area and 31 UST sites on the Ohio side of the study area. (Appendix B).

Ohio superfund sites were obtained from the Ohio EPA Division of Emergency and Remedial Response (DERR). The DERR provided graphic (GIS) data representing superfund sites within the Hamilton County portion of the study area. The file contained six sites; all of which are located within the study area. (Appendix B).

Kentucky superfund sites were obtained from the KDWM Superfund Branch. Of the 86 total records for Kenton County, only two are located within the study area and one of which is the Brent Spence Bridge (Appendix B).

Landfill locations were also researched during the environmental review process. The Ohio EPA Division of Solid and Infectious Waste Management website was accessed for information pertaining to possible landfills current or historically operated landfills in the study area. According to several sources on the website, no landfills are located on the Ohio side of the study area. In addition, the Kentucky Division of Waste Management website was reviewed for the presence of any current or historically operated landfills in Kenton County. According to the list of Permitted Solid Waste Landfills, there are none present in Kenton County.

3.2 ECOLOGICAL RESOURCES

The highly developed urban nature of the study area suggests that natural environment concerns are minimized. There is minimum natural terrestrial habitat in the study area; however, the Ohio River represents a significant aquatic resource.

The presence of mussel beds in the Ohio River between river miles 470 and 472 was researched by contacting the United States Army Corps of Engineers (USACE), the Ohio DNR Division of Water, the Kentucky Department of Fish and Wildlife Resources (KDFWR), and the Kentucky State Nature Preserves Commission (KSNPC). Responses indicate that the study area is in the range of several federal endangered mussels. Several surveys of freshwater mussels in the Ohio River were reviewed but none occurred within the study area. The potential presence of endangered mussels species in the Ohio River will require mussel surveys to determine if any particular alternative would impact any species.

Potential wetland locations were obtained from the KDFWR and the Ohio DNR Geographic Information Systems (GIS). Potential wetlands were identified on both the Ohio and Kentucky sides of the study area (Appendix B).

The study area was also researched for the presence of wild and scenic rivers, outstanding resource waters, high quality fishing streams and spawning areas. The Commonwealth of

Kentucky confirmed that there are no designated wild and scenic rivers, outstanding resource waters, high quality fishing streams or spawning areas in the study area (Cliff Schneider, personal correspondence).

Several agency websites were reviewed for the presence of threatened and endangered (T&E) species in the study area. The Ohio Natural Heritage Database of T&E species contains lists of endangered species in Hamilton County. Kentucky also has similar lists housed at the KDFWR and the KSNPC. Neither of the state databases revealed specific locations or habitats within the study area. Additionally, the USFWS websites for Regions Three and Four contain "by county" lists of T&E species ranges. The USFWS Region 3 listed the Indiana bat [federally endangered (E)], the bald eagle (federally threatened), running buffalo clover (E), and the sheepnose mussel [candidate for federal listing (C)] with ranges that include Hamilton County, Ohio. Likewise, the USFWS Region 4 listed running buffalo clover and the following mussel species with ranges that include Kenton County, Kentucky: rough pigtoe (E), tuberculed-blossom pearly mussel (E), pink mucket pearly mussel (E), white wartyback pearly mussel (E), orange-footed pearly mussel (E), cracking pearly mussel (E), ring pink (E), winged mapleleaf (E), purple cat's paw pearly mussel (E), fanshell (E), clubshell (E), northern riffleshell (E), and scaleshell (C). No specific point locations for T&E species or critical habitat were identified in the study area; however, potential habitat characteristics for the Indiana bat, running buffalo clover, and freshwater mussels may exist within the study area. It can be anticipated the USFWS will identify several freshwater mussel species, the Indiana bat, and running buffalo clover as potentially being impacted by the project and may require species-specific surveys.

The presence of nature preserves, natural areas, state parks, national parks, local parks, and other public land was also researched. The Kentucky Stewardship data, obtained from KDFWR information systems, did not reveal any state or national parks or preserves in the Kentucky portion of the study area. The Ohio DNR Division of Natural Areas and Preserves did not reveal any state or national parks or preserves in the study area around Cincinnati. Data provided with ESRI ArcView 8.3, as well as area maps, provided local park locations, of which there are several in the study area. The largest, Devou Park, is located partially within the study area in Covington (Appendix B). Other parks that boarder the corridors include Lincoln Park, Laural Park, Lincoln Recreation Complex, the Queensgate Ballfields, and Albert B. Sabin Park on the Ohio side, as well as Goebel Park on the Kentucky side.

The Kentucky Natural Resources and Environmental Protection Cabinet (NREPC) Division of Forestry and the Ohio DNR Division of Forestry were both contacted to determine if any state or national champion trees are located within the study area. No state or national champion trees are recorded within Kenton County. Four state champion trees are recorded within Cincinnati; however, none of these are located within the study area.

3.3 KEY ENVIRONMENTAL RESOURCES ISSUES

- Many local parks boarder the existing interstate corridor. Expansion outside the corridor to the east or west on both the Ohio side and Kentucky side would impact these resources. These resources are protected under Section 4(f) the United States Department of Transportation Act of 1966 (49 USC 303).

- Several small potential wetland areas are indicated west of the existing interstate corridor in Cincinnati along the Ohio River. These areas may represent important riparian habitat. Further field investigation would be required if expansion was planned west of the study area.

- Several UST sites are located in the study area; particularly, a concentrated number exist on the Kentucky side surrounding the southern bridge landing area. This is also the location of a hazardous materials incident associated with the Brent Spence Bridge. Expansion or reconstruction in an area surrounding the bridge approach on the Kentucky side would warrant consideration of these materials.

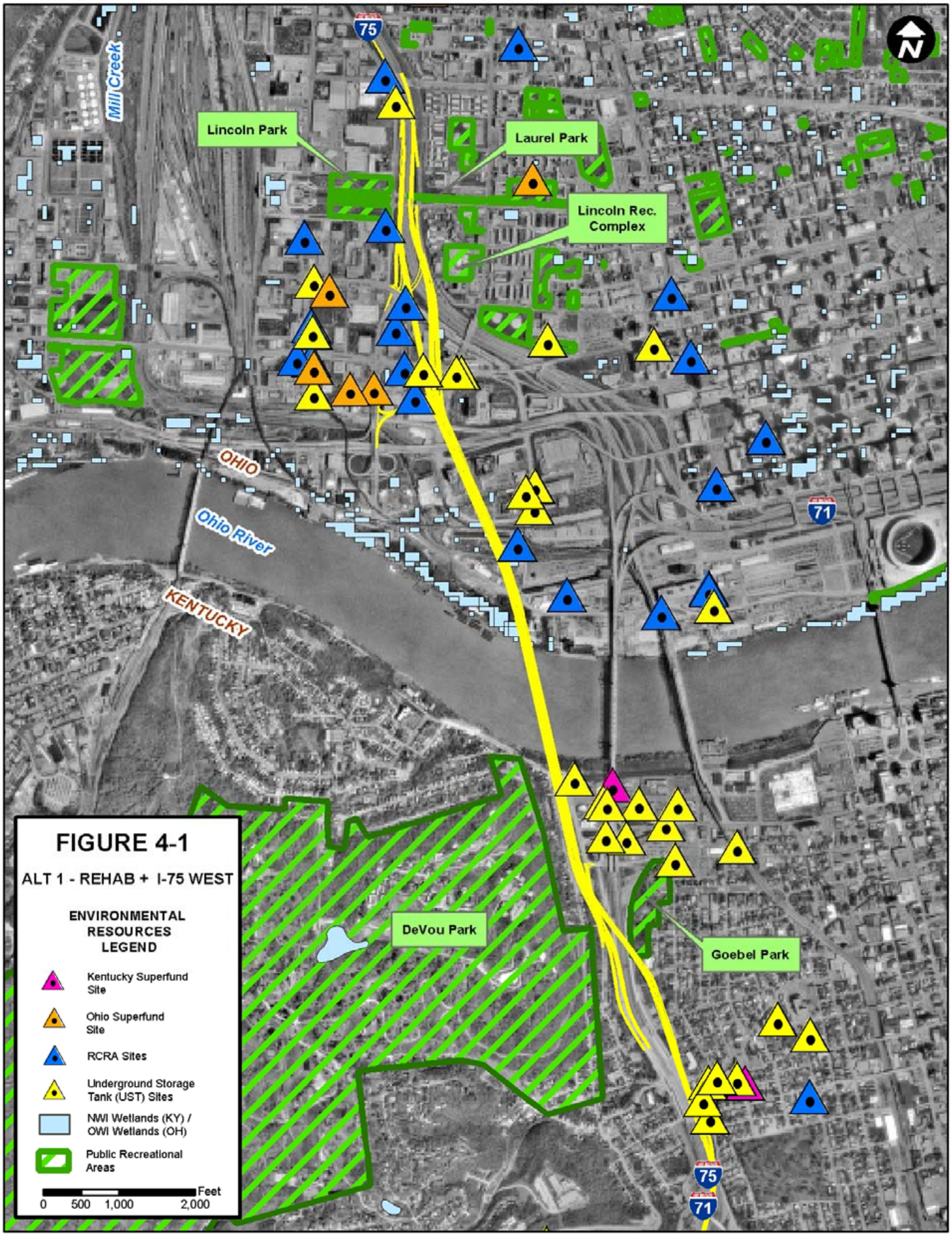
3.4 ANALYSIS OF ALTERNATIVES

Analysis of the conceptual alternatives was conducted by reviewing the corridor that defines the individual alternatives, as well as immediately adjacent properties that may be impacted by the resultant right-of-way acquisition.

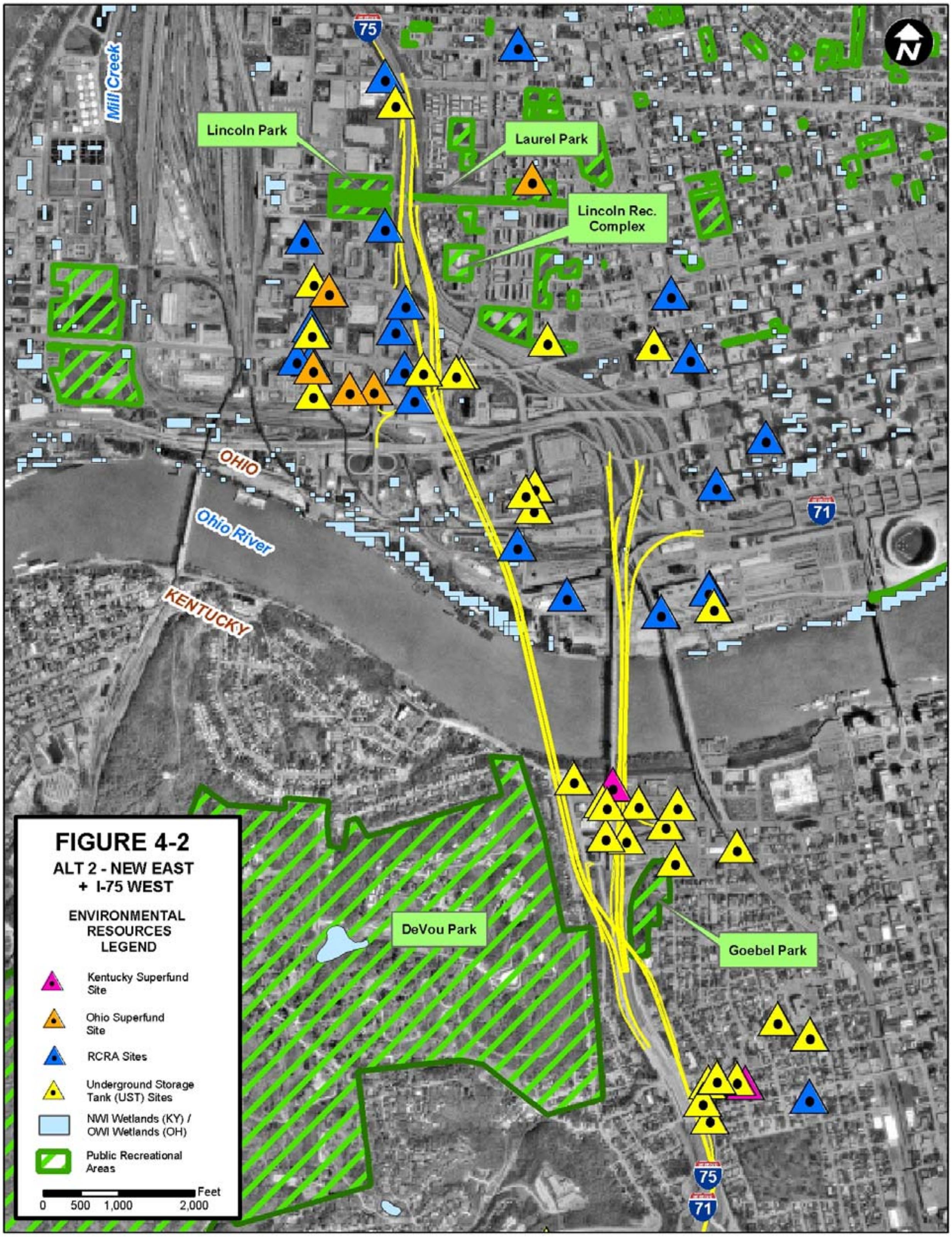
Several RCRA and UST sites are located along the conceptual alternatives. Alternative 1, 2, and 6 (*Rehab plus I-75 West, New East plus I-75 West, and Rehab plus I-75 / I-71 West)* share similar routes and therefore, share similar hazardous material resource related concerns. Eight RCRA sites are located along/adjacent to these alternatives (within 500 feet). Intermodal Transportaion Services, Inc. and Key Truck Sales appear to be the only RCRA sites potentially impacted by Alternatives 1, 2, and 6; although, the proposed alignments do not represent exact design footprints. Numerous USTs are also located immediately adjacent to these conceptual alternatives. They include: seven unnamed USTs on the Ohio side of the study area and six unnamed UST sites on the Kentucky side of the study area. Alternatives 1, 2, and 6 also carry potential impacts to the Brent Spence Bridge Superfund site, as well as five small potential wetland areas (according to National Wetland Inventory and Ohio Wetland Inventory data sets). Relative to other alternatives, Alternatives 1, 2, and 6 present moderate impacts to hazardous material sites and wetlands.

Goebel Park in Covington is located immediately adjacent to the conceptual corridors of Alternatives 1, 2, and 6; however, initial engineer plans indicate that impacts near the park will be contained within the existing right-of-way (Figures 4-1, 4-2 and 4-3). Given this, Alternatives 1, 2, and 6 carry low impacts to park resources.

Three RCRA sites and two unnamed UST sites are located adjacent to Alternatives 4 (*Single Bridge Replacement)* on the Ohio side, while five RCRA sites and two unnamed UST sites are located adjacent to Alternative 5 (*Double Bridge Replacement [Elevated I-75 Roadways in Ohio]*) on the Ohio side (Figure 4-4 and 4-5). Several USTs are also located adjacent to the existing corridor on the Kentucky side representing potential impacts for both Alternatives 4 and 5. Similarly, a superfund site, namely paint related material from the Brent Spence Bridge, is also located on the Kentucky side. This site would likely be disturbed by construction activities associated with both Alternatives 4 and 5.



Mill Creek
75
Lincoln Park
Laurel Park
Lincoln Rec. Complex
OHIO
Ohio River
KENTUCKY
71
DeVou Park
Goebel Park
75
71
FIGURE 4-1
ALT 1 - REHAB + I-75 WEST
ENVIRONMENTAL RESOURCES LEGEND
Kentucky Superfund Site
Ohio Superfund Site
RCRA Sites
Underground Storage Tank (UST) Sites
NWI Wetlands (KY) / OWI Wetlands (OH)
Public Recreational Areas
Feet
0 500 1,000 2,000


75
Mill Creek
Lincoln Park
Laurel Park
Lincoln Rec. Complex
OHIO
Ohio River
KENTUCKY
71
DeVou Park
Goebel Park
FIGURE 4-2
ALT 2 - NEW EAST + I-75 WEST
ENVIRONMENTAL RESOURCES LEGEND
Kentucky Superfund Site
Ohio Superfund Site
RCRA Sites
Underground Storage Tank (UST) Sites
NWI Wetlands (KY) / OWI Wetlands (OH)
Public Recreational Areas
Feet
0 500 1,000 2,000

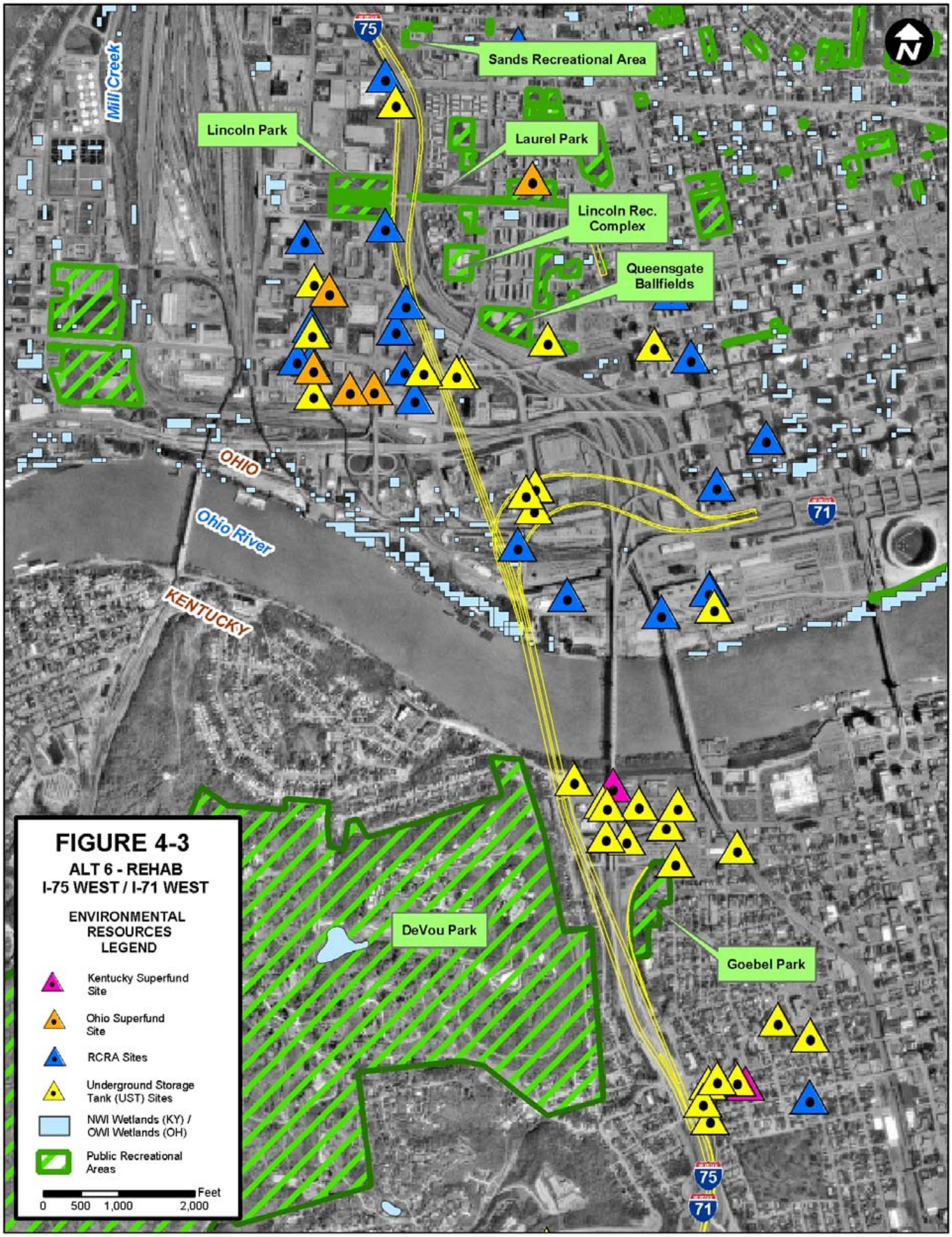


FIGURE 4-3
ALT 6 - REHAB
I-75 WEST / I-71 WEST
ENVIRONMENTAL
RESOURCES
LEGEND
Kentucky Superfund Site
Ohio Superfund Site
RCRA Sites
Underground Storage Tank (UST) Sites
NWI Wetlands (KY) / OWI Wetlands (OH)
Public Recreational Areas
Feet
0 500 1,000 2,000
Sands Recreational Area
Lincoln Park
Laurel Park
Lincoln Rec. Complex
Queensgate Ballfields
Mill Creek
OHIO
Ohio River
KENTUCKY
DeVou Park
Goebel Park
75
71

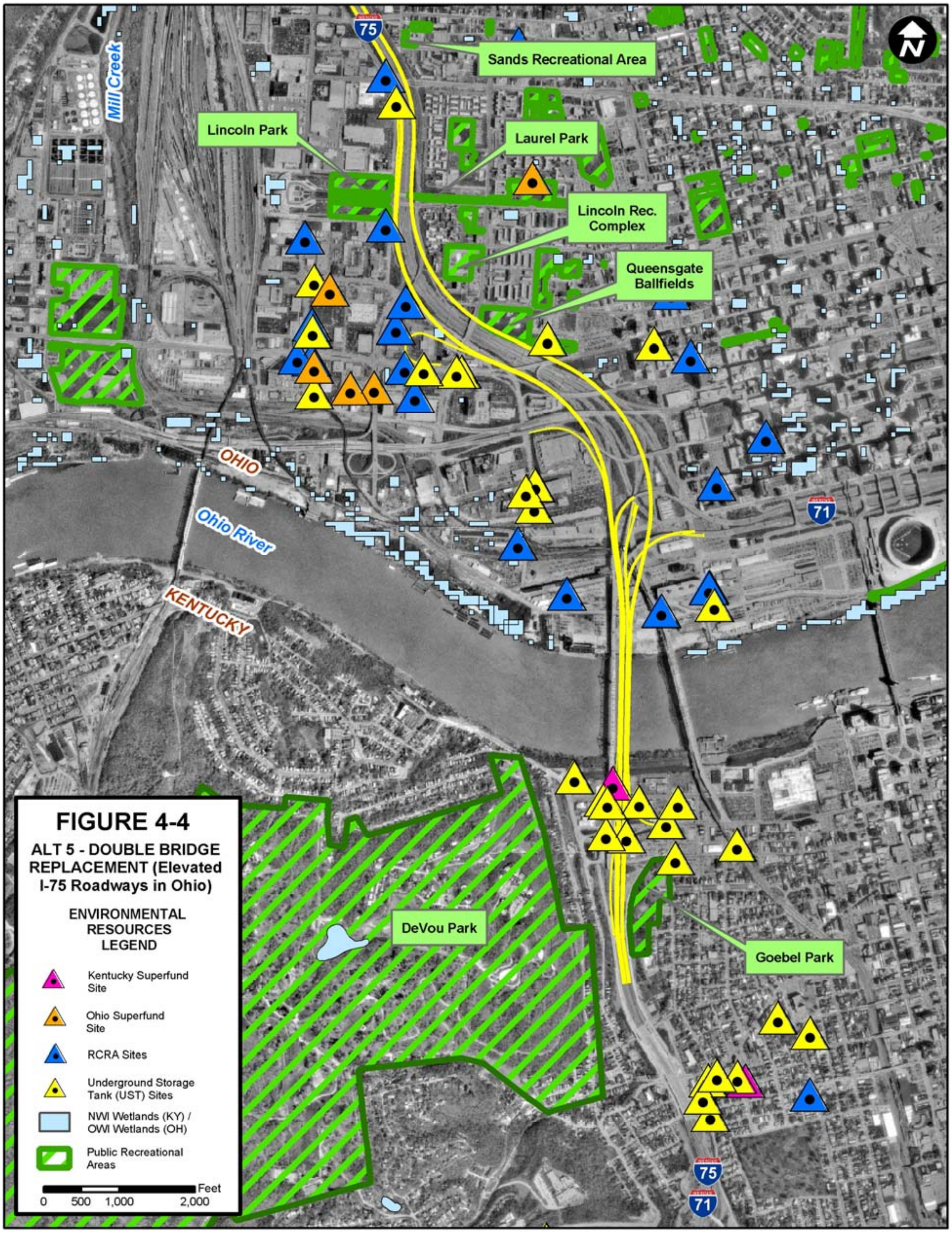
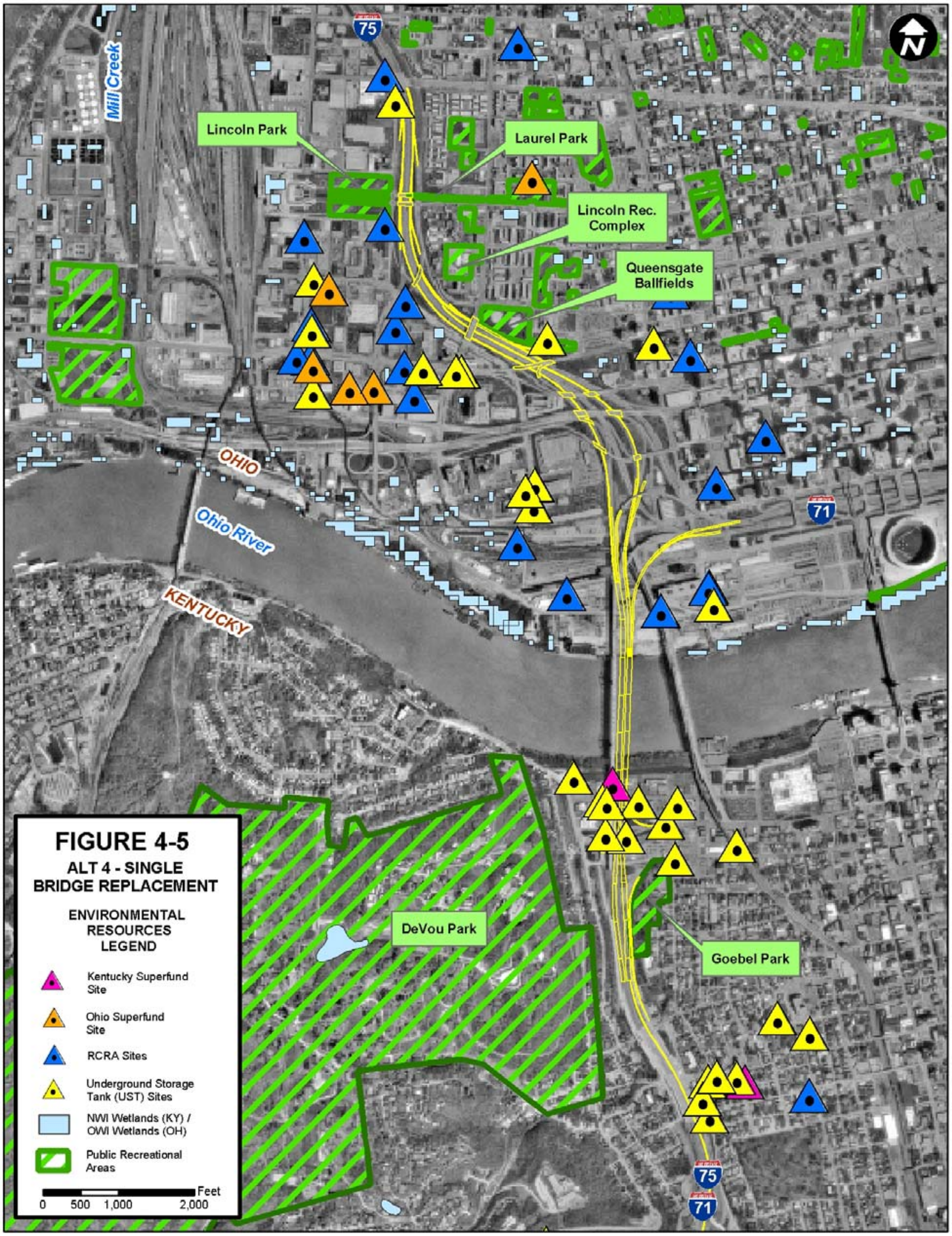


FIGURE 4-4
ALT 5 - DOUBLE BRIDGE REPLACEMENT (Elevated I-75 Roadways in Ohio)
ENVIRONMENTAL RESOURCES LEGEND
Kentucky Superfund Site
Ohio Superfund Site
RCRA Sites
Underground Storage Tank (UST) Sites
NWI Wetlands (KY) / OWI Wetlands (OH)
Public Recreational Areas
Feet
0 500 1,000 2,000
Sands Recreational Area
Lincoln Park
Laurel Park
Lincoln Rec. Complex
Queensgate Ballfields
DeVou Park
Goebel Park
Mill Creek
OHIO
Ohio River
KENTUCKY
75
71



75
Mill Creek
Lincoln Park
Laurel Park
Lincoln Rec. Complex
Queensgate Ballfields
OHIO
Ohio River
KENTUCKY
71
DeVou Park
Goebel Park
FIGURE 4-5
ALT 4 - SINGLE BRIDGE REPLACEMENT
ENVIRONMENTAL RESOURCES LEGEND
Kentucky Superfund Site
Ohio Superfund Site
RCRA Sites
Underground Storage Tank (UST) Sites
NWI Wetlands (KY) / OWI Wetlands (OH)
Public Recreational Areas
Feet
0 500 1,000 2,000

Two local parks, Laurel Park and Queensgate Ballfields, appear to be impacted on their western margins by Alternatives 4 and 5. Alternative 5 includes widening the existing corridor; thus, presenting a higher likelihood of impacts to adjacent parks. It is important to note, however, that future design refinements may be able to avoid impacts to these park resources. Such resources are protected under Section 4(f) of the United States Department of Transportation Act of 1966 (49 USC 303).

According to the National Wetland Inventory and Ohio Wetland Inventory data sets, no wetland areas would be impacted by Alternatives 4 and 5. This conclusion requires field verification if the *Single Bridge Replacement* or the *Double Bridge Replacement (Elevated I-75 Roadways in Ohio)* alternative is further considered. Relative to other proposed alternatives, Alternative 4 bears low impacts to hazardous material sites and parks, while Alternative 5 carries moderate impacts to hazardous material sites and parks. Both alternatives present low potential impacts to wetlands.

4.0 COMMUNITY IMPACT ASSESSMENT

The proposed alternatives and study area primarily follow the existing I-75 interstate corridor through downtown areas of Cincinnati, Ohio and Covington, Kentucky. The study area is urban in nature and consists of well established neighborhoods and commercial properties.

4.1 NEIGHBORHOODS/COMMUNITY COHESION

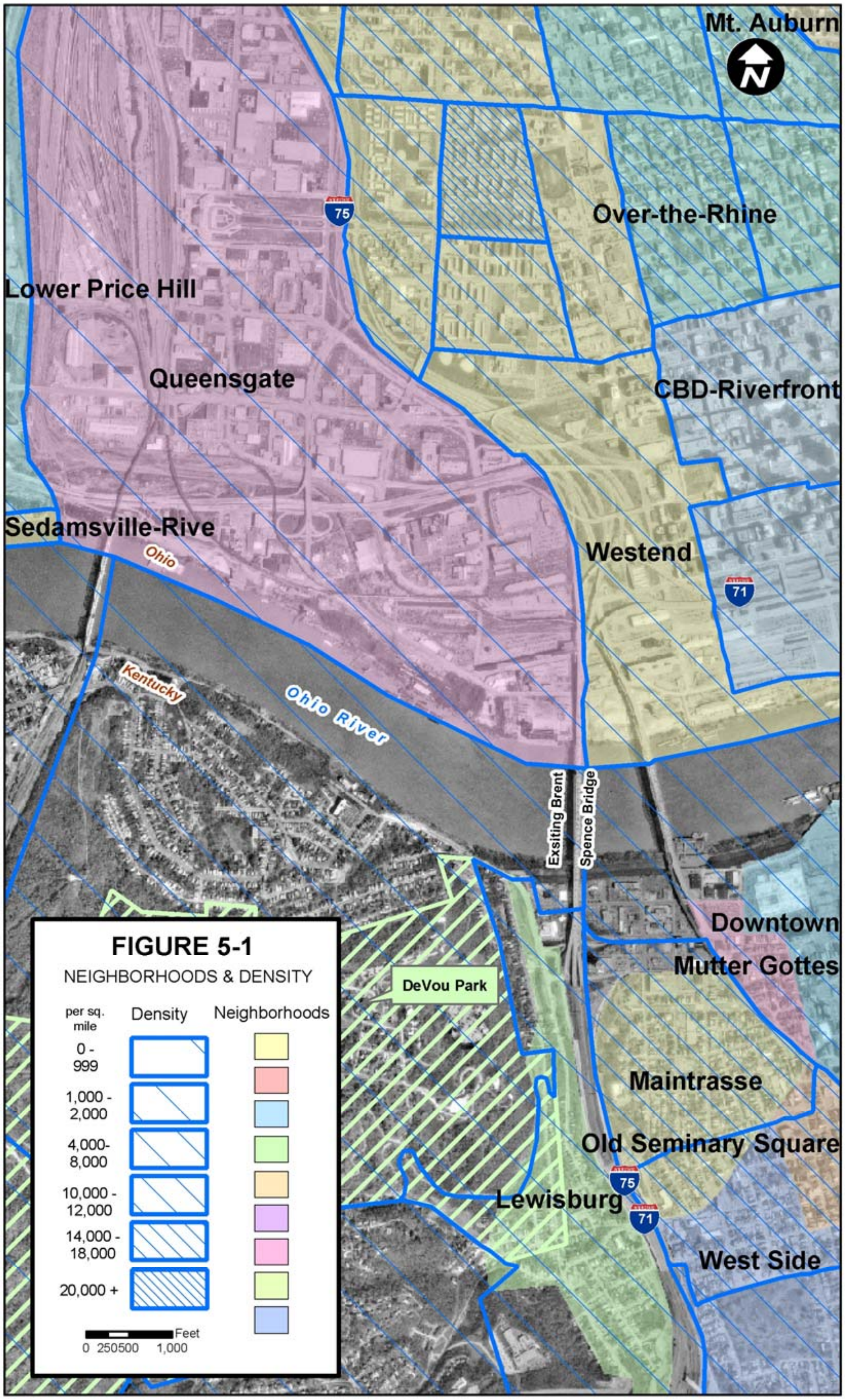
Community cohesion assessment is a process to evaluate the effects a transportation action/project may have on a community's quality of life. The assessment includes analysis of isolation, disruption of services, and/or disconnection between interdependent resources. A community can be defined in part, by its geographic component, but also by shared behavioral patterns and common interests, including the use of common facilities. When determining the affects of a project on a community, characteristics such as neighborhood boundaries, demographic information, and the location of residences, businesses, schools, churches, and parks are all considered. A more detailed analysis of such entities and factors is necessary as the potential alternatives for the Brent Spence Bridge are carried forward for more detailed evaluation during the next phase of the project.

The City of Cincinnati has several well established neighborhoods located near the existing I-75/I-71 corridor in the study area (Source: Cincinnati Department of City Planning). These neighborhoods include Queensgate and Westend. Similarly, there are several residential communities along the interstate corridor in the City of Covington (Source: Covington Community Design and Development Center). These include: Mainstrasse, West Side, and Lewisburg. With the exception of the I-75/I-71 interstate itself and the Ohio River, no physical barriers exist between neighborhoods in the study area. (Figure 5-1).

Issues associated with community cohesion and neighborhood cohesiveness were evaluated by reviewing demographic data such as density, as well as land use inventories such as commercial and residential distinctions. Many Cincinnati and Covington neighborhoods are cohesive communities with significant history and community infrastructure. The Queensgate neighborhood within the project area is the exception to this.


Queensgate Neighborhood

It is important to note that while the City of Cincinnati recognizes Queensgate as a 'neighborhood,' this designation does not necessarily represent a 'neighborhood' in terms of a cohesive, residential community. The southern end of Queensgate is sparsely populated (density < 1000 per square mile) and heavily dominated by commercial buildings. All other neighborhoods in the study area have a density greater than 1,000 people per square mile. When compared to Queensgate, other neighborhoods adjacent to I-75/I-71 (i.e. Westend and Mainstrasse) have densities as much as ten times greater. (Figures 5-1 and Figure 5-2).


Mt. Auburn
Over-the-Rhine
Lower Price Hill
Queensgate
CBD-Riverfront
Sedamsville-Rive
Ohio
Westend
Kentucky
Ohio River
Exsiting Brent
Spence Bridge
Downtown
Mutter Gottes
DeVou Park
Maintrasse
Old Seminary Square
Lewisburg
West Side
75
71
FIGURE 5-1
NEIGHBORHOODS & DENSITY
per sq. mile
Density
Neighborhoods
0 - 999
1,000 - 2,000
4,000- 8,000
10,000 - 12,000
14,000 - 18,000
20,000 +
0 250500 1,000 Feet

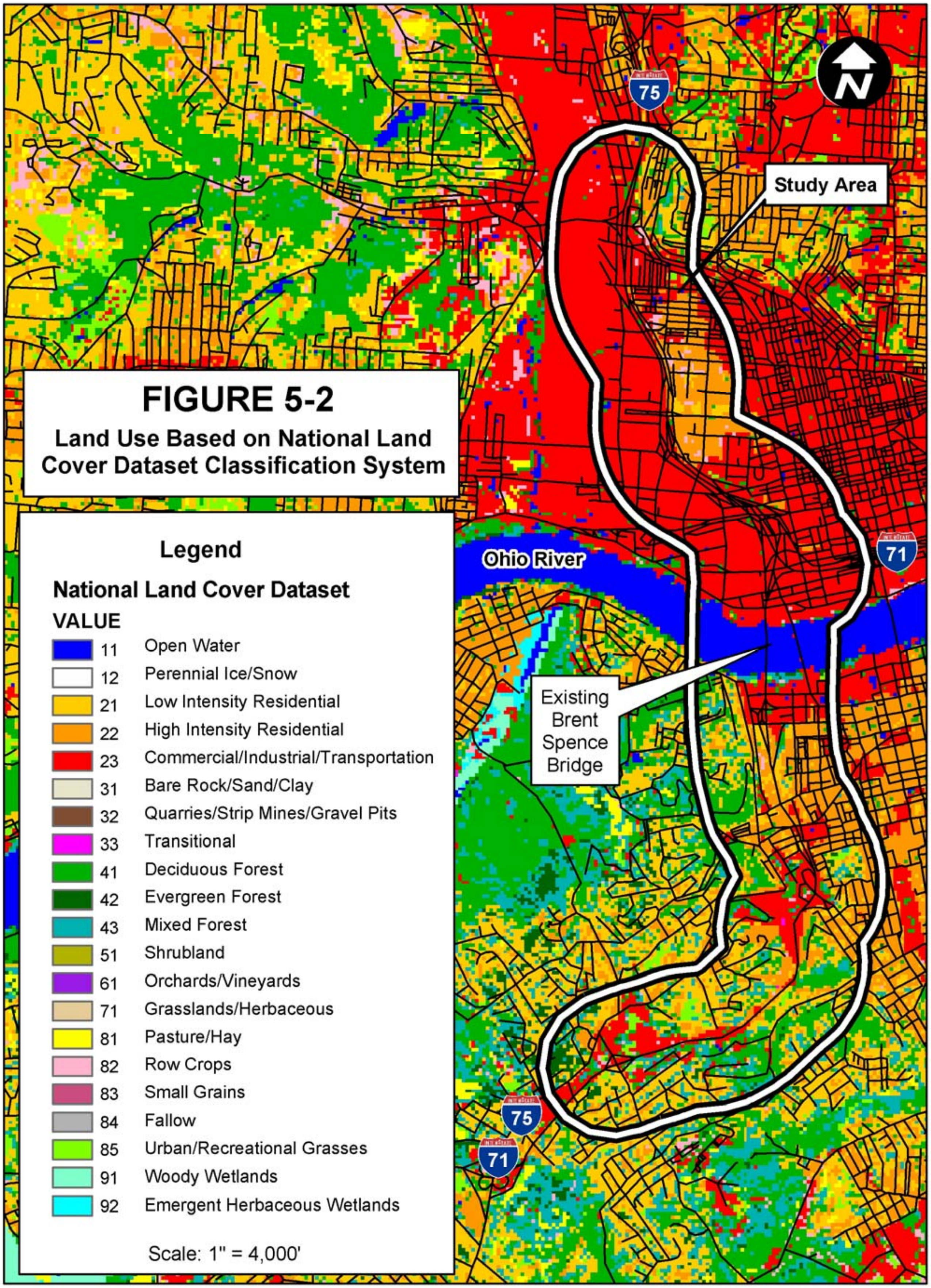


FIGURE 5-2
Land Use Based on National Land Cover Dataset Classification System
Legend
National Land Cover Dataset
VALUE
11 Open Water
12 Perennial Ice/Snow
21 Low Intensity Residential
22 High Intensity Residential
23 Commercial/Industrial/Transportation
31 Bare Rock/Sand/Clay
32 Quarries/Strip Mines/Gravel Pits
33 Transitional
41 Deciduous Forest
42 Evergreen Forest
43 Mixed Forest
51 Shrubland
61 Orchards/Vineyards
71 Grasslands/Herbaceous
81 Pasture/Hay
82 Row Crops
83 Small Grains
84 Fallow
85 Urban/Recreational Grasses
91 Woody Wetlands
92 Emergent Herbaceous Wetlands
Scale: 1" = 4,000'
Study Area
Ohio River
Existing Brent Spence Bridge
75
71
75
71
N

4.2 ENVIRONMENTAL JUSTICE

The study area was assessed via secondary source data for potential environmental justice concerns. According to the Federal Highway Administration's publication FHWA-EP-00-013, environmental justice has three fundamental principles:

1) "To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations."

2) "To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process."

3) "To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations."

The City of Cincinnati displays several census tracts of densely populated minority and low-income areas. The areas east of the existing interstate corridor in Cincinnati are diverse relative to both income and ethnicity. Some census tracts represent poverty levels as high as 70-80%. These areas are located east of the northern part of the project area. Similarly, some tracts in the northeast part of the project area represent minority levels of 90-100%. High minority areas are located immediately adjacent to the existing I-75 corridor in the Westend neighborhood of Cincinnati. The southern part of the project area in Cincinnati and the project area in Covington represents more moderate levels of minority and low-income populations (Figure 5-3). The poverty levels range from 10-20% to 30-40 % in this area.

4.3 KEY COMMUNITY IMPACT ISSUES

- The study area, particularly east of I-75 in the northern section, is characterized by high minority, low income populations. Any shifts east of the existing corridor in this northern segment may present environmental justice related issues associated with residential displacements.

- Several significant HUD-assisted housing projects/developments exist in the study area, including the multi-million dollar redevelopment initiative known as HOPE VI (Figure 5-3).

- Further investigation of community cohesion impacts will be necessary if the proposed alignments are shifted even slightly east of the existing interstate corridor in Cincinnati. In addition, consideration of such resources is also necessary if Alternatives 1, 2, or 6 are shifted west of the existing corridor into the Lewisburg neighborhood of Covington.

- East/west cross street connectivity across I-75/I-71, particularly on the Kentucky side, will need further consideration as the project proceeds toward the design phase.

- Noise, air, and other environmental impacts to surrounding neighborhoods will also require future evaluation as potential environmental justice related issues.

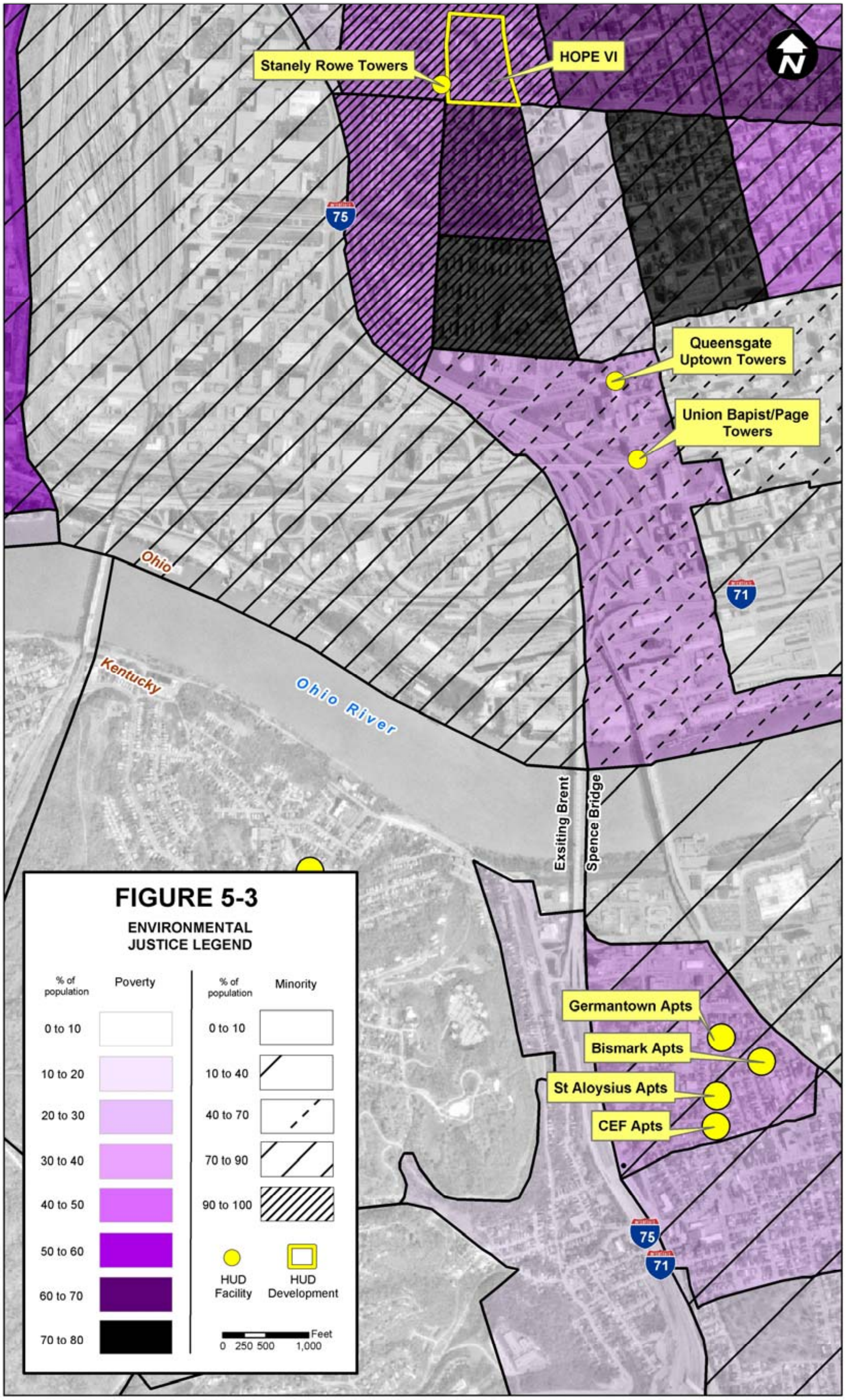


FIGURE 5-3
ENVIRONMENTAL JUSTICE LEGEND
% of population
Poverty
0 to 10
10 to 20
20 to 30
30 to 40
40 to 50
50 to 60
60 to 70
70 to 80
% of population
Minority
0 to 10
10 to 40
40 to 70
70 to 90
90 to 100
HUD Facility
HUD Development
Feet
0 250 500 1,000
Stanely Rowe Towers
HOPE VI
N
75
Queensgate Uptown Towers
Union Bapist/Page Towers
Ohio
71
Kentucky
Ohio River
Exsiting Brent
Spence Bridge
Germantown Apts
Bismark Apts
St Aloysius Apts
CEF Apts
75
71

4.4 ANALYSIS OF ALTERNATIVES

Analysis of the conceptual alternatives was conducted by reviewing the corridor that defines the individual alternatives, as well as immediately adjacent properties that may be impacted by right-of-way acquisition.

The proposed conceptual alternatives for the Brent Spence Bridge project carry varying impacts to these communities/neighborhoods. A cursory overview of the neighborhood map illustrates that two of the proposed alternatives, Alternative 4 (*Single Bridge Replacement*) and Alternative 5 (*New I-75 / I-71 West*) would have minimal impacts on community cohesion as their alignments follow the existing I-75/I-71 interstate corridor. (Figures 5-4 and 5-5). The remaining three alternatives would impact the southeast corner of the Queensgate neighborhood in Cincinnati west of I-75. (Figures 5-6, 5-7 and 5-8). In addition, Alternatives 1 and 2 include a segment that impacts the western edge of the Mainstrasse neighborhood in Covington.

As noted, the neighborhood most impacted by the proposed conceptual alternatives is Queensgate in Cincinnati. The southern end of this neighborhood is dominated by commercial and industrial buildings. Based on field observations, no parks, churches, schools, or other neighborhood resources would be isolated by bisecting the southwestern corner of Queensgate, as proposed in Alternatives 1, 2, and 6. Any potential impacts to community cohesion in the Mainstrasse neighborhood of Covington, also appear to be minimal.

According to census data, there are several minority and low-income neighborhoods or communities in, or adjacent to, the study area. Four of the five remaining bridge alternatives do not appear to disproportionately displace, or otherwise impact, minority or low-income populations (Figures 5-9, 5-10, 5-11 and 5-12). The conceptual alternatives and their corridors cross census tracks of varying minority and poverty levels. Immediately adjacent to the proposed alternatives, minority levels range from 0-10% to 90-100%. Poverty levels range from 0-10% to 50-60%.

Alternative 5 *(Double Bridge Replacement [Elevated I-75 Roadways in Ohio])* is almost completely contained in a corridor characterized by a population ranging between 20% and 50% below poverty. The demographics along this corridor also display minority percentages between 40% and 100% (Figure 5-13). Whether or not this represents a disproportionate impact to minority or low-income populations would be a premature assessment at this stage of evaluation. The only potential displacements appear to be a result of widening I-75 in the northern reach of the study area; however, the actual numbers of displacements that may occur, if any, is uncertain. Surrounding census tracks to the east show similar, and in some instances higher, minority and poverty levels than those immediately adjacent to the facility. When compared to the other conceptual alternatives, the *New I-75 / I-71 West* Alternative potentially impacts only areas of concentrated minority and low income citizens; whereas, other alternatives potentially impact areas of varying concentrations of minority and low income citizens. Environmental justice consideration for Alternative 5 can be better determined when an exact footprint for the proposed interstate and bridge structure is decided in a future more detailed environmental evaluation or engineering document.

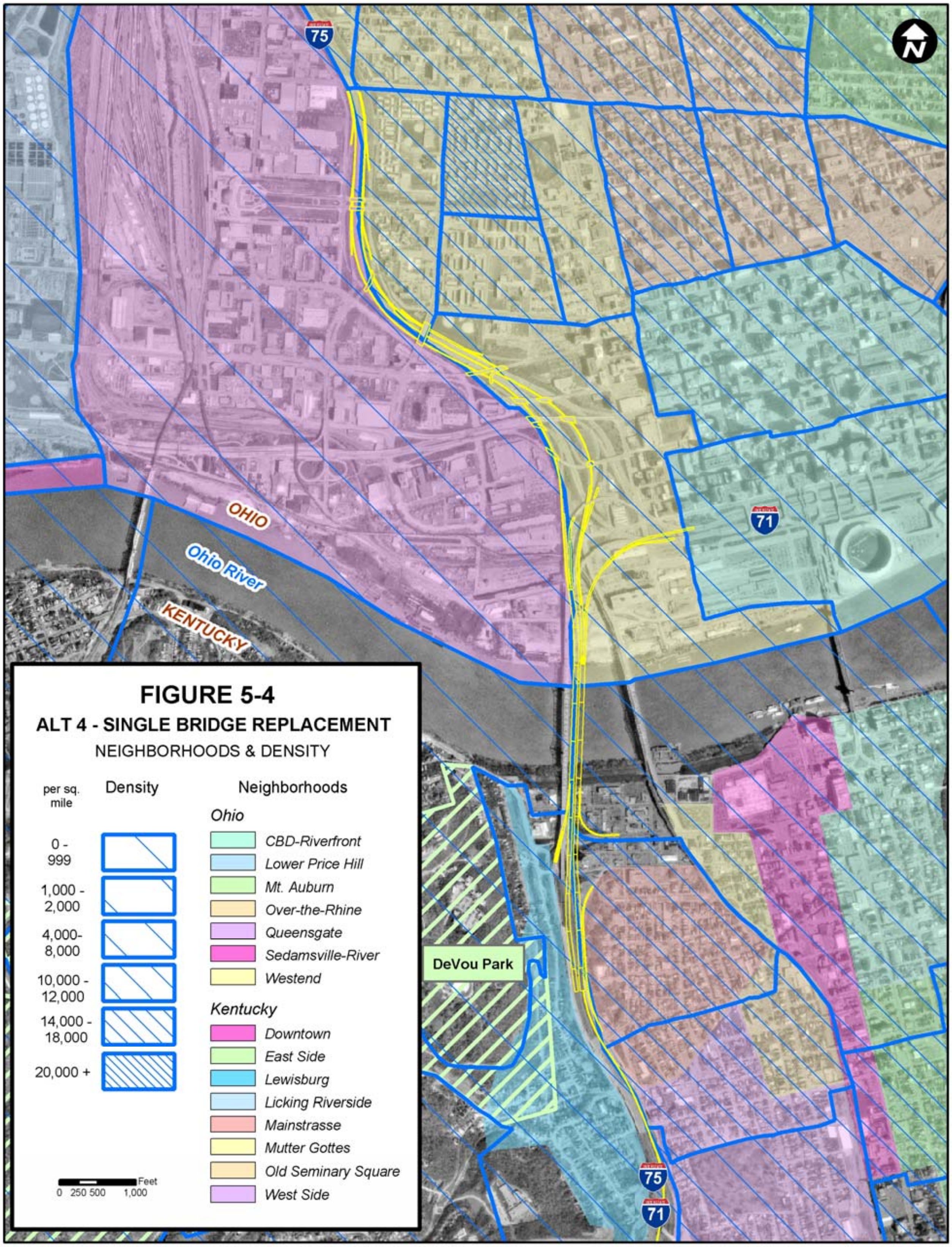


FIGURE 5-4
ALT 4 - SINGLE BRIDGE REPLACEMENT
NEIGHBORHOODS & DENSITY
per sq. mile
Density
Neighborhoods
Ohio
0 - 999
1,000 - 2,000
4,000- 8,000
10,000 - 12,000
14,000 - 18,000
20,000 +
CBD-Riverfront
Lower Price Hill
Mt. Auburn
Over-the-Rhine
Queensgate
Sedamsville-River
Westend
Kentucky
Downtown
East Side
Lewisburg
Licking Riverside
Mainstrasse
Mutter Gottes
Old Seminary Square
West Side
Feet
0 250 500 1,000
OHIO
Ohio River
KENTUCKY
DeVou Park
75
71

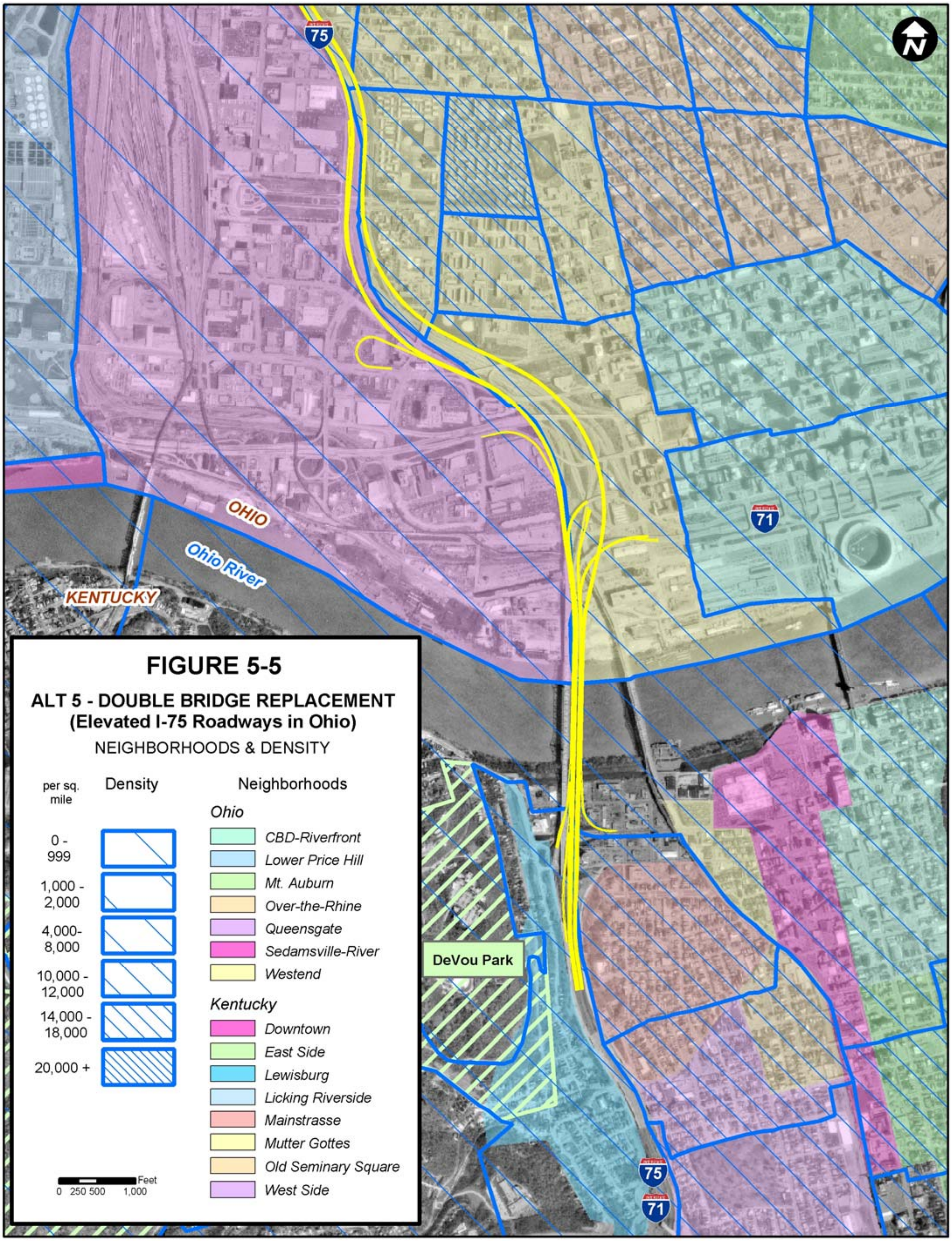
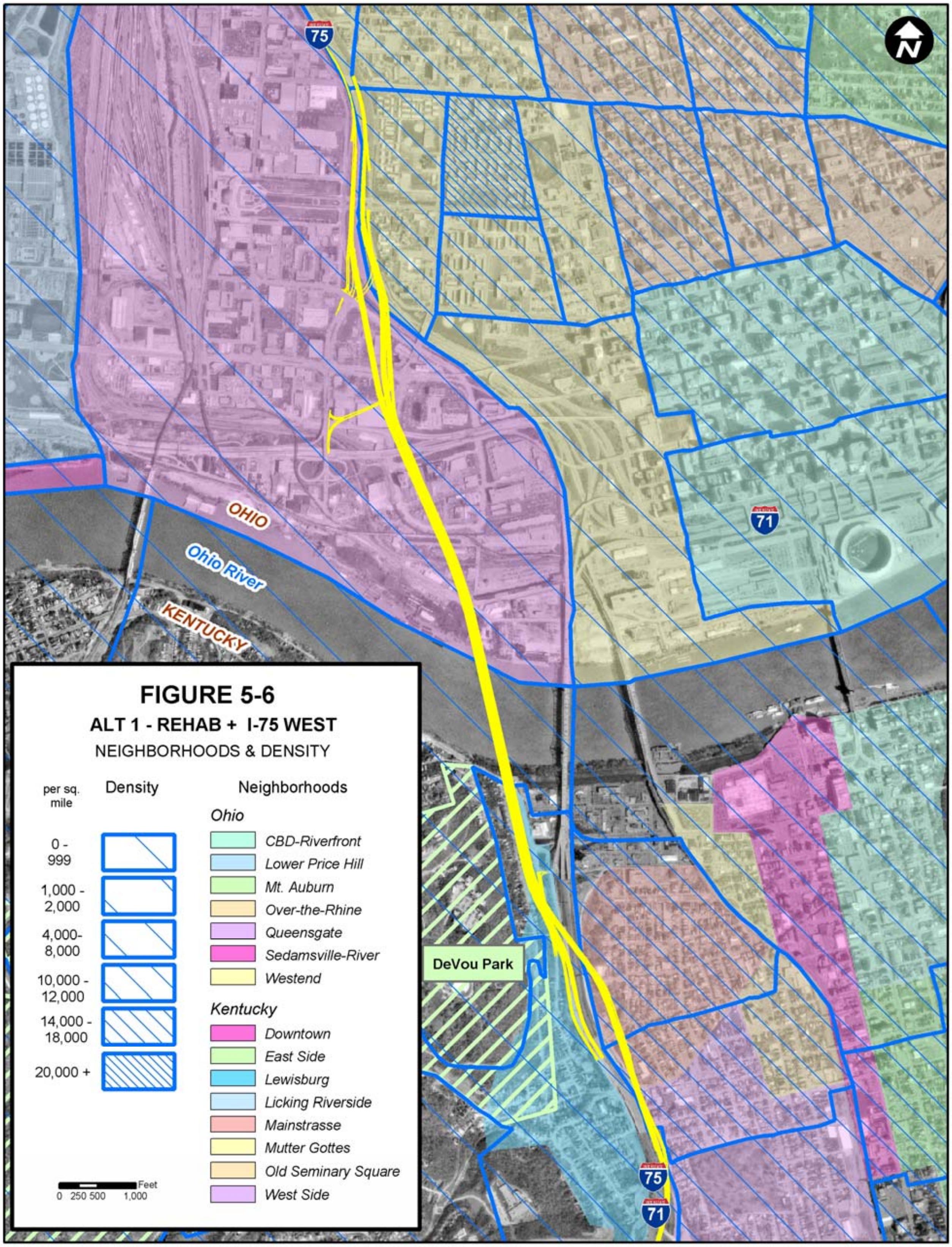


FIGURE 5-5
ALT 5 - DOUBLE BRIDGE REPLACEMENT
(Elevated I-75 Roadways in Ohio)
NEIGHBORHOODS & DENSITY
per sq. mile
Density
Neighborhoods
Ohio
0 - 999
1,000 - 2,000
4,000- 8,000
10,000 - 12,000
14,000 - 18,000
20,000 +
CBD-Riverfront
Lower Price Hill
Mt. Auburn
Over-the-Rhine
Queensgate
Sedamsville-River
Westend
Kentucky
Downtown
East Side
Lewisburg
Licking Riverside
Mainstrasse
Mutter Gottes
Old Seminary Square
West Side
Feet
0 250 500 1,000
OHIO
Ohio River
KENTUCKY
DeVou Park
75
71
N



OHIO
Ohio River
KENTUCKY
DeVou Park
75
71
FIGURE 5-6
ALT 1 - REHAB + I-75 WEST
NEIGHBORHOODS & DENSITY
per sq. mile
Density
Neighborhoods
0 - 999
1,000 - 2,000
4,000- 8,000
10,000 - 12,000
14,000 - 18,000
20,000 +
Ohio
CBD-Riverfront
Lower Price Hill
Mt. Auburn
Over-the-Rhine
Queensgate
Sedamsville-River
Westend
Kentucky
Downtown
East Side
Lewisburg
Licking Riverside
Mainstrasse
Mutter Gottes
Old Seminary Square
West Side
Feet
0 250 500 1,000

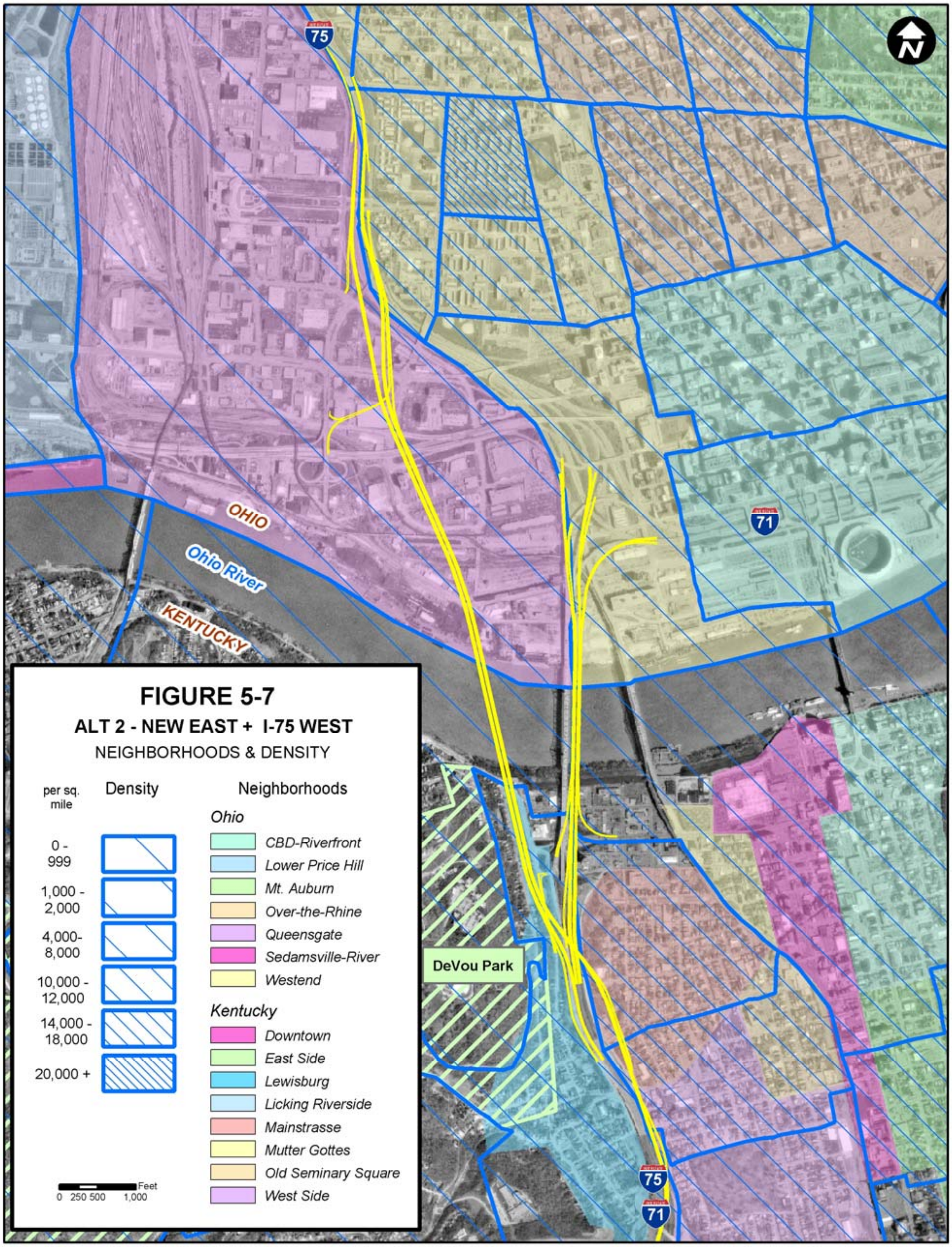
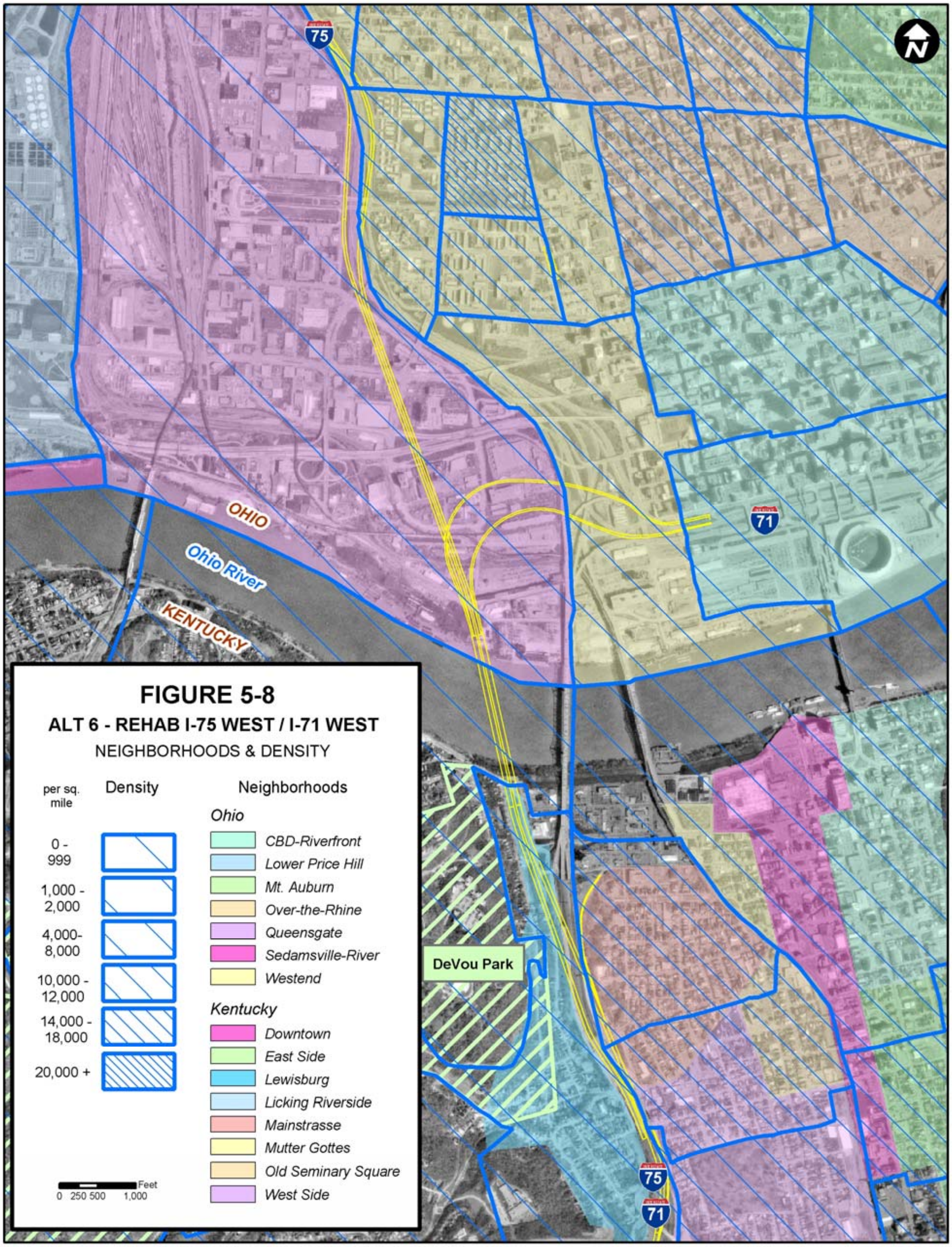
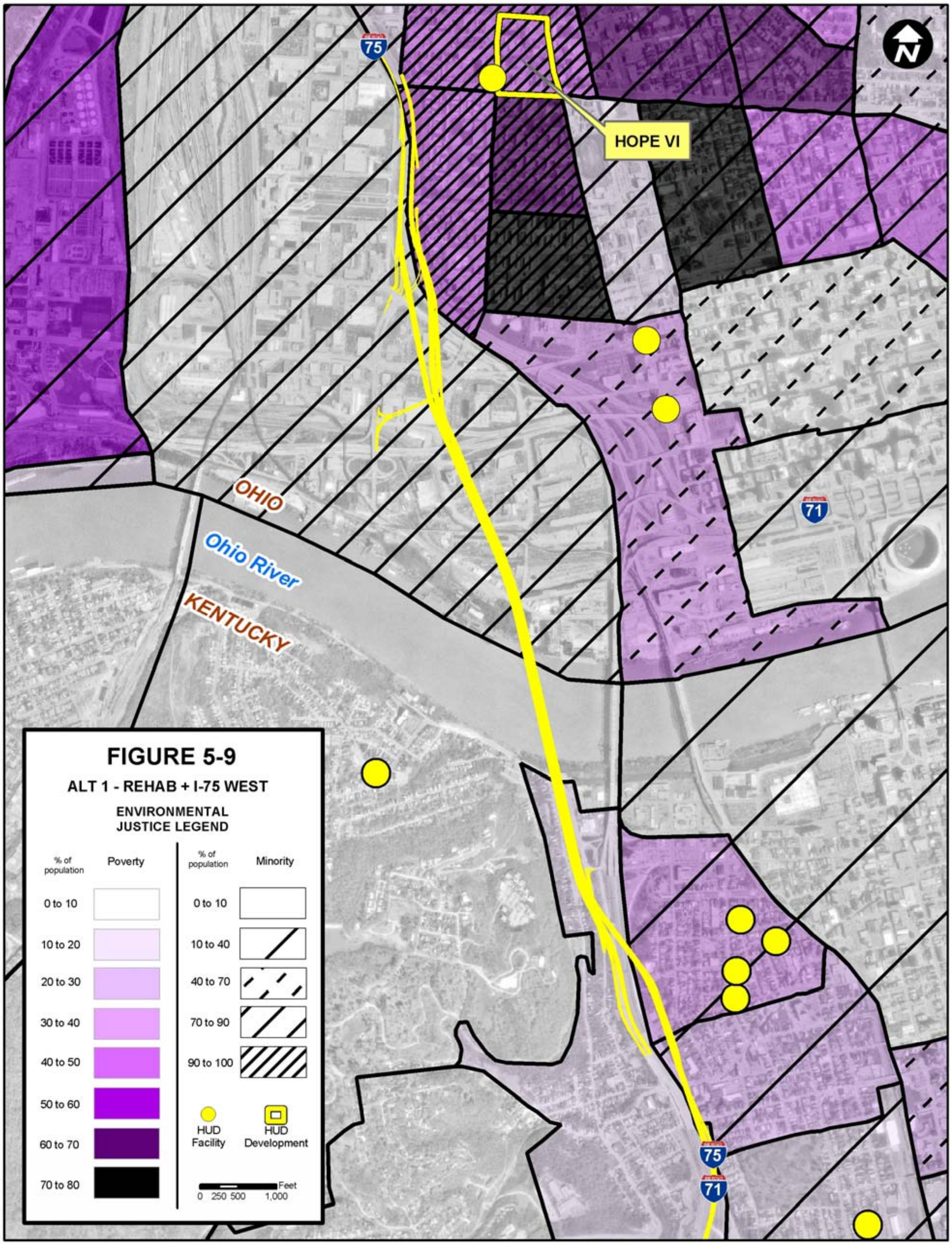


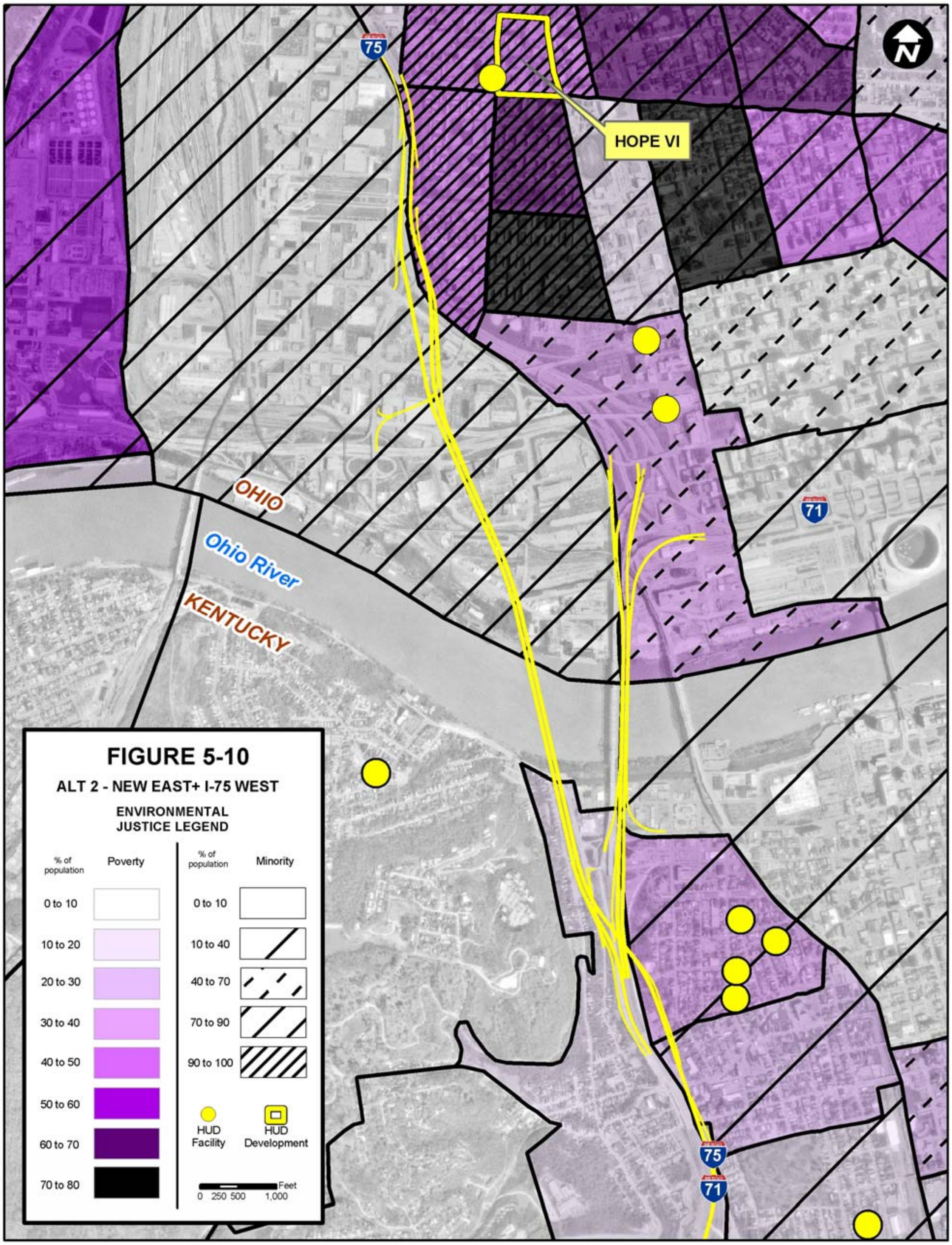
FIGURE 5-7
ALT 2 - NEW EAST + I-75 WEST
NEIGHBORHOODS & DENSITY
per sq. mile
Density
Neighborhoods
Ohio
0 - 999
CBD-Riverfront
Lower Price Hill
1,000 - 2,000
Mt. Auburn
Over-the-Rhine
4,000- 8,000
Queensgate
Sedamsville-River
10,000 - 12,000
Westend
Kentucky
14,000 - 18,000
Downtown
East Side
20,000 +
Lewisburg
Licking Riverside
Mainstrasse
Mutter Gottes
Old Seminary Square
West Side
Feet
0 250 500 1,000
OHIO
Ohio River
KENTUCKY
DeVou Park
75
71



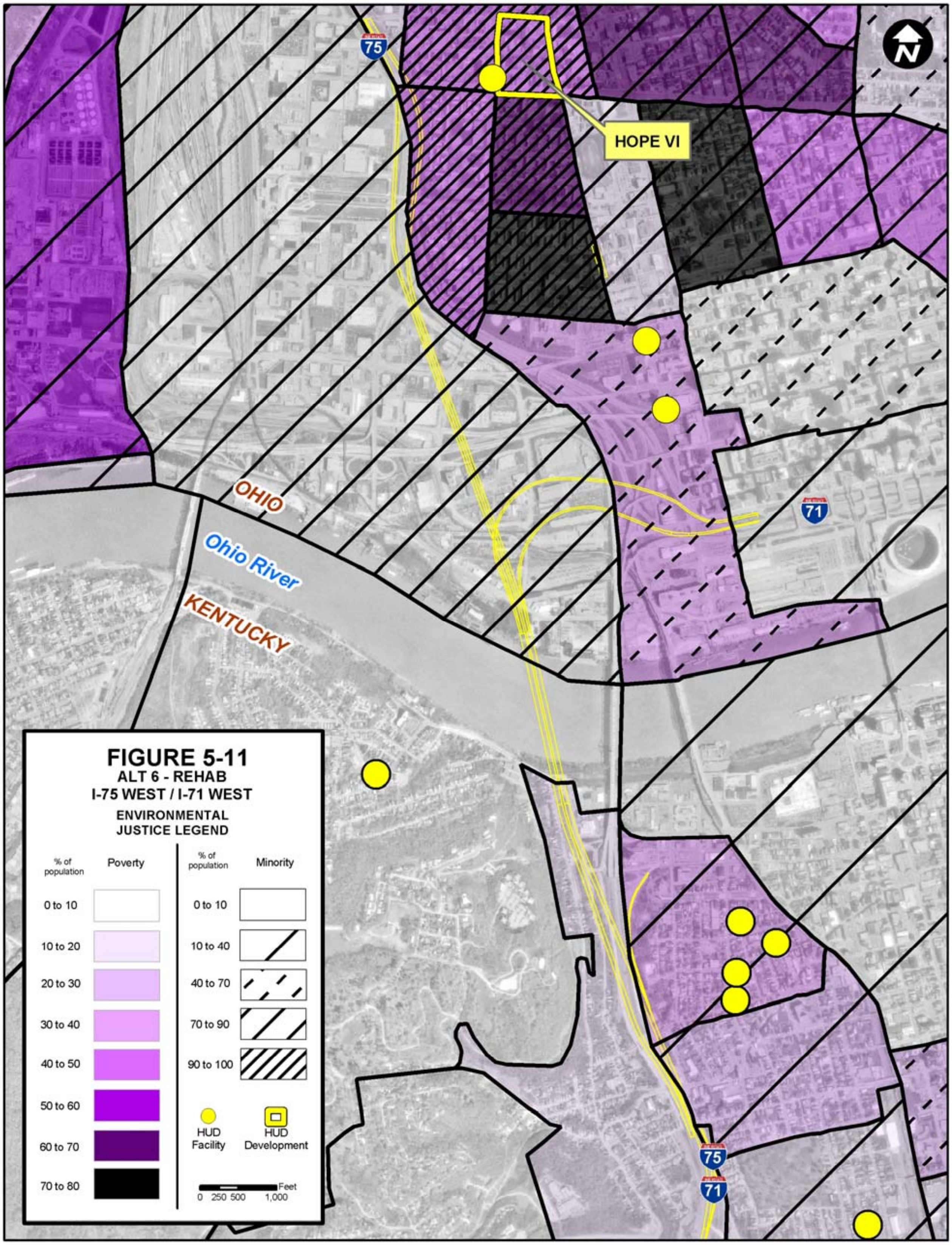
75
71
OHIO
Ohio River
KENTUCKY
DeVou Park
75
71
FIGURE 5-8
ALT 6 - REHAB I-75 WEST / I-71 WEST
NEIGHBORHOODS & DENSITY
per sq. mile
Density
Neighborhoods
Ohio
0 - 999
CBD-Riverfront
Lower Price Hill
1,000 - 2,000
Mt. Auburn
Over-the-Rhine
4,000- 8,000
Queensgate
Sedamsville-River
10,000 - 12,000
Westend
Kentucky
14,000 - 18,000
Downtown
East Side
20,000 +
Lewisburg
Licking Riverside
Mainstrasse
Mutter Gottes
Old Seminary Square
West Side
Feet
0 250 500 1,000

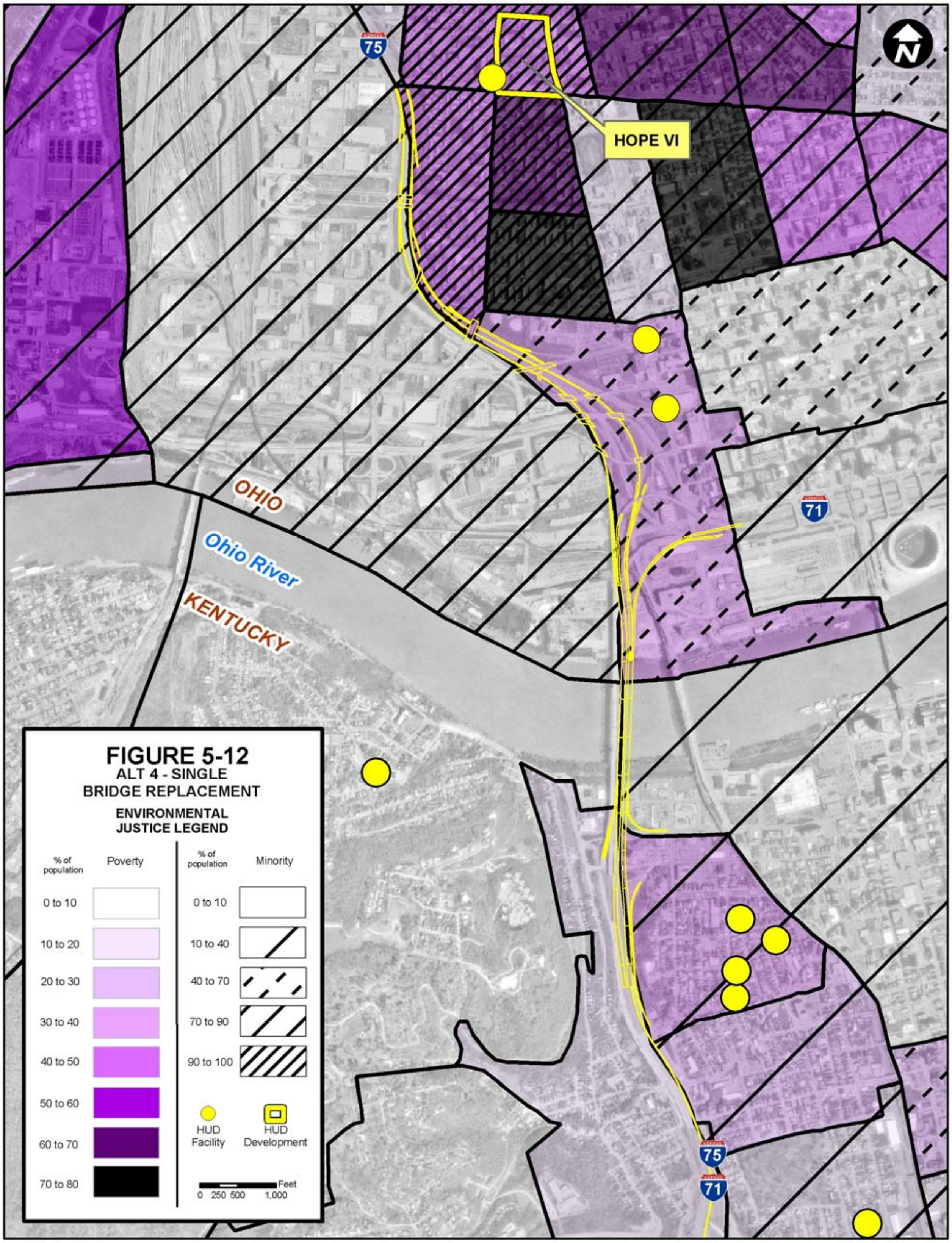


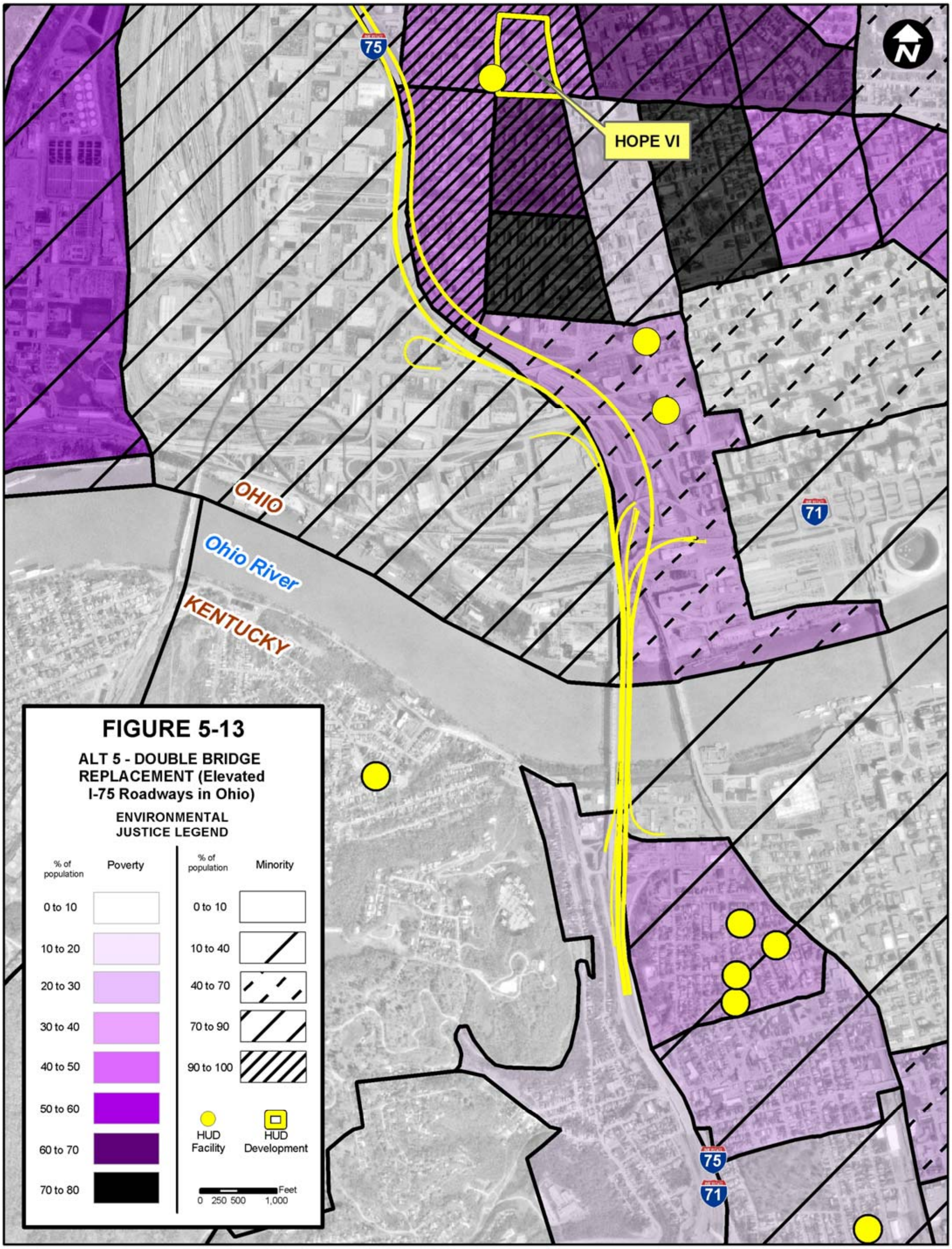
75
HOPE VI
OHIO
Ohio River
KENTUCKY
71
FIGURE 5-9
ALT 1 - REHAB + I-75 WEST
ENVIRONMENTAL
JUSTICE LEGEND
% of population
Poverty
0 to 10
10 to 20
20 to 30
30 to 40
40 to 50
50 to 60
60 to 70
70 to 80
% of population
Minority
0 to 10
10 to 40
40 to 70
70 to 90
90 to 100
HUD Facility
HUD Development
Feet
0 250 500 1,000
75
71



HOPE VI
75
71
OHIO
Ohio River
KENTUCKY
FIGURE 5-10
ALT 2 - NEW EAST+ I-75 WEST
ENVIRONMENTAL
JUSTICE LEGEND
% of population
Poverty
% of population
Minority
0 to 10
10 to 20
20 to 30
30 to 40
40 to 50
50 to 60
60 to 70
70 to 80
0 to 10
10 to 40
40 to 70
70 to 90
90 to 100
HUD Facility
HUD Development
Feet
0 250 500 1,000
75
71


75
HOPE VI
OHIO
Ohio River
KENTUCKY
71
FIGURE 5-11
ALT 6 - REHAB
I-75 WEST / I-71 WEST
ENVIRONMENTAL
JUSTICE LEGEND
% of population
Poverty
0 to 10
10 to 20
20 to 30
30 to 40
40 to 50
50 to 60
60 to 70
70 to 80
% of population
Minority
0 to 10
10 to 40
40 to 70
70 to 90
90 to 100
HUD Facility
HUD Development
Feet
0 250 500 1,000
75
71


75
HOPE VI
OHIO
Ohio River
KENTUCKY
71
75
71
FIGURE 5-12
ALT 4 - SINGLE
BRIDGE REPLACEMENT
ENVIRONMENTAL
JUSTICE LEGEND
% of population
Poverty
0 to 10
10 to 20
20 to 30
30 to 40
40 to 50
50 to 60
60 to 70
70 to 80
% of population
Minority
0 to 10
10 to 40
40 to 70
70 to 90
90 to 100
HUD Facility
HUD Development
Feet
0 250 500 1,000



HOPE VI
75
71
OHIO
Ohio River
KENTUCKY
FIGURE 5-13
ALT 5 - DOUBLE BRIDGE REPLACEMENT (Elevated I-75 Roadways in Ohio)
ENVIRONMENTAL JUSTICE LEGEND
% of population
Poverty
0 to 10
10 to 20
20 to 30
30 to 40
40 to 50
50 to 60
60 to 70
70 to 80
% of population
Minority
0 to 10
10 to 40
40 to 70
70 to 90
90 to 100
HUD Facility
HUD Development
Feet
0 250 500 1,000

Federally assisted Housing and Urban Development (HUD) projects were also mapped and evaluated for their proximity to the proposed alternatives. Ten HUD assisted projects exist in the Cincinnati, Ohio section of the study area. Eleven such projects exist in the Covington, Kentucky section of the study area. None of the remaining conceptual alternatives (Alternatives 1, 2, 4, 5, or 6) impacts HUD projects/properties. (Figures 5-9, 5-10, 5-11, 5-12 and 5-13).

5.0 NOISE AND AIR

5.1 NOISE IMPACTS

The five remaining conceptual alternatives proposed for the Brent Spence Bridge will likely carry varying noise impacts. Several traffic related factors, as well as structural components can affect noise levels. Sensitive noise receivers located within the study area include residential and recreational properties, libraries, schools, hospitals, motels, and hotels along the existing and/or proposed alignments. These areas include, but are not limited to, residential properties along the northeast side of the corridor in Ohio (Westend) and along the southwest and southeast side of the corridor in Kentucky (Lewsiburg, Mainstrasse, and West Side). Recreational properties including Lincoln Park, Laurel Park, Lincoln Recreational Complex, Queensgate Ballfields, Albert B. Sabin Park, DeVou Park, and Goebel Park, as well as Our Lady of Mercy High School and the Stowe Adult Education Center, are also considered sensitive receivers.

No noise analysis was conducted for this study; however, future studies will need to model potential noise impacts based on FHWA's Highway Traffic Noise Prediction Model (Report No. FHWA-RD-77-108). Traffic noise studies for road projects in Ohio are performed in accordance with 23 Code of Federal Regulations (CFR) 772 and ODOT's *Standard Procedure for Analysis and Abatement of Highway Traffic Noise* (September 2001). Studies in Kentucky follow the same CFR and KYTC's *Noise Abatement Policy* (February 2000). In both states, there are five main steps comprising traffic noise studies. These are: (1) identify noise sensitive receivers, (2) determine existing ambient peak noise levels, (3) predict future peak noise levels, (4) identify traffic noise impacts, and (5) evaluate mitigation measures for sensitive receivers where traffic noise impacts occur.

It is important to note that potential noise impacts are not anticipated to be "fatal flaws" associated with any of the five conceptual alternatives.

5.2 AIR QUALITY

On April 15, 2004, the USEPA designated the Greater Cincinnati region (including all of Hamilton County, Ohio and Kenton County, Kentucky) as "Basic Non-attainment" for 8-hour ozone violations (Figure 6). There area is also designated as non-attainment for 1-hour ozone violations.

The Metropolitan Planning Organization (Ohio, Kentucky, Indiana Regional Council of Governments) has received air conformity approval of their long range plan. This plan includes a placeholder for a replacement of the Brent Spence Bridge with a 10-lane facility.

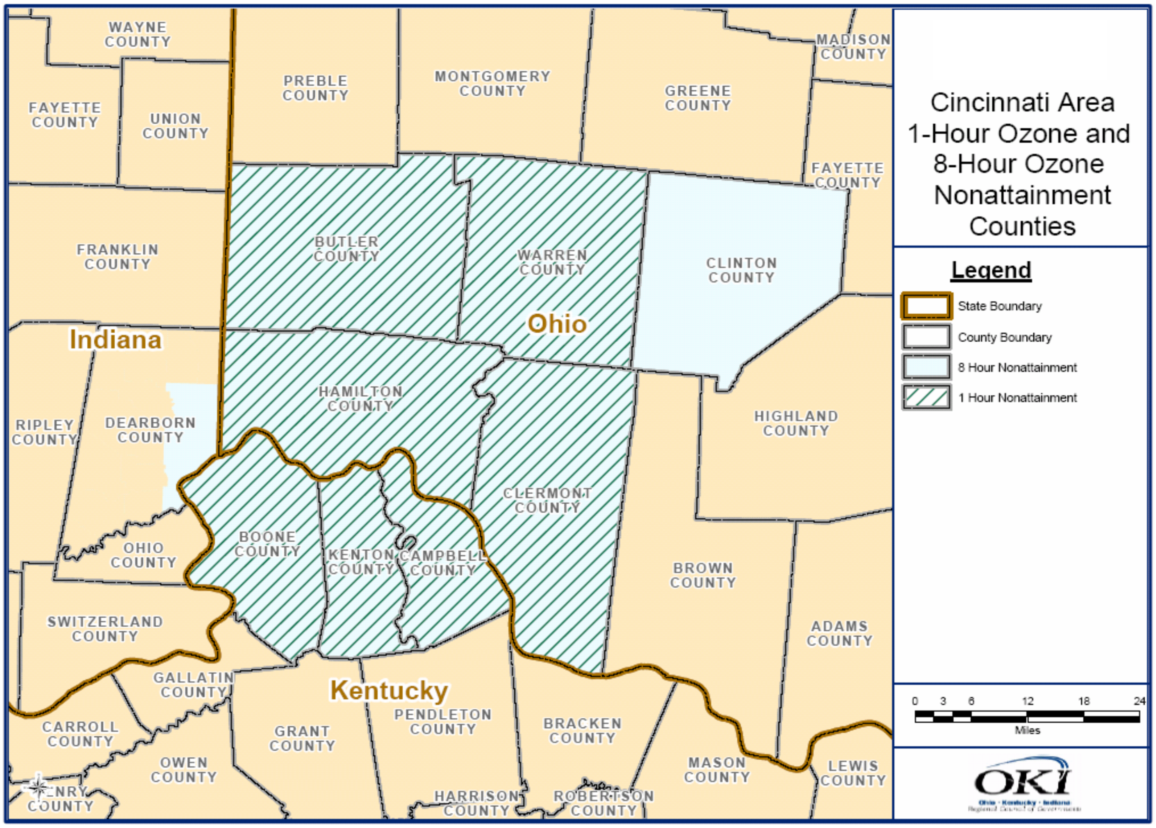


Figure 6 Non-attainment areas within Ohio and Kentucky (Source: 2030 Regional Transportation Plan: 2004 Update. OKI)

For this study, no air quality analysis was conducted. However, in order for the project to be incompliance with the Clean Air Act Amendment of 1990, future studies will need to include a microscale analysis of carbon monoxide (CO) using the latest USEPA approved computer models. This analysis is needed to determine whether the project would result in violations of the National Ambient Air Quality Standards (NAAQS) for CO.

6.0 NAVIGATION / PERMITS

The Unites States (US) Coast Guard indicated that greater horizontal clearance may be needed for skewed crossings as presented in *Alternative 1 - Rehab + I-75 West, Alternative 2 - New East + I-75 West, and Alternative 6 - Rehab plus I-75 West / I-71 West.* Contact was made for early coordination with of the US Coast Guard (email correspondence).

The United States Army Corps of Engineers (Corps) Section 404 permit process would likely be required as the Ohio River and its associated tributaries (including wetlands) are considered "waters of the US." Similarly, a state level 401 Water Quality Certification and associated permit(s) will also likely be required by Ohio and Kentucky. Such permits can not be sought and reviewed until an alternative has been selected, wetlands have been delineated and verified by the Corps, and the construction limits established. All of the conceptual alternatives (1, 2, 4, 5 and 6) would likely require such permitting.

7.0 SUMMARY

A relative comparison of the five conceptual alternatives shows that Alternatives 4 and 5 (*Single Bridge Replacement and Double Bridge Replacement [Elevated I-75 Roadways in Ohio]*) have the lowest overall potential environmental impacts. Table 3 is a *relative* comparison between the conceptual alternatives. The affected resource categories are *not* weighted by their value; thus; "low", "moderate" and "high" express the same significance across resources categories. "Low" represents the fewest impacts to a given resources when compared to all other conceptual alternatives. "Moderate" indicates that the amount of impacts associated with a given alternative falls between the amount of impacts associated with other conceptual alternatives. "High" represents the greatest possible impacts to a given resource category when compared to all other conceptual alternatives. "High" does *not* imply significant or severe impacts relative to a threshold value or regulatory interpretation.

Table 1: Summary of Environmental Impacts**

Resource Category	Relative Rating of Potential Impacts				
	Alternative 1	**Alternative 2**	**Alternative 4**	**Alternative 5**	**Alternative 6**
Cultural Resources	Moderate	Moderate	Low	Moderate	Moderate
Hazardous Material Sites	Moderate	Moderate	Low	Moderate	Moderate
Parks	Moderate	Moderate	Low	Moderate	Moderate
Wetlands	Moderate	Moderate	Low	Low	Moderate
Community Cohesion	Low	Low	Low	Low	Low
Environmental Justice	Low	Low	Low	Moderate	Low
Noise and Air	N/A*	N/A	N/A	N/A	N/A
Navigation/Permits	Moderate	Moderate	Low	Low	Moderate

* N/A indicates no discernable difference in the level of impacts as no data was available or analyzed

** Based on secondary source data and no regulatory agencies coordination other than that indicated in Appendix A.

All five conceptual alternatives are viable alternatives from a planning standpoint. While some of the conceptual alternatives incur varying levels of impacts to different environmental resources, it is the conclusion of this evaluation that no major "show stoppers" exist based on secondary source data. However, primary research and data collection related to threatened and endangered species may warrant a different conclusion upon further investigation. Impacts to Section 4(f) resources (both parks and historic properties) may also warrant a different conclusion. For this reason, Alternatives 5 and 6 carry some potential red flags depending on the footprint and profile of the final design. The Brent Spence Bridge is surrounded by both the unique natural environment of the Ohio River, as well as the culturally complex environments of Cincinnati and Covington. To insure a thorough resource evaluation, a more complete environmental review and associated documentation will likely be required by regulatory agencies for a project of this magnitude.

REFERENCES CITED

Anonymous
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II. APPENDICES

Report of Geotechnical Overview
Replacement of the I-71/I-75 Bridge
Over the Ohio River
Brent Spence Bridge
Kenton County, Kentucky to
Hamilton County, Ohio

1. Project Description

The Brent Spence Bridge spanning the Ohio River is a major commuter route between Cincinnati and Northern Kentucky on the existing I-71/I-75 corridor. The bridge crosses the Ohio River near river mile point 471 and connects the cities of Covington, Kentucky and Cincinnati, Ohio. The bridge is a three span, double deck bridge with four traffic lanes per level. The bridge, originally opened in 1963 with three traffic lanes per level was designed to handle a traffic volume of approximately 85,000 vehicles per day. The traffic lane configuration was modified in 1985, creating four lanes per level with the removal of the emergency pull-off lanes and increasing the design capacity of the bridge to approximately 130,000 vehicles per day. The current volume of traffic that crosses the bridge is reportedly approximately 155,000 vehicles per day.

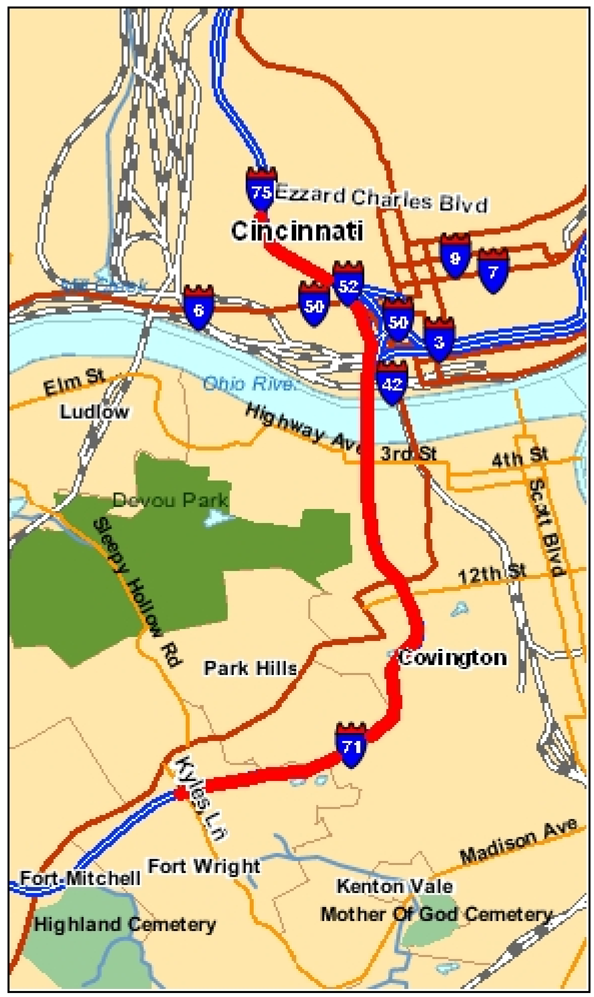

Figure 1. Project Corridor Orientation

Fuller, Mossbarger, Scott and May Engineers, Inc. (FMSM) has compiled this geotechnical overview as support information for the feasibility study concerning the possible replacement of the Brent Spence Bridge and associated approaches. The corridor studied is approximately four miles in length and 600 feet in width (300 feet beyond and parallel to each side of the existing alignment). Refer to Figure 1 for corridor orientation. The southern limit of the overview area is bounded by Kyles Lane in Covington, Kentucky. The overview area is bounded to the north by Ezzard Charles Blvd. in Cincinnati, Ohio.

2. Scope of Work

The scope of work for this study consists of performing a geotechnical overview for the proposed bridge and roadway corridor based upon research of available published data, discussions and review of projects and information from the Kentucky Transportation Cabinet (KYTC); and previous experience of FMSM in the area. Tasks performed by FMSM included review of the following items:

- Available topographic and geologic mapping of the area published by the United States Geological Survey (USGS) and the Kentucky Geological Survey (KGS).
- United States Department of Agriculture, Soil Conservation Service Soil Surveys of Kenton County, Kentucky.
- Available records and information obtained from the Division of Materials, KYTC.
- Available National Wetlands Inventory maps compiled by the US Department of Interior, Fish and Wildlife Service.
- Review of other available information obtained during the field reconnaissance and research.
- KYTC Underwater inspection records of the existing Brent Spence Bridge, 1991, 1996, 2001.

FMSM personnel performed a field reconnaissance of the proposed bridge and roadway corridor on November 13, 2003. Based upon the results of the field reconnaissance and review of the available information, the general site geology of the area has been summarized. Features of geotechnical significance that may influence the proposed project have been identified and discussed in this report. The following sections present the results of this overview.

3. Physiographic/Geologic Setting

3.1. Topography and Drainage

The proposed roadway corridor is situated in the Outer Blue Grass Physiographic Region in northern Kentucky and Ohio. The Outer Blue Grass Physiographic Region in this area is characterized by rolling terrain with deep valleys, which were formed by the erosional dissection of the regional sedimentary rocks. Terrain in the immediate vicinity of the existing I-71/I-75 roadway and bridge consists of a series of floodplain terraces that have been formed by the erosional processes of the Ohio River. The floodplains are relatively flat to gently rolling, and are within large valleys. Bottom areas immediately adjacent the Ohio River and connecting streams often have sloughs, ponds, swampy areas and eroded banks. Upland areas are composed of rolling hills and locally flat-topped ridges.

The immediate area around Brent Spence Bridge, downtown Cincinnati, Ohio and Covington, Kentucky are predominately situated on older alluvial floodplain terraces, with the ground surface ranging from approximate elevation 455 feet at the Ohio River to approximate elevation 550 feet within the cities. The existing I-71/I-75 roadway traverses hilly terrain on the southwest side of Covington, reaching the approximate elevation of 900 feet near Kyles Lane.

Man made diversions directed towards the Ohio River and connecting streams generally control surface drainage in the study area. Undeveloped areas along river floodplains contain areas of possible stagnate water and/or poor flowing conditions during wet periods. Backwater sloughs exist in the vicinity along the Ohio River. These sloughs become inundated during higher water stages of the river. Natural streams generally have a dendritic drainage pattern in the region. Flooding occurs periodically along the Ohio River and connecting streams because of the large watershed that the natural drainage system controls. Normal pool elevation of the Ohio River in the area of the existing bridge is approximately 455 feet.

3.2. Unconsolidated Overburden and Stratigraphy

Based on a review of available geologic mapping (Geology of the Covington Quadrangle, USGS, 1971), information derived from the Ohio Department of Natural Resources, and the US Department of Agriculture Soil Conservation Service Soil Survey of Boone, Campbell, and Kenton Counties, Kentucky, the current and possible locations for the future bridge replacement are covered by alluvium, terrace deposits, and lacustrine and glacial outwash deposits in the floodplain areas of the Ohio River. Residual soils and some glacial outwash deposits exist on upland areas. Upland areas are underlain by bedrock belonging to the Kope, Fairview, Bellevue Tongue of the Grant Lake Limestone, and Bull Fork Formations. Bedrock beneath the alluvium and lower terrace, outwash, and lacustrine deposits consists of the Kope Formation and possibly the Point Pleasant Formation. The bedrock of the Point Pleasant, Kope, Fairview, Bellevue tongue, and Bull Fork Formations is Middle to Upper Ordovician in age, consisting of varying percentages of interbedded shale and limestone. Table 1 provides general descriptions of soil and bedrock lithologies from the referenced mapping. No faults or other structural concerns were noted on the geologic mapping reviewed in the vicinity.

Table 1. Lithology in the Project Area

Name of Unit	Approximate Elevation of Unit (feet)*	Description
Alluvium	470 - 510	Clay, Silt, Gravel, and Sand in modern floodplain and channel deposits, [0 to 55'+]
Terrace Deposits	520 - 600	Clay, Silt, and Gravel; commonly contains limestone and siltstone cobbles and slabs, including igneous cobbles, [0 to 70'+]
Outwash Deposits	480 - 535 790 - 930	Clay, Silt, and Gravel; gravel is poorly to well sorted, rounded to sub-angular; glacial transported quartzite, sandstone, chert, igneous often crossbedded with terrace deposits, [0 to 150']

Table 1. Lithology in the Project Area
(Continued)

Name of Unit	Approximate Elevation of Unit (feet)*	Description
Lacustrine (Lake) Deposits (?)	520 - 610	Clay, Silt, Sand, and possibly Gravel; Predominately greenish-gray silty clay; lower part of unit contains organics, [0 to 35’]
Artificial Fill	485 - 525	Unknown Properties
Lexington Limestone	<385 (?)	Limestone and subordinate shale, gray, micro-grained to coarsely crystalline grained, fossiliferous zones.
Point Pleasant Formation	< 385 (?) - 490	Limestone (45% to 70%) interbedded with Shale; Limestone is gray, fine to coarse grained, fossiliferous, locally phosphatic, zones sparry, zones bioclastic; Shale is gray, slightly calcareous, [105’]
Kope Formation	490 - 700	Shale (55% to 85%) interbedded with Limestone; Shale is gray, laminated to thinly bedded, zones slightly calcareous, often weathers readily; Limestone is gray, fine to coarse grained, zones argillaceous, thin bedded, sometimes bioclastic, [205’ to 240’]
Fairview Formation	690 - 820	Shale (45% to 60%) interbedded with Limestone; Shale is gray, laminated to thin bedded, slightly calcareous; Limestone is gray, fine to coarse grained, thin bedded, zones irregular bedded, bioclastic, fossiliferous, [90’ to 120’]
Bellevue Tongue of the Grant Lake Limestone	790 - 840	Limestone, gray, rubbly/irregular bedded, fossiliferous/bioclastic, argillaceous, often lenticular, with shale partings, [7’ to 20’]
Bull Fork Formation	810 – 900+	Limestone (>50%) interbedded with Shale (portions Siltstone); Limestone is micro-grained to coarsely crystalline grained, zones argillaceous, very thin to thin bedded, zones irregular bedded, fossiliferous, bioclastic; Shale/Siltstone is gray, silty, thin bedded, calcareous, [85’+]

*As noted on USGS Geologic Mapping in the general vicinity of the proposed project.
[ ] – Designates approximate range of thickness of unit according to USGS.

Karst features such as sinkholes, sub-terrainian channels, and other solution features periodically occur in the area underlain by high percentages of limestone. Karst features are observed more often in the upland areas that have relatively thin soil horizons.

3.3. Ground Water Hydrology

Because of the permeable nature of the subsurface stratum in the floodplain areas in the vicinity of the bridge, the water table near the current bridge location is influenced by the water surface elevation of the Ohio River at any given time. Based on information derived from The Kentucky Geological Survey's Groundwater Resources of Kenton County, Kentucky (2001), ground water flows in the unconsolidated sediments within the floodplains yield 200 to 550 gpm (gallons per minute) in finer grained sediments and as much as 1000 gpm in coarser sediments. The Kope, Fairview, Grant Lake and Bull Fork Formations often yield 100 to 500 gpm in wells drilled in valley bottoms and along upland streams, and usually insignificant amounts of water in wells placed along hillsides and hilltops. Most groundwater in the upland areas is derived from precipitation that has drained through soils and bedrock fractures, joints, bedding planes, and faults. Karst channels also influence the groundwater flow in upland areas in the region.

3.4. Regional Seismicity

The Covington – Cincinnati area is susceptible to periodical earthquake events. There have been 14 moderate earthquakes that caused minor damage in Ohio since 1776 and numerous similar quakes have occurred during that time in Kentucky. No deaths have been recorded by the events in Ohio. A series of four earthquakes, part of the New Madrid Earthquakes of 1811 and 1812 in Southeast Missouri and Northeast Arkansas, were of sufficient intensity to topple chimneys in Cincinnati. A major earthquake centered in Charleston, South Carolina in 1886 was strongly felt in Kentucky and Ohio. More recently, an earthquake centered in Sharpsville, Kentucky in 1980 was strongly felt throughout the study area, causing minor to moderate damage in communities near the Ohio River.

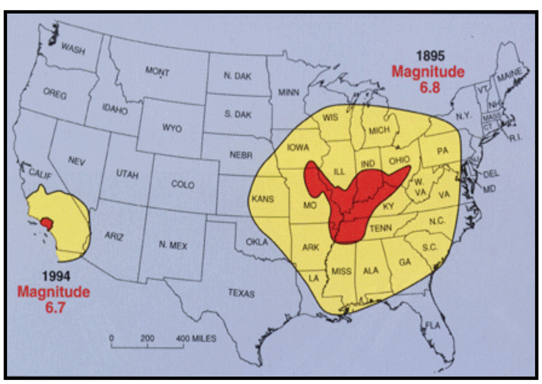

Figure 2. Relative Size of Affected Areas

Although earthquakes in the central and eastern United States are less frequent than in the western United States, they affect much larger areas. Figure 2 (Source: http://quake.wr.usgs.gov/) shows two areas affected by earthquakes of similar magnitude-the 1895 Charleston, Missouri, earthquake in the New Madrid seismic zone and the 1994 Northridge, California, earthquake. Red indicates minor to major damage to buildings and their contents. Yellow indicates shaking felt, but little or no damage to objects.

Earthquake epicenters and magnitudes for the Central and Eastern United States are presented in Figure 3. This figure indicates the corridor within this study is in an area of moderate seismic potential.

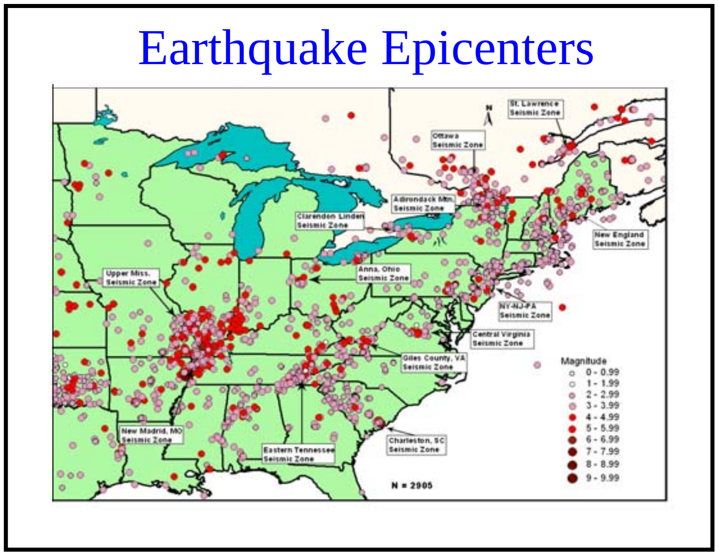

Figure 3. Earthquake Epicenters and Magnitudes in the Central and Eastern United States

4. Existing Corridor Features

4.1. General

The primary land uses in the immediate vicinity of the proposed bridge - roadway corridor consists of urban/suburban areas within the cities of Cincinnati, Ohio and Newport and Covington, Kentucky. Specific categories of land uses include commercial properties and businesses, utility and industrial facilities, residential communities, undeveloped woodlands and grasslands, pasture lands, and public areas such as parks. There are flood control levees and walls on both sides of the Ohio River. A well established network of roads, drainage facilities, and utilities exists throughout the area on both sides of the Ohio River. The utility company CINergy has a large transfer station on the north side of the river, immediately west of the bridge. No cemeteries were found within the right-of-way of I-71/I-75 corridor or the immediate vicinity of the existing bridge. The Lynn Grove Cemetery exists approximately 500 feet east of existing I-71/I-75 to the south of 13th Street in Covington, Kentucky. Other cemeteries may exist in the area that were not encountered during this field reconnaissance.

4.2. Features within Bottom and Alluvial Terrace Areas

The existing Brent Spence Bridge is situated along an alluvial floodplain terrace bank crossing the Ohio River. The existing roadways and bridge utilize a complex matrix of approaches, embankments, retaining walls and elevated structures on both sides of the river. The Brent Spence Bridge serves as the I-71 and I-75 crossing for the river at Covington/Newport, Kentucky and Cincinnati, Ohio. The communities of Covington and Newport cover the alluvial terraces on the Kentucky side of the river. Based on the construction of the existing Brent Spence Bridge and the Paul Brown Stadium, depths to bedrock range from the approximate depths of 80 feet to 100 feet in the alluvial floodplains at the bridge. Flood control levees and floodwalls are situated along the Kentucky side of the river in the vicinity of the existing bridge protecting the Covington and Newport communities, see Figure 4.

Figure 4. View Looking East from I-71/I-75 Showing Flood Control Levee in Covington, Kentucky

In the immediate vicinity of the existing I-71/I-75 bridge on the Kentucky side of the Ohio River is a Hampton Inn on the west side of the bridge and Courtyard by Marriott, Holiday Inn, and Extended Stay hotels situated on the east side of the bridge. A storm sewer transfer and overflow facility is situated between the bridge and the Hampton Inn. Beyond the immediate vicinity of the bridge on the Kentucky side are numerous commercial, public and residential properties.

On the Ohio side of the river, a gravel and rock distribution facility is situated under and on the west and east sides of the existing bridge. The CINergy West End substation is situated approximately 250 feet west of the existing bridge on the Ohio side. The sub-station covers approximately 11 acres. There are numerous high voltage transmission towers, lines, and related facilities at the substation that service downtown Cincinnati and Northern Kentucky. The high voltage transmission lines cross the river and traverse the area, particularly on the west side of the bridge. The facility also routes two major natural gas lines to and from Northern Kentucky. The century-old Longworth Hall, formerly a train depot, is adjacent to and west of the CINergy substation. Longworth Hall is on the National Register of Historic Places. The Paul Brown Stadium and related facilities are situated approximately 0.3 miles east of the existing bridge on the Cincinnati side of the river. The Clay Wade Bailey Bridge, used as a railroad and roadway crossing, is situated approximately 800 feet to 1000 feet east and upriver of the Brent

Spence Bridge. The city of Cincinnati encompasses the surrounding area on the Ohio side of the bridge. That portion of downtown Cincinnati is situated on an older alluvial floodplain terrace. There are numerous high-rise buildings, commercial properties, residential properties as well as public properties and facilities on the Cincinnati side of the river within close proximity of the existing roadway. There are also numerous approach roads and ramps that network into the I-71/I-75 interchange on and off the existing bridge. Flood control facilities such as levees and floodwalls are present along the Ohio River.

4.3. Upland Areas

The upland areas within and near the project area are only situated on the Kentucky side of the river. They are west and south of the existing bridge location. Upland areas are likely to be encountered only in the creation of new approaches that may be built south of the existing bridge, and possibly at any relocation or modified section of I-71/I-75 at the southern portion of the project. The land uses in the upland areas include urban and suburban areas, undeveloped woodland, grasslands, various commercial and public properties and facilities, public utilities and parklands.

Based on the previously referenced literature and mapping reviewed, and FMSM's general knowledge of the area, the soils generally consist of a silty clay to silty loams, varying in depth from 2.5 feet to greater than 10 feet. The soils on the upland areas are prone to moderate to severe erosion when exposed at the surface. The upland soils are generally residual in origin, with localized areas of glacial outwash deposits. As previously mentioned, karst features such as sinkholes exist in some upland areas.

Bedrock encountered in the upland areas will contain varying percentages of interbedded limestones and shales. The higher the percentage of shale in the bedrock, the more prone to weathering and slope creep. The bedrock of the Kope Formation is well known in the area for its soil-like behavior upon exposure to the elements, as shown in Figure 5.

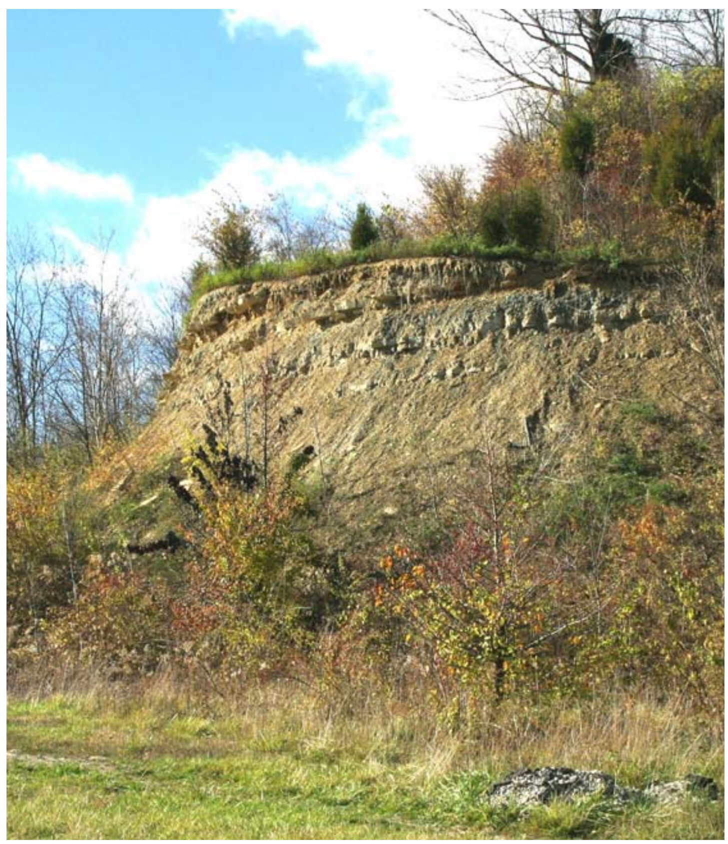

Figure 5. Outcrop of Kope Formation showing severe weathering and soil-like characteristics.

4.4. Potential Wetlands and Flooding

A review of National Wetlands Inventory maps by FMSM personnel indicates that wetland/stream environments exist along the Ohio River and showed several ponds in the area. Flooding occurs periodically along the Ohio River. Cincinnati, Covington, and Newport have built numerous floodwalls, levees, and diversions to control seasonal flooding along the river.

4.5. Conditions at the Existing Bridge Crossing

A review of FMSM's 2001 underwater inspection report for the existing bridge indicates that two main piers rest in water with depths varying from 22 to 37 feet below normal pool elevation. The river bottom at the pier locations was described as consisting of sand, silt, cobbles, boulders and tree debris, and varied from approximate elevation 418 to 433 feet. Review of existing bridge drawings, dated 1960, and supplied by the KYTC indicate the two main piers are supported by caissons founded on bedrock. The design bottom of caisson elevations are shown to be approximately 371 feet at the northern pier, and 375 feet at the southern pier. The drawings also indicate the land piers immediately adjacent to the Ohio River to be supported by pile foundations.

5. Geotechnical and Other Concerns

5.1. General Concerns Associated with Possible Bridge Location

The placement of a new bridge at this location will be affected by numerous concerns which include, but are not limited to the following constraints:

1. The CINergy substation facilities and Longworth Hall on the northwest side of the bridge reduce the logistics of a tie-in of the new bridge at that location;
2. The storm sewer facilities on the southwest side of the bridge on the Kentucky side of the river is also a potential logistics factor;
3. Rerouting I-71/I-75 significantly to the west on the south side of the existing bridge would potentially involve a significant cut in the upland areas previously described to create suitable roadway approaches;
4. There are several hotels situated on both sides of the existing bridge on the Kentucky side that would potentially be in the path of any proposed location for a new bridge; and
5. Any proposed location of a new bridge will require the relocation of numerous commercial, residential and public facilities on both sides of the Ohio River. The following sections of this report present geotechnical issues related to construction of the proposed I-71/I-75 roadway and bridge over the Ohio River.

5.2. Geological and Geotechnical Conditions

The bridge will require deep foundations that will require protection from scour within the Ohio River. No shallow bedrock is expected to be encountered along the Ohio River within the defined project corridor. Shallow bedrock is likely to be encountered only in cuts located in upland areas associated with the southern roadway approaches.

When considering both geotechnical concerns and existing urban development, the proposed bridge location will likely be more feasible just east and/or at the existing bridge location on both the Kentucky and Ohio sides. This alternative would likely impact fewer existing structures and facilities, including primary electrical transmission lines and gas lines that are situated on the west side of the existing bridge. There would likely be fewer design problems associated with the proposed bridge and approaches in relation to construction adjacent to existing historical or operational facilities.

5.2.1. Geotechnical Concerns associated with the Structure of a New Bridge. Because of the depth to bedrock at the existing bridge, foundation systems for the replacement bridge will likely be rock bearing, deep foundations. Typical foundation types for bridges with similar subsurface conditions include: driven piles, drilled shafts, and dredged caissons. The foundation of the two main piers of the existing bridge reportedly consist of dredged caissons founded on bedrock. Each type of foundation system should be evaluated to determine which is the most efficient and cost effective. Both driven piles and drilled shafts are considered slender foundations, and will develop axial capacity from the friction between the pile/shaft perimeter and the surrounding soils as well as end bearing capacity from the founding stratum. Resistance to lateral movement of the slender deep foundations will be derived from the surrounding soils and is dependent upon the embedment lengths, diameters and material properties of the piles or shafts. Dredged caisson foundations follow a spread footing concept, which derives bearing capacity at the bearing surface under the caisson. This type of foundation is typically massive, and can withstand significant lateral loads.

5.2.2. Roadway Concerns. The exiting I-75/I-71 roadway will need to be tied into a new bridge in the alluvial floodplain and possibly upland areas previously described. Roadway structures will need to be designed considering the affects of flooding as well as seismic events. Existing roadways have utilized numerous wall systems that retain embankment and unconsolidated cut areas in areas of restricted right-of-way.

Because of the highly urbanized setting of the existing corridor, right-of-way will likely be very restricted and traditional embankment construction will exist minimally. Mechanically Stabilized Earth (MSE) walls, tied back walls, and elevated structures may be required to minimize the proposed roadway foot print and influence on adjacent properties. The use of lightweight fill materials may also be required to reduce roadway loads on, or adjacent to, existing facilities.

Soil and bedrock cuts may be necessary in upland areas if the new alignment is constructed to the west of the existing roadway. Because of the highly degradable nature of the local rock formations, soil cuts should be designed with as flat an outslope as possible to reduce erosion and promote revegetation. Additionally, intercept ditching may be required above the daylight points of soil cuts to direct surface runoff away from soil cut faces. Rock cuts should be designed to promote stability on a long term basis with consideration to maintenance costs.

5.3. Seismic Concerns

The possibility of a significant seismic event should be considered in relation to the construction and long term stability of the bridge and roadway structures. A seismic event could create several geotechnical problems, including liquefaction of foundation soils and dynamic loading caused by high frequency lateral movement. Liquefaction induces a reduction of the load bearing capacity of the soils in the affected areas. This loss of strength could cause embankment settlement/failures, or the loss of frictional soil resistance to bridge substructure foundations. The loss of frictional strength could leave the foundations laterally unsupported. A second potential geotechnical concern could be a seismic event introducing lateral movements and therefore loads into the foundation systems of structures. Introducing lateral loads while there is a loss of soil strength would require the foundation system to carry all structural and induced loads internally. Additionally, the proposed bridge site should be characterized seismically in order to provide spectra response to the bridge design team. It is recommended that seismic analyses be performed using data collected from sample borings along the proposed centerlines of any bridge structures.

5.4. Scour Concerns

Because of the previously described alluvial, glacial outwash and lacustrine deposits present at potential locations for the new bridge, scour will be of concern in areas surrounding bridge foundations, and embankments adjacent to streams. A final scour study should be performed in conjunction with hydrological and hydraulic modeling during the design of the selected bridge structure. Typically the KYTC requires that the tops of all spread footings and the bases of all shaft/pile caps be constructed below the anticipated maximum scour elevation.

6. Conclusions

The purpose of this overview was to provide a general summary of the geologic conditions and geotechnical concerns related to the general site conditions, soil, bedrock, and other features likely to be encountered within the proposed bridge-roadway corridor and to identify geotechnical features that could have an adverse impact on design and construction. FMSM has reached the following conclusions about the proposed roadway corridor.

6.1. Based on the field reconnaissance of the proposed corridor and information reviewed during this study, there is no significant difference geotechnically crossing on the east or west sides of the existing bridge along the river. The alignment for a new bridge is likely best situated immediately east of the existing bridge because that location appears less intrusive to surrounding facilities. This would likely create fewer geotechnical concerns associated with construction methods that may be required to avoid existing structures and facilities. In regards to the south approach to the bridge, construction to the west of the existing alignment will likely involve rock cuts in slopes historically known for instability and severe degradation. Construction to the east of the existing roadway may require significant embankment retaining structures. Neither of these two issues is considered a "fatal" geotechnical flaw. When evaluating geotechnical issues within the City of Cincinnati, the alluvial terrace deposits will likely present similar subsurface conditions whether to the east or west of the existing alignment.

6.2. Bridge foundations are likely to be situated in deep alluvial and glacial outwash materials. It is recommended that a geotechnical exploration of the selected alignment be performed to determine the soil and bedrock stratigraphy to establish foundation characteristics for evaluation of embankment slope stability and settlement, bridge foundation design, scour susceptibility, liquefaction potential and seismic response. Engineering analyses should be performed at each substructure location in order to develop appropriate geotechnical information for design and identify potential areas of concern. Such analyses should include: slope stability at bridge abutment locations; bearing capacity of spread footings and dredged caissons; axial and lateral capacity of drilled shafts and/or pile groups; negative skin friction/uplift capacity of piles and/or shafts, and wave equation/drivability analyses for piles.

6.3. Karst features exist in the area, most noticeably in the upland areas above the southern portion of the project where limestone percentages are high. If the I-71/I-75 approaches are shifted into these hillsides, karst features could be encountered. Foundation elements for the new bridge and approaches in these areas should also consider possible affects of karst on foundations.

6.4. It is recommended that a site specific seismic evaluation be performed at the bridge site selected for final design. Testing in the form of cross-hole logging, seismic reflection/refraction profiling, and seismic cone penetration testing should be evaluated for use in data acquisition. The purposes of a seismic evaluation would be to: identify soils along the proposed bridge alignment that may be susceptible to liquefaction, estimate the potential induced settlements at substructure locations, assess the stability of the approach embankments and quantify possible deformation under seismic loading, and develop representative foundation response spectra for use in structural design.

6.5. Scour along the foundation elements of a proposed new bridge will need to be considered for any design. It is recommended that a hydrographic survey and detailed scour analysis be performed for the stream crossing selected for final design. The results of the analyses should be used to determine foundation embedment lengths, and span arrangements.

6.6. The effects of groundwater on soil strengths and stability need to be considered during the design of the proposed new bridge and associated roadways.

6.7. Particular attention will need to be given to the affects the construction of the proposed bridge will have on potential flooding to the surrounding communities. Protection of levees, floodwalls, and other flood control facilities should be considered during the design and construction of any new bridge.

6.8 Roadway aspects to be addressed as design continues include: use of flatter cut and embankment slopes to reduce soil/rock erodibility, stabilization of soft/wet areas prior to embankment construction, and soil/rock creep where traditional embankments can be utilized. Where construction space is limited and traditional embankment configurations cannot be utilized, elevated roadways and retained/reinforced, embankments will be used extensively in the design of the roadways and interchanges.

6.9. The information presented in this report should be viewed in the general nature in which it was intended. A more detailed study, which was beyond the scope of this work, will be required to more specifically define potential problem areas within the proposed corridor. A thorough geotechnical exploration of the selected alignment and grade will be required to assist the design and construction of a roadway and bridge(s) within this corridor.

IIB. CULTURAL RESOURCES TECHNICAL MEMORANDUM

CULTURAL RESOURCES TECHNICAL MEMORANDUM
Feasibility and Constructability Study for the Replacement / Rehabilitation of the Brent Spence Bridge, Hamilton County, Ohio, and Kenton County, Kentucky

Prepared by

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The Brent Spence Bridge study corridor is currently loosely defined. It extends from between Harrison Avenue and Hopple Street on the north to just west of Kyles Lane on the south. The study corridor is about 4000 feet (1219 meters) wide. North of the river, the study corridor is bounded on the west by the Mill Creek channel (Figure 1). On the east, it parallels I-75 approximately 2000 feet (609 meters) from the interstate. South of the river, the corridor is shown as extending onto the top of Kenton/Park Hills on the west and the Covington rail yards on the east (Figure 2).

The following discussion is broken into four parts: Variables Affecting Preservation; Architectural Resources; Archaeological Resources; and Key Cultural Resource Issues. It is noted that this is a preliminary planning document that should be refined as the planning and design tasks of the project move forward. Many of the cultural resources discussed herein will not be impacted in any way as it is presumed that the planning alternatives and eventual preferred alignment will have significantly narrower footprints than the study corridor.

VARIABLES AFFECTING PRESERVATION

The project study corridor lies within the bounds of three active river valleys: Mill Creek on the Ohio side; the Ohio River proper; and the Licking Creek on the Kentucky side. Also, a now-channelized stream, Willow Run, was historically present in west Covington. The stream was channelized and covered when I-75 was constructed (Kornilowicz-Weldon 1993). Further, for some 200 plus years, the study area portion of the four stream valleys has been the scene of increasingly intense industrial and urban development. Thus, certain natural and cultural factors have effected the preservation of cultural resources within the study corridor.

Three natural factors are known to or may have affected cultural resources preservation in the study corridor. These are alluviation, flood displacement and scouring, and colluviation. Alluviation, resulting from overbank deposition along all three rivers, is persistent across the project study area. According to the *Soil Survey for Hamilton County, Ohio* (Lerch et al. 1982) and the *Soil Survey for Boone, Campbell, and Kenton Counties, Kentucky* (Weisenberger et al. 1989), the soils of both the floodplain and first and second terraces are alluvial in origin. In the historic period, both the floodplain and the first terrace have been subject to overbank flooding and the soil profiles suggest that this condition has been common through the Holocene period. Thus, surface burial has occurred in all three settings and archaeological sites can be expected at depth.

Flooding routinely results in the movement and even eradication of buildings and other surface features. Flooding also can result in displacement of items resulting in redeposition and loss of context. While displacement and redeposition is likely to be relatively common in the study area, intensive and wide-spread scouring which results in the removal of soil matrix and, in some cases underlying parent rock, is uncommon. Such scouring tends to result from catastrophic floods, like that that scoured the Norwood lateral valley, or from the movement of glaciers across the landscape. In the study area, the removal of cultural features due to scouring is considered unlikely, while the displacement and redeposition of artifacts from flooding should be considered likely.

Colluviation resulting from the downslope migration of rock and/or soil is noted in the soil manuals as present in both the Kentucky and Ohio study areas. The colluvial deposition, in either area, does not appear to be massive. While prehistoric sites may have been affected by colluvial events over the past 10,000 years, there is no indication that large-scale burial of cultural features or sites has occurred.

The cultural factors that have affected archaeological and architectural resources in the area are redevelopment and abandonment. Initial building in an area usually results in alteration to the existing topography. In urban settings, the period of initial historic development literally lays the foundations upon which subsequent development occurs. Thus, each succeeding period of development constructs its foundations upon the fill and foundations of the preceding period (Sullebarger Associates 1991). Development and subsequent redevelopment in all sections of the study area has resulted in feature burial. The abandonment of features, in particular privies, wells, and cisterns, also has resulted in their burial. Subsequent development in an area also masks such features from view. Based on the results of excavations conducted by Purtill et al. (2003), Miller et al. (2000), and others, it is considered likely that buried archaeological features or deposits would be encountered in areas now hosting buildings, parking lots, roads, railroads, or other elements of the built environment.

ARCHITECTURAL RESOURCES

Previously recorded architectural properties are present in the study corridor on both sides of the river. The Ohio Historic Inventory (OHI) and Kentucky’s William S. Webb Museum of Anthropology and Office of State Archaeology (OSA) files contain reference to over 1000 structures. On Figure 2, we have shown only individual properties that lie outside of the National Register districts as the number of properties inside the districts is quite high. The known architectural resources and districts are briefly discussed below.

OHIO

The OHPO databases contain information on 231 individual buildings or features which have been assigned OHI numbers within the study corridor. Of this grouping, 17 individual properties have been determined eligible to the National Register of Historic Places (NRHP) or are listed on the Register. Of these, 3 individual properties also are designated National Historic Landmarks (Carew Tower, Plum Street Temple, and Union Terminal).

In addition to the individual properties, 8 areas have been recommended or are listed as National Register Districts. These NR Districts lie partially within or abut the study area as do 16 properties or locations which have been designated as Local Historic Districts (LHDs).

The 231 properties listed on the Register are shown on Figure 1. The location plottings on the figure are based on UTM information provided in various OHPO databases. The exact locations of the 231 properties have not been field confirmed. The most notable known error in the existing OHPO GIS property plottings are those of Carew Tower. The building is plotted in different locations in the OHPO National Register and OHI files. Both plottings are shown on Figure 1. The building is located at the easternmost location.

The NRHP individual properties include 17 buildings. Of these, the one currently closest to the existing bridge approach corridor is the B&O Freight Terminal building (now locally called Longworth Hall and Design Center). Historically located between 2^{nd} and 3^{rd} Streets, Longworth Hall lies adjacent to the west side of the bridge approach (Mitchell 1986). The individual properties range in age from 1810 (Betts House) to 1933 (Cincinnati Union Terminal) and include both secular and religious structures.

The 8 NRHP Districts include: Betts-Longworth; Dayton Street; Laurel Homes; Ninth Street; Over-the-Rhine; Race Street; West Fourth Street; and West Fourth Street Amendment. As shown on Figure 1, the districts are concentrated east of I-75 where they encompass significant tracts within downtown Cincinnati. The districts were listed between 1973 (Dayton Street) and 1995 (Race Street) and there are currently 1646 buildings subsumed within district boundaries. Unlike the NRHP districts on the Kentucky side which are dominated by residential buildings, many of the Ohio-side districts are comprised of commercial buildings or buildings now undergoing conversion from commercial to residential uses.

KENTUCKY

The KHC databases contain information on 879 individual buildings or features which have been assigned Kentucky OAS designations within the study corridor. Of this grouping, 141 properties have been determined not eligible to the NRHP, 174 are listed on or determined eligible to the Register and lie outside of District boundaries, and 564 are within

Districts and listed on or determined eligible to the Register. All or parts of 9 National Register Districts are present in the study area.

As would be expected, the Kentucky OAS properties include both residential and commercial buildings. As was the case on the Ohio side of the study area, both secular and religious buildings are included as individual properties and as contributing elements to the districts. The buildings date predominately to the nineteenth century within the commercial districts. In particular, the Covington Downtown District, just outside the study area, contains a variety of pre-World War II, twentieth-century buildings as well. For reasons related to the historic period settlement pattern, the majority of the buildings in the study area, however, are residential. Initial settlement of the Covington/Newport area began to either side of the Licking River. Residential development spread east-to-west from the Licking River to Willow Run which lay at the base of Kenton/Park Hills. Thus, buildings within the West Side / Main Strasse, Lewisburg, and Westside Neighborhood National Register Districts, in particular, tend to be residential rather than commercial (Sahrbacker 1991; Kornilowicz-Weldon 1993).

The nine NR Districts include: Bavarian Brewery Co.; East Lewisburg; Fort Mitchell Heights; Lee Holman; Lewisburg; Mutter Goettes; Seminary Square; West Side / Main Strasse; and Westside Neighborhood. As shown on Figure 2, the districts are located on both the east and west sides of existing I-75 and encompass large areas of the study corridor. Unlike the Cincinnati side, the Covington-area districts are dominated by residential buildings (Anonymous n.d.; Henderson 1980; Langsam 1983; Sahrbacker 1991; Kornilowicz-Weldon 1993).

ARCHAEOLOGICAL RESOURCES

Terrestrial archaeological sites are known to exist in the project area on both sides of the river. The recorded number of such resources, however, is surprisingly low: only 5 sites are listed in either the Ohio Archaeological Inventory (OAI) or Kentucky's OSA files. No underwater shipwrecks are listed in either site and, as far as can be determined, no systematic underwater survey has been conducted of the Cincinnati – Covington – Newport stretch of the Ohio River. The known archaeological resources in each state are briefly discussed below as are the expected archaeological resources.

OHIO

According to the Ohio State Historic Preservation Office (OHPO) files, there are 4 archaeological sites recorded within the study corridor. All of the sites are prehistoric and all of them were disturbed in the historic period. The sites are 33Ha1 (Cincinnati Tablet Mound), 33Ha242, 33Ha311 (Seventh Street Mound), and 33Ha312 (Richmond Street Mound). Although Site 33Ha242 is unnamed, it, like the other three sites, is noted as a prehistoric mound site.

Site 33Ha312 is unassigned to a specific Woodland period and its mound characteristics are unspecified. Similarly, the construction characteristics of the mound at the Middle Woodland Seventh Street Mound (Site 33Ha311) also are unspecified. In contrast, Site 33Ha1 is an earthen mound assigned to the Early Woodland period and Site 33Ha242 is reported as a Middle Woodland stone mound.

Both Adena and Hopewell mound sites are known to have functioned as both mortuary and residential loci. In the case of Sites 33Ha1 and 33Ha311, mortuary use was identified. All of the sites, however, yielded lithics, ceramics, floral, and faunal remains. The presence of these artifact classes suggests residential use within the site boundaries though likely not of the mounds proper.

In all cases, the prehistoric sites are on the first and second terraces above the main stream Ohio and Mill Creek valleys. Historic development on both terraces and on the active floodplain has certainly impacted any prehistoric deposits except possibly those buried at depth. Prehistoric sites, however, are identified in all of these settings when even limited systematic Phase I survey is conducted (Purtill et al. 2003).

Although no historic archaeological sites are recorded within the Ohio study corridor, historic archaeological sites do exist. The most prominent of these is the Cincinnati & White Water Canal. The canal is shown on early maps (Bowman and Scroggs 1978). The then-abandoned canal between Cincinnati and Valley Junction, Ohio, was purchased in 1863 by the Cincinnati & Indiana Railroad Company. The Cincinnati & Indiana used the existing canal bed in which to construct a new rail bed (Anonymous 1899:12-13). Today, the canal toe path and bed are obvious north of the B&O Freight Terminal building between 2nd and 3rd Streets.

During recent construction for the Paul Brown Stadium, its associated facility field, and Fort Washington Way, historic features in the form of foundations and shaft features were observed in the areas northeast of I-75 and the Brent Spence Bridge approach lanes and the Clay Wade Bailey Bridge. Historic maps illustrating this area and the zone northwest of the approach lanes in the vicinity of the B&O Freight Terminal Building show increasingly dense commercial and industrial buildup of the area between 1815 and 1908 (Anonymous 1815; Robinson & Fairbank 1829; Barnum 1831; Rickey 1846; Mendenhall 1908). Buildings dating to all nineteenth and twentieth century decades, except the period 1800 to 1840, still exist in this portion of the study area; others were removed to make way for new development. Based on excavations conducted elsewhere in the urban core of Cincinnati and along its riverfront (Anonymous 1988), it is likely that building remnants and intact features such as privies, cisterns, and wells, remain. As noted above in the redevelopment discussion, these features are now buried or otherwise obscured.

KENTUCKY

The single previously recorded archaeological site on the Kentucky side is Site 15Ke122. This historic scatter with associated feature provides little insight into the types of archaeological sites likely to occur in the Kentucky portion of the project area. Based on features revealed, however, during the redevelopment of the area immediately east of the bridge between the Internal Revenue Center and the bridge approach lanes, it is likely that possible resources will duplicate those of the Ohio side. During the redevelopment, historic features in the form of foundations, privies, wells, and cisterns were observed. This was expected, as the area was dominated by small industry and residential buildings in the nineteenth and early twentieth centuries (Anonymous n.d.; Henderson 1980; Langsam 1983; Sahrbacker 1991; Kornilowicz-Weldon 1993).

KEY CULTURAL RESOURCES ISSUES

Any proposed modification to the Brent Spence Bridge location and its approaches will have impact on previously recorded cultural properties and will likely impact presently unrecorded terrestrial archaeological resources. In addition, the possibility exists that presently unrecorded underwater archaeological resources are present within the study area as currently defined. Based on the research conducted in the development of this technical memorandum, the key cultural resource issues from north to south in the study area are:

- Eastward expansion of I-75 north of Liberty Street would impact the Dayton Street Historic District and might impact the NRHP-listed Police Station No. 5. In addition, there is a high likelihood that archaeological features would be present.

- Westward expansion of I-75 immediately north of Lincoln Park may impact two NRHP-listed properties (Ohio National Guard Armory and Our Lady of Mercy High School).

- Eastward expansion between 4th and 5th Streets north of the I-75/Fort Washington Way interchange would impact the West Fourth Street and West Fourth Street Amendment Historic Districts. In addition, there is a high likelihood that archaeological features would be present.

- Westward expansion or new construction west of I-75 between the river and 3rd Street would impact the National Register-listed B&O Freight Terminal Building. This building is currently covered by a preservation easement managed by the Cincinnati Preservation Association (CPA). While the easement can be overridden by eminent domain, past CPA executive director Beth Sullebarger indicated this year that CPA would protect such action. Construction or expansion might also affect remnants of the now-abandoned and reused Cincinnati & White Water Canal. Finally, there is a high likelihood that archaeological features would be present.

- It is considered possible that submerged cultural resources including shipwrecks may exist in the Ohio River on either riverfront and in the channel.

- Westward expansion or new construction west of I-75 between the riverfront and the Euclid Avenue interchange would impact the National Register Lewisburg Historic

District and its individually listed elements. In addition, there is a high likelihood that archaeological features would be present.

- Eastward expansion or new construction east of I-75 between the riverfront and the Euclid Avenue interchange would immediately impact the West Side /Main Strasse, Westside Neighborhood, Bavarian Brewery Co., and East Lewisburg historic districts and their individually listed elements. In addition, there is a high likelihood that archaeological features would be present.

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IIC. TECHNICAL MEMORANDUM UST/HAZMAT AND NATURAL ENVIRONMENT

DRAFT
Technical Memorandum
UST/Hazmat and Natural Environment

As part of the Feasibility and Constructability Study for the Replacement/Rehabilitation of Brent Spence Bridge Third Rock Consultants, LLC (Third Rock) has completed a desktop review of available UST/Hazmat records and natural environment information for the study corridor. Data from a variety of sources were compiled to evaluate the study corridor. Several agencies were contacted to acquire data pertaining to the human and natural environment of the project corridor. Those data sources are listed below.

- United States Environmental Protection Agency (EPA)
- United States Fish and Wildlife Service (USFWS) Region 3
- United States Army Corps of Engineers (USACE)
- Ohio EPA
- Ohio Department of Natural Resources (DNR)
- Ohio Bureau of Underground Storage Tank (UST) Regulations
- Kentucky Department of Fish and Wildlife Resources (KDFWR)
- Kentucky Natural Resources and Environmental Protection Cabinet (KNREPC)
- Kentucky Division of Waste Management (KDWM).

Underground Storage Tanks/Hazardous Materials

The significance of any specific UST/Hazmat record is unknown without completing a more detail assessment, such as an agency hard copy file review typically conducted during the phase I design project phase. Some records may strongly suggest a significant liability to the project such as the presence of a federal superfund site, municipal landfill or a major abandoned industrial facility. No such records were identified for obvious red flag sites in the corridor that would require consideration by the project team in the selection of project alternatives. It should be noted however that considering this project is located in a major urban area, UST/Hazmat concerns should be expected along any alternative selected.

The large-quantity hazardous waste generators (LQG), small-quantity hazardous waste generators (SQG), treatment/storage/disposal facilities (TSD) and hazardous waste transporters (Transporter) data were downloaded from the EPA Envirofacts Data Warehouse. The downloaded data contained 421 records for hazardous waste generators and handlers in specified zip codes. The zip codes searched for Cincinnati were 45202, 45203, 45204, 45214, 45219, 45220, 45221, and 45225, and those searched for Covington were 41011, 41014, and 41016. All sites were overlaid on the project area and then were deemed inside or outside of the project corridor. Sites outside the project corridor were eliminated. Out of 421 total records, 37 fell within the project corridor.

One hazardous waste site is specifically related to the Brent Spence Bridge itself. This site is related to the previous painting operation of the bridge. Sandblasting grit was not properly controlled and resulted in lead contamination in the soil below the bridge in

Kentucky. The Kentucky Transportation Cabinet has completed some corrective action, and additional work is anticipated.

UST data was obtained from two sources. For Kentucky, the Kentucky Division of Waste Management (KDWM) maintains the UST database. UST data for Ohio was obtained from the Ohio Bureau of UST Regulations (BUSTR), which is housed in the State Fire Marshal's Office of the Ohio Department of Commerce. Sites within the study corridor were identified using the zip code, and address and plotted using geocoding software. There are 26 UST sites on the Kentucky side of the study corridor and 31 UST sites on the Ohio side of the project corridor.

Ohio superfund sites were obtained from the Ohio EPA Division of Emergency and Remedial Response (DERR). Brian Gara of DERR provided a shapefile to Third Rock via email of points representing superfund sites within the Hamilton County portion of the project corridor on July 10, 2003. The file received contained six sites; all six sites fell within the project corridor.

Kentucky superfund sites were obtained from the KDWM Superfund Branch. Out of 86 total records for Kenton County, only two are known to fall within the project corridor. Due to the poor quality or limited location information, more could possibly be within the project corridor.

Landfill locations were also researched during the environmental footprint process. The Ohio EPA Division of Solid and Infectious Waste Management website was accessed for information pertaining to possible landfills current or historically operated landfills in the project area. According to several sources on the website, no landfills are located on the Ohio side of the project corridor. Additionally, the Kentucky Division of Waste management website was reviewed for the presence of any current or historically operated landfills in Kenton County. According to the list of Permitted Solid Waste Landfills there are none present in Kenton County.

Natural Environment

The highly developed urban nature of the study area suggests that natural environmental concerns are minimized. There are very little terrestrial natural habitat areas in the study area, however the Ohio River represents a significant aquatic resource.

The presence of mussel beds in the Ohio River between river miles 470 and 472 was researched by contacting the USACE, the Ohio DNR Division of Water, KDFWR, and the Kentucky State Nature Preserves Commission (KSNPC). Responses indicate that the project area is in the range of several federal endangered mussels. Several surveys of freshwater mussels in the Ohio River were reviewed but none conducted surveys within the project area. The potential presence of endangered mussels species in the Ohio River will require mussel surveys to determine if any particular alternative could impact the species.

Wetland locations were obtained from the KDFWR and the Ohio DNR Geographic Information Systems (GIS). Wetlands are present on both the Ohio and Kentucky sides of the project corridor. There were no significant wetland areas identified in the project area.

The project area was also researched for the presence of wild and scenic rivers, outstanding resource waters, high quality fishing stream, and spawning areas. Cliff Schneider, an aquatic biologist with the state of Kentucky, confirmed that there are no designated wild and scenic rivers, outstanding resource waters, high quality fishing streams or spawning areas in the study area.

Several agency websites were reviewed for the presence of threatened and endangered (T&E) species in the project area. Ohio Natural Heritage Database of T&E species. The website contains lists of endangered species in Hamilton county, however no specific locations or habitats were confirmed in the project area. Additionally, the USFWS Region 3 contains "by county" lists of T&E species. Kentucky also has similar lists housed at the KDFWR and the KSNPC. No specific point locations for T&E species or critical habitat were identified in the study area. It can be anticipated the USFWS will identify several freshwater mussel species and the Indiana bat a potentially being impacted the project.

The presence of nature preserves, natural areas, state parks, national parks, local parks and other public land was also researched. The Kentucky Stewardship data, obtained from KDFWR information systems did not reveal any such lands on the Kentucky portion of the study corridor. The Ohio DNR Division of Natural Areas and Preserves did not reveal any state or national level parks or preserves in the area. Data provided with ESRI's ArcView 8.3 provided local park locations of which there area several in the study area. The largest, Devou Park, is located partially within the project area in Covington.

The Kentucky NREPC Division of Forestry and the Ohio DNR Division of Forestry were both contacted to determine if any state or national champion trees resided within the project corridor. In Kenton County, no state or champion federal trees were known to exist. However, Cincinnati contains 4 state champions. None of the champion trees fall within the project corridor.

APPENDIX B
TRUCK DIVERSION STUDY

Brent Spence Truck Diversion Technical Memorandum
Travel Forecasting

The Brent Spence Truck Diversion study analyzes the impacts of diverting truck trips off the Brent Spence Bridge onto alternate routes. The Ohio Kentucky Indiana (OKI) Regional Council of Governments' 2030 transportation model and the ITS Deployment Analysis System (IDAS) software are utilized to complete this task.

In 2030, the Brent Spence Bridge carries 197,000 vehicle trips per day. Truck trips account for 22% of this total. In the Cincinnati area there are 77,000 truck trips traveling across the Ohio River on a daily basis with the Brent Spence Bridge accounting for 43,000 of them. This is 56% of the total number of truck trips going across the Ohio River. The table below describes the number of vehicle trips crossing the Ohio River in the Cincinnati area for auto and truck classes.

	Auto Volume	**% Of Total Auto Trips crossing OH River**	**Truck Volume**	**% Of Total Truck Trips crossing OH River**
I-275 West Bridge	48,000	10.3%	12,000	15.6%
Brent Spence Bridge	154,000	33.1%	43,000	55.8%
Clay Wade Bailey Bridge	24,000	5.2%	2,000	2.6%
Roebling Bridge	20,000	4.3%	2,000	2.6%
Taylor Southgate Bridge	22,000	4.7%	1,000	1.3%
I-471	96,000	20.6%	8,000	10.4%
Combs-Hehl Bridge	103,000	22.2%	9,000	11.7%
Total number of trips on OH River bridges	465,000	NA	77,000	NA

*** Number of trips has been rounded to the nearest 1,000.*

Originally, the model is set so that trucks are prohibited from using the Brent Spence Bridge to cross the Ohio River. The modeling team noticed that trucks trips transfer to the nearest bridge, the Clay Wade Bailey. This truck trip behavior is not representative of realistic expectations and, to compensate, truck trips are ultimately prohibited from using the Brent Spence Bridge, the Clay Wade Bailey Bridge, and the Roebling Bridge, as well as the $4^{th}/5^{th}$ Street and 12^{th} Street bridges in Kentucky. This diverts the majority of truck trips to the downtown I-471 Bridge while the Taylor Southgate, Combs-Hehl, and I-275 west bridges also collected a smaller percentage of the total. Listed below are the volumes of vehicle trips after the trucks are diverted. In the final truck trip diversion scenario, the Brent Spence, Roebling, Taylor Southgate, $4^{th}/5^{th}$ Street, and 12^{th} Street bridges all show an increase in the number auto trips.

	Auto Volume	**% Of Total Auto Trips crossing OH River**	**Truck Volume**	**% Of Total Truck Trips crossing OH River**
I-275 West Bridge	46,000	10.0%	15,000	19.7%
Brent Spence Bridge	166,000	36.0%	0	0.0%
Clay Wade Bailey Bridge	16,000	3.5%	0	0.0%
Roebling Bridge	25,000	5.4%	0	0.0%
Taylor Southgate Bridge	23,000	5.0%	6,000	7.9%
I-471	86,000	18.7%	40,000	52.6%
Combs-Hehl Bridge	99,000	21.5%	15,000	19.7%
Total number of trips on OH River bridges	461,000	NA	76,000	NA

*** Number of trips has been rounded to the nearest 1,000.*

The truck diversion creates a 0.38% increase in total number of regional Vehicle Miles Traveled (VMT), a 0.34% increase in total Vehicle Hours Traveled (VHT), and a 0.78% increase in total Vehicle Hours of Delay (VHD). Evaluating just the truck trips, VMT increases by 0.97%, the VHT by 2.4%, and VHD by 0.63%. More detailed information concerning the increases in VMT, VHT, and VHD can be found in the table on the following page.

	Total			Truck			Auto		
	2030 Base	**Truck Diversion**	**% Change**	**2030 Base**	**Truck Diversion**	**% Change**	**2030 Base**	**Truck Diversion**	**% Change**
VMT	85,855,000	86,181,000	0.38%	9,855,000	10,194,000	3.4%	76,000,000	75,987,000	-0.02%
VHT	3,026,000	3,043,000	0.56%	273,000	287,000	5.0%	2,753,000	2,756,000	0.12%
VHD	990,000	997,700	0.76%	75,000	80,000	7.1%	915,000	917,000	0.25%

** Numbers have been rounded to the nearest 1,000

The IDAS software program is used to calculate user benefits/costs. The 2030 base and truck diversion networks are entered into IDAS which produces an estimated annual cost of $482,700 associated with diverting trucks on to the bridges mentioned previously. These costs are an accumulation of change in In-Vehicle Travel Time, Travel Time Reliability, Fuel Consumption, and an increase in Accidents. IDAS calculates these costs using default values in terms of 1995 dollars. Listed below are the overall costs rounded to the nearest $100 that are calculated using the IDAS defaults. Tables 1 through 6 in the Appendix show the detailed calculations for each cost.

	2030 Base	**2030 Truck Diversion**	**Benefit with Truck Diversion**
In-Vehicle Travel Time	$30,157,600	$30,546,100	($388,500)
Travel Time Reliability	$10,400	$11,000	($500)
Fuel	$7,335,700	$7,417,400	($81,700)
Accident	$6,818,000	$6,830,000	($12,000)
Total	$44,321,800	$44,804,500	($482,700)

APPENDIX

TABLE 1 – In-Vehicle Travel Time Costs

Transportation Mode	$ Per Person Hour	2030 Base		2030 Truck Diversion		Difference
		Person Hours Of Travel	Cost	Person Hours Of Travel	Cost	
Autos	$8.50	2,968,000	$25,228,000	2,977,000	$25,304,500	($76,500)
Trucks	$20.80	237,000	$4,929,600	252,000	$5,241,600	($312,000)
Total			$30,157,600		$30,546,100	($388,500)

TABLE 2 – Travel Time Reliability Costs (hours of unexpected delay)

Transportation Mode	$ Per Person Hour	2030 Base		2030 Truck Diversion		Difference
		Person Hours Of Delay	Cost	Person Hours Of Delay	Cost	
Autos	$22.50	281.1	$7,200	289.2	$7,400	($200)
Trucks	$62.40	52.2	$3,300	57.0	$3,600	($300)
Total			$10,500		$11,000	($500)

TABLE 3 – Fuel Costs

Transportation Mode	$ Per Gallon	2030 Base		2030 Truck Diversion		Difference
		Fuel Consumption (gal)	Cost	Fuel Consumption (gal)	Cost	
Autos	$1.21	4,540,000	$5,493,400	4,541,000	$5,494,610	($1,210)
Trucks	$1.15	1,602,000	$1,842,300	1,672,000	$1,922,800	($80,500)
Total			$7,335,700		$7,417,410	($81,710)

TABLE 4 – Fatality Costs

Transportation Mode	Internal Cost	External Cost	2030 Base		2030 Truck Diversion		Difference
			Number of Fatalities	Cost	Number of Fatalities	Cost	
Autos	$2,317,398.00	$408,952.00	0.376	$1,025,000	0.376	$1,025,000	$0
Trucks	$2,317,398.00	$408,952.00	0.057	$154,000	0.059	$160,000	($6,000)
Total				$1,179,000		$1,185,000	($6,000)

TABLE 5 – Injury Costs

Transportation Mode	Internal Cost	External Cost	2030 Base		2030 Truck Diversion		Difference
			Number of Injuries	Cost	Number of Injuries	Cost	
Autos	$50,760.00	$8,958.00	74.4	4,443,000	74.1	4,425,000	$18,000
Trucks	$50,760.00	$8,958.00	12.9	770,000	13.3	794,000	($24,000)
Total				5,213,000		5,219,000	($6,000)

TABLE 6 – Property Damage Only Costs

Transportation Mode	Internal Cost	External Cost	2030 Base		2030 Truck Diversion		Difference
			Number of PDO	Cost	Number of PDO	Cost	
Autos	$2824.00	$498.00	110.0	$365,000	109.0	$362,000	$3,000
Trucks	$2824.00	$498.00	18.5	$61,000	19.2	$64,000	($3,000)
Total				$426,000		$426,000	$0

APPENDIX C

ANDERSON FERRY STUDY

ANDERSON FERRY
OHIO RIVER CROSSING STUDY

Conducted in conjunction with the

BRENT SPENCE FEASIBILITY AND CONSTRUCTABILITY STUDY

March 2004

Prepared by

AMERICAN
American Consulting Engineers, PLC

BURGESS & NIPLE

TABLE OF CONTENTS

Anderson Ferry Ohio River Crossing

The scope of work for the Brent-Spence bridge study included a preliminary study of a new Ohio River crossing near the existing Anderson Ferry. This location is approximately 6 miles west of the existing Brent-Spence Bridge and is near the Cincinnati/Northern Kentucky International Airport.

Two alternatives were studied for the possible future roadway associated with this crossing. Alternate No. 1 begins in Kentucky, near the existing KY 3076 (Mineola Pike) interchange with I-275. It extends Mineola Pike, crossing the Ohio River approximately 2500 feet west of the existing Anderson Ferry, and terminates at U.S. 50 in Ohio.

Alternate No. 2 begins at the KY 212 interchange (the airport interchange) with I-275 and extends KY 212 to the same crossing location as Alternate No. 1.

A brief review of the 2030 projected traffic volumes indicated that an interchange with U.S. 50 in Ohio would be required. The predominant traffic movements were toward Cincinnati, making that movement the thru route (see attached alternate exhibit). A detailed traffic operational analysis was not performed, but the traffic projections indicate that a minimum of 2 lanes in each direction would be required for the mainline roadway.

A detailed traffic simulation model should be developed prior to design of this facility to more accurately assess the operational characteristics and lane requirements. This would be especially helpful in the connector/U.S. 50 interchange area.

The interchange with U.S. 50 is somewhat conceptual, but provides for all traffic movements and could be constructed similar to the conceptual layout. All ramps are currently anticipated to carry one lane of traffic, but the required lanes should be confirmed by a more detailed traffic analysis.

The existing facility, at the southern tie-in of Alternate 1 (Mineola Pike), provides a 3 lane bridge over I-75. Lane addition/drop would be required at the north interchange ramps unless Mineola Pike is improved prior to, or in conjunction with this project. The Alternate 2 southern tie-in with KY 212 can utilize the existing 4 lane roadway and bridge over I-275 as part of the new facility.

Several factors influenced the choice of design speed for these alternates. Both existing roads are less than 2 miles in length, with the length of the new roadway extension at approximately 2 miles. This minor extension to already short roadways, when combined with the restrictive topography and urban setting, led to a design speed choice of 45 mph for this facility.

The typical section utilized for both alternates is as follows:

- 4 driving lanes at 12 feet each
- 14 foot median (raised)
- 12 foot outside shoulders
- 18 foot ditch at 6:1

The estimated construction cost of these alternates (not including any right of way or utility relocation) is:

- Alternate 1 $80 million

- Alternate 2 $95 million

Anderson Ferry Bridge Technical Memorandum
Travel Forecasting

The Anderson Ferry Bridge study is meant to determine the amount of traffic that would use a new river crossing near Anderson Ferry Road from U.S. 50 in Ohio to I-275 in Kentucky as well as identify the impact such a crossing would have on the Brent Spence Bridge. The study utilizes the Ohio Kentucky Indiana (OKI) Regional Council of Governments' transportation model to compare a 2030 modified network that includes the Anderson Ferry Bridge crossing to the 2030 Existing plus Future OKI network.

Regionally, there is a significant amount of traffic that utilizes the bridges across the Ohio River. In 1995 and 2030 there are 7 bridges between Ohio and Kentucky in the reach of the river between the I-275 bridges to the east and west. The bridge system remains largely the same with one exception. The L & N Bridge near the Cincinnati Central Business District (CBD) has been closed to traffic and the Taylor Southgate Bridge was replaced. The bridge to the immediate west of the Anderson Ferry area is the west I-275 Bridge. To the east, the nearest Ohio River bridges are the Brent Spence Bridge and the Clay Wade Bailey Bridge. In the 1995 network, these three bridges carry almost 189,000 vehicle trips per day, which is approximately 50% of the total traffic and 33,000 truck trips, which is 72% of the truck traffic that crosses the Ohio River in the OKI region. In 2030, the total volume of traffic increases to 53% or 288,000 vehicle trips per day while the number of truck trips increases to 58,000 or 75%. The tables below describe the volume of vehicle trips on all the bridges for both 1995 and 2030. Further information concerning vehicle trips on the Ohio River bridges can be found in Tables 1 through 6 in the Appendix.

1995 Vehicle Trip Volumes

	Total Trips	Auto Trips	Truck Trips	Percentage of Truck Trips
I-275 West Bridge	35,000	29,000	6,000	17%
Brent Spence Bridge	143,000	116,000	26,000	19%
Clay Wade Bailey Bridge	8,000	8,000	1,000	8%
Roebling Bridge	23,000	21,000	2,000	7%
L & N Bridge	14,000	13,000	1,000	5%
I-471 Bridge	92,000	88,000	5,000	5%
Combs-Hehl Bridge	74,000	70,000	5,000	6%

*** Volumes have been rounded to the nearest 1,000*

2030 Base Vehicle Trip Volumes

	Total Trips	Auto Trips	Truck Trips	Percentage of Truck Trips
I-275 West Bridge	57,000	45,000	12,000	21%
Brent Spence Bridge	219,000	173,000	45,000	21%
Clay Wade Bailey Bridge	12,000	11,000	1,000	8%
Roebling Bridge	25,000	23,000	2,000	9%
Taylor Southgate Bridge	18,000	17,000	1,000	6%
I-471 Bridge	102,000	95,000	7,000	7%
Combs-Hehl Bridge	108,000	99,000	9,000	8%

*** Volumes have been rounded to the nearest 1,000*

The new bridge crosses the river starting at a point west of Anderson Ferry Road on U.S. 50 and goes to the I-275/Mineola Pike interchange at the Airport Exchange Business Park. The bridge crossing is assumed to be a four-lane facility with two lanes in either direction. From the interchange with US 50 to the I-275 interchange the facility type is a major collector with a posted speed limit of 45 mph. This design assumes an upgrade to Erlanger Rd. from where it intersects with the new river crossing to the I-275 interchange.

Based on these assumptions, the new bridge carries a 24-hour volume that is slightly more than 35,000 vehicle trips per day. The largest amount of traffic utilizing the new bridge travels between U.S. 50 in Ohio and the Cincinnati Northern Kentucky International Airport (CVG). The bridge also collects traffic from I-71 and I-75, from portions of I-275, and a smaller amount from the Cincinnati CBD.

When the Anderson Ferry Bridge crossing is included in the 2030 highway infrastructure it diverts a certain number of vehicle trips from the surrounding bridges. The crossing generates 13,000 new vehicle trips across the river on a daily basis. Additionally, it diverts 16,000 vehicle trips from the Brent Spence Bridge. The remaining 6,000 vehicle trips on the Anderson Ferry crossing are a result of vehicle trips diverting from the I-275 West, Clay Wade Bailey, and Combs-Hehl bridges. Of the total 35,000 vehicle trips on Anderson Ferry, 4,000 or slightly more than 11%, are truck trips. One half of these truck trips divert from the Brent Spence Bridge. The remaining 50% are diverted from the other Ohio River crossings in the surrounding area.

During the AM and PM hours there is a similar shift in vehicle trips due to the addition of the Anderson Ferry Bridge. In the AM peak hour the new bridge carries 4,000 auto trips, which in turn helps reduce the number of auto trips on the Brent Spence Bridge by 1,400. The Anderson Ferry Bridge also carries 300 truck trips during the AM peak hour. Consequently, the number of truck trips on the Brent Spence Bridge drops from 3,000 to 2,900. During the PM peak hour, there are 3,500 auto trips and 300 truck trips on the Anderson Ferry Bridge. This changes the auto trips on the Brent Spence Bridge by 1,300 and the truck trips by 100.

The percentage of truck trips on the Brent Spence Bridge increases 73% between 1995 and 2030. The truck trip increase represents a 13% jump in the overall number of vehicle trips on the Brent Spence Bridge. By adding the Anderson Ferry crossing in 2030, the Brent Spence Bridge truck traffic increases by 65% instead, which is an 8% difference. The table on the following page compares the daily traffic volumes on all the Ohio River bridges. Tables 1-6 in the Appendix provide additional detailed information concerning the number of auto and truck trips crossing the Ohio River in the Cincinnati area.

Daily Bridge Volumes by Vehicle Classification for 2030 Alternatives

	2030 Base			2030 AF			% Change		
	Total Vehicle	Auto	Truck	Total Vehicle	Auto	Truck	Total Vehicle	Auto	Truck
I- 275 West	57,000	45,000	12,000	55,000	43,000	12,000	-4%	-4%	-3%
Anderson Ferry	0	0	0	35,000	31,000	4,000	NA	NA	NA
Brent Spence	219,000	173,000	45,000	203,000	160,000	43,000	-8%	-9%	-5%
Clay Wade Bailey	12,000	11,000	1,000	10,000	9,000	1,000	-21%	-20%	-26%
Roebling	25,000	23,000	2,000	25,000	23,000	2,000	0%	0%	-1%
Taylor Southgate	18,000	17,000	1,000	18,000	17,000	1,000	1%	1%	1%
I-471	102,000	95,000	7,000	102,000	94,000	7,000	-1%	-1%	-1%
Combs-Hehl	108,000	99,000	9,000	107,000	98,000	9,000	-1%	-1%	0%

*** Volumes have been rounded to the nearest 1,000*

With the reduction of vehicle trips on several of the Ohio River bridges, there is also an improvement in the V/C or volume to capacity ratio. In this case, the ratio is a measurement of the change in congestion on a highway facility. When calculating V/C using a regional travel demand model, the volume on a facility is permitted to exceed the capacity. Occasionally, the V/C ratio is greater than 1.0. When this occurs significant delay is added to the travel time on the facility. The AM peak hour Brent Spence Bridge V/C, in particular, changes from 1.30 in the 2030 Base Alternative to 1.19 in the Anderson Ferry Alternative. The PM peak hour V/C changes from 1.34 to 1.26. The V/C ratios for all the Cincinnati Ohio River bridges are listed below. The Anderson Ferry Alternative indicates improvements for each river crossing.

AM Peak Hour V/C on the Ohio River Bridges

Bridge	2030 Base	2030 Anderson Ferry	Percent Change
I-275 West – Eastbound	1.32	1.21	-8.33 %
I-275 West – Westbound	0.70	0.66	-5.71 %
Anderson Ferry – Northbound	NA	0.83	NA
Anderson Ferry – Southbound	NA	1.05	NA
Brent Spence – Northbound	1.30	1.19	-8.46 %
Brent Spence – Southbound	1.34	1.26	-5.97 %
Clay Wade Bailey – Northbound	0.27	0.24	-11.11 %
Clay Wade Bailey - Southbound	0.72	0.58	-19.44 %
Roebling – Northbound	1.14	1.13	-0.88 %
Roebling – Southbound	1.37	1.32	-3.65 %
Taylor Southgate – Northbound	0.71	0.71	0.00 %
Taylor Southgate – Southbound	0.44	0.43	-2.27 %
I-471 – Northbound	1.20	1.19	-0.83 %
I-471 – Southbound	0.84	0.81	-3.57 %
Combs-Hehl – Eastbound	0.72	0.72	0.00 %
Combs-Hehl - Westbound	1.40	1.39	-0.71 %

PM Peak Hour V/C on the Ohio River Bridges

Bridge	2030 Base	2030 Anderson Ferry	Change in 2030
I-275 West – Eastbound	0.83	0.81	-2.41 %
I-275 West – Westbound	0.87	0.78	-10.34 %
Anderson Ferry – Northbound	NA	0.98	NA
Anderson Ferry – Southbound	NA	0.64	NA
Brent Spence – Northbound	1.28	1.18	-7.81 %
Brent Spence – Southbound	1.26	1.19	-5.46 %
Clay Wade Bailey – Northbound	0.38	0.28	-26.32 %
Clay Wade Bailey - Southbound	0.34	0.29	-14.71 %
Roebling – Northbound	1.15	1.15	0.00 %
Roebling – Southbound	1.38	1.37	-0.72 %
Taylor Southgate – Northbound	0.50	0.50	0.00 %
Taylor Southgate – Southbound	0.57	0.61	-7.02 %
I-471 – Northbound	0.78	0.77	-1.28 %
I-471 – Southbound	1.16	1.16	0.00 %
Combs-Hehl – Eastbound	1.23	1.22	-0.81 %
Combs-Hehl - Westbound	0.78	0.77	-1.28 %

The most significant changes occur where traffic will cross the river in order to access the airport. Without the Anderson Ferry Bridge, approximately 30% of all airport traffic utilizes the Brent Spence Bridge. Once the Anderson Ferry Bridge is introduced to the roadway network, the percentage on the Brent Spence Bridge decreases to slightly more than 26%. Both the west I-275 Bridge and the Clay Wade Bailey Bridge experience similar reductions. Overall, the Anderson Ferry Bridge will handle almost 10% of all trips going into and out of the CVG. Additional information concerning airport trips crossing the bridges can be found in Table 7 in the Appendix.

The new Anderson Ferry Bridge also affects the travel time for trips throughout the region. This study evaluated data for five specific origin – destination (O-D) pairs.

- Cincinnati Central Business District (CBD) to the CVG
- University of Cincinnati to the CVG
- City of Florence, Kentucky to Cincinnati CBD
- Evendale/GE Plant to Florence Kentucky
- Western Hills Plaza Shopping Complex to the Greater Cincinnati International Airport

Listed in the tables on the next page are the travel times in minutes for each of these O-D pairs. The data is listed for both the AM and PM peak periods. The travel time improvements range from 1-7 minutes. This is a direct result of people using the new river crossing either as part of their trip or because it has helped reduce the number of trips on another river crossing.

AM Peak Travel Time (minutes)

Origin – Destination	2030 Base	2030 AF	Improvement in minutes
Cincinnati CBD to CVG	12.86	11.89	0.97
Univ. of Cincinnati to CVG	16.03	14.75	1.28
Florence, KY to Cincinnati CBD	16.35	14.79	1.56
Florence, KY to Evendale/GE Plant	28.83	27.26	1.57
Western Hills Plaza Shopping Complex to CVG	28.16	20.27	7.89

PM Peak Travel Time (minutes)

Origin – Destination	2030 Base	2030 AF	Improvement in minutes
Cincinnati CBD to CVG	12.37	11.53	0.84
Univ. of Cincinnati to CVG	14.65	13.67	0.98
Florence, KY to Cincinnati CBD	12.73	11.73	1.00
Florence, KY to Evendale/GE Plant	28.13	27.10	1.03
Western Hills Plaza Shopping Complex to CVG	25.33	17.95	7.38

APPENDIX

Table 1 – AM Peak Hour Volume of Auto Trips on the Ohio River Bridges

Bridge	1995	2030 Base	2030 Anderson Ferry
I – 275 West	3,000	5,500	5,200
Anderson Ferry	0	0	4,000
Brent Spence	12,800	17,800	16,400
Clay Wade Bailey	1,500	2,500	4,100
Roebling	2,000	2,200	2,100
L & N/Taylor Southgate	1,500	2,000	2,000
I – 471	9,800	10,500	10,400
Combs-Hehl	8,200	11,300	11,300
Bridge Volume in CBD	27,600	35,000	35,000
Total Bridge Volume	38,800	51,800	55,500

*** Volumes have been rounded to the nearest 100*

Table 2 – PM Peak Hour Volume of Auto Trips on the Ohio River Bridges

Bridge	1995	2030 Base	2030 Anderson Ferry
I – 275 West	3,100	4,800	4,500
Anderson Ferry	0	0	3,500
Brent Spence	12,100	17,300	16,000
Clay Wade Bailey	1,200	1,900	1,500
Roebling	2,000	2,200	2,200
L & N/Taylor Southgate	1,700	1,900	2,000
I – 471	9,300	9,900	9,900
Combs-Hehl	7,600	10,800	10,600
Bridge Volume in CBD	26,300	33,200	31,600
Total Bridge Volume	37,000	48,800	50,200

*** Volumes have been rounded to the nearest 100*

Table 3 – Daily Volume of Auto Trips on the Ohio River Bridges

Bridge	1995	2030 Base	2030 Anderson Ferry
I – 275 West	28,900	45,200	43,400
Anderson Ferry	0	0	31,000
Brent Spence	116,400	173,400	159,600
Clay Wade Bailey	7,600	11,400	9,400
Roebling	20,900	22,700	22,700
L & N/Taylor Southgate	13,300	16,500	16,700
I – 471	87,700	94,700	94,200
Combs-Hehl	69,600	99,200	98,300
Bridge Volume in CBD	245,900	318,700	302,600
Total Bridge Volume	344,400	463,100	475,300

*** Volumes have been rounded to the nearest 100*

Table 4 – AM Peak Hour Volume of Truck Trips on the Ohio River Bridges

Bridge	1995	2030 Base	2030 Anderson Ferry
I – 275 West	400	900	800
Anderson Ferry	0	0	300
Brent Spence	1,800	3,000	2,900
Clay Wade Bailey	100	200	200
Roebling	100	200	200
L & N/Taylor Southgate	100	100	100
I – 471	300	600	600
Combs-Hehl	400	700	700
Bridge Volume in CBD	2,400	4,100	4,000
Total Bridge Volume	3,200	5,700	5,800

** *Volumes have been rounded to the nearest 100*

Table 5 – PM Peak Hour Volume of Truck Trips on the Ohio River Bridges

Bridge	1995	2030 Base	2030 Anderson Ferry
I – 275 West	400	700	700
Anderson Ferry	0	0	300
Brent Spence	1,600	2,700	2,600
Clay Wade Bailey	100	100	100
Roebling	100	200	200
L & N/Taylor Southgate	100	100	100
I – 471	300	500	500
Combs-Hehl	300	600	600
Bridge Volume in CBD	2,200	3,600	3,500
Total Bridge Volume	2,900	4,900	5,100

** *Volumes have been rounded to the nearest 100*

Table 6 – Daily Volume of Truck Trips on the Ohio River Bridges

Bridge	1995	2030 Base	2030 Anderson Ferry
I – 275 West	5,800	12,000	11,700
Anderson Ferry	0	0	4,000
Brent Spence	26,500	45,200	43,000
Clay Wade Bailey	700	900	700
Roebling	1,700	2,300	2,500
L & N/Taylor Southgate	700	1,100	1,100
I – 471	4,600	7,500	7,400
Combs-Hehl	4,800	9,100	9,000
Bridge Volume in CBD	34,200	57,000	54,700
Total Bridge Volume	44,800	78,100	79,400

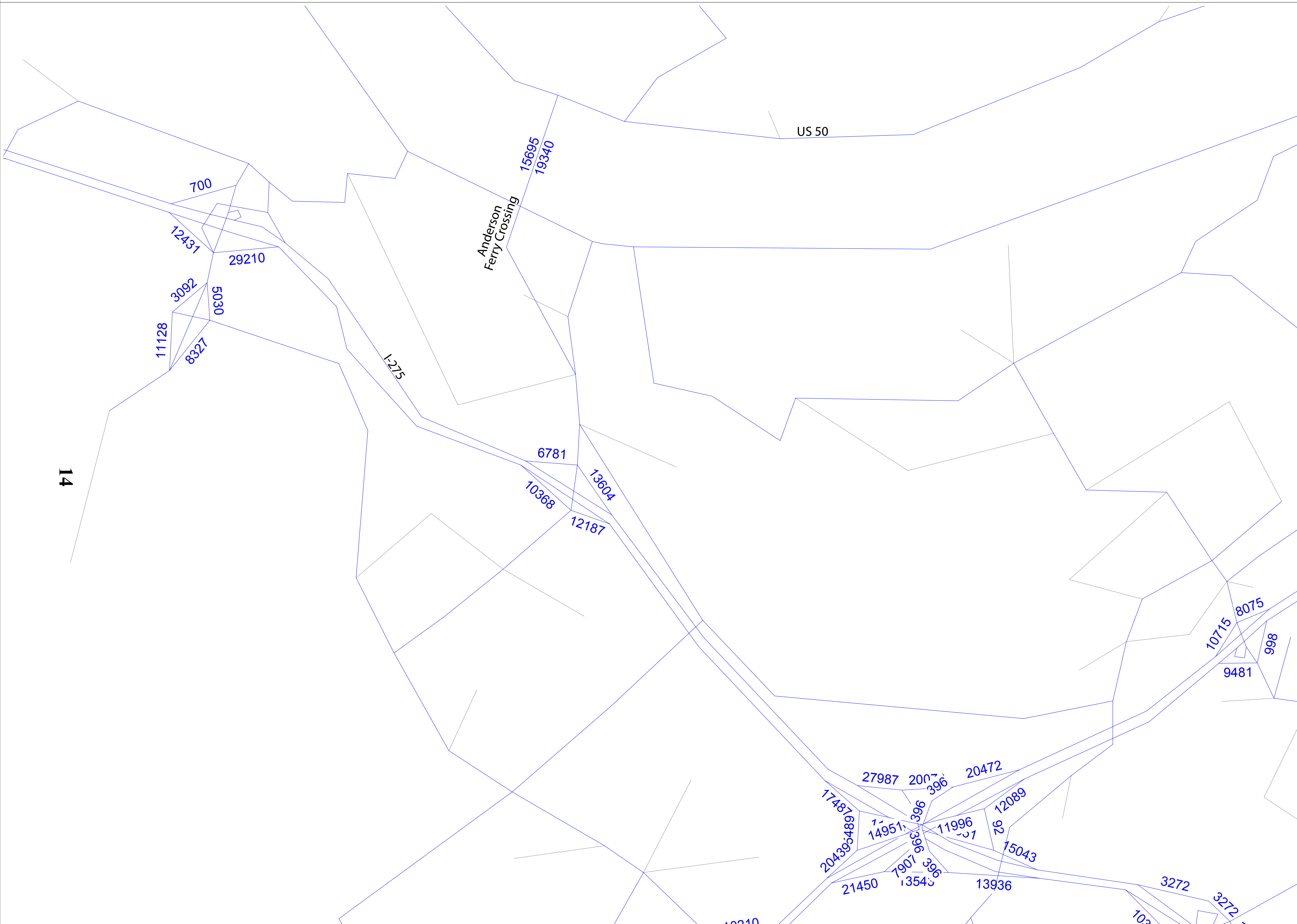
** *Volumes have been rounded to the nearest 100*

Table 7 – Cincinnati Northern Kentucky International Airport Summary

	1995	2030 Base	2030 AF
Vehicles to CVG	21,000	46,000	47,000
Vehicles from CVG	21,000	46,000	46,000
Number of CVG vehicles using			
I – 275 West Bridge	6,000	16,000	15,000
Anderson Ferry Bridge	0	0	9,000
Brent Spence Bridge	9,000	28,000	24,000
Clay Wade Bailey Bridge	1,000	3,000	1,000

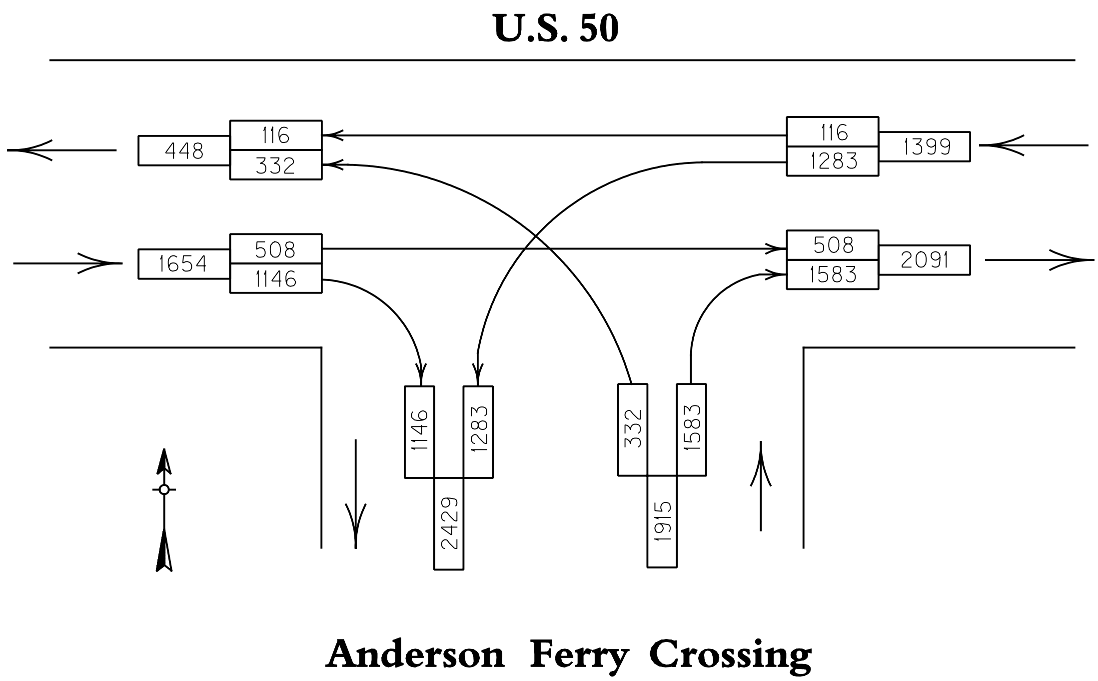
*** Volumes have been rounded to the nearest 1,000*

I-275 24-hour Volumes



10/10/2003

2030 AM Design Hour



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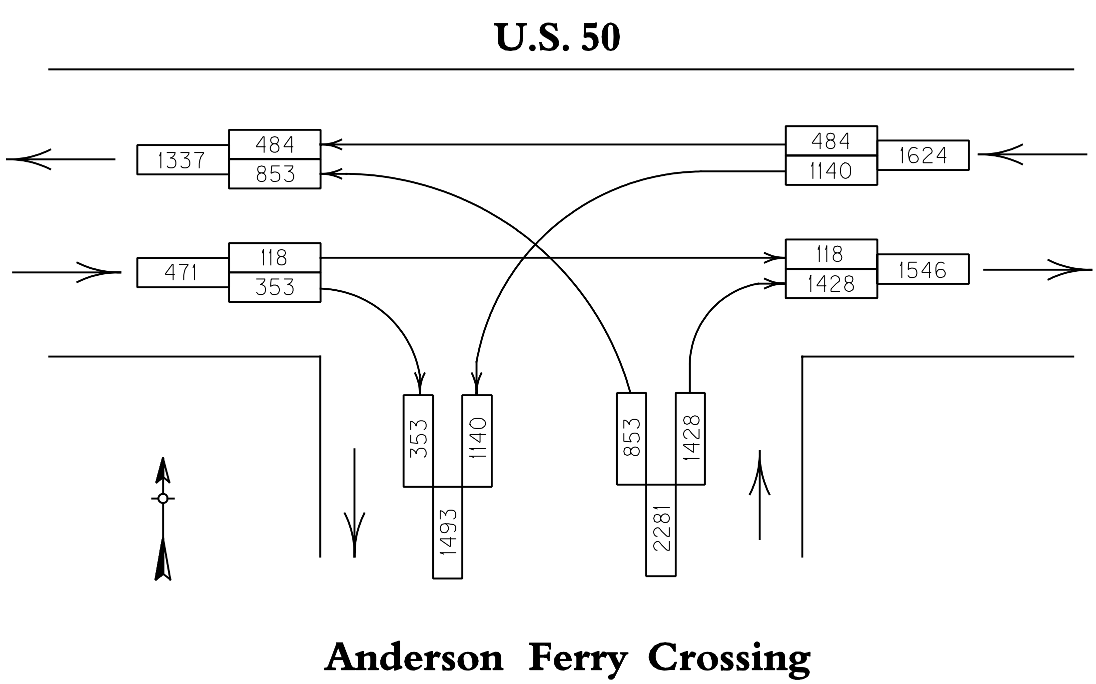
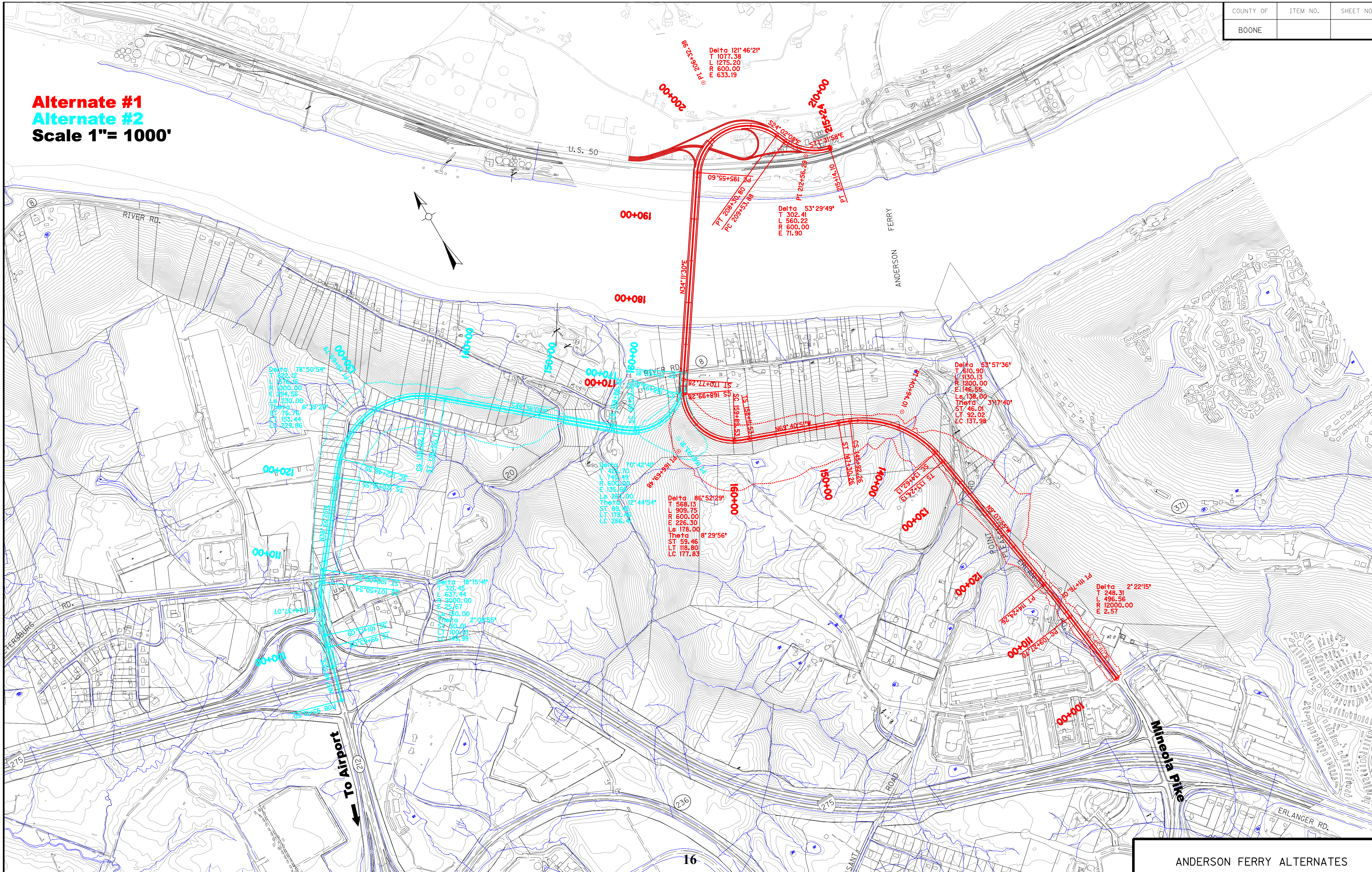




COUNTY OF
ITEM NO.
SHEET NO.
BOONE
Alternate #1
Alternate #2
Scale 1"= 1000'
U.S. 50
RIVER RD.
ANDERSON
FERRY
Delta 121°46'21"
T 1077.38
L 1275.20
R 600.00
E 633.19
Delta 53°29'49"
T 302.41
L 560.22
R 600.00
E 71.90
Delta 53°57'36"
T 610.90
L 1130.13
R 1200.00
E 146.55
Ls 138.00
Theta 3°17'40"
ST 46.01
LT 92.02
LC 137.98
Delta 86°52'29"
T 568.13
L 909.75
R 600.00
E 226.30
Ls 178.00
Theta 8°29'56"
ST 59.46
LT 118.80
LC 177.83
Delta 2°22'15"
T 248.31
L 496.56
R 12000.00
E 2.57
Delta 78°50'54"
Delta 70°42'41"
Delta 18°15'41"
100+00
110+00
120+00
130+00
140+00
150+00
160+00
170+00
180+00
190+00
200+00
210+00
215+24
N34°11'30"E
N69°40'51"W
N9°07'59"W
S24°02'08"E
S77°31'58"E
To Airport
Mineola Pike
ERLANGER RD.
ANDERSON FERRY ALTERNATES

APPENDIX D
TRAFFIC

I. SUMMARY

Operational Analysis Results

Operational analysis was conducted for the study area using CORSIM. The Kyles Lane interchange is the south boundary of the model and the Ezzard Charles interchange is northern limits. Analysis was conducted for the AM and PM peaks using the 30th highest hour for existing conditions and 2030 No-Build conditions.

Geometric Characteristics

Northbound I-71/75 mainline is three lanes as it passes Kyles Lane. It remains a three-lane section until a fourth lane is added at Fourth Street in Kentucky. The four lanes are carried across the Brent Spence Bridge then two lanes drop to NB I-71. Two lanes are added from SB I-71 and the resulting four-lane section is carried past Ezzard Charles. In the southbound direction, I-75 mainline passes Ezzard Charles as a four-lane section. Two lanes are dropped to NB I-71 then two lanes are added from SB I-71. Four lanes are carried across the Brent Spence Bridge and past the Kyles Lane interchange.

In addition to the number of lanes, another geometric feature significantly impacts traffic operations in the corridor. A long 5% grade exists in Kentucky. This grade begins around 12th Street and continues up past Kyles Lane. The length of the grade is over 2.5 miles and has a significant impact on truck speeds on this section.

Existing Results

In the AM Peak, northbound I-71/75 operates at LOS F from Kyles Lane through the I-71 and I-75 split in Ohio. Southbound I-71 operates at LOS F north of the Ezzard Charles off-ramp. See Figure 1.

During the PM Peak, northbound I-71/75 in Kentucky operates at LOS F from South of Kyles Lane until the 12th Street off-ramp. From the 12th Street off-ramp to the 5th Street off-ramp, NB I-71/75 is LOS E. Southbound I-71/75 in Kentucky is LOS F from the 4th Street on-ramp through the Kyles Lane interchange. The Brent Spence Bridge operates at LOS E in both the northbound and southbound directions. In Ohio, NB I-75 is LOS E from the 9th Street on-ramp to the Gest Street on-ramp. From Gest Street to the Ezzard Charles on-ramp, NB I-75 is LOS F, and north of Ezzard Charles, NB I-75 operates at LOS E. On southbound I-75, the mainline performs at LOS F from the Ezzard Charles off-ramp to the merge with SB I-71. Southbound I-71 also performs at LOS F as it merges with SB I-75. See Figure 2.

2030 No-Build Results

During the AM Peak, northbound I-71/75 performs at LOS F from south of Kyles Lane to the I-71 and I-75 split in Ohio. Southbound I-75 is LOS F from north of Ezzard Charles to the merge with southbound I-71, then again from the 12th Street on-ramp in Kentucky to south of Kyles Lane. See Figure 3.

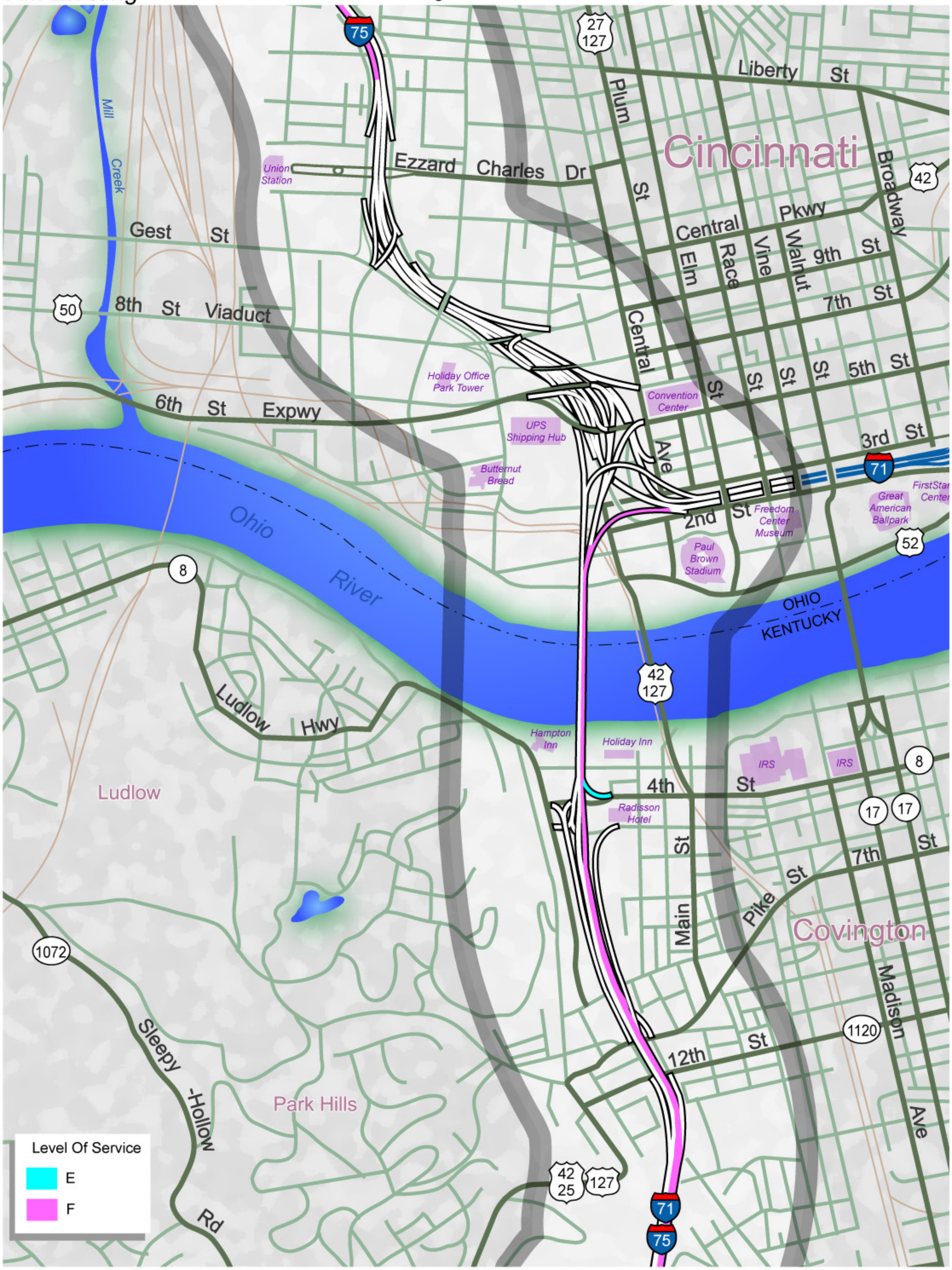
In the PM Peak, northbound I-71/75 operates at LOS F from south of Kyles Lane to the 5th Street off-ramp in Ohio. NB I-75 also performs at LOS F from the 9th Street on-ramp to the Ezzard Charles on-ramp, and LOS E north of Ezzard Charles. In the southbound direction, I-75 is LOS F from north of Ezzard Charles to the Brent Spence Bridge. It performs at LOS E on the Brent Spence Bridge. In Kentucky, SB I-71/75 is at LOS F from the Pike Street off-ramp to south of Kyles Lane. Southbound I-71 performs at LOS F as it merges with SB I-75. See Figure 4.

Conclusions

Mainline traffic in the study area is significantly over capacity. The four lanes traveling southbound past Ezzard Charles and the three lanes northbound past Kyles Lane cannot handle the traffic traveling through these sections. This meters the amount of traffic able to enter the network. To correct this, these sections need additional lanes. The number of additional lanes and the distance upstream of these locations that the widening would need to begin will be determined in a future phase of the project.

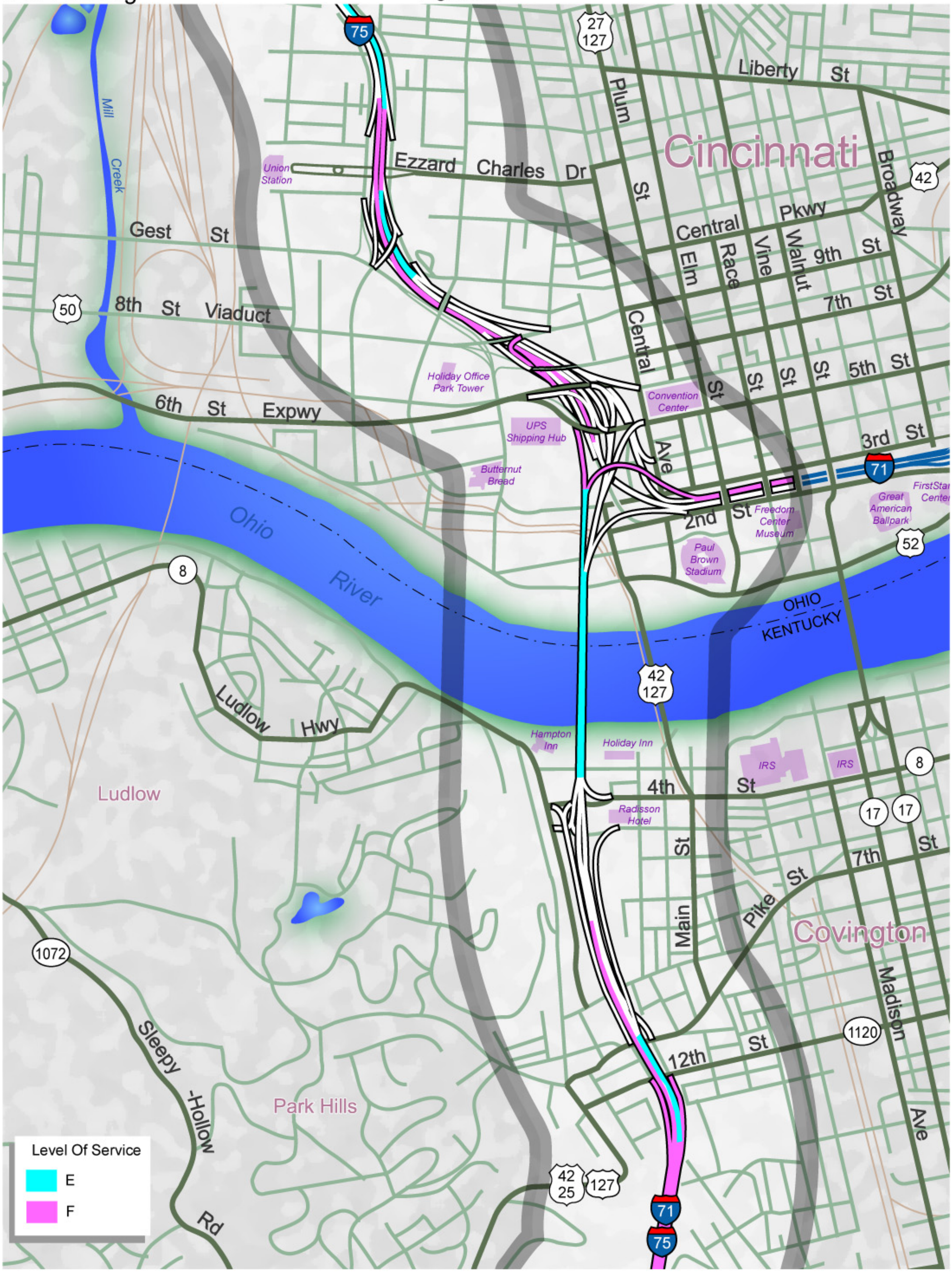
AM Existing

Figure 1



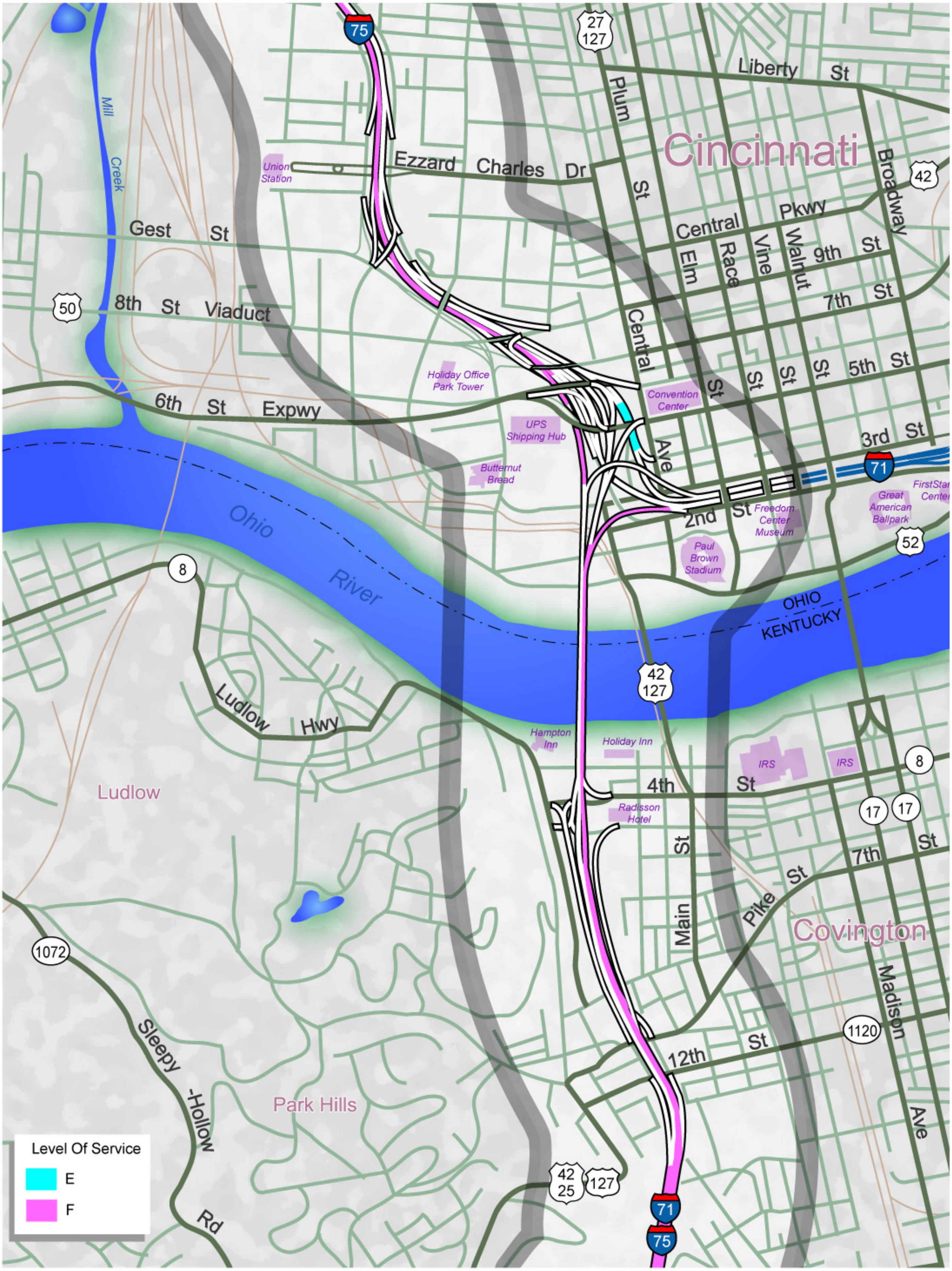
PM Existing

Figure 2



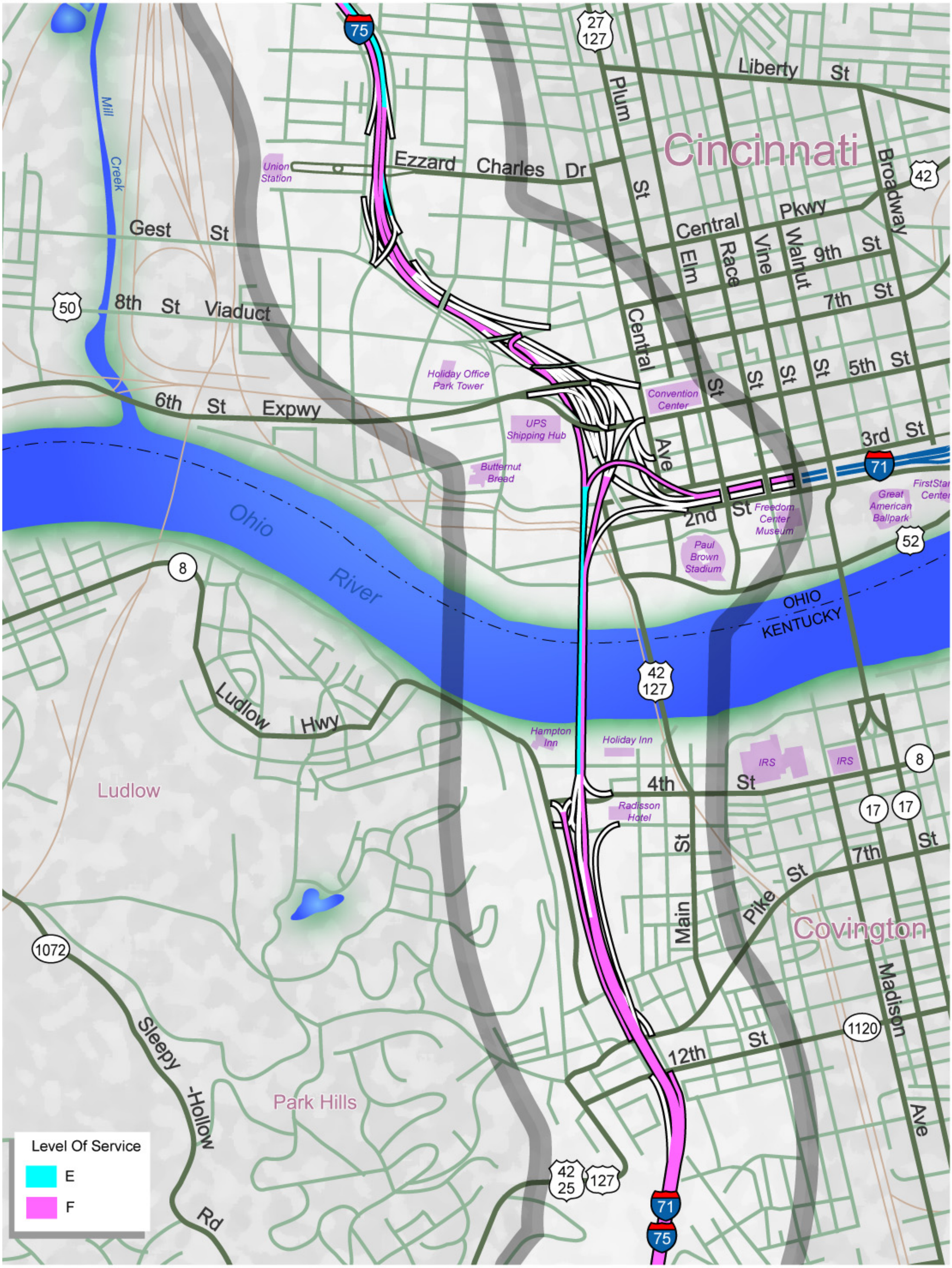
2030 AM No-Build

Figure 3



2030 PM No-Build

Figure 4



II. TECHNICAL MEMOS

MEMORANDUM

TO: **Modeling Advisory Group**

FROM: **Randy Kill, PE**

SUBJECT: **Brent Spence Bridge Modeling Methodology**

June 8, 2004

As per your request, I have listed the steps taken to obtain the existing ground counts, current and future year travel demand assignments and the CORSIM modeling efforts to date. I have also included a volume table that shows ground count comparisons with the current year travel demand assignments for select locations. A full comparison of all counts for the study area with current and future year assignments will be sent separately. Additionally, exhibits showing the five alternatives for the Brent Spence Bridge are attached. Please let me know if you have any questions.

Existing Ground Counts

- Traffic counts were conducted in June and July of 2003. These counts consisted of pneumatic tube counts and manual counts. Due to safety concerns with the high speeds and limited shoulders on the Ohio side of the bridge, these counts were conducted in the following manner:
  - ODOT set up a truck mounted camera at five locations to videotape all the ramps and mainline sections from 6AM – 9AM and 3PM-6PM.
  - The videotapes were then viewed at Burgess & Niple, and manual counts performed for the links.
- Where available, recent count data was obtained from various sources including ODOT and KYTC.
- All counts were then seasonally adjusted for day of week and month of year using the Seasonal Adjustment Factors published by ODOT's Office of Technical Services.

Travel Demand Modeling

- In September 2003 Burgess & Niple received the OKI model files designated for use during the Anderson Ferry and Brent Spence Bridge studies.
- The model files included socioeconomic data and input files for the 1995 calibration year and for a future year run of 2030. Runs were completed using both model networks.
- The 2030 network was then modified to include truck prohibitions on the Brent Spence Bridge, the Clay Wade Bailey Bridge, the Roebling Bridge, and the $4^{th}/5^{th}$ Street and 12^{th} Street bridges in Kentucky. The model run with network modifications, along with the 2030 base data were used to complete the travel demand modeling portion of the Truck Diversion Study.
- In January 2004 additional modeling was requested. This included coding six Brent Spence bridge alternatives and running them using the same trip tables as the rest of the Brent Spence Bridge study. The 2030 base model provided by OKI was modified for each of the six alternatives and then run.
- Additionally, the 1995 travel demand data did not match the ground count dates so a 2003 model run was requested and completed. The 1995 network files along with a method suggested in the OKI manual to interpolate between the 1995 and 2030 socioeconomic data were used to create a 2003 model run. The process required for modifying the model input file can be found in the description for Step 12 of the OKI/MVRPC Travel Demand Model User's Guide, Version 6.0.
- The first 2003 model run did not incorporate any changes to the 1995 roadway network. Since there had been significant improvements in the Cincinnati CBD area between 1995 and 2003, another 2003 model run was completed that incorporated the highway improvements along Fort Washington Way.

- The highway assignment step of the model specifies peak conversion factors for each of the four peak periods. These factors are in the TranPlan script for Step 61 as "CONFAC". The peak conversion factors listed in this step were multiplied by the period volumes to obtain AM and PM peak hour volumes. For the AM peak hour this factor is 0.53. The PM peak hour factor is 0.35.
- To determine the percentage of trips in each peak period as well as directionality, diurnal factors are applied in Step 54 of the travel demand model. The full diurnal factor tables were derived from a trips-in-motion analysis. This analysis was completed using data from the 1995 household survey for the OKI Region. The factors depict the proportion of trips completed in each half hour of a full 24-hour time period. The factors are disaggregated by trip purpose, travel mode, and direction. Utilizing several sub-steps, Step 54 converts the peak and off-peak person trip tables into vehicle trip tables, adds them together, converts them to P/A and A/P format, applies the diurnal factors, and then separates the trip table into the peak period tables. Additional information on this process can be located in Chapter 32 of the OKI/MVRPC Travel Demand Model User's Guide, Version 6.0.

CORSIM Modeling

- CORSIM models of the AM and PM peak hours for the existing year were developed using existing ground counts. On April 29th, these models were presented to ODOT, KYTC and the consultant team. As a result of this meeting it was determined that the CORSIM model did not show enough delay and that the existing counts were possibly constrained. Because of this, the decision was made to develop a current year travel demand run and use these assignments for the existing condition.
- On May 12, the revised CORSIM files were shown using the TRANPLAN assignments. At that time it was determined that the TRANPLAN assignments were too high and that directional splits and ramp volumes were unrealistic. The consensus was to get together with OKI, KYTC and ODOT to develop certified traffic. This led to the conference call that took place on June 2.

Data

Table 1 shows a comparison of existing counts and TRANPLAN assignments for select locations. A couple of interesting things to note are:

- In general, the 2003 TRANPLAN assignments are much higher than the counts
- Significant directionality exists in the counts, especially on I-71/75, South of 12th St, and on the Brent Spence Bridge. This directional split is not represented in the TRANPLAN assignments.

Table 1 – 2003 Counts vs. 2003 TRANPLAN

Location	Direction	2003 Counts		2003 TRANPLAN	
		AM Peak	PM Peak	AM Peak	PM Peak
I-71/75, South of 12th St	NB	5691	4976	8094	7295
	SB	3820	7052	7812	8100
I-71/75 on Brent Spence Bridge	NB	6084	5299	8425	7446
	SB	4165	7061	8000	7764
I-75, North of 7th St off-ramp	SB	6149	4285	9112	6359
I-75, North of 6th St on-ramp	NB	3146	4930	4928	6542
I-71, East of I-75	EB	4616	4673	4439	4397
	WB	3530	5148	3769	3781
12th St Between I-75 NB and I-75 SB	EB	306	370	569	328
	WB	172	257	737	830

Issues/Concerns

- Existing traffic counts are capacity constrained and thus a little low.
- 2003 TRANPLAN assignments are significantly overestimated and do not accurately reflect existing directionality.
- 2030 TRANPLAN assignments show similar results as the 2003 assignments and will therefore not predict the future assignments.

Actions

With this memo we are requesting that the modeling advisory group develop a methodology to determine peak hour traffic assignments for the future no-build and alternatives. Once the generated assignments are agreed to by OKI, KYTC and ODOT, the assignments will be used for the Brent Spence Bridge Feasibility and Constructability Study, and not subject to change. In addition, we ask that the group also determine who will do the work required to generate the assignments as well as the associated time frame.

Brent Spence Bridge Modeling Advisory Group
June 8, 2004

Location	Direction	Direction @ Intersection	AM Existing	PM Existing	AM Baseline	PM Baseline	AM Alt 1	PM Alt 1	AM Alt 2	PM Alt 2	AM Alt 4	PM Alt 4	AM Alt 5	PM Alt 5	AM Alt 6	PM Alt 6
I-75 ML, N of 7th St off-ramp	SB		6149	4285	11315	8333	6930	4364	7014	4410	11774	8759	5668	3388	6824	4364
7th St off-ramp	SB		1226	106	993	643	1084	622	1074	622	1044	613	1174	665	1089	639
I-75 ML, N of I-71/5th off-ramp	SB		4923	4179	10322	8076	5846	3743	5939	3788	10730	8146	4495	2723	5735	3714
I-71/5th off-ramp	SB		2872	2384	4308	2798	4333	2751	4311	3703	4290	2716	4495	2723	4357	2736
5th St off-ramp	SB		915	358	935	483	926	471	891	466	920	463	1065	499	1018	482
I-75 ramp to I-71/Second	SB		1957	2026	3372	2316	3406	2280	3420	2238	3371	2253	3431	2224	3340	2253
I-75 ramp to I-71	SB		1135	1583	1360	1427	1372	1419	1394	1410	1390	1418	1407	1431	1248	1352
I-75 ramp to Second	SB		822	443	2012	889	2034	861	2026	828	1981	835	2024	793	2092	901
I-75 ML, N of 9th St on-ramp	SB		2051	1795	6015	5277	1512	992	1627	1085	6438	5430	NA	NA	1377	978
9th St on-ramp	SB		97	122	687	959	801	1003	687	1044	904	1029	NA	NA	410	679
I-75 ML, N of 6th St on-ramp	SB		2148	1917	6702	6236	2313	1995	2314	2129	7342	6334	7409	6119	1787	1657
6th St on -ramp	SB		426	1583	834	660	689	635	786	665	820	680	NA	NA	708	638
I-75 ML, N of I-71 on-ramp	SB		2574	3500	7536	6896	3002	2630	3100	2794	8162	7014	8371	6975	2495	2295
I-71 on-ramp to I-75	SB		1591	3561	3061	3030	3006	3007	3040	2966	3025	3016	2835	2819	2146	2229
I-71/75 on Brent Spence Bridge	SB		4165	7061	10597	9926	6008	5637	6140	5730	11187	10030	11206	9794	4641	4524
I-71/75 off-ramp to 5th St	SB		718	839	1091	962	1197	1027	1250	1122	1267	1130	1738	1142	1282	1165
I-71/75 ML, N of off-ramp to Pike/12th	SB		3477	6222	9503	8965	4810	4611	5133	4687	9917	9025	9468	8652	3359	3359
Off-ramp to Pike/12th	SB		263	150	605	474	524	404	567	433	759	470	605	373	670	514
I-71/75 ML, N of 5th St on-ramp (Covington)	SB		3184	6072	8899	8491	4287	4208	4566	4254	9158	8554	8899	8279	2689	2845
5th St on-ramp (Covington)	SB		350	550	788	965	831	1044	704	1006	686	970	788	1051	380	821
I-71/75 ML, N of 12th St on-ramp	SB		3534	6622	9487	9456	10251	9722	10359	9698	9844	9524	9687	9330	10845	10093
12th St on-ramp	SB		286	430	934	1033	1074	1121	997	1148	943	1045	985	1153	846	990
I-71/75 ML, S of 12th St on-ramp	SB		3820	7052	10421	10489	11325	10843	11356	10846	10787	10569	10672	10483	11691	11083
I-71/75 ML, S of 12th St off-ramp	NB		5601	4976	9579	9053	11643	10458	11638	10466	10941	10165	10920	10177	11905	10584
12th St off-ramp	NB		254	391	604	860	1088	1112	1067	1127	956	1083	988	1075	896	1011
I-71/75 ML, S of 5th St off-ramp (Covington)	NB		5437	4585	8975	8193	5599	4824	5726	4826	9986	9082	9930	9104	11054	9573
5th St off-ramp (Covington)	NB		1020	543	595	428	792	621	797	581	794	550	670	556	NA	NA
I-71/75 ML, S of Pike On-ramp	NB		4147	4042	8379	7764	4806	4203	4929	4245	9192	8532	9259	8548	11054	9573
Pike St on-ramp	NB		594	381	1017	872	544	593	600	616	822	707	713	676	619	681
I-71/75 ML, S of 4th St on-ramp (Covington)	NB		4741	4423	9396	8636	5350	4796	5529	4861	10014	9239	9972	9224	4107	6991
4th St on-ramp (Covington)	NB		1073	876	832	1450	617	1237	681	1264	743	1290	511	1164	805	1376
I-71/75 on Brent Spence Bridge	NB		6084	5299	10228	10086	5967	6033	6210	6125	10757	10529	10483	10388	4912	8367
I-71/75 off-ramp to I-71/Second	NB		2997	2064	3043	2909	3066	3007	3082	3029	3108	3044	3743	3283	2478	2373
I-71 ramp to Second	NB		820	157	482	252	516	276	521	283	496	288	1018	427	1073	331
I-71/75 off-ramp to I-71	NB		2177	1907	2561	2657	2550	2731	2563	2746	2612	2757	2726	2856	3253	3141
I-75 ML, S of 5th St off-ramp	NB		3087	3235	7186	2909	2900	3026	3128	3099	7647	7484	1585	1548	2436	2945
5th St off-ramp	NB		548	276	1592	1039	1746	1069	1820	1091	1795	1185	989	809	1266	961
I-75 ML, S of 6th St off-ramp	NB		2539	2959	5594	6138	1154	1957	1308	2008	5852	6299	596	740	1170	1606
6th St off-ramp	NB		675	675	648	805	646	755	714	793	713	821	596	740	623	745
I-75 ML, S of combined I-71/4th/6th on-ramp	NB		1864	2284	4946	5333	508	1202	594	1215	5139	5478	0	0	547	861
Combined I-71/4th/6th on-ramp	NB		1282	2646	1883	3195	1868	3156	1849	3142	1824	3134	1858	3280	1850	3096
I-75 ML, S of 9th St on-ramp	NB		3146	4930	6829	8528	2376	4358	2443	4357	6963	8612	1858	3280	2397	3957
I-71 ML, N of NB I-75 off-ramp	SB		3530	5148	6965	9008	2510	4815	2577	4797	7096	9067	1993	3778	2531	4428
I-71 ramp to I-71/75, N of 3rd St on-ramp	SB		1461	2670	2881	2335	2757	2259	2779	2270	2780	2266	2677	2120	1116	963
3rd St on-ramp to I-71/75	SB		130	891	180	695	249	748	261	696	245	750	158	699	1030	1266
I-71/3rd St ramp to I-71/75	SB		1591	3561	3061	3030	3006	3007	3040	2966	3025	3016	2835	2819	2146	2229
I-71 ramp to NB I-75	SB		2069	2478	1835	1994	1824	1985	1829	1955	1831	1956	1990	2037	4412	3986
I-71 SB ramp to 6th St	NB		902	1383	800	869	1039	1328	1010	1332	902	1330	1053	1338	937	1290

Brent Spence Bridge Modeling Advisory Group

June 8, 2004

Location	Direction	Direction @ Intersection	AM Existing	PM Existing	AM Baseline	PM Baseline	AM Alt 1	PM Alt 1	AM Alt 2	PM Alt 2	AM Alt 4	PM Alt 4	AM Alt 5	PM Alt 5	AM Alt 6	PM Alt 6
I-71 SB Combined ramp, S of 4th on-ramp	NB		1167	1095	1035	1125	785	657	818	623	1167	626	937	699	767	580
4th St on-ramp to I-71 SB Combined ramp	NB		245	1221	861	1459	867	1448	840	1336	845	1412	821	1469	830	1462
I-71 SB Combined ramp, S of 6th St on-ramp	NB		1412	2316	1896	2584	1652	2105	1658	2154	2012	2038	1758	2168	1597	2042
6th St on ramp to I-71 SB Combined ramp	NB		151	485	595	1523	602	1420	562	1551	558	1484	557	1422	693	1404
I-71/4th/6th Combined Ramp, S of I-75 off-ramp	NB		1563	2801	2491	4107	2254	3525	2220	3705	2570	3522	2315	3590	2290	3446
I-75 9th St Ramp	NB		100	250	140	499	138	477	140	459	138	474	140	523	138	501
Off-Ramp near 9th to on-ramp from 9th	NB		281	155	401	413	386	369	370	368	390	389	459	315	381	350
9th to 8th	WB		328	1573	144	668	141	669	144	700	143	669	599	356	138	755
8th to 7th	EB		748	476	865	294	1363	293	865	291	666	1374	634	271	670	288
6th to I-75 S and 5th St	EB		2482	2987	3941	2669	3762	3762	3941	2677	3874	2687	4248	2903	3861	2660
6th to 5th	EB		513	100	1593	515	1527	1527	1593	519	1555	513	1667	535	1639	536
6th to I-75 S	EB		685	1704	834	660	689	635	786	665	820	680	0	0	708	638
6th to I-71 N	EB		1304	1183	1541	1494	1546	1496	1509	1494	1499	1493	1619	1512	1514	1486
6th to Second	SB		239	121	0	0	0	0	0	0	0	0	0	0	0	0
I-75 S/6th Combined to 5th	EB		1428	458	2528	998	2453	1998	2484	985	2475	976	2732	1034	2657	1018
I-75 S/6th Combined to I-71	SB		2439	2766	2874	2921	2918	2915	2903	2904	2889	2911	3026	2943	2762	2838
I-75 S/6th Combined to Second	SB		1061	564	2012	889	2034	861	2026	828	1981	835	2024	793	2092	901
End link on Second	EB		1261	821	2653	1394	2640	1467	2585	1260	2631	1272	2622	1310	2423	1214
I-71 ML end link	EB		4616	4673	5435	5578	5468	5646	5466	5650	5501	5668	5752	5799	6015	5979
I-75/I-71 Combined to 6th	NB		1577	2058	1448	1674	1685	2083	1724	1803	1615	2151	1649	2078	1560	2035
6th to 6th	WB		123	782	832	1566	841	1645	849	1604	864	1612	980	1679	813	1622
6th/I-75 N Combined to 6th	WB		1700	2840	2280	3240	2526	3728	2573	3407	2479	3763	2629	3757	2373	3657
New Alignment I-75 (Alt 1,2)	NB		NA	NA	NA	NA	4957	4522	4845	4513	NA	NA	NA	NA	NA	NA
Merged with old Alignment I-75	NB		NA	NA	NA	NA	7467	9337	7422	9310	7644	9649	2536	4336	3080	4968
On Ramp from Ezzard Charles Dr	NB		NA	NA	NA	NA	171	295	172	292	172	278	171	260	172	268
I-75 N of on ramp from Ezzard Charles Dr	NB		NA	NA	NA	NA	7638	9632	7594	9602	7816	9927	7691	4596	3252	5236
I-75 Entry link	SB		NA	NA	NA	NA	12530	9312	12532	9301	11847	9215	11814	8478	12360	9150
New Alignment I-75 (Alt 1,2)	SB		NA	NA	NA	NA	6275	3958	6366	3981	10982	8328	5449	3161	6079	3964
Old Alignment S of New Alignment (Alt 1,2)	SB		NA	NA	NA	NA	5133	4470	5089	4438	NA	NA	NA	NA	NA	NA
Old Alignment N of New Alignment (Alt 1,2)	NB		NA	NA	NA	NA	6687	5936	6793	5953	10941	10165	10920	10177	11905	10584
Merged with old Alignment I-75 (Alt 1,2)	SB		NA	NA	NA	NA	9420	8678	9655	8692	9158	8554	8899	8279	10465	9272
On Ramp from 9th ST	NB		NA	NA	NA	NA	134	457	134	440	133	455	135	498	134	471
9th St to Ezzard Charles Dr	NB		NA	NA	NA	NA	392	388	376	388	395	407	464	354	385	380
Off Ramp to Ezzard Charles Dr	SB		NA	NA	NA	NA	472	212	460	212	252	217	NA	NA	545	212
I-75 S of off ramp to Ezzard Charles Dr	SB		NA	NA	NA	NA	12058	9100	12072	9090	11595	8997	5449	3161	6774	4642
Off Ramp to Freeman Ave	SB		NA	NA	NA	NA	651	672	617	671	613	670	NA	NA	695	678
I-75 S of off ramp to Freeman Ave	SB		NA	NA	NA	NA	11407	8428	11455	8419	10982	8328	5449	3161	6079	3964
On ramp from Western Ave	SB		NA	NA	NA	NA	655	406	648	429	792	431	219	227	745	400
I-71 entry link	WB		3530	5148	4716	4330	4581	4243	4716	4225	4610	4222	4667	4157	5528	4949
9th St S of ramp to I-75	NB		381	405	541	912	524	846	510	827	528	863	599	455	519	851
2nd St Entry link	EB		200	100	641	505	606	450	559	432	650	437	598	517	331	313
St to Ezzard Charles Dr	NB		381	405	NA	NA	392	388	422	468	440	477	511	444	174	477
I-75 S of off ramp at end of network	SB		3418	6189	9880	9893	10610	10109	10654	10119	10223	9979	10169	9923	10877	10248
Off ramp at end of network	SB		402	863	541	596	715	734	702	727	564	589	503	558	814	835
End link I-75	SB		3776	6626	10667	10722	11347	10831	11349	10836	10984	10762	10930	10719	11525	10960
On ramp at end of network	SB		358	437	787	829	737	722	695	717	761	783	761	796	648	712
Entry Link I-75	NB		5306	5073	9633	9296	11364	10248	11354	10256	11020	10176	11026	10180	11474	10298
Off ramp at start of network	NB		330	588	553	686	485	629	494	633	709	679	698	677	443	9704

Brent Spence Bridge Modeling Advisory Group
June 8, 2004

Location	Direction	Direction @ Intersection	AM Existing	PM Existing	AM Baseline	PM Baseline	AM Alt 1	PM Alt 1	AM Alt 2	PM Alt 2	AM Alt 4	PM Alt 4	AM Alt 5	PM Alt 5	AM Alt 6	PM Alt 6
I-75 N of off ramp at start of network	NB		4976	4485	9080	8611	10879	9619	10860	9624	10311	9497	10328	9503	11031	594
On tramp at start of network	NB		715	491	499	442	764	839	778	843	630	668	592	674	874	880
Ramp from Freeman Ave	NB		NA	NA	598	669	NA	NA	NA	NA	593	652	590	648	590	637
Off ramp to Ezzard Charles Dr	NB		NA	NA	42	82	NA	NA	NA	NA	45	70	47	90	40	97
ON ramp from Freeman Ave to I-75	NB		NA	NA	556	586	NA	NA	NA	NA	548	582	543	558	549	540
I-75 N of new alignment (Alt 5)	NB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5328	4832	NA	NA
New Alignment I-75 (Alt 5)	NB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5155	5557	NA	NA
Off ramp from 6th St to new alignment I-75 (Alt 5)	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	962	856	NA	NA
6th St to Second (Alt 5)	SB		1969	2887	2347	2155	2235	2235	2347	2159	2319	2173	1619	1512	2222	2124
I-75 S of new ramp from 6th (Alt 5)	SB		2148	1917	6702	6236	2313	1995	2314	2129	7342	6334	8371	6975	1787	1657
I-75 merged with old alignment (Alt 5)	NB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7691	9893	3080	4968
9th/Western Ave on ramp to new alignment (Alt 5)	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1044	803	NA	NA
Western Ave	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	648	570	NA	NA
On ramp to old alignment I-75 from Western Ave (Alt 5)	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	219	227	NA	NA
Western Ave S of on ramp to old alignment (Alt 5)	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	429	343	NA	NA
New Alignment S of on ramp from 9th/Western Ave	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7409	6119	NA	NA
New on ramp from 9th to I-75	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	615	460	NA	NA
New Alignment I-75	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6365	5316	NA	NA
I-71 N of off ramp to I-75 new alignment (Alt 6)	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1677	1869
I-71 to I-75 new alignment (Alt 6)	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2735	2121
Entry Link I-75 (Alt 6)	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12360	9150
I-75 merged with old alignment (Alt 6)	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10465	9272
New Alignment I-75 (Alt 6)	NB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7522	6310
Old alignment N of New Alignment (Alt 6)	NB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3488	3263
Old alignment N of on ramp from Ezzard Charles Dr (Alt 6)	NB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3252	5236
Old Alignment S of New Alignment (Alt 6)	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7319	4844
New Alignment (Alt 6)	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5041	4306
I-75 new alignment N of off ramp to I-71 (Alt 6)	NB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4756	4857
Off ramp from new Alignment I-75 to I-71 (Alt 6)	NB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1849	759
End Link I-75 merged (Alt 6)	NB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8008	10093
New alignment I-75 N of off ramp to W 5th (Alt 6)	NB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6605	5577
Off ramp from new Alignment I-75 to W 5th (Alt 6)	NB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	917	734
New alignment I-75 S of on ramp from I-71	SB		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7776	6427
2nd St @ Elm St	EB	In	2081	821	3135	1645	3156	1587	3106	1543	3128	1560	3640	1737	3496	1545
	EB	Out	1547	617	2958	1562	2966	1505	2930	1465	2962	1478	3362	1634	3299	1462
	NB	In	40	100	921	655	991	677	973	672	985	669	993	674	1160	796
	NB	Out	534	279	1098	737	1178	760	1147	750	1151	750	1271	778	1357	877
	SB	Out	40	25	0	0	0	0	0	0	0	0	0	0	0	0
9th St @ Central Ave	SB	In	25	127	0	0	0	0	0	0	0	0	0	0	0	0
	WB	In	399	1353	1002	2024	1107	2036	1235	2083	1211	2046	578	1717	716	1831
	WB	Out	500	1823	981	1971	1089	1987	1220	2037	1194	2001	554	1661	694	1777
	NB	In	538	687	832	495	849	501	854	507	858	482	832	481	861	497
	NB	Out	462	344	852	548	865	551	869	553	874	527	855	538	884	551
On to 75 N to on to 75 S			425	1573	832	1628	942	1672	832	1744	1046	1697	356	356	547	1435
End link			328	1451	144	668	141	669	144	700	143	669	356	1648	138	755

Brent Spence Bridge Modeling Advisory Group
June 8, 2004

Location	Direction	Direction @ Intersection	AM Existing	PM Existing	AM Baseline	PM Baseline	AM Alt 1	PM Alt 1	AM Alt 2	PM Alt 2	AM Alt 4	PM Alt 4	AM Alt 5	PM Alt 5	AM Alt 6	PM Alt 6
7th St @ Central Ave	EB	In	1974	598	1686	937	2164	915	1727	913	1709	900	1808	936	1760	927
	EB	Out	1856	613	2307	1209	2749	1245	2390	1256	2361	1264	2229	1137	2250	1230
	NB	In	432	450	1453	767	1476	831	1517	850	1509	846	1253	683	1351	800
	NB	Out	550	419	832	495	849	501	854	507	858	482	832	481	861	497
Off ramp from I 75 S			1226	106	994	959	1084	622	1074	622	1044	613	1174	665	1089	639
Off road from 9th			748	476	865	294	1363	293	865	291	666	1374	634	271	670	288
6th St @ Central Ave	WB	In	436	1364	1431	2179	1411	2203	1408	2170	1413	2168	1444	2184	1391	2137
	WB	Out	463	782	832	1607	841	1645	849	1604	864	1612	979	1679	813	1622
Ramp to freeway			151	485	594	1483	602	1420	562	1551	558	1484	557	1423	693	1405
	NB	In	436	504	1641	1761	1667	1767	1671	1898	1675	1835	1521	1692	1616	1747
	NB	Out	120	381	1453	767	1476	831	1517	850	1509	846	1253	683	1351	801
	SB	Out	138	202	192	84	161	74	151	63	157	61	174	91	150	57
On ramp from I 71/75 N			1577	2058	1550	1707	1685	2083	1724	1803	1615	2151	1649	2078	1390	2035
5th St @ Central Ave	EB	In	1976	734	4122	2036	4200	3067	4254	2075	4270	2162	3723	1843	3923	1973
	EB	Out	1871	897	2617	1294	2644	1918	2648	1311	2632	1354	2483	1244	2490	1256
	NB	In	349	589	278	1108	275	1094	233	1207	254	1102	387	1161	312	1103
	SB	In	137	202	192	84	161	74	151	63	157	61	174	91	150	57
	NB	Out	461	504	1641	1761	1667	2128	1671	1898	1675	1835	1521	1692	1616	1747
	SB	Out	130	124	334	173	325	189	319	136	373	135	280	160	279	130
4th St @ Central	WB	Out	247	1221	879	1459	867	1448	840	1336	845	1412	822	1474	829	1461
	WB	In	329	994	442	1449	447	1443	401	1438	407	1430	523	1515	402	1417
	NB	In	320	911	774	1107	757	1084	741	1091	746	1075	780	1104	784	1087
	SB	In	133	124	191	117	185	87	182	77	236	90	140	104	135	65
	SB	Out	205	219	199	176	195	146	194	132	233	135	184	162	130	79
3rd St @ Elm St	WB	In	791	1429	1458	2021	1400	2056	1274	2014	1315	2045	1531	2237	1355	2099
	WB	Out	584	496	1716	1624	1636	1640	1513	1598	1585	1631	1892	1849	1010	1273
	WB	Out	130	891	180	695	249	748	261	745	245	750	158	699	1030	1266
	NB	In	534	279	1098	737	1178	760	1147	750	1151	750	1271	778	1357	877
	NB	Out	611	321	661	431	695	427	648	420	638	408	753	467	672	437
W 4th St @ Philadelphia St	WB	In	916	1443	1565	1728	1387	1690	1381	1789	1424	1711	1305	1736	1092	1609
	WB	Out	1536	1919	1770	2290	1621	2115	1614	2147	1685	2115	1499	2111	1400	2088
	NB	In	449	403	334	178	334	499	334	456	357	503	297	463	392	506
	SB	In	704	534	489	688	504	558	484	531	507	532	470	539	440	565
	NB	Out	352	301	593	604	579	632	564	628	567	630	533	615	496	590
	SB	Out	181	160	26	0	25	0	21	2	37	405	41	12	28	0
St to Crescent Ave			464	1034	938	840	1005	878	932	884	943	825	988	948	596	713
St to W 5th			419	938	805	728	729	775	838	772	604	740	818	864	307	568
W 5th St @ Philadelphia	EB	In	1615	1077	1476	1419	1587	1604	1607	1664	1630	1653	1819	1605	1599	1732
	EB	Out	1378	905	1100	1449	1193	1610	1214	1646	1229	1625	1444	1654	1122	1540
	NB	In	123	164	0	0	0	0	0	0	0	0	0	0	0	0
	SB	In	176	195	110	384	122	411	119	402	119	405	136	370	91	327
	NB	Out	459	393	485	355	516	406	513	420	521	433	512	419	568	519
	SB	Out	77	164	0	0	0	0	0	0	0	0	0	0	0	0
From Crescent			600	463	881	990	794	984	810	1084	837	1103	1149	1049	682	998
Ramp to Crescent			204	390	596	413	637	459	647	446	688	449	933	501	734	523

Brent Spence Bridge Modeling Advisory Group
June 8, 2004

Location	Direction	Direction @ Intersection	AM Existing	PM Existing	AM Baseline	PM Baseline	AM Alt 1	PM Alt 1	AM Alt 2	PM Alt 2	AM Alt 4	PM Alt 4	AM Alt 5	PM Alt 5	AM Alt 6	PM Alt 6
W 4th @ Crescent Ave	WB	In	45	96	236	112	276	103	320	112	339	85	170	84	289	145
	EB	Out	26	280	104	259	117	291	94	261	87	257	93	254	84	275
	NB	In	238	395	596	413	637	459	647	446	688	449	933	502	734	523
	SB	In	102	177	487	700	349	707	303	666	345	681	437	662	217	631
	NB	Out	272	415	236	525	912	562	966	558	1027	534	1102	585	1021	667
	SB	Out	87	113	384	441	233	416	207	406	258	423	344	409	133	356
W 5th @ Crescent Ave	WB	In	200	390	596	413	637	459	647	446	688	449	933	501	734	523
	EB	Out	86	86	384	441	233	416	207	406	258	428	344	409	133	356
	NB	In	53	53	0	0	0	0	0	0	0	0	0	0	0	0
	SB	In	87	113	384	441	233	416	207	406	258	423	344	409	133	356
	NB	Out	238	395	596	413	637	459	647	446	688	449	933	502	734	523
	SB	Out	16	75	0	0	0	0	0	0	0	0	0	0	0	0
I 75 N ramp @ Pike St	EB	In	621	328	881	769	690	656	717	660	780	728	760	720	709	673
	WB	In	178	503	823	993	763	966	668	991	709	994	789	1061	479	814
	EB	Out	476	366	840	803	878	706	858	718	837	734	887	714	667	600
	WB	Out	177	486	809	943	736	911	635	935	681	938	770	1018	425	743
	NB	In	448	402	962	856	705	587	707	618	851	655	820	628	523	536
	NB	Out	594	381	1018	872	544	593	601	617	822	706	713	677	620	680
I 75 N ramp @ 12th St	EB	In	287	370	1062	707	422	910	463	357	646	405	554	357	457	350
	WB	In	414	483	921	979	965	990	977	997	967	1008	957	1021	952	990
	EB	Out	354	585	828	925	894	946	922	959	914	966	869	929	938	963
	WB	Out	172	257	796	766	875	342	879	904	803	872	810	897	841	852
	NB	In	254	391	604	860	1088	1112	1067	1127	956	1083	988	1075	893	1011
	NB	Out	429	402	962	856	705	587	707	618	851	655	820	628	523	536
I 75 S ramp @ Pike St	EB	In	612	249	834	749	640	630	660	631	729	700	699	693	634	632
	WB	In	198	486	809	943	736	911	635	660	681	938	770	1018	425	743
	EB	Out	686	328	881	769	690	656	717	935	780	728	760	720	709	673
	WB	Out	180	572	617	734	531	689	529	691	656	728	649	715	510	679
	SB	In	328	678	621	496	539	424	571	459	766	498	661	439	681	536
	SB	Out	272	513	767	686	696	621	621	672	740	680	721	716	520	559
I 75 S ramp @ 12th St	EB	In	145	112	785	568	245	299	264	295	382	287	340	295	249	284
	WB	In	181	257	796	766	875	910	879	904	803	872	810	897	841	852
	EB	Out	12	82	352	707	422	342	463	357	646	402	554	357	457	350
	WB	Out	306	370	1062	279	320	368	303	366	337	393	331	398	307	356
	SB	In	278	513	767	686	696	621	621	672	740	680	721	716	520	559
	SB	Out	286	430	933	1033	1075	1121	997	1149	942	1044	986	1151	846	990

BURGESS & NIPLE

FINAL

To:	Herb Mack, PE Project Manager, Burgess & Niple	**Date:**	June 17, 2004
From:	Randy Kill, PE Project Engineer, Burgess & Niple Paul Dorothy, PhD, PE, AICP Director of Operational Modeling/Geometrics, Burgess & Niple	**Subject:**	Meeting Notes for: Brent Spence Bridge Feasibility and Constructability Study Modeling Advisory Group Conference Call on June15, 2004

Project Memorandum

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A modeling advisory group conference call was held on June 15, 2004 for the Feasibility and Constructability Study for the Replacement/Rehabilitation of the Brent Spence Bridge.

Participants included:

Name	Organization	Phone/Email
Rob Bostrom	KYTC	502-564-7686 rob.bostrom@ky.gov
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Randy Kill	Burgess & Niple	614-459-2050 rkill@burnip.com
Jamie Snow	Burgess & Niple	614-459-2050 jsnow@burnip.com

Notes from the meetings are as follows:

Issues discussed:
- Background
- Existing Counts
- Certified Traffic
- CORSIM Parameters

Background

- It was stated that the Brent Spence Bridge Feasibility and Constructability Study is scheduled for completion in November of 2004. Full environmental process will begin this summer. The participating agencies noted that this schedule will be difficult to meet.
- The North-South Initiative was used for the MIS of the Brent Spence Bridge. The MIS used raw TRANPLAN assignments from the OKI model. Concerns with applying this approach to the Brent Spence Bridge Study include:
  - Putting incorrect information into the public
  - Assignments will not be acceptable in the environmental process
  - Cannot build an accurate CORSIM network without reliable assignments

Existing Counts

- Main question is whether the existing counts are "constrained" by geometry or actually represent "demand".
  - Concern raised because CORSIM model is not showing enough queuing for existing conditions.
- It was decided that raw counts should be factored up to 30th highest hour rather than using typical day traffic and that no seasonal factors will be applied to the raw counts.
- Truck percentage will be calculated from representative videotape manual counts rather than use the estimated 10%.
  - Cars will be FHWA class 1-3
  - Trucks will be FHWA class 4-13
- Where possible ARTIMIS data will be used to verify or supplement the existing counts

Certified Traffic

- OKI travel demand model appears to be overestimating in both the existing and 2030 assignments.
    - Peak hour factors of 0.53 and 0.35 for the AM and PM peaks respectively were derived using household surveys on a 30-minute level for the entire OKI region. These factors were developed as region wide factors and, thus, may not be appropriate for the small Brent Spence Bridge study area.
    - ARTIMIS, KYTC, ODOT and B&N counts will be used to derive new peak hour factors that are specific to the study area.
- Rather than generating ODOT "Certified Traffic" we should be developing "Refined Traffic", and save "Certified Traffic" for the preferred alternative
    - Link by link growth factors will be generated by taking the growth predicted between the 2003 OKI model and the 2030 OKI model.
    - These growth factors will then be applied to the 30th highest hour volumes created using the raw traffic counts.
    - Method used for developing growth factors will be a hybrid of the ratio and additive methods. Ratio will be used for low volume links and additive will be used for high volume links. Cutoff between low and high volume will be 500 vph to start, and adjusted if necessary.

CORSIM Parameters

- CORSIM model not replicating existing backups
    - Some CORSIM parameters may need adjusted
    - Use 30th highest hour counts
    - Check truck percentages
- Once the inputs to the CORSIM model are updated with 30th highest hour counts and a refined truck percentage, the model will be re-run. The output for this revised model will be examined to determine if there is still difficulty replicating existing conditions.
- B&N will provide KYTC with a list of CORSIM parameters and their default values. If it is determined to change any of these default values, data and reasoning supporting the change will be outlined in memo format.

Future Products

- A Peak Hour Factors technical memo will be produced by B&N. This memo will utilize study area specific data to adjust the peak hour factors currently shown in the OKI model for use in the study area.
- A Truck Percentage technical memo will be created by B&N to document the truck percentage that is selected for corridor analysis. This analysis will utilize data from the study area to create this new truck percentage.
- A Traffic Assignments technical memo will be produced by B&N to document "refined traffic" to be used in this study. This memo will detail raw traffic counts adjusted to 30th highest hour. Further, the memo will quantify the additive and ratio growth factors that were used to create future 2030 traffic projections, as

well as the 2030 traffic. The growth factors will be developed using TRANPLAN assignments.

- A CORSIM Parameters technical memo will be produced by B&N documenting the default parameters used in the CORSIM model, as well as the data and reasoning behind any variation from the defaults.

Outstanding Issues

- Methodology needs to be determined to validate the CORSIM model. This will provide a quantitative measure as to when we are replicating existing conditions. Once the input data has been finalized and an initial run of the revised CORSIM model has been done, further discussion on this subject will be necessary.

Next conference call will be at 2:00 PM on July 8, 2004

MEMORANDUM

TO: **Modeling Advisory Group**

FROM: **Randy Kill, PE**

SUBJECT: **Brent Spence Bridge Peak Hour Factors**

July 1, 2004

The OKI Regional Travel Demand Model currently includes 11 counties located in southwest Ohio, northern Kentucky and southeast Indiana. In this model, the AM Peak Period is defined as 6:00 AM to 8:30 AM and the PM Peak Period is from 3:00 PM to 6:30 PM. Using household surveys on a 30-minute level for the entire OKI region, factors of 0.53 and 0.35 were developed to calculate the AM and PM Peak hours from the AM and PM Peak Period assignments respectively. Because of the small study area compared to the overall OKI model, new peak hour factors will be calculated for the study area.

Count Locations
The following 24-hour counts will be used for this calculation:

A. NB I-71/75 off-ramp to 5th St in Covington (counted by B&N)
B. NB I-71/75 on-ramp from 4th St in Covington (counted by B&N)
C. 4th St, east of I-71/75 in Covington (counted by B&N)
D. SB I-171/75 on-ramp from 4th St/Crescent Ave in Covington (counted by B&N)
E. SB I-75 to off-ramp Ezzard Charles in Cincinnati (counted by ODOT)
F. SB I-75 off-ramp to 7th St in Cincinnati (counted by ODOT)
G. NB I-75 on-ramp from 6th St in Cincinnati (counted by ODOT)
H. I-71/75 at mile post 191.3 in Covington (counted by KYTC)

AM Peak Hour Factor

Location	AM Peak Period (vph)	AM Peak Hour (vph)	AM Peak Hour Factor	Weighted AM Peak Hour Factor
A	2565	1145	0.45	0.0318
B	2068	1078	0.52	0.0296
C	2970	1537	0.52	0.0425
D	849	479	0.56	0.0131
E	1030	502	0.49	0.0139
F	2535	1298	0.51	0.0356
G	282	152	0.54	0.0042
H	24,041	10,754	0.45	0.2977
TOTAL	36,340			**0.4684**

The weighted AM Peak Hour Factor is calculated using the following formula:

$$\text{Weighted Peak Hour Factor} = \frac{\text{Peak Period Volume for Location}}{\text{Total Peak Period Volume}} \quad \text{X} \quad \text{Peak Hour Factor}$$

PM Peak Hour Factor

Location	AM Peak Period (vph)	AM Peak Hour (vph)	AM Peak Hour Factor	Weighted AM Peak Hour Factor
A	1645	543	0.33	0.0100
B	3164	1007	0.32	0.0186
C	6337	1917	0.30	0.0348
D	3387	1123	0.33	0.0205
E	708	262	0.37	0.0048
F	860	281	0.33	0.0052
G	2227	1720	0.39	0.0159
H	36,222	10,992	0.30	0.1992
TOTAL	54,550			**0.309**

The weighted PM Peak Hour Factor is calculated using the following formula:

$$\text{Weighted Peak Hour Factor} = \frac{\text{Peak Period Volume for Location}}{\text{Total Peak Period Volume}} \quad X \quad \text{Peak Hour Factor}$$

Conclusions

Based on the previous calculations, 0.47 will be applied to the AM peak period of the OKI Regional Travel Demand model to calculate AM peak hour. In addition, 0.31 will be used to calculate the PM peak hour. These factors will remain constant between 2003 and 2030 model runs.

MEMORANDUM

TO: **Modeling Advisory Group**

FROM: **Herb Mack, PE**
Randy Kill, PE

SUBJECT: **Brent Spence Bridge Traffic Assignments**

July 6, 2004

During the Modeling Advisory Group conference call on June 15th, the following decisions were made. Raw traffic counts will not have ODOT seasonal adjustment factors applied, but will be adjusted to 30th highest hour. Also, raw output assignments from the OKI Regional Travel Demand model will not be used, instead, growth factors will be created between the 2003 and 2030 assignments. The method used for developing the growth factors will be a hybrid of the ratio and additive methods. Ratio will be used for low volume links and additive will be used for high volume links. Cutoff between low and high volume will be 500 vph. The following provides more detail on the calculation of the 2030 refined assignments for the Brent Spence Bridge Feasibility and Constructability project.

30th Highest Hour
The 30th highest hour volumes were calculated using the following procedure:

- Used existing traffic counts to calculate the % of the 24-hour volume that occurs in the peak hour (K factor) during a normal day.
- Used the reported "K and D Factors by Functional Classification for 30th Highest Hour", published by ODOT Technical Services, determined the K factor for the ATR's located within the study area or ATR's adjacent to the study area.
- Calculated the 30th highest hour correction factor by dividing the 30th highest K factor by the normal day K factor.
- Applied this correction factor to the raw AM and PM counts.

<u>Normal Day K Factor</u>
The following 24-hour counts were used for this calculation:

A. NB I-71/75 off-ramp to 5th St in Covington (counted by B&N)
B. NB I-71/75 on-ramp from 4th St in Covington (counted by B&N)
C. 4th St, east of I-71/75 in Covington (counted by B&N)
D. SB I-171/75 on-ramp from 4th St/Crescent Ave in Covington (counted by B&N)
E. SB I-75 to off-ramp Ezzard Charles in Cincinnati (counted by ODOT)
F. SB I-75 off-ramp to 7th St in Cincinnati (counted by ODOT)
G. NB I-75 on-ramp from 6th St in Cincinnati (counted by ODOT)
H. I-71/75 at mile post 191.3 in Covington (counted by KYTC)

Location	24-Hour Volume (veh)	Peak Hour Volume (vph)	K Factor (%)	Weighted K Factor (%)
A	9305	1139	12.24	0.47
B	15,187	1035	6.52	0.40
C	26,634	1871	7.02	0.76
D	11,518	1062	9.22	0.43
E	4292	502	11.70	0.21
F	7297	1299	17.80	0.53
G	5522	860	15.57	0.35
H	164,988	10,992	6.66	4.49
TOTAL	244,743			**7.64**

The weighted K Factor is calculated using the following formula:

$$\text{Weighted K Factor} = \frac{\text{24-Hour Volume for Location}}{\text{Total 24-Hour Volume}} \times \text{K Factor}$$

30th Highest K Factor

The following ATR's located on I-75 were used to calculate the 30th highest hour K factor.

ATR #	**Milepost**	**ADT**	**30th Highest Hour K Factor**
528S (Southbound Only)	6.25	71,030	8.36%
524	15.10	146,660	8.30%

Unfortunately, the closest ATR at milepost 6.25 only operates in the southbound direction. However, the K factor is nearly identical to the ATR located at milepost 15.10. Also, doubling the ADT for ATR 528S shows a similar ADT as ATR 524. Because of these similarities, the ATR 524 will be used to represent the 30th highest hour K factor for the study area.

30th Highest Hour Correction Factor

$$\text{30th Highest Hour Correction Factor } (CF_{30}) = \frac{\text{30th Highest Hour K Factor}}{\text{Normal Day K Factor}}$$

$CF_{30} = 8.30/7.64 = \mathbf{1.09}$

All AM and PM raw counts were multiplied by 1.09 to calculate 30th highest hour assignments.

Refined 2030 Assignments

2003 and 2030 travel demand assignments were used to calculate the refined 2030 assignments using a hybrid mix of the ratio and additive methods. These methods were applied on a link-by-link basis.

Ratio Method

$$\text{Refined 2030 Assignment} = \frac{\text{2030 TRANPLAN Assignment}}{\text{2003 TRANPLAN Assignment}} \times \text{30th Highest Hour Assignment}$$

The ratio method was applied to links with a 30th highest hour assignment less than 500 vph.

Additive Method

Refined 2030 Assignment = (2030 TRANPLAN Assignment – 2003 TRANPLAN Assignment) + 30th Highest Hour Assignment

The additive method was applied to links with a 30th highest hour assignment greater than or equal to 500 vph, or with a 2030 assignment of 0.

Balancing

Because two different methods were applied to calculate refined 2030 assignment, there are areas where the applied methodologies overlap which causes an inbalance in assignments between these adjacent links. To create a balanced network, the following method was used.

- Held the refined 2030 assignments on the Brent Spence Bridge, as well as all ramps in the network constant.
- Added and subtracted off and on-ramps to the Brent Spence Bridge assignments to create balanced mainline assignments.
- Adjusted intersection approach and exiting link volumes as necessary to match the ramps.

MEMORANDUM

TO: **Modeling Advisory Group**

FROM: **Herb Mack, PE**
Randy Kill, PE

SUBJECT: **Brent Spence Bridge Truck Percentages**

July 6, 2004

Manual truck counts were taken on the Brent Spence Bridge for the AM and PM peak hours. These counts were conducted using the videotaped ramps from July 2003. FHWA classifications were used for this count with cars being designated FHWA class 1-3 and trucks FHWA class 4-13. Based on these counts, the following truck percentages were observed on the Brent Spence Bridge.

	Truck %	
	AM Peak	PM Peak
NB Brent Spence Bridge	6.9	8.8
SB Brent Spence Bridge	10.6	6.8

For future modeling tasks, these truck percentages will be used to represent the mainline throughout the study area.

Modeling Advisory Group
Existing Counts July 6, 2004

Location	Direction	Direction @ Intersection	Reference #	Comments	Date of Count	ODOT Adjustment Factor	AM Existing Adjusted	AM Raw Count	Date of Count	ODOT Adjustment Factor	PM Existing Adjusted	PM Raw Count
Southbound I-75												
I-75 ML, N of 7th St off-ramp	SB		1	Reference 2 + Reference 3			6149	6759			4285	4662
7th St off-ramp	SB		2		7/31/2003	0.91	1226	1349	7/30/2003	0.93	106	115
I-75 ML, N of I-71/5th off-ramp	SB		3		7/31/2003	0.91	4923	5410	7/30/2003	0.93	4179	4547
I-71/5th off-ramp	SB		4	Reference 5 + Reference 6			2872	3112			2384	2543
5th St off-ramp	SB		5		7/31/2003	0.91	915	1005	7/30/2003	0.93	358	385
I-75 ramp to I-71/Second	SB		6	Reference 7 + Reference 8			1957	2107			2026	2158
I-75 ramp to I-71	SB		7		7/30/2003	0.93	1135	1221	7/29/2003	0.94	1583	1684
I-75 ramp to Second	SB		8		7/30/2003	0.93	822	886	7/29/2003	0.94	443	474
I-75 ML, N of 9th St on-ramp	SB		9	Reference 3 - Reference 4			2051	2298			1795	2004
9th St on-ramp	SB		10	Reference 11 - Reference 9			97	12			804	761
I-75 ML, N of 6th St on-ramp	SB		11	Reference 13 - Reference 12 (PM Only)	7/30/2003 (AM)	0.93	2148	2310			2599	2765
6th St. on-ramp	SB		12		7/30/2003	0.93	426	459	7/29/2003	0.94	679	723
I-75 SB to I-71/75 SB	SB		13	Reference 11 + Refernce 12 (AM Only)			2574	2769	7/29/2003	0.94	3278	3488
I-71 on-ramp to I-75	SB		14		7/30/2003 (PM)	0.93	1591	1711	7/29/2003	0.94	3561	3787
I-71/75 on Brent Spence Bridge	SB		15	Reference 13 + Reference 14			4165	4480			6839	7275
I-71/75 off-ramp to 5th St	SB		16	Reference 89 + Reference 90			718	772			839	901
I-71/75 ML, N of off-ramp to Pike/12th	SB		17	Reference 15 - Reference 16			3447	3708			6000	6374
Off-ramp to Pike/12th	SB		18	Assumed			263	263			150	150
I-71/75 ML, N of 4th St on-ramp (Covington)	SB		19	Reference 17 - Reference 18			3184	3445			5850	6224
4th St on-ramp (Covington)	SB		20	Assumed			350	350			550	550
I-71/75 ML, N of 12th St on-ramp	SB		21	Reference 19 + Reference 20			3534	3795			6400	6774
12th St on-ramp	SB		22	SB Out of Reference 108			286	300			430	452
I-71/75 ML, S of 12th St on-ramp	SB		23	Reference 21 + Reference 22			3820	4095			6830	7226
Off ramp at Kyles	SB		24		6/25/2003	0.92	402	437	6/24/2003	0.92	863	939
I-75 S of off ramp at Kyles	SB		25	Reference 23 - Reference 24			3418	3658			5967	6287
On ramp at Kyles	SB		26		6/25/2003	0.92	358	389	6/24/2003	0.92	437	475
End link I-75	SB		27	Reference 25 + Reference 26			3776	4047			6404	6762
Northbound I-75												
Entry Link I-75	NB		28	Reference 29 + Reference 30			5306	5784			4983	5324
Off ramp at Kyles	NB		29		6/25/2003	0.92	330	359	6/24/2003	0.92	588	640
I-75 N of Kyle off ramp	NB		30	Reference 32 - Reference 31			4976	5425			4395	4684
On ramp at Kyles	NB		31		6/24/2003	0.93	715	769	6/24/2004	0.93	491	529
I-71/75 ML, S of 12th St off-ramp	NB		32	Reference 34 + Reference 33			5691	6194			4886	5213
12th St off-ramp	NB		33	Reference 106 NB IN			254	281			391	433
I-71/75 ML, S of 5th St off-ramp (Covington)	NB		34	Reference 35 + Reference 36			5437	5913			4495	4780
5th St off-ramp (Covington)	NB		35		6/25/2003	0.92	1020	1109	6/24/2003	0.92	543	589
I-71/75 ML, S of Pike On-ramp	NB		36	Reference 38 - Reference 37			4417	4804			3952	4191
Pike St on-ramp	NB		37	Reference 105 NB Out			594	660			381	423
I-71/75 ML, S of 4th St on-ramp (Covington)	NB		38	Reference 40 - Reference 39			5011	5464			4333	4614
4th St on-ramp (Covington)	NB		39		6/24/2003	0.93	1073	1154	6/23/2003	0.93	876	941
I-71/75 on Brent Spence Bridge	NB		40	Reference 41 + Reference 42			6084	6618			5209	5555
I-71/75 off-ramp to I-71/Second	NB		41	Reference 55 + Reference 56			2997	3228			2064	2174
I-75 ML, S of 5th St off-ramp	NB		42	Reference 43 + Reference 44			3087	3390			3145	3381
5th St off-ramp	NB		43	Counted on EB Approach of Reference 98			548	601			186	199
I-75 ML, S of 6th St off-ramp	NB		44	Reference 45 + Reference 46			2539	2789			2959	3182
6th St off-ramp	NB		45		7/31/2003	0.91	675	742	7/30/2003	0.93	675	726

Modeling Advisory Group
Existing Counts July 6, 2004

Location	Direction	Direction @ Intersection	Reference #	Comments	Date of Count	ODOT Adjustment Factor	AM Existing Adjusted	AM Raw Count	Date of Count	ODOT Adjustment Factor	PM Existing Adjusted	PM Raw Count
I-75 ML, S of C-D Road on-ramp	NB		46		7/31/2003	0.91	1864	2047	7/30/2003	0.93	2284	2456
C-D Road on-ramp	NB		47		7/31/2003	0.91	1282	1410	7/30/2003	0.93	2646	2845
I-75 ML, S of 9th St on-ramp	NB		48	Reference 46 + Reference 47			3146	3457			4930	5301
Southbound I-71												
I-71 ML, N of NB I-75 off-ramp	SB		49	Reference 50 + Reference 52			3530	3832			5148	5472
I-71 ramp to I-71/75, N of 3rd St on-ramp	SB		50	Reference 14 - Reference 51			1461	1558			2670	2807
3rd St on-ramp to I-71/75	SB		51	Reference 100 I-75 outbound			130	153			891	980
I-71 ramp to NB I-75	SB		52	Reference 58 + Reference 53			2069	2274			2478	2665
I-71 SB ramp to 6th St	NB		53		7/31/2003	0.91	902	992	7/30/2003	0.93	1383	1487
Northbound I-71												
I-75 S/6th Combined to I-71	SB		54	Reference 7 + Reference 72			2439	2622			2766	2940
I-71/75 ramp to Second	NB		55		9/16/2003	0.95	820	863	9/16/2003	0.95	157	167
I-71/75 off-ramp to I-71	NB		56		9/16/2003	0.92	2177	2365	9/16/2003	0.95	1907	2007
I-71 ML end link	EB		57	Reference 54 + Reference 56			4616	4987			4673	4947
Northbound I-75 C-D Road												
C-D Road, S of 4th on-ramp	NB		58		7/31/2003	0.91	1167	1282	7/30/2003	0.93	1095	1178
4th St on-ramp to C-D Road	NB		59		7/31/2003	0.91	245	268	7/30/2003	0.93	1221	1313
C-D Road, S of 6th St on-ramp	NB		60	Reference 58 + Reference 59			1412	1550			2316	2491
6th St on ramp to C-D Road	NB		61	Reference 62 - Reference 60			151	170			485	521
C-D Road, S of NB I-75 off-ramp	NB		62	Reference 47 + Reference 63			1563	1720			2801	3012
C-D Road, N of NB I-75 off-ramp	NB		63		7/31/2003	0.91	281	310	7/30/2003	0.93	155	167
9th St on-ramp to C-D Road	NB		64	Assumed			100	100			250	250
Misc. Cincinnati Ramps												
9th St, E of SB I-75 off-ramp	WB		65	Reference 95 WB out - Reference 64			400	487			1573	1755
9th St, W of SB I-75 off-ramp	WB		66	Reference 65 - Reference 10			303	475			769	994
8th to 7th	EB		67	Reference 96 EB Approach - Reference 2			748	820			476	513
6th to I-75 and 5th St	EB		68	Reference 69 + Reference 70 + Reference 72			2482	2681			2019	2142
6th to 5th	EB		69	Reference 98 EB Approach from North Ramps - Reference 5			513	564			36	35
6th to I-75 S/Second St	EB		70	Reference 12 + Reference 71			665	716			800	851
6th to Second	SB		71		7/30/2003	0.93	239	257	7/29/2003	0.94	121	128
6th to I-71 N	EB		72		7/30/2003	0.93	1304	1401	7/29/2003	0.94	1183	1256
6th to 6th	WB		73	Reference 97 US 50 outbound			123	145			782	858
NB I-75/I-71 Combined to 6th	NB		74	Reference 45 + Reference 53			1577	1734			2058	2213
6th/I-75 N Combined to 6th	WB		75	Reference 73 + Reference 74			1700	1879			2840	3071
I-75 S/6th Combined to 5th	EB		76	Reference 98 EB Approach from North Ramps			1428	1569			394	420
I-75 S/6th Combined to Second	SB		77	Reference 8 + Reference 71			1061	1143			564	602
2nd St Entry link	EB		78	Assumed			200	200			100	100
2nd St, W of NB I-71/75 on-ramp	EB		79	Reference 77 + Reference 78			1261	1343			664	702
Eastbound Approach to 2nd & Elm Intersection	EB		80	Reference 55 + Reference 79			2081	2206			821	869
Misc. Covington Ramps												
4th St, E of NB I-71/75 off-ramp	WB		81		6/24/2003	0.93	1537	1653	6/23/2003	0.93	1910	2054
4th St, W of NB I-71/75 off-ramp	WB		82	Reference 81 - Reference 39			464	499			1034	1113
4th St to SB I-71/75 C-D Road	SB		83	Reference 82 - Reference 84			419	450			938	1010
4th St, E of Crescent	WB		84		6/24/2003	0.93	45	49	6/23/2003	0.93	96	103

Location	Direction	Direction @ Intersection	Reference #	Comments	Date of Count	ODOT Adjustment Factor	AM Existing Adjusted	AM Raw Count	Date of Count	ODOT Adjustment Factor	PM Existing Adjusted	PM Raw Count
Crescent to SB I-71/75 C-D at 4th	SB		85	Reference 86 - Reference 83			26	28			140	149
Combined 4th St/Crescent to SB I-71/75 C-D Road	SB		86		6/24/2003	0.93	445	478	6/23/2003	0.93	1078	1159
SB C-D Road between SB I-71/75 on-ramp and off-ramp	SB		87	Reference 18 + Reference 86			708	741			1228	1309
SB C-D Road, S of SB I-71/75 off-ramp	SB		88	Reference 107 SB In			328	344			678	713
SB I-71/75 off-ramp to WB 5th St.	WB		89		6/24/2003	0.93	204	219	6/24/2003	0.93	390	419
SB I-71/75 off-ramp to EB 5th St.	EB		90		6/24/2003	0.93	514	553	6/24/2003	0.93	448	482
5th St E of Crescent	EB		91		6/24/2003	0.93	84	90	6/23/2003	0.93	86	93
5th St, E of SB I-71/75 off-ramp	EB		92	Reference 90 + Reference 91			598	643			534	575
5th St, E of NB I-71/75 off-ramp	EB		93	Reference 35 + Reference 92			1618	1752			1077	1164
2nd St @ Elm St	EB	In	94				2081	2206			821	869
	EB	Out					1547	1640			617	654
	NB	In					40	42			100	106
	NB	Out					534	629			279	304
	SB	Out					40	42			25	27
9th St @ Central Ave	SB	In	95		9/5/2003	0.85	25	28	9/4/2003	0.91	127	140
	WB	In					399	469			1353	1484
	WB	Out					500	587			1823	2005
	NB	In					538	633			687	758
	NB	Out					462	543			344	377
7th St @ Central Ave	EB	In	96		9/4/2003	0.91	1974	2169	9/3/2003	0.93	598	628
	EB	Out					1856	2038			613	661
	NB	In					432	478			450	485
	NB	Out					550	609			419	452
6th St @ Central Ave	WB	In	97		9/5/2003	0.85	436	516	9/4/2003	0.91	1349	1490
	WB	Out					251	296			1284	1407
	NB	In					434	507			508	524
	NB	Out					481	565			375	423
	SB	Out					138	162			198	218
5th St @ Central Ave	EB	In	98		9/4/2003	0.91	1976	2170	9/3/2003	0.93	734	619
	EB	Out					1871	2059			897	798
	NB	In					349	386			589	634
	SB	In					137	152			202	218
	NB	Out					461	507			504	540
	SB	Out					130	142			124	133
4th St @ Central	WB	Out	99		9/4/2003	0.91	247	272	9/3/2003	0.93	1221	1255
	WB	In					329	362			994	980
	NB	In					320	352			911	982
	NB	Out					330	363			589	605
	SB	In					133	147			124	135
	SB	Out					205	226			219	237
3rd St @ Elm St	WB	In	100		9/5/2003	0.85	791	933	9/4/2003	0.91	1429	1571
	WB	Out					584	689			496	543
	WB	Out					130	153			891	980
	NB	In					534	629			279	304
	NB	Out					611	720			321	352

Modeling Advisory Group
Existing Counts July 6, 2004

Location	Direction	Direction @ Intersection	Reference #	Comments	Date of Count	ODOT Adjustment Factor	AM Existing Adjusted	AM Raw Count	Date of Count	ODOT Adjustment Factor	PM Existing Adjusted	PM Raw Count
W 4th St @ Philadelphia St	WB	In	101				916	916			1443	1443
	WB	Out					1536	1536			1919	1919
	NB	In					449	449			403	403
	SB	In					704	704			534	534
	NB	Out					352	352			301	301
	SB	Out					181	181			160	160
W 5th St @ Philadelphia	EB	In	102				1615	1615			1077	1077
	EB	Out					1378	1378			905	905
	NB	In					123	123			164	164
	SB	In					176	176			195	195
	NB	Out					459	459			393	393
	SB	Out					77	77			164	164
W 4th @ Crescent Ave	WB	In	103				45	45			96	96
	EB	Out					26	26			280	280
	NB	In					238	238			395	395
	SB	In					102	102			177	177
	NB	Out					272	272			415	415
	SB	Out					87	87			113	113
W 5th @ Crescent Ave	WB	In	104				200	200			390	390
	EB	Out					86	86			86	86
	NB	In					53	53			53	53
	SB	In					87	87			113	113
	NB	Out					238	238			395	395
	SB	Out					16	16			75	75
I 75 N ramp @ Pike St	EB	In	105		6/25/2003	0.92	621	690	6/25/2003	0.90	328	368
	WB	In					178	198			503	559
	EB	Out					476	529			366	409
	WB	Out					177	196			486	540
	NB	In					448	497			402	445
	NB	Out					594	660			381	423
I 75 N ramp @ 12th St	EB	In	106		6/25/2003	0.90	287	320	6/25/2003	0.90	307	342
	WB	In					414	460			483	537
	EB	Out					354	394			522	580
	WB	Out					172	190			257	285
	NB	In					254	281			391	433
	NB	Out					429	477			402	447
I 75 S ramp @ Pike St	EB	In	107		6/24/2003	0.90	612	680	6/24/2003	0.90	249	264
	WB	In					198	220			486	590
	EB	Out					686	756			328	356
	WB	Out					180	195			616	668
	SB	In					328	344			678	713
	SB	Out					272	293			501	543
I 75 S ramp @ 12th St	EB	In	108		6/23/2003	0.95	145	152	6/23/2003	0.95	112	119
	WB	In					181	190			232	244
	EB	Out					306	322			370	391
	WB	Out					12	12			57	59
	SB	In					278	293			513	539
	SB	Out					286	300			430	452

Modeling Advisory Group
AM Traffic Assignments
July 6, 2004

Location	Direction	Direction @ Intersection	AM Raw Count	AM 30th Highest Hour	2003 AM OKI Assignments	2030 AM OKI Assignments	2030 Adjusted Assignment	Method Used	2030 Balanced Assignments
Southbound I-75									
I-75 ML, N of 7th St off-ramp	SB		6759	7367	8081	10035	9321	Additive	9455
7th St off-ramp	SB		1349	1470	996	881	1355	Additive	1355
I-75 ML, N of I-71/5th off-ramp	SB		5410	5897	7086	9153	7964	Additive	8100
I-71/5th off-ramp	SB		3112	3392	3316	3820	3896	Additive	3896
5th St off-ramp	SB		1005	1095	807	830	1118	Additive	1118
I-75 ramp to I-71/Second	SB		2107	2297	2509	2990	2778	Additive	2778
I-75 ramp to I-71	SB		1221	1331	796	1205	1740	Additive	1740
I-75 ramp to Second	SB		886	966	1713	1784	1037	Additive	1037
I-75 ML, N of 9th St on-ramp	SB		2298	2505	3770	5335	4069	Additive	4284
9th St on-ramp	SB		12	13	386	609	21	Ratio	21
I-75 ML, N of 6th St on-ramp	SB		2310	2518	4156	5943	4305	Additive	4305
6th St. on-ramp	SB		459	500	572	740	668	Additive	668
I-75 SB to I-71/75 SB	SB		2769	3018	4728	6683	4973	Additive	4973
I-71 on-ramp to I-75	SB		1711	1865	2368	2713	2210	Additive	2210
I-71/75 on Brent Spence Bridge	SB		4480	4883	7095	9395	7183	Additive	7183
I-71/75 off-ramp to 5th St	SB		772	841	925	967	884	Additive	884
I-71/75 ML, N of off-ramp to Pike/12th	SB		3708	4042	6170	8428	6300	Additive	6300
Off-ramp to Pike/12th	SB		263	287	400	536	385	Ratio	385
I-71/75 ML, N of 4th St on-ramp (Covington)	SB		3445	3755	5771	7892	5876	Additive	5915
5th St on-ramp (Covington)	SB		350	382	401	699	664	Ratio	664
I-71/75 ML, N of 12th St on-ramp	SB		3795	4137	6171	8591	6556	Additive	6579
12th St on-ramp	SB		300	327	756	827	358	Ratio	358
I-71/75 ML, S of 12th St on-ramp	SB		4095	4464	6928	9417	6953	Additive	6937
Off ramp at Kyles	SB		437	476	489	488	476	Ratio	476
I-75 S of off ramp at Kyles	SB		3658	3987	6439	8930	6478	Additive	6461
On ramp at Kyles	SB		389	424	604	697	489	Ratio	489
End link I-75	SB		4047	4411	7042	9627	6996	Additive	6950
Northbound I-75									
Entry Link I-75	NB		5784	6305	7154	8542	7692	Additive	7956
Off ramp at Kyles	NB		359	391	685	491	280	Ratio	280
I-75 N of Kyle off ramp	NB		5425	5913	6470	8053	7496	Additive	7676
On ramp at Kyles	NB		769	838	709	443	572	Additive	572
I-71/75 ML, S of 12th St off-ramp	NB		6194	6751	7178	8495	8069	Additive	8248
12th St off-ramp	NB		281	306	823	535	199	Ratio	199
I-71/75 ML, S of 5th St off-ramp (Covington)	NB		5913	6445	6355	7959	8049	Additive	8049
5th St off-ramp (Covington)	NB		1109	1209	639	528	1098	Additive	1098
I-71/75 ML, S of Pike On-ramp	NB		4804	5236	5719	7431	6948	Additive	6948

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Pike St on-ramp	NB		660	719	857	902	764	Additive	764
I-71/75 ML, S of 4th St on-ramp (Covington)	NB		5464	5956	6575	8334	7714	Additive	7714
4th St on-ramp (Covington)	NB		1154	1258	896	737	1099	Additive	1099
I-71/75 on Brent Spence Bridge	NB		6618	7214	7471	9071	8814	Additive	8814
I-71/75 off-ramp to I-71/Second	NB		3228	3519	2375	2699	3842	Additive	3842
I-75 ML, S of 5th St off-ramp	NB		3390	3695	5096	6373	4972	Additive	4972
5th St off-ramp	NB		601	655	1499	1412	568	Additive	568
I-75 ML, S of 6th St off-ramp	NB		2789	3040	3596	4961	4405	Additive	4405
6th St off-ramp	NB		742	809	573	575	810	Additive	810
I-75 ML, S of C-D Road on-ramp	NB		2047	2231	3023	4386	3594	Additive	3594
C-D Road on-ramp	NB		1410	1537	1347	1669	1859	Additive	1859
I-75 ML, S of 9th St on-ramp	NB		3457	3768	4370	6056	5454	Additive	5454
Southbound I-71									
I-71 ML, N of NB I-75 off-ramp	SB		3832	4177	3343	4182	5016	Additive	4867
I-71 ramp to I-71/75, N of 3rd St on-ramp	SB		1558	1698	1870	2544	2373	Additive	2157
3rd St on-ramp to I-71/75	SB		153	167	498	159	53	Ratio	53
I-71 ramp to NB I-75	SB		2274	2479	1473	1627	2633	Additive	2710
I-71 SB ramp to 6th St	NB		992	1081	879	908	1110	Additive	1110
Northbound I-71									
I-75 S/6th Combined to I-71	SB		2622	2858	2233	2548	3173	Additive	3173
I-71/75 ramp to Second	NB		863	941	671	428	698	Additive	698
I-71/75 off-ramp to I-71	NB		2365	2578	1704	2217	3091	Additive	3144
I-71 ML end link	EB		4987	5436	3937	4819	6318	Additive	6317
Northbound I-75 C-D Road									
C-D Road, S of 4th on-ramp	NB		1282	1397	594	719	1522	Additive	1600
4th St on-ramp to C-D Road	NB		268	292	635	780	359	Ratio	359
C-D Road, S of 6th St on-ramp	NB		1550	1690	1230	1499	1959	Additive	1959
6th St on ramp to C-D Road	NB		170	185	551	526	177	Ratio	177
C-D Road, S of NB I-75 off-ramp	NB		1720	1875	1780	2025	2119	Additive	2136
C-D Road, N of NB I-75 off-ramp	NB		310	338	432	355	277	Ratio	277
9th St on-ramp to C-D Road	NB		100	109	125	124	108	Ratio	108
Misc. Cincinnati Ramps									
9th St, E of SB I-75 off-ramp	WB		487	531	513	738	756	Additive	756
9th St, W of SB I-75 off-ramp	WB		475	518	127	128	519	Additive	735
8th to 7th	EB		820	894	653	613	854	Additive	854
6th to I-75 and 5th St	EB		2681	2922	3241	3495	3176	Additive	3176

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6th to 5th	EB		564	615	1232	1413	795	Additive	795
6th to I-75 S/Second St	EB		716	780	572	740	948	Additive	948
6th to Second	SB		257	280	0	0	280	Additive	280
6th to I-71 N	EB		1401	1527	1436	1343	1434	Additive	1434
6th to 6th	WB		145	158	679	738	172	Ratio	155
NB I-75/I-71 Combined to 6th	NB		1734	1890	1452	1483	1921	Additive	1921
6th/I-75 N Combined to 6th	WB		1879	2048	2130	2222	2140	Additive	2076
I-75 S/6th Combined to 5th	EB		1569	1710	2040	2242	1912	Additive	1912
I-75 S/6th Combined to Second	SB		1143	1246	1713	1784	1317	Additive	1317
2nd St Entry link	EB		200	218	0	568	786	Ratio	786
2nd St, W of NB I-71/75 on-ramp	EB		1343	1464	1713	2352	2103	Additive	2103
Eastbound Approach to 2nd & Elm Intersection	EB		2206	2405	2384	2780	2801	Additive	2801
Misc. Covington Ramps									
4th St, E of NB I-71/75 off-ramp	WB		1653	1802	1402	1570	1970	Additive	1970
4th St, W of NB I-71/75 off-ramp	WB		499	544	505	831	870	Additive	870
4th St to SB I-71/75 C-D Road	SB		450	491	332	621	918	Ratio	815
4th St, E of Crescent	WB		49	53	173	210	65	Ratio	65
Crescent to SB I-71/75 C-D at 4th	SB		28	31	77	92	36	Ratio	36
Combined 4th St/Crescent to SB I-71/75 C-D Road	SB		478	521	409	713	825	Additive	851
SB C-D Road between SB I-71/75 on-ramp and off-ramp	SB		741	808	807	1250	1250	Additive	1236
SB C-D Road, S of SB I-71/75 off-ramp	SB		344	375	408	551	506	Ratio	572
SB I-71/75 off-ramp to WB 5th St.	WB		219	239	255	529	496	Ratio	496
SB I-71/75 off-ramp to EB 5th St.	EB		553	603	670	438	371	Additive	388
5th St E of Crescent	EB		90	98	114	340	293	Ratio	293
5th St, E of SB I-71/75 off-ramp	EB		643	701	784	779	696	Additive	681
5th St, E of NB I-71/75 off-ramp	EB		1752	1910	1420	1308	1797	Additive	1779
2nd St @ Elm St	EB	In	2206	2405	2384	2780	2801	Additive	2801
	EB	Out	1640	1788	2196	2623	2215	Additive	2215
	NB	In	42	46	124	816	301	Ratio	806
	NB	Out	629	686	314	974	1346	Additive	1346
	SB	Out	42	46	0	0	46	Additive	46
9th St @ Central Ave	SB	In	28	31	0	0	31	Additive	31
	WB	In	469	511	618	889	783	Additive	783
	WB	Out	587	640	642	870	868	Additive	868
	NB	In	633	690	822	737	605	Additive	605
	NB	Out	543	592	798	756	550	Additive	550

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7th St @ Central Ave	EB	In	2169	2364	1649	1495	2210	Additive	2210
	EB	Out	2038	2221	2048	2046	2219	Additive	2219
	NB	In	478	521	1221	1289	589	Additive	589
	NB	Out	609	664	822	737	579	Additive	579
6th St @ Central Ave	WB	In	516	562	1133	1269	699	Additive	699
	WB	Out	296	323	1230	1265	332	Ratio	314
	NB	In	507	553	1414	1455	594	Additive	594
	NB	Out	565	616	1221	1289	684	Additive	684
	SB	Out	162	177	96	170	313	Ratio	295
5th St @ Central Ave	EB	In	2170	2365	3538	3655	2482	Additive	2482
	EB	Out	2059	2244	2222	2321	2343	Additive	2343
	NB	In	386	421	198	246	522	Ratio	522
	SB	In	152	166	96	170	294	Ratio	294
	NB	Out	507	553	1414	1455	594	Additive	594
	SB	Out	142	155	196	295	232	Ratio	361
4th St @ Central	WB	Out	272	296	635	780	364	Ratio	359
	WB	In	362	395	274	392	565	Ratio	708
	NB	In	352	384	587	687	449	Ratio	449
	NB	Out	363	396	225	292	513	Ratio	513
	SB	In	147	160	69	170	397	Ratio	350
	SB	Out	226	246	69	177	635	Ratio	635
3rd St @ Elm St	WB	In	933	1017	1335	1293	975	Additive	705
	WB	Out	689	751	1143	1522	1130	Additive	1130
	WB	Out	153	167	498	159	53	Ratio	53
	NB	In	629	686	314	974	1346	Additive	1346
	NB	Out	720	785	504	587	868	Additive	868
W 4th St @ Philadelphia St	WB	In	916	998	1318	1387	1068	Additive	1175
	WB	Out	1536	1674	1402	1570	1843	Additive	1970
	NB	In	449	489	363	297	401	Ratio	450
	SB	In	704	767	400	433	800	Additive	850
	NB	Out	352	384	376	525	536	Ratio	450
	SB	Out	181	197	303	23	15	Ratio	55
W 5th St @ Philadelphia	EB	In	1615	1760	1420	1308	1648	Additive	1779
	EB	Out	1378	1502	971	976	1507	Additive	1507
	NB	In	123	134	0	0	134	Additive	134
	SB	In	176	192	63	97	295	Ratio	128
	NB	Out	459	500	514	430	416	Additive	450
	SB	Out	77	84	0	0	84	Additive	84

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W 4th @ Crescent Ave	WB	In	45	49	173	210	60	Ratio	65
	EB	Out	26	28	77	92	34	Ratio	36
	NB	In	238	259	0	0	259	Additive	259
	SB	In	102	111	190	432	253	Ratio	253
	NB	Out	272	296	429	737	510	Ratio	446
	SB	Out	87	95	0	0	95	Additive	95
W 5th @ Crescent Ave	WB	In	200	218	255	529	453	Ratio	496
	EB	Out	86	94	0	0	94	Additive	293
	NB	In	53	58	0	0	58	Additive	58
	SB	In	87	95	0	0	95	Additive	95
	NB	Out	238	259	0	0	259	Additive	300
	SB	Out	16	17	0	0	17	Additive	56
I 75 N ramp @ Pike St	EB	In	690	752	715	781	818	Additive	818
	WB	In	198	216	443	729	355	Ratio	355
	EB	Out	529	577	653	744	667	Additive	667
	WB	Out	196	214	429	718	358	Ratio	358
	NB	In	497	542	783	854	613	Additive	613
	NB	Out	660	719	857	902	764	Additive	764
I 75 N ramp @ 12th St	EB	In	320	349	505	941	650	Ratio	650
	WB	In	460	501	812	816	505	Additive	505
	EB	Out	394	429	702	735	450	Ratio	470
	WB	Out	190	207	653	705	223	Ratio	223
	NB	In	281	306	823	535	199	Ratio	199
	NB	Out	477	520	783	854	591	Additive	625
I 75 S ramp @ Pike St	EB	In	680	741	669	740	812	Additive	812
	WB	In	220	240	429	718	402	Ratio	402
	EB	Out	756	824	715	781	890	Additive	890
	WB	Out	195	213	426	547	273	Ratio	273
	SB	In	344	375	408	551	506	Ratio	572
	SB	Out	293	319	365	680	595	Ratio	595
I 75 S ramp @ 12th St	EB	In	152	166	409	696	282	Ratio	260
	WB	In	190	207	653	705	223	Ratio	223
	EB	Out	322	351	505	941	654	Ratio	654
	WB	Out	12	13	165	313	25	Ratio	35
	SB	In	293	319	365	680	595	Ratio	595
	SB	Out	300	327	756	827	358	Ratio	358

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Location	Direction	Direction @ Intersection	PM Raw Count	PM 30th Higherst Hour	2003 PM OKI Assignments	2030 PM OKI Assignments	2030 Adjusted Assignment	Method Used	Balanced Assignment
Southbound I-75									
I-75 ML, N of 7th St off-ramp	SB		4662	5082	5632	7721	7171	Additive	7134
7th St off-ramp	SB		115	125	519	569	137	Ratio	137
I-75 ML, N of I-71/5th off-ramp	SB		4547	4956	5113	7153	6996	Additive	6997
I-71/5th off-ramp	SB		2543	2772	1991	2478	3259	Additive	3261
5th St off-ramp	SB		385	420	463	427	387	Ratio	387
I-75 ramp to I-71/Second	SB		2158	2352	1529	2051	2874	Additive	2874
I-75 ramp to I-71	SB		1684	1836	774	1264	2326	Additive	2326
I-75 ramp to Second	SB		474	517	755	787	549	Additive	549
I-75 ML, N of 9th St on-ramp	SB		2004	2184	3122	4674	3736	Additive	3736
9th St on-ramp	SB		761	829	799	849	879	Additive	879
I-75 ML, N of 6th St on-ramp	SB		2765	3014	3922	5524	4616	Additive	4616
6th St. on-ramp	SB		723	788	512	585	861	Additive	861
I-75 SB to I-71/75 SB	SB		3488	3802	4433	6109	5478	Additive	5478
I-71 on-ramp to I-75	SB		3787	4128	2444	2684	4368	Additive	4368
I-71/75 on Brent Spence Bridge	SB		7275	7930	6877	8793	9846	Additive	9846
I-71/75 off-ramp to 5th St	SB		901	982	939	852	895	Additive	895
I-71/75 ML, N of off-ramp to Pike/12th	SB		6374	6948	5939	7940	8949	Additive	8949
Off-ramp to Pike/12th	SB		150	164	421	420	163	Ratio	163
I-71/75 ML, N of 4th St on-ramp (Covington)	SB		6224	6784	5517	7521	8788	Additive	8786
4th St on-ramp (Covington)	SB		550	600	724	854	730	Additive	730
I-71/75 ML, N of 12th St on-ramp	SB		6774	7384	6241	8375	9518	Additive	9516
12th St on-ramp	SB		452	493	934	915	483	Ratio	483
I-71/75 ML, S of 12th St on-ramp	SB		7226	7876	7174	9290	9992	Additive	9999
Off ramp at Kyles	SB		939	1024	682	528	870	Additive	870
I-75 S of off ramp at Kyles	SB		6287	6853	6492	8762	9123	Additive	9129
On ramp at Kyles	SB		475	518	552	734	700	Additive	700
End link I-75	SB		6762	7371	7044	9497	9824	Additive	9829
Northbound I-75									
Entry Link I-75	NB		5324	5803	6495	8234	7542	Additive	7699
Off ramp at Kyles	NB		640	698	602	608	704	Additive	704
I-75 N of Kyle off ramp	NB		4684	5106	5892	7627	6841	Additive	6995
On ramp at Kyles	NB		529	577	569	392	400	Additive	400
I-71/75 ML, S of 12th St off-ramp	NB		5213	5682	6461	8018	7239	Additive	7395
12th St off-ramp	NB		433	472	987	762	364	Ratio	364
I-71/75 ML, S of 5th St off-ramp (Covington)	NB		4780	5210	5474	7257	6993	Additive	7031
5th St off-ramp (Covington)	NB		589	642	503	379	518	Additive	518
I-71/75 ML, S of Pike On-ramp	NB		4191	4568	4971	6877	6474	Additive	6513

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Pike St on-ramp	NB		423	461	596	772	597	Ratio	597
I-71/75 ML, S of 4th St on-ramp (Covington)	NB		4614	5029	5567	7648	7110	Additive	7110
4th St on-ramp (Covington)	NB		941	1026	1027	1284	1283	Additive	1283
I-71/75 on Brent Spence Bridge	NB		5555	6055	6595	8934	8394	Additive	8394
I-71/75 off-ramp to I-71/Second	NB		2174	2370	2111	2576	2835	Additive	2835
I-75 ML, S of 5th St off-ramp	NB		3381	3685	4484	6357	5558	Additive	5558
5th St off-ramp	NB		199	217	729	920	274	Ratio	274
I-75 ML, S of 6th St off-ramp	NB		3182	3468	3756	5436	5148	Additive	5284
6th St off-ramp	NB		726	791	680	713	824	Additive	824
I-75 ML, S of C-D Road on-ramp	NB		2456	2677	3076	4723	4324	Additive	4460
C-D Road on-ramp	NB		2845	3101	2718	2830	3213	Additive	3213
I-75 ML, S of 9th St on-ramp	NB		5301	5778	5794	7553	7537	Additive	7673
Southbound I-71									
I-71 ML, N of NB I-75 off-ramp	SB		5472	5964	3349	3835	6450	Additive	6450
I-71 ramp to I-71/75, N of 3rd St on-ramp	SB		2807	3060	1605	2068	3523	Additive	3523
3rd St on-ramp to I-71/75	SB		980	1068	839	615	844	Additive	844
I-71 ramp to NB I-75	SB		2665	2905	1744	1766	2927	Additive	2927
I-71 SB ramp to 6th St	NB		1487	1621	1166	1176	1631	Additive	1631
Northbound I-71									
I-75 S/6th Combined to I-71	SB		2940	3205	2107	2587	3685	Additive	3685
I-71/75 ramp to Second	NB		167	182	323	223	126	Ratio	126
I-71/75 off-ramp to I-71	NB		2007	2188	1787	2354	2755	Additive	2709
I-71 ML end link	EB		4947	5392	3894	4941	6439	Additive	6394
Northbound I-75 C-D Road									
C-D Road, S of 4th on-ramp	NB		1178	1284	579	590	1295	Additive	1295
4th St on-ramp to C-D Road	NB		1313	1431	1257	1292	1466	Additive	1466
C-D Road, S of 6th St on-ramp	NB		2491	2715	1836	1882	2761	Additive	2761
6th St on ramp to C-D Road	NB		521	568	1290	1313	591	Additive	591
C-D Road, S of NB I-75 off-ramp	NB		3012	3283	3126	3196	3353	Additive	3353
C-D Road, N of NB I-75 off-ramp	NB		167	182	407	365	163	Ratio	140
9th St on-ramp to C-D Road	NB		250	273	505	442	239	Ratio	239
Misc. Cincinnati Ramps									
9th St, E of SB I-75 off-ramp	WB		1755	1913	1437	1442	1918	Additive	1977
9th St, W of SB I-75 off-ramp	WB		994	1083	637	592	1038	Additive	1098
8th to 7th	EB		513	559	315	260	504	Additive	504
6th to I-75 and 5th St	EB		2142	2335	2311	2364	2388	Additive	2520

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6th to 5th	EB		35	38	466	456	37	Ratio	160
6th to I-75 S/Second St	EB		851	928	512	585	1001	Additive	1001
6th to Second	SB		128	140	0	0	140	Additive	140
6th to I-71 N	EB		1256	1369	1333	1323	1359	Additive	1359
6th to 6th	WB		858	935	1452	1423	906	Additive	937
NB I-75/I-71 Combined to 6th	NB		2213	2412	1845	1890	2457	Additive	2455
6th/I-75 N Combined to 6th	WB		3071	3347	3297	3312	3362	Additive	3392
I-75 S/6th Combined to 5th	EB		420	458	929	883	435	Ratio	547
I-75 S/6th Combined to Second	SB		602	656	755	787	688	Additive	688
2nd St Entry link	EB		100	109	0	447	556	Ratio	512
2nd St, W of NB I-71/75 on-ramp	EB		702	765	755	1234	1244	Additive	1200
Eastbound Approach to 2nd & Elm Intersection	EB		869	947	1078	1457	1326	Additive	1326
Misc. Covington Ramps									
4th St, E of NB I-71/75 off-ramp	WB		2054	2239	1782	2028	2485	Additive	2485
4th St, W of NB I-71/75 off-ramp	WB		1113	1213	755	744	1202	Additive	1202
4th St to SB I-71/75 C-D Road	SB		1010	1101	698	645	1048	Additive	1048
4th St, E of Crescent	WB		103	112	57	99	195	Ratio	154
Crescent to SB I-71/75 C-D at 4th	SB		149	162	82	230	456	Ratio	309
Combined 4th St/Crescent to SB I-71/75 C-D Road	SB		1159	1263	780	874	1357	Additive	1357
SB C-D Road between SB I-71/75 on-ramp and off-ramp	SB		1309	1427	1201	1294	1520	Additive	1520
SB C-D Road, S of SB I-71/75 off-ramp	SB		713	777	477	439	739	Additive	790
SB I-71/75 off-ramp to WB 5th St.	WB		419	457	356	366	470	Ratio	470
SB I-71/75 off-ramp to EB 5th St.	EB		482	525	583	486	428	Additive	428
5th St E of Crescent	EB		93	101	158	391	251	Ratio	337
5th St, E of SB I-71/75 off-ramp	EB		575	627	740	877	764	Additive	764
5th St, E of NB I-71/75 off-ramp	EB		1164	1269	1243	1257	1283	Additive	1283
2nd St @ Elm St	EB	In	869	947	1078	1457	1326	Additive	1326
	EB	Out	654	713	1015	1384	1082	Additive	1000
	NB	In	106	116	217	580	309	Ratio	400
	NB	Out	304	331	280	653	773	Ratio	700
	SB	Out	27	29	0	0	29	Additive	29
9th St @ Central Ave	SB	In	140	153	0	0	153	Additive	153
	WB	In	1484	1618	1720	1793	1691	Additive	1691
	WB	Out	2005	2185	1715	1746	2216	Additive	2216
	NB	In	758	826	454	438	810	Additive	810
	NB	Out	377	411	459	486	435	Ratio	435

Modeling Advisory Group
PM Traffic Assignments
July 6, 2004

Location	Direction	Direction @ Intersection	PM Raw Count	PM 30th Highers t Hour	2003 PM OKI Assignments	2030 PM OKI Assignments	2030 Adjusted Assignment	Method Used	Balanced Assignment
7th St @ Central Ave	EB	In	628	685	834	830	681	Additive	681
	EB	Out	661	720	1012	1070	778	Additive	778
	NB	In	485	529	632	680	577	Additive	577
	NB	Out	452	493	454	438	475	Ratio	475
6th St @ Central Ave	WB	In	1490	1624	1932	1930	1622	Additive	1622
	WB	Out	1407	1534	2742	2736	1528	Additive	1528
	NB	In	524	571	1495	1559	635	Additive	700
	NB	Out	423	461	632	680	496	Ratio	496
	SB	Out	218	238	52	74	338	Ratio	318
5th St @ Central Ave	EB	In	619	675	1657	1803	821	Additive	821
	EB	Out	798	870	1101	1146	915	Additive	950
	NB	In	634	691	1007	981	665	Additive	665
	SB	In	218	238	52	74	338	Ratio	338
	NB	Out	540	589	1495	1559	653	Additive	653
	SB	Out	133	145	121	153	183	Ratio	200
4th St @ Central	WB	Out	1255	1368	1257	1292	1403	Additive	1466
	WB	In	980	1068	1117	1283	1234	Additive	1234
	NB	In	982	1070	1093	981	958	Additive	958
	NB	Out	605	659	942	920	637	Additive	637
	SB	In	135	147	69	104	222	Ratio	222
	SB	Out	237	258	79	156	510	Ratio	275
3rd St @ Elm St	WB	In	1571	1712	2066	1782	1428	Additive	1525
	WB	Out	543	592	1213	1438	817	Additive	800
	WB	Out	980	1068	839	615	844	Additive	844
	NB	In	304	331	280	653	773	Ratio	700
	NB	Out	352	384	265	382	553	Ratio	553
W 4th St @ Philadelphia St	WB	In	1443	1573	1507	1530	1596	Additive	1700
	WB	Out	1919	2092	1782	2028	2338	Additive	2485
	NB	In	403	439	486	423	382	Ratio	450
	SB	In	534	582	455	610	737	Additive	780
	NB	Out	301	328	456	535	385	Ratio	385
	SB	Out	160	174	209	0	0	Additive	60
W 5th St @ Philadelphia	EB	In	1077	1174	1243	1257	1188	Additive	1283
	EB	Out	905	986	1149	1283	1120	Additive	1077
	NB	In	164	179	0	0	179	Additive	179
	SB	In	195	213	238	340	304	Ratio	200
	NB	Out	393	428	331	314	406	Ratio	406
	SB	Out	164	179	0	0	179	Additive	179

Modeling Advisory Group
PM Traffic Assignments
July 6, 2004

Location	Direction	Direction @ Intersection	PM Raw Count	PM 30th Higherst Hour	2003 PM OKI Assignments	2030 PM OKI Assignments	2030 Adjusted Assignment	Method Used	Balanced Assignment
W 4th @ Crescent Ave	WB	In	96	105	57	99	182	Ratio	154
	EB	Out	280	305	82	230	856	Ratio	309
	NB	In	395	431	0	0	431	Additive	431
	SB	In	177	193	240	620	498	Ratio	400
	NB	Out	415	452	413	465	509	Ratio	525
	SB	Out	113	123	0	0	123	Additive	123
W 5th @ Crescent Ave	WB	In	390	425	356	366	437	Ratio	470
	EB	Out	86	94	0	0	94	Additive	337
	NB	In	53	58	0	0	58	Additive	160
	SB	In	113	123	0	0	123	Additive	150
	NB	Out	395	431	0	0	431	Additive	431
	SB	Out	75	82	0	0	82	Additive	75
I 75 N ramp @ Pike St	EB	In	368	401	572	681	478	Ratio	478
	WB	In	559	609	729	879	759	Additive	759
	EB	Out	409	446	592	711	535	Ratio	535
	WB	Out	540	589	665	835	759	Additive	775
	NB	In	445	485	552	759	667	Ratio	667
	NB	Out	423	461	596	772	597	Ratio	597
I 75 N ramp @ 12th St	EB	In	342	373	290	627	806	Ratio	700
	WB	In	537	585	850	867	602	Additive	602
	EB	Out	580	632	840	819	611	Additive	650
	WB	Out	285	311	735	678	287	Ratio	310
	NB	In	433	472	987	762	364	Ratio	364
	NB	Out	447	487	552	759	670	Ratio	670
I 75 S ramp @ Pike St	EB	In	264	288	544	663	351	Ratio	351
	WB	In	590	643	665	835	813	Additive	813
	EB	Out	356	388	572	681	462	Ratio	462
	WB	Out	668	728	570	650	808	Additive	808
	SB	In	713	777	477	439	739	Additive	790
	SB	Out	543	592	543	608	657	Additive	657
I 75 S ramp @ 12th St	EB	In	119	130	229	503	285	Ratio	285
	WB	In	244	266	735	678	245	Ratio	300
	EB	Out	391	426	290	627	921	Ratio	700
	WB	Out	59	64	283	247	56	Ratio	56
	SB	In	539	588	543	608	653	Additive	653
	SB	Out	452	493	934	915	483	Ratio	483

BURGESS & NIPLE

FINAL

To: Herb Mack, PE
Project Manager, Burgess & Niple

From: Randy Kill, PE
Project Engineer, Burgess & Niple
Paul Dorothy, PhD, PE, AICP
Director of Operational Modeling/Geometrics, Burgess & Niple

Date: July 29, 2004

Subject: Meeting Notes for: Brent Spence Bridge Feasibility and Constructability Study Modeling Advisory Group Conference Call on July 8, 2004

Project Memorandum

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A modeling advisory group conference call was held on July 8, 2004 for the Feasibility and Constructability Study for the Replacement/Rehabilitation of the Brent Spence Bridge.

Notes from the meetings are as follows:

- It was questioned why the raw count was higher than the seasonal adjusted count. Randy commented that the previous information was adjusted using the seasonal adjustment factors. At the last conference call it was decided that the raw counts will be used and no adjustment factor will be applied. The adjustment factor and adjusted volumes were included in the table simply to be consistent with previous versions. Only the raw counts were used for calculations.

- It was requested to see locations and volumes for the individual AM and PM counts that were conducted. This information will be placed on a map to provide better clarity.

- Concerns were expressed that the truck percentages and volumes for the AM and PM peaks on the bridge may be low. KYTC stated they have counts showing 18% tucks in the AM and 15% trucks in the PM. Also have vehicle counts that are higher than the counts being used in this project. It was decided that the bridge would be recounted using a manual count and another technology (radar based on length based categories). Another suggestion was laser. Will count vehicle classification count on the 4th/5th Street ramps on same day. Based on these results, will verify that current ramp counts north of the bridge are acceptable.

- 30th highest hour adjustment factor will be determined using the following process. KYTC will send B&N ATR records for 2003. From these records, the 30th highest hour and corresponding K factor for 2003 will be determined. This

K factor will be compared with the K factor for the day B&N's counts were taken. This ratio will become the new adjustment factor.
- It was decided that the next meeting would again be a conference call and would cover the new counts taken on the bridge as well as the 2030 assignments. Once these assignments are accepted, a face-to-face meeting will be set up to cover the CORSIM model results and validation.

Future Products
- The Traffic Assignments technical memo will be updated by B&N to reflect the additional mainline counts conducted. This memo will also include the new 30th highest hour adjusted volumes as well as the new 2030 assignments.
- The Truck Percentages technical memo will be revised based on the new classification counts conducted on the bridge.
- Hard copies of the raw traffic count data will be submitted to ODOT District 8, ODOT Technical Services, and KYTC Multimodal Programs.

Next conference call will be scheduled after the new counts are completed.

MEMORANDUM

TO: **Modeling Advisory Group**

FROM: **Herb Mack, PE**
Randy Kill, PE

SUBJECT: **30th Highest Hour Traffic Assignments**

August 27, 2004

During the Modeling Advisory Group conference call on July 8, 2004, the procedure previously used to calculate the 30th highest hour assignments was modified. This memo outlines the new procedures and calculations for the 30th highest hour assignments. It also replaces the 30th highest hour section of the July 6, 2004 Brent Spence Bridge Traffic Assignments memo.

30th Highest Hour
The 30th highest hour volumes were calculated using the following procedure:

- 2003 ATR data was provided by KYTC for a location close to the study area.
- Average Annual Daily Traffic (AADT) and 30th highest hour was calculated from the ATR data.
- Normal day K factor for the day B&N counts conducted calculated using ATR data.
- 30th highest hour K factor calculated using ATR data.
- Calculated the 30th highest hour correction factor by dividing the 30th highest K factor by the normal day K factor.
- Applied this correction factor to the raw AM and PM counts.

<u>ATR Information</u>
The ATR used for this calculation is 63N and 64S. This ATR is located on I-75 at milepoint 176.1. This ATR location was chosen because it was the closest to the study area with data for all of 2003. Rom the data, the AADT for 2003 was calculated at 101,128 vehicles.

<u>Normal Day K Factor</u>
The date used to calculate the normal day K factor is July 30, 2003. From the ATR, the peak hour volume is 7886.

Normal Day K Factor = 7886/101128 = 0.078

<u>30th Highest K Factor</u>
From the ATR data, the 30th highest hour occurs on Friday October 17, 2003 from 4 to 5 PM. The volume for this hour is 9194.

30th Highest K Factor = 9194/101128 = 0.091.

<u>30th Highest Hour Correction Factor</u>

$$\text{30}^{\text{th}}\text{ Highest Hour Correction Factor }(CF_{30}) = \frac{\text{30}^{\text{th}}\text{ Highest Hour K Factor}}{\text{Normal Day K Factor}}$$

$CF_{30} = 0.091/0.078 =$ **1.17**

All AM and PM raw counts were multiplied by 1.17 to calculate 30th highest hour assignments.

MEMORANDUM

TO: **Modeling Advisory Group**

FROM: **Herb Mack, PE**
Randy Kill, PE

SUBJECT: **New Traffic Counts**

August 27, 2004

During the Modeling Advisory Group conference call on July 8, 2004, concerns were expressed that the truck percentages and volumes for the AM and PM peaks on the bridge may be low. KYTC stated they have counts showing 18% tucks in the AM and 15% trucks in the PM. Also have vehicle counts that are higher than the counts being used in this project. It was decided that the bridge would be recounted for volume and classification.

The new counts were conducted during the week of July 19, 2004. Table 1 shows a comparison of the old traffic counts with the new traffic counts and Table provides a comparison of the old truck percentages and the new truck percentages.

Table 1 – Traffic Count Comparison

Location (Peak Period)	Old Count	New Count
NB I-71/75, South of 4th St on-ramp (AM)	5464	5017
NB I-71/75, South of 4th St on-ramp (PM)	4614	4158
SB I-71/75, South of 5th St off-ramp (AM)	3708	4190
SB I-71/75, South of 5th St off-ramp (AM)	6374	5973
4th St on-ramp to NB I-71/75 (AM)	1154	962
4th St on-ramp to NB I-71/75 (PM)	941	968
5th St off-ramp from SB I-71/75 (AM)	772	647
5th St off-ramp from SB I-71/75 (PM)	901	757
NB on Brent Spence Bridge (AM)	6618	5979*
NB on Brent Spence Bridge (PM)	5555	5126*
SB on Brent Spence Bridge (AM)	4480	4837*
SB on Brent Spence Bridge (PM)	7275	6730*

* Calculated by adding new counts

Table 2 – Truck Percentages Comparison

Location (Peak Period)	Old Percentages	New Percentages
NB on Brent Spence Bridge (AM)	6.9	11.0*
NB on Brent Spence Bridge (PM)	8.8	14.6*
SB on Brent Spence Bridge (AM)	10.6	13.2*
SB on Brent Spence Bridge (PM)	6.8	17.6*

* Calculated using new counts

Conclusions

Because the new counts appear to verify the existing counts, the existing counts will be used to develop 30th highest hour and 2030 Baseline assignments. In regards to the truck percentages, the new truck percentages match more closely with historical data and will be used for the CORSIM modeling.

Modeling Advisory Group
Existing Counts
August 30, 2004

Location	Direction	Direction @ Intersection	Reference #	Comments	AM Date of Count	AM Raw Count	PM Date of Count	PM Raw Count
Southbound I-75								
I-75 ML, N of Ezzard Charles off-ramp	SB		1A	Reference 1C + Reference 1B		7938		4996
Ezzard Charles off-ramp	SB		1B		4/23/2003 (ODOT)	501	4/22/2003 (ODOT)	177
I-75 ML, N of Gest St off-ramp	SB		1C	Reference 1E + Reference 1D		7437		4819
Gest St off-ramp	SB		1D		7/22/2004	851	7/21/2004	553
I-75 ML, N of Ezzard Charles on-ramp	SB		1E	Reference 1 - Reference 1F		6586		4266
Ezzard Charles on-ramp	SB		1F		7/22/2004	173	7/21/2004	396
I-75 ML, N of 7th St off-ramp	SB		1	Reference 2 + Reference 3		6759		4662
7th St off-ramp	SB		2		7/31/2003	1349	7/30/2003	115
I-75 ML, N of I-71/5th off-ramp	SB		3		7/31/2003	5410	7/30/2003	4547
I-71/5th off-ramp	SB		4	Reference 5 + Reference 6		3112		2543
5th St off-ramp	SB		5		7/31/2003	1005	7/30/2003	385
I-75 ramp to I-71/Second	SB		6	Reference 7 + Reference 8		2107		2158
I-75 ramp to I-71	SB		7		7/30/2003	1221	7/29/2003	1684
I-75 ramp to Second	SB		8		7/30/2003	886	7/29/2003	474
I-75 ML, N of 9th St on-ramp	SB		9	Reference 3 - Reference 4		2298		2004
9th St on-ramp	SB		10	Reference 11 - Reference 9		12		761
I-75 ML, N of 6th St on-ramp	SB		11	Reference 13 - Reference 12 (PM Only)	7/30/2003 (AM)	2310		2765
6th St. on-ramp	SB		12		7/30/2003	459	7/29/2003	723
I-75 SB to I-71/75 SB	SB		13	Reference 11 + Refernce 12 (AM Only)		2769	7/29/2003	3488
I-71 on-ramp to I-75	SB		14		7/30/2003 (PM)	1711	7/29/2003	3787
I-71/75 on Brent Spence Bridge	SB		15	Reference 13 + Reference 14		4480		7275
I-71/75 off-ramp to 5th St	SB		16	Reference 89 + Reference 90		772		901
I-71/75 ML, N of off-ramp to Pike/12th	SB		17	Reference 15 - Reference 16		3708		6374
Off-ramp to Pike/12th	SB		18		7/22/2004	267	7/21/2004	506
I-71/75 ML, N of 4th St on-ramp (Covington)	SB		19	Reference 17 - Reference 18		3441		5868
4th St on-ramp (Covington)	SB		20	Reference 87 - Reference 88		401		952
I-71/75 ML, N of 12th St on-ramp	SB		21	Reference 19 + Reference 20		3842		6820
12th St on-ramp	SB		22	SB Out of Reference 108		300		452
I-71/75 ML, S of 12th St on-ramp	SB		23	Reference 21 + Reference 22		4142		7272
Off ramp at Kyles	SB		24		6/25/2003	437	6/24/2003	939
I-75 S of off ramp at Kyles	SB		25	Reference 23 - Reference 24		3705		6333
On ramp at Kyles	SB		26		6/25/2003	389	6/24/2003	475
End link I-75	SB		27	Reference 25 + Reference 26		4094		6808
Northbound I-75								
Entry Link I-75	NB		28	Reference 29 + Reference 30		5784		5324
Off ramp at Kyles	NB		29		6/25/2003	359	6/24/2003	640
I-75 N of Kyle off ramp	NB		30	Reference 32 - Reference 31		5425		4684
On ramp at Kyles	NB		31		6/24/2003	769	6/24/2004	529
I-71/75 ML, S of 12th St off-ramp	NB		32	Reference 34 + Reference 33		6194		5213
12th St off-ramp	NB		33	Reference 106 NB IN		281		433
I-71/75 ML, S of 5th St off-ramp (Covington)	NB		34	Reference 35 + Reference 36		5913		4780
5th St off-ramp (Covington)	NB		35		6/25/2003	1109	6/24/2003	589
I-71/75 ML, S of Pike On-ramp	NB		36	Reference 38 - Reference 37		4804		4191
Pike St on-ramp	NB		37	Reference 105 NB Out		660		423
I-71/75 ML, S of 4th St on-ramp (Covington)	NB		38	Reference 40 - Reference 39		5464		4614
4th St on-ramp (Covington)	NB		39		6/24/2003	1154	6/23/2003	941

Modeling Advisory Group
Existing Counts
August 30, 2004

Location	Direction	Direction @ Intersection	Reference #	Comments	AM Date of Count	AM Raw Count	PM Date of Count	PM Raw Count
I-71/75 on Brent Spence Bridge	NB		40	Reference 41 + Reference 42		6618		5555
I-71/75 off-ramp to I-71/Second	NB		41	Reference 55 + Reference 56		3228		2174
I-75 ML, S of 5th St off-ramp	NB		42	Reference 43 + Reference 44		3390		3381
5th St off-ramp	NB		43	Counted on EB Approach of Reference 98		601		199
I-75 ML, S of 6th St off-ramp	NB		44	Reference 45 + Reference 46		2789		3182
6th St off-ramp	NB		45		7/31/2003	742	7/30/2003	726
I-75 ML, S of C-D Road on-ramp	NB		46		7/31/2003	2047	7/30/2003	2456
C-D Road on-ramp	NB		47		7/31/2003	1410	7/30/2003	2845
I-75 ML, S of 9th St on-ramp	NB		48	Reference 46 + Reference 47		3457		5301
9th St on-ramp	NB		48A	Reference 64A - Reference 64B		169		780
I-75 ML, S of Gest St on-ramp	NB		48B	Reference 48 + Reference 48A		3626		6081
Gest St on-ramp	NB		48C		7/22/2004	708	7/21/2004	701
I-75 ML, S of Ezzard Charles on-ramp	NB		48D	Reference 48B + Reference 48C		4334		6782
Ezzard Charles on-ramp	NB		48E		7/22/2004	106	7/21/2004	369
I-75 ML, N of Ezzard Charles on-ramp	NB		48F	Reference 48D + Reference 48E		4440		7151
Southbound I-71								
I-71 ML, N of NB I-75 off-ramp	SB		49	Reference 50 + Reference 52		3832		5472
I-71 ramp to I-71/75, N of 3rd St on-ramp	SB		50	Reference 14 - Reference 51		1558		2807
3rd St on-ramp to I-71/75	SB		51	Reference 100 I-75 outbound		153		980
I-71 ramp to NB I-75	SB		52	Reference 58 + Reference 53		2274		2665
I-71 SB ramp to 6th St	NB		53		7/31/2003	992	7/30/2003	1487
Northbound I-71								
I-75 S/6th Combined to I-71	SB		54	Reference 7 + Reference 72		2622		2940
I-71/75 ramp to Second	NB		55		9/16/2003	863	9/16/2003	167
I-71/75 off-ramp to I-71	NB		56		9/16/2003	2365	9/16/2003	2007
I-71 ML end link	EB		57	Reference 54 + Reference 56		4987		4947
Northbound I-75 C-D Road								
C-D Road, S of 4th on-ramp	NB		58		7/31/2003	1282	7/30/2003	1178
4th St on-ramp to C-D Road	NB		59		7/31/2003	268	7/30/2003	1313
C-D Road, S of 6th St on-ramp	NB		60	Reference 58 + Reference 59		1550		2491
6th St on ramp to C-D Road	NB		61	Reference 62 - Reference 60		170		521
C-D Road, S of NB I-75 off-ramp (4th/71)	NB		62	Reference 47 + Reference 63		1720		3012
C-D Road, S of 9th St on-ramp	NB		63		7/31/2003	310	7/30/2003	167
9th St on-ramp to C-D Road	NB		64		7/22/2004	159	7/21/2004	854
C-D Road, S of NB I-75 off-ramp (9th)	NB		64A	Reference 63 + Reference 64		469		1021
C-D Road, S of Gest on-ramp	NB		64B	AM Estimated		300	7/21/2004	241
Gest St on-ramp to C-D Road	NB		64C		7/22/2004	122	7/21/2004	125
C-D Road, N of Gest on-ramp	NB		64D	Reference 64B + Reference 64C		422		366
Misc. Cincinnati Ramps								
9th St, E of SB I-75 off-ramp	WB		65	Reference 95 WB out - Reference 64		428		1151
9th St, W of SB I-75 off-ramp	WB		66	Reference 65 - Reference 10		416		390
8th to 7th	EB		67	Reference 96 EB Approach - Reference 2		820		513
6th to I-75 and 5th St	EB		68	Reference 69 + Reference 70 + Reference 72		2681		2142
6th to 5th	EB		69	Reference 98 EB Approach from North Ramps - Reference 5		564		35
6th to I-75 S/Second St	EB		70	Reference 12 + Reference 71		716		851

Modeling Advisory Group
Existing Counts
August 30, 2004

Location	Direction	Direction @ Intersection	Reference #	Comments	AM Date of Count	AM Raw Count	PM Date of Count	PM Raw Count
6th to Second	SB		71		7/30/2003	257	7/29/2003	128
6th to I-71 N	EB		72		7/30/2003	1401	7/29/2003	1256
6th to 6th	WB		73	Reference 97 US 50 outbound		145		858
NB I-75/I-71 Combined to 6th	NB		74	Reference 45 + Reference 53		1734		2213
6th/I-75 N Combined to 6th	WB		75	Reference 73 + Reference 74		1879		3071
I-75 S/6th Combined to 5th	EB		76	Reference 98 EB Approach from North Ramps		1569		420
I-75 S/6th Combined to Second	SB		77	Reference 8 + Reference 71		1143		602
2nd St Entry link	EB		78	Assumed		200		100
2nd St, W of NB I-71/75 on-ramp	EB		79	Reference 77 + Reference 78		1343		702
Eastbound Approach to 2nd & Elm Intersection	EB		80	Reference 55 + Reference 79		2206		869
Misc. Covington Ramps								
4th St, E of NB I-71/75 off-ramp	WB		81		6/24/2003	1653	6/23/2003	2054
4th St, W of NB I-71/75 off-ramp	WB		82	Reference 81 - Reference 39		499		1113
4th St to SB I-71/75 C-D Road	SB		83	Reference 82 - Reference 84		450		1010
4th St, E of Crescent	WB		84		6/24/2003	49	6/23/2003	103
Crescent to SB I-71/75 C-D at 4th	SB		85	Reference 86 - Reference 83		28		149
Combined 4th St/Crescent to SB I-71/75 C-D Road	SB		86		6/24/2003	478	6/23/2003	1159
SB C-D Road between SB I-71/75 on-ramp and off-ramp	SB		87	Reference 18 + Reference 86		745		1665
SB C-D Road, S of SB I-71/75 off-ramp	SB		88	Reference 107 SB In		344		713
SB I-71/75 off-ramp to WB 5th St.	WB		89		6/24/2003	219	6/24/2003	419
SB I-71/75 off-ramp to EB 5th St.	EB		90		6/24/2003	553	6/24/2003	482
5th St E of Crescent	EB		91		6/24/2003	90	6/23/2003	93
5th St, E of SB I-71/75 off-ramp	EB		92	Reference 90 + Reference 91		643		575
5th St, E of NB I-71/75 off-ramp	EB		93	Reference 35 + Reference 92		1752		1164
2nd St @ Elm St	EB	In	94	Estimated		2206		869
	EB	Out				1640		654
	NB	In				42		106
	NB	Out				629		304
	SB	Out				42		27
9th St @ Central Ave	SB	In	95		9/5/2003	28	9/4/2003	140
	WB	In				469		1484
	WB	Out				587		2005
	NB	In				633		758
	NB	Out				543		377
7th St @ Central Ave	EB	In	96		9/4/2003	2169	9/3/2003	628
	EB	Out				2038		661
	NB	In				478		485
	NB	Out				609		452
6th St @ Central Ave	WB	In	97		9/5/2003	516	9/4/2003	1490
	WB	Out				296		1407
	NB	In				507		524
	NB	Out				565		423
	SB	Out				162		218

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Location	Direction	Direction @ Intersection	Reference #	Comments	AM Date of Count	AM Raw Count	PM Date of Count	PM Raw Count
5th St @ Central Ave	EB	In	98		9/4/2003	2170	9/3/2003	619
	EB	Out				2059		798
	NB	In				386		634
	SB	In				152		218
	NB	Out				507		540
	SB	Out				142		133
4th St @ Central	WB	Out	99		9/4/2003	272	9/3/2003	1255
	WB	In				362		980
	NB	In				352		982
	NB	Out				363		605
	SB	In				147		135
	SB	Out				226		237
3rd St @ Elm St	WB	In	100		9/5/2003	933	9/4/2003	1571
	WB	Out				689		543
	WB	Out				153		980
	NB	In				629		304
	NB	Out				720		352
W 4th St @ Philadelphia St	WB	In	101	Estimated based on older counts		916		1443
	WB	Out				1536		1919
	NB	In				449		403
	SB	In				704		534
	NB	Out				352		301
	SB	Out				181		160
W 5th St @ Philadelphia	EB	In	102	Estimated based on older counts		1615		1077
	EB	Out				1378		905
	NB	In				123		164
	SB	In				176		195
	NB	Out				459		393
	SB	Out				77		164
W 4th @ Crescent Ave	WB	In	103	Estimated		45		96
	EB	Out				26		280
	NB	In				238		395
	SB	In				102		177
	NB	Out				272		415
	SB	Out				87		113
W 5th @ Crescent Ave	WB	In	104	Estimated based on older counts		200		390
	EB	Out				86		86
	NB	In				53		53
	SB	In				87		113
	NB	Out				238		395
	SB	Out				16		75
I 75 N ramp @ Pike St	EB	In	105		6/25/2003	690	6/25/2003	368
	WB	In				198		559
	EB	Out				529		409
	WB	Out				196		540
	NB	In				497		445
	NB	Out				660		423

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Location	Direction	Direction @ Intersection	Reference #	Comments	AM Date of Count	AM Raw Count	PM Date of Count	PM Raw Count
I 75 N ramp @ 12th St	EB	In	106		6/25/2003	320	6/25/2003	342
	WB	In				460		537
	EB	Out				394		580
	WB	Out				190		285
	NB	In				281		433
	NB	Out				477		447
I 75 S ramp @ Pike St	EB	In	107		6/24/2003	680	6/24/2003	264
	WB	In				220		590
	EB	Out				756		356
	WB	Out				195		668
	SB	In				344		713
	SB	Out				293		543
I 75 S ramp @ 12th St	EB	In	108		6/23/2003	152	6/23/2003	119
	WB	In				190		244
	EB	Out				322		391
	WB	Out				12		59
	SB	In				293		539
	SB	Out				300		452

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Location	Direction	Direction @ Intersection	AM Raw Count	AM 30th Highest Hour	2003 AM OKI Assignments	2030 AM OKI Assignments	2030 Adjusted Assignment	Method Used	2030 Balanced Assignments
Southbound I-75									
I-75 ML, N of Ezzard Charles off-ramp	SB		7938	9287	8922	10353	10718	Additive	11014
Ezzard Charles off-ramp	SB		501	586	600	309	295	Additive	295
I-75 ML, N of Gest St off-ramp	SB		7437	8701	8321	10043	10423	Additive	10719
Gest St off-ramp	SB		851	996	705	531	822	Additive	822
I-75 ML, N of Ezzard Charles on-ramp	SB		6586	7706	7617	9512	9601	Additive	9897
Ezzard Charles on-ramp	SB		173	202	464	522	228	Ratio	228
I-75 ML, N of 7th St off-ramp	SB		6759	7908	8081	10035	9862	Additive	10125
7th St off-ramp	SB		1349	1578	996	881	1463	Additive	1463
I-75 ML, N of I-71/5th off-ramp	SB		5410	6330	7086	9153	8397	Additive	8662
I-71/5th off-ramp	SB		3112	3641	3316	3820	4145	Additive	4145
5th St off-ramp	SB		1005	1176	807	830	1198	Additive	1198
I-75 ramp to I-71/Second	SB		2107	2465	2509	2990	2946	Additive	2946
I-75 ramp to I-71	SB		1221	1429	796	1205	1837	Additive	1837
I-75 ramp to Second	SB		886	1037	1713	1784	1108	Additive	1108
I-75 ML, N of 9th St on-ramp	SB		2298	2689	3770	5335	4253	Additive	4467
9th St on-ramp	SB		12	14	386	609	22	Ratio	22
I-75 ML, N of 6th St on-ramp	SB		2310	2703	4156	5943	4490	Additive	4490
6th St. on-ramp	SB		459	537	572	740	705	Additive	705
I-75 SB to I-71/75 SB	SB		2769	3240	4728	6683	5195	Additive	5195
I-71 on-ramp to I-75	SB		1711	2002	2368	2713	2347	Additive	2347
I-71/75 on Brent Spence Bridge	SB		4480	5242	7095	9395	7541	Additive	7541
I-71/75 off-ramp to 5th St	SB		772	903	925	967	945	Additive	945
I-71/75 ML, N of off-ramp to Pike/12th	SB		3708	4338	6170	8428	6596	Additive	6596
Off-ramp to Pike/12th	SB		267	312	400	536	419	Ratio	419
I-71/75 ML, N of 4th St on-ramp (Covington)	SB		3441	4026	5771	7892	6147	Additive	6177
5th St on-ramp (Covington)	SB		401	469	401	699	817	Ratio	817
I-71/75 ML, N of 12th St on-ramp	SB		3842	4495	6171	8591	6915	Additive	6994
12th St on-ramp	SB		300	351	756	827	384	Ratio	384
I-71/75 ML, S of 12th St on-ramp	SB		4142	4846	6928	9417	7335	Additive	7378
Off ramp at Kyles	SB		437	511	489	488	510	Additive	510
I-75 S of off ramp at Kyles	SB		3705	4335	6439	8930	6826	Additive	6868
On ramp at Kyles	SB		389	455	604	697	525	Ratio	525
End link I-75	SB		4094	4790	7042	9627	7375	Additive	7393
Northbound I-75									
Entry Link I-75	NB		5784	6767	7154	8542	8155	Additive	8402
Off ramp at Kyles	NB		359	420	685	491	301	Ratio	301
I-75 N of Kyle off ramp	NB		5425	6347	6470	8053	7930	Additive	8101
On ramp at Kyles	NB		769	900	709	443	634	Additive	634

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Location	Direction	Direction @ Intersection	AM Raw Count	AM 30th Highest Hour	2003 AM OKI Assignments	2030 AM OKI Assignments	2030 Adjusted Assignment	Method Used	2030 Balanced Assignments
I-71/75 ML, S of 12th St off-ramp	NB		6194	7247	7178	8495	8564	Additive	8735
12th St off-ramp	NB		281	329	823	535	214	Ratio	214
I-71/75 ML, S of 5th St off-ramp (Covington)	NB		5913	6918	6355	7959	8522	Additive	8522
5th St off-ramp (Covington)	NB		1109	1298	639	528	1186	Additive	1186
I-71/75 ML, S of Pike On-ramp	NB		4804	5621	5719	7431	7333	Additive	7333
Pike St on-ramp	NB		660	772	857	902	817	Additive	817
I-71/75 ML, S of 4th St on-ramp (Covington)	NB		5464	6393	6575	8334	8152	Additive	8152
4th St on-ramp (Covington)	NB		1154	1350	896	737	1191	Additive	1191
I-71/75 on Brent Spence Bridge	NB		6618	7743	7471	9071	9343	Additive	9343
I-71/75 off-ramp to I-71/Second	NB		3228	3777	2375	2699	4100	Additive	4100
I-75 ML, S of 5th St off-ramp	NB		3390	3966	5096	6373	5244	Additive	5244
5th St off-ramp	NB		601	703	1499	1412	616	Additive	616
I-75 ML, S of 6th St off-ramp	NB		2789	3263	3596	4961	4628	Additive	4628
6th St off-ramp	NB		742	868	573	575	870	Additive	870
I-75 ML, S of C-D Road on-ramp	NB		2047	2395	3023	4386	3758	Additive	3758
C-D Road on-ramp	NB		1410	1650	1347	1669	1972	Additive	1972
I-75 ML, S of 9th St on-ramp	NB		3457	4045	4370	6056	5731	Additive	5731
9th St on-ramp	NB		169	198	115	119	205	Ratio	205
I-75 ML, S of Gest St on-ramp	NB		3626	4242	4485	6175	5932	Additive	5932
Gest St on-ramp	NB		708	828	659	493	662	Additive	662
I-75 ML, S of Ezzard Charles on-ramp	NB		4334	5071	5145	6668	6594	Additive	6594
Ezzard Charles on-ramp	NB		106	124	183	153	104	Ratio	104
I-75 ML, N of Ezzard Charles on-ramp	NB		4440	5195	5328	6821	6688	Additive	6700
Southbound I-71									
I-71 ML, N of NB I-75 off-ramp	SB		3832	4483	3343	4182	5323	Additive	5105
I-71 ramp to I-71/75, N of 3rd St on-ramp	SB		1558	1823	1870	2544	2497	Additive	2290
3rd St on-ramp to I-71/75	SB		153	179	498	159	57	Ratio	57
I-71 ramp to NB I-75	SB		2274	2661	1473	1627	2815	Additive	2815
I-71 SB ramp to 6th St	NB		992	1161	879	908	1190	Additive	1190
Northbound I-71									
I-75 S/6th Combined to I-71	SB		2622	3068	2233	2548	3383	Additive	3383
I-71/75 ramp to Second	NB		863	1010	671	428	767	Additive	767
I-71/75 off-ramp to I-71	NB		2365	2767	1704	2271	3334	Additive	3334
I-71 ML end link	EB		4987	5835	3937	4819	6717	Additive	6717
Northbound I-75 C-D Road									
C-D Road, S of 4th on-ramp	NB		1282	1500	594	719	1625	Additive	1625
4th St on-ramp to C-D Road	NB		268	314	635	780	385	Ratio	385
C-D Road, S of 6th St on-ramp	NB		1550	1814	1230	1499	2083	Additive	2010

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6th St on ramp to C-D Road	NB		170	199	551	526	190	Ratio	190
C-D Road, S of NB I-75 off-ramp	NB		1720	2012	1780	2025	2257	Additive	2200
C-D Road, N of NB I-75 off-ramp	NB		310	363	432	355	298	Ratio	228
9th St on-ramp to C-D Road	NB		159	186	125	124	185	Ratio	185
C-D Road, S of NB I-75 off-ramp (9th)	NB		469	549	558	479	470	Additive	413
C-D Road, S of Gest on-ramp	NB		300	351	443	360	285	Ratio	208
Gest St on-ramp to C-D Road	NB		122	143	40	38	136	Ratio	136
C-D Road, N of Gest on-ramp	NB		422	494	483	397	406	Ratio	344
Misc. Cincinnati Ramps									
9th St, E of SB I-75 off-ramp	WB		428	501	513	738	726	Additive	730
9th St, W of SB I-75 off-ramp	WB		416	487	127	128	491	Ratio	708
8th to 7th	EB		820	959	653	613	919	Additive	919
6th to I-75 and 5th St	EB		2681	3137	3241	3495	3391	Additive	3391
6th to 5th	EB		564	660	1232	1413	841	Additive	841
6th to I-75 S/Second St	EB		716	838	572	740	1005	Additive	1005
6th to Second	SB		257	301	0	0	301	Additive	301
6th to I-71 N	EB		1401	1639	1436	1343	1546	Additive	1546
6th to 6th	WB		145	170	679	738	184	Ratio	166
NB I-75/I-71 Combined to 6th	NB		1734	2029	1452	1483	2059	Additive	2059
6th/I-75 N Combined to 6th	WB		1879	2198	2130	2222	2290	Additive	2226
I-75 S/6th Combined to 5th	EB		1569	1836	2040	2242	2038	Additive	2038
I-75 S/6th Combined to Second	SB		1143	1337	1713	1784	1409	Additive	1409
2nd St Entry link	EB		200	234	0	568	802	Ratio	802
2nd St, W of NB I-71/75 on-ramp	EB		1343	1571	1713	2352	2211	Additive	2211
Eastbound Approach to 2nd & Elm Intersection	EB		2206	2581	2384	2780	2977	Additive	2977
Misc. Covington Ramps									
4th St, E of NB I-71/75 off-ramp	WB		1653	1934	1402	1570	2102	Additive	2102
4th St, W of NB I-71/75 off-ramp	WB		499	584	505	831	910	Additive	910
4th St to SB I-71/75 C-D Road	SB		450	527	332	621	816	Additive	897
4th St, E of Crescent	WB		49	57	173	210	70	Ratio	13
Crescent to SB I-71/75 C-D at 4th	SB		28	33	77	92	39	Ratio	45
Combined 4th St/Crescent to SB I-71/75 C-D Road	SB		478	559	409	713	863	Additive	942
SB C-D Road between SB I-71/75 on-ramp and off-ramp	SB		745	872	807	1250	1314	Additive	1361
SB C-D Road, S of SB I-71/75 off-ramp	SB		344	402	408	551	544	Ratio	544
SB I-71/75 off-ramp to WB 5th St.	WB		219	256	255	529	532	Ratio	486
SB I-71/75 off-ramp to EB 5th St.	EB		553	647	670	438	415	Additive	461
5th St E of Crescent	EB		90	105	114	340	315	Ratio	291
5th St, E of SB I-71/75 off-ramp	EB		643	752	784	779	747	Additive	752
5th St, E of NB I-71/75 off-ramp	EB		1752	2050	1420	1308	1938	Additive	1938

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Location	Direction	Direction @ Intersection	AM Raw Count	AM 30th Highest Hour	2003 AM OKI Assignments	2030 AM OKI Assignments	2030 Adjusted Assignment	Method Used	2030 Balanced Assignments
2nd St @ Elm St	EB	In	2206	2581	2384	2780	2977	Additive	2977
	EB	Out	1640	1919	2196	2623	2346	Additive	2250
	NB	In	42	49	124	816	323	Ratio	323
	NB	Out	629	736	314	974	1396	Additive	1000
	SB	Out	42	49	0	0	49	Additive	49
9th St @ Central Ave	SB	In	28	33	0	0	33	Additive	33
	WB	In	469	549	618	889	820	Additive	820
	WB	Out	587	687	642	870	915	Additive	915
	NB	In	633	741	822	737	656	Additive	656
	NB	Out	543	635	798	756	593	Additive	593
7th St @ Central Ave	EB	In	2169	2538	1649	1495	2384	Additive	2384
	EB	Out	2038	2384	2048	2046	2382	Additive	2382
	NB	In	478	559	1221	1289	627	Additive	627
	NB	Out	609	713	822	737	628	Additive	628
6th St @ Central Ave	WB	In	516	604	1133	1269	740	Additive	740
	WB	Out	296	346	1230	1265	356	Ratio	356
	NB	In	507	593	1414	1455	634	Additive	634
	NB	Out	565	661	1221	1289	729	Additive	683
	SB	Out	162	190	96	170	336	Ratio	336
5th St @ Central Ave	EB	In	2170	2539	3538	3655	2656	Additive	2656
	EB	Out	2059	2409	2222	2321	2508	Additive	2608
	NB	In	386	452	198	246	560	Ratio	520
	SB	In	152	178	96	170	315	Ratio	315
	NB	Out	507	593	1414	1455	634	Additive	634
	SB	Out	142	166	196	295	249	Ratio	249
4th St @ Central	WB	Out	272	318	635	780	391	Ratio	391
	WB	In	362	424	274	392	607	Ratio	607
	NB	In	352	412	587	687	482	Ratio	482
	NB	Out	363	425	225	292	551	Ratio	510
	SB	In	147	172	69	170	426	Ratio	426
	SB	Out	226	264	69	177	682	Ratio	614
3rd St @ Elm St	WB	In	933	1092	1335	1293	1050	Additive	1100
	WB	Out	689	806	1143	1522	1185	Additive	1117
	WB	Out	153	179	498	159	57	Ratio	57
	NB	In	629	736	314	974	1396	Additive	1000
	NB	Out	720	842	504	587	926	Additive	926

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Location	Direction	Direction @ Intersection	AM Raw Count	AM 30th Highest Hour	2003 AM OKI Assignments	2030 AM OKI Assignments	2030 Adjusted Assignment	Method Used	2030 Balanced Assignments
W 4th St @ Philadelphia St	WB	In	916	1072	1318	1387	1141	Additive	1250
	WB	Out	1536	1797	1402	1570	1966	Additive	2102
	NB	In	449	525	363	297	459	Additive	459
	SB	In	704	824	400	433	856	Additive	856
	NB	Out	352	412	376	525	575	Ratio	475
	SB	Out	181	212	303	23	16	Ratio	16
W 5th St @ Philadelphia	EB	In	1615	1890	1420	1308	1777	Additive	1938
	EB	Out	1378	1612	971	976	1617	Additive	1617
	NB	In	123	144	0	0	144	Additive	144
	SB	In	176	206	63	97	317	Ratio	80
	NB	Out	459	537	514	430	453	Additive	453
	SB	Out	77	90	0	0	90	Additive	90
W 4th @ Crescent Ave	WB	In	45	53	173	210	64	Ratio	13
	EB	Out	26	30	77	92	36	Ratio	36
	NB	In	238	278	0	0	278	Additive	278
	SB	In	102	119	190	432	272	Ratio	272
	NB	Out	272	318	429	737	547	Ratio	425
	SB	Out	87	102	0	0	102	Additive	102
W 5th @ Crescent Ave	WB	In	200	234	255	529	486	Ratio	486
	EB	Out	86	101	0	0	101	Additive	291
	NB	In	53	62	0	0	62	Additive	41
	SB	In	87	102	0	0	102	Additive	102
	NB	Out	238	278	0	0	278	Additive	278
	SB	Out	16	19	0	0	19	Additive	60
I 75 N ramp @ Pike St	EB	In	690	807	715	781	873	Additive	873
	WB	In	198	232	443	729	381	Ratio	381
	EB	Out	529	619	653	744	710	Additive	710
	WB	Out	196	229	429	718	384	Ratio	384
	NB	In	497	581	783	854	652	Additive	652
	NB	Out	660	772	857	902	817	Additive	817
I 75 N ramp @ 12th St	EB	In	320	374	505	941	698	Ratio	617
	WB	In	460	538	812	816	542	Additive	542
	EB	Out	394	461	702	735	483	Ratio	483
	WB	Out	190	222	653	705	240	Ratio	240
	NB	In	281	329	823	535	214	Ratio	214
	NB	Out	477	558	783	854	629	Additive	650

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Location	Direction	Direction @ Intersection	AM Raw Count	AM 30th Highest Hour	2003 AM OKI Assignments	2030 AM OKI Assignments	2030 Adjusted Assignment	Method Used	2030 Balanced Assignments
I 75 S ramp @ Pike St	EB	In	680	796	669	740	866	Additive	866
	WB	In	220	257	429	718	431	Ratio	431
	EB	Out	756	885	715	781	950	Additive	909
	WB	Out	195	228	426	547	293	Ratio	293
	SB	In	344	402	408	551	544	Ratio	544
	SB	Out	293	343	365	680	639	Ratio	639
I 75 S ramp @ 12th St	EB	In	152	178	409	696	303	Ratio	200
	WB	In	190	222	653	705	240	Ratio	240
	EB	Out	322	377	505	941	702	Ratio	650
	WB	Out	12	14	165	313	27	Ratio	45
	SB	In	293	343	365	680	639	Ratio	639
	SB	Out	300	351	756	827	384	Ratio	384

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Location	Direction	Direction @ Intersection	PM Raw Count	PM 30th Highest Hour	2003 PM OKI Assignments	2030 PM OKI Assignments	2030 Adjusted Assignment	Method Used	2030 Balanced Assignment
Southbound I-75									
I-75 ML, N of Ezzard Charles off-ramp	SB		4996	5845	6168	8156	7833	Additive	7808
Ezzard Charles off-ramp	SB		177	207	244	190	161	Ratio	161
I-75 ML, N of Gest St off-ramp	SB		4819	5638	5923	7965	7680	Additive	7647
Gest St off-ramp	SB		553	647	823	585	409	Additive	409
I-75 ML, N of Ezzard Charles on-ramp	SB		4266	4991	5100	7380	7271	Additive	7238
Ezzard Charles on-ramp	SB		396	463	533	341	296	Ratio	296
I-75 ML, N of 7th St off-ramp	SB		4662	5455	5632	7721	7544	Additive	7507
7th St off-ramp	SB		115	135	519	569	148	Ratio	148
I-75 ML, N of I-71/5th off-ramp	SB		4547	5320	5113	7153	7360	Additive	7360
I-71/5th off-ramp	SB		2543	2975	1991	2478	3462	Additive	3462
5th St off-ramp	SB		385	450	463	427	415	Ratio	415
I-75 ramp to I-71/Second	SB		2158	2525	1529	2051	3047	Additive	3047
I-75 ramp to I-71	SB		1684	1970	774	1264	2460	Additive	2460
I-75 ramp to Second	SB		474	555	755	787	587	Additive	587
I-75 ML, N of 9th St on-ramp	SB		2004	2345	3122	4674	3897	Additive	3897
9th St on-ramp	SB		761	890	799	849	940	Additive	940
I-75 ML, N of 6th St on-ramp	SB		2765	3235	3922	5524	4837	Additive	4837
6th St. on-ramp	SB		723	846	512	585	919	Additive	919
I-75 SB to I-71/75 SB	SB		3488	4081	4433	6109	5757	Additive	5757
I-71 on-ramp to I-75	SB		3787	4431	2444	2684	4671	Additive	4671
I-71/75 on Brent Spence Bridge	SB		7275	8512	6877	8793	10428	Additive	10428
I-71/75 off-ramp to 5th St	SB		901	1054	939	852	967	Additive	967
I-71/75 ML, N of off-ramp to Pike/12th	SB		6374	7458	5939	7940	9459	Additive	9459
Off-ramp to Pike/12th	SB		506	592	421	420	591	Additive	591
I-71/75 ML, N of 4th St on-ramp (Covington)	SB		5868	6866	5517	7521	8870	Additive	8870
4th St on-ramp (Covington)	SB		952	1114	724	854	1244	Additive	1244
I-71/75 ML, N of 12th St on-ramp	SB		6820	7979	6241	8375	10113	Additive	10113
12th St on-ramp	SB		452	529	934	915	510	Additive	510
I-71/75 ML, S of 12th St on-ramp	SB		7272	8508	7174	9290	10624	Additive	10624
Off ramp at Kyles	SB		939	1099	682	528	945	Additive	945
I-75 S of off ramp at Kyles	SB		6333	7410	6492	8762	9680	Additive	9680
On ramp at Kyles	SB		475	556	552	734	738	Additive	738
End link I-75	SB		6808	7965	7044	9497	10418	Additive	10418
Northbound I-75									
Entry Link I-75	NB		5324	6229	6495	8234	7968	Additive	7999
Off ramp at Kyles	NB		640	749	602	608	755	Additive	755
I-75 N of Kyle off ramp	NB		4684	5480	5892	7627	7215	Additive	7244
On ramp at Kyles	NB		529	619	569	392	442	Additive	442

Modeling Advisory Group
PM Traffic Assignments
August 30, 2004

Location	Direction	Direction @ Intersection	PM Raw Count	PM 30th Highest Hour	2003 PM OKI Assignments	2030 PM OKI Assignments	2030 Adjusted Assignment	Method Used	2030 Balanced Assignment
I-71/75 ML, S of 12th St off-ramp	NB		5213	6099	6461	8018	7656	Additive	7686
12th St off-ramp	NB		433	507	987	762	282	Additive	282
I-71/75 ML, S of 5th St off-ramp (Covington)	NB		4780	5593	5474	7257	7376	Additive	7404
5th St off-ramp (Covington)	NB		589	689	503	379	565	Additive	565
I-71/75 ML, S of Pike On-ramp	NB		4191	4903	4971	6877	6809	Additive	6839
Pike St on-ramp	NB		423	495	596	772	641	Ratio	641
I-71/75 ML, S of 4th St on-ramp (Covington)	NB		4614	5398	5567	7648	7479	Additive	7479
4th St on-ramp (Covington)	NB		941	1101	1027	1284	1358	Additive	1358
I-71/75 on Brent Spence Bridge	NB		5555	6499	6595	8934	8838	Additive	8838
I-71/75 off-ramp to I-71/Second	NB		2174	2544	2111	2576	3009	Additive	3009
I-75 ML, S of 5th St off-ramp	NB		3381	3956	4484	6357	5829	Additive	5829
5th St off-ramp	NB		199	233	729	920	294	Ratio	294
I-75 ML, S of 6th St off-ramp	NB		3182	3723	3756	5436	5403	Additive	5535
6th St off-ramp	NB		726	849	680	713	882	Additive	882
I-75 ML, S of C-D Road on-ramp	NB		2456	2874	3076	4723	4521	Additive	4653
C-D Road on-ramp	NB		2845	3329	2718	2830	3441	Additive	3441
I-75 ML, S of 9th St on-ramp	NB		5301	6202	5794	7553	7961	Additive	8094
9th St on-ramp	NB		780	913	480	425	858	Additive	858
I-75 ML, S of Gest St on-ramp	NB		6081	7115	6274	7979	8820	Additive	8952
Gest St on-ramp	NB		701	820	626	519	713	Additive	713
I-75 ML, S of Ezzard Charles on-ramp	NB		6782	7935	6899	8498	9534	Additive	9665
Ezzard Charles on-ramp	NB		369	432	336	235	302	Ratio	302
I-75 ML, N of Ezzard Charles on-ramp	NB		7151	8367	7236	8733	9864	Additive	9967
Southbound I-71									
I-71 ML, N of NB I-75 off-ramp	SB		5472	6402	3349	3835	6888	Additive	6888
I-71 ramp to I-71/75, N of 3rd St on-ramp	SB		2807	3284	1605	2068	3747	Additive	3747
3rd St on-ramp to I-71/75	SB		980	1147	839	615	923	Additive	923
I-71 ramp to NB I-75	SB		2665	3118	1744	1766	3140	Additive	3140
I-71 SB ramp to 6th St	NB		1487	1740	1166	1176	1750	Additive	1750
Northbound I-71									
I-75 S/6th Combined to I-71	SB		2940	3440	2107	2587	3920	Additive	3920
I-71/75 ramp to Second	NB		167	195	323	223	135	Ratio	135
I-71/75 off-ramp to I-71	NB		2007	2348	1787	2354	2915	Additive	2874
I-71 ML end link	EB		4947	5788	3894	4941	6835	Additive	6794
Northbound I-75 C-D Road									
C-D Road, S of 4th on-ramp	NB		1178	1378	579	590	1389	Additive	1389
4th St on-ramp to C-D Road	NB		1313	1536	1257	1292	1571	Additive	1571
C-D Road, S of 6th St on-ramp	NB		2491	2914	1836	1882	2960	Additive	2960

Modeling Advisory Group
PM Traffic Assignments
August 30, 2004

Location	Direction	Direction @ Intersection	PM Raw Count	PM 30th Highest Hour	2003 PM OKI Assignments	2030 PM OKI Assignments	2030 Adjusted Assignment	Method Used	2030 Balanced Assignment
6th St on ramp to C-D Road	NB		521	610	1290	1313	633	Additive	633
C-D Road, S of NB I-75 off-ramp	NB		3012	3524	3126	3196	3594	Additive	3594
C-D Road, N of NB I-75 off-ramp	NB		167	195	407	365	175	Ratio	152
9th St on-ramp to C-D Road	NB		854	999	505	442	936	Additive	936
C-D Road, S of NB I-75 off-ramp (9th)	NB		1021	1195	911	808	1092	Additive	1088
C-D Road, S of Gest on-ramp	NB		241	282	432	383	250	Ratio	230
Gest St on-ramp to C-D Road	NB		125	146	40	73	267	Ratio	267
C-D Road, N of Gest on-ramp	NB		366	428	472	456	414	Ratio	497
Misc. Cincinnati Ramps									
9th St, E of SB I-75 off-ramp	WB		1151	1347	1437	1442	1352	Additive	1441
9th St, W of SB I-75 off-ramp	WB		390	456	637	592	424	Ratio	501
8th to 7th	EB		513	600	315	260	545	Additive	583
6th to I-75 and 5th St	EB		2142	2506	2311	2364	2559	Additive	2529
6th to 5th	EB		35	41	466	456	40	Ratio	161
6th to I-75 S/Second St	EB		851	996	512	585	1069	Additive	1069
6th to Second	SB		128	150	0	0	150	Additive	150
6th to I-71 N	EB		1256	1470	1333	1323	1460	Additive	1460
6th to 6th	WB		858	1004	1452	1423	975	Additive	1007
NB I-75/I-71 Combined to 6th	NB		2213	2589	1845	1890	2634	Additive	2634
6th/I-75 N Combined to 6th	WB		3071	3593	3297	3312	3608	Additive	3639
I-75 S/6th Combined to 5th	EB		420	491	929	883	467	Ratio	576
I-75 S/6th Combined to Second	SB		602	704	755	787	736	Additive	736
2nd St Entry link	EB		100	117	0	447	564	Ratio	525
2nd St, W of NB I-71/75 on-ramp	EB		702	821	755	1234	1300	Additive	1261
Eastbound Approach to 2nd & Elm Intersection	EB		869	1017	1078	1457	1396	Additive	1396
Misc. Covington Ramps									
4th St, E of NB I-71/75 off-ramp	WB		2054	2403	1782	2028	2649	Additive	2649
4th St, W of NB I-71/75 off-ramp	WB		1113	1302	755	744	1291	Additive	1291
4th St to SB I-71/75 C-D Road	SB		1010	1182	698	645	1129	Additive	1129
4th St, E of Crescent	WB		103	121	57	99	209	Ratio	162
Crescent to SB I-71/75 C-D at 4th	SB		149	174	82	230	489	Ratio	320
Combined 4th St/Crescent to SB I-71/75 C-D Road	SB		1159	1356	780	874	1450	Additive	1450
SB C-D Road between SB I-71/75 on-ramp and off-ramp	SB		1665	1948	1201	1294	2041	Additive	2041
SB C-D Road, S of SB I-71/75 off-ramp	SB		713	834	477	439	796	Additive	796
SB I-71/75 off-ramp to WB 5th St.	WB		419	490	356	366	504	Ratio	430
SB I-71/75 off-ramp to EB 5th St.	EB		482	564	583	486	467	Additive	541
5th St E of Crescent	EB		93	109	158	391	269	Ratio	269
5th St, E of SB I-71/75 off-ramp	EB		575	673	740	877	810	Additive	810
5th St, E of NB I-71/75 off-ramp	EB		1164	1362	1243	1257	1376	Additive	1376

Modeling Advisory Group
PM Traffic Assignments
August 30, 2004

Location	Direction	Direction @ Intersection	PM Raw Count	PM 30th Highest Hour	2003 PM OKI Assignments	2030 PM OKI Assignments	2030 Adjusted Assignment	Method Used	2030 Balanced Assignment
2nd St @ Elm St	EB	In	869	1017	1078	1457	1396	Additive	1396
	EB	Out	654	765	1015	1384	1134	Additive	934
	NB	In	106	124	217	580	331	Ratio	331
	NB	Out	304	356	280	653	829	Ratio	761
	SB	Out	27	32	0	0	32	Additive	32
9th St @ Central Ave	SB	In	140	164	0	0	164	Additive	164
	WB	In	1484	1736	1720	1793	1809	Additive	1809
	WB	Out	2005	2346	1715	1746	2377	Additive	2377
	NB	In	758	887	454	438	871	Additive	871
	NB	Out	377	441	459	486	467	Ratio	467
7th St @ Central Ave	EB	In	628	735	834	830	731	Additive	731
	EB	Out	661	773	1012	1070	831	Additive	831
	NB	In	485	567	632	680	615	Additive	615
	NB	Out	452	529	454	438	513	Additive	513
6th St @ Central Ave	WB	In	1490	1743	1932	1930	1741	Additive	1858
	WB	Out	1407	1646	2742	2736	1640	Additive	1640
	NB	In	524	613	1495	1559	677	Additive	677
	NB	Out	423	495	632	680	532	Ratio	532
	SB	Out	218	255	52	74	363	Ratio	363
5th St @ Central Ave	EB	In	619	724	1657	1803	870	Additive	870
	EB	Out	798	934	1101	1146	979	Additive	1026
	NB	In	634	742	1007	981	716	Additive	686
	SB	In	218	255	52	74	363	Ratio	363
	NB	Out	540	632	1495	1559	696	Additive	696
	SB	Out	133	156	121	153	197	Ratio	197
4th St @ Central	WB	Out	1255	1468	1257	1292	1503	Additive	1571
	WB	In	980	1147	1117	1283	1313	Additive	1313
	NB	In	982	1149	1093	981	1037	Additive	1037
	NB	Out	605	708	942	920	686	Additive	686
	SB	In	135	158	69	104	238	Ratio	238
	SB	Out	237	277	79	156	548	Ratio	331
3rd St @ Elm St	WB	In	1571	1838	2066	1782	1554	Additive	1554
	WB	Out	543	635	1213	1438	860	Additive	830
	WB	Out	980	1147	839	615	923	Additive	923
	NB	In	304	356	280	653	829	Ratio	761
	NB	Out	352	412	265	382	594	Ratio	564

Modeling Advisory Group
PM Traffic Assignments
August 30, 2004

Location	Direction	Direction @ Intersection	PM Raw Count	PM 30th Highest Hour	2003 PM OKI Assignments	2030 PM OKI Assignments	2030 Adjusted Assignment	Method Used	2030 Balanced Assignment
W 4th St @ Philadelphia St	WB	In	1443	1688	1507	1530	1711	Additive	1875
	WB	Out	1919	2245	1782	2028	2491	Additive	2649
	NB	In	403	472	486	423	410	Ratio	430
	SB	In	534	625	455	610	780	Additive	780
	NB	Out	301	352	456	535	413	Ratio	413
	SB	Out	160	187	209	0	0	Additive	23
W 5th St @ Philadelphia	EB	In	1077	1260	1243	1257	1274	Additive	1376
	EB	Out	905	1059	1149	1283	1193	Additive	1143
	NB	In	164	192	0	0	192	Additive	192
	SB	In	195	228	238	340	326	Ratio	200
	NB	Out	393	460	331	314	436	Ratio	436
	SB	Out	164	192	0	0	192	Additive	192
W 4th @ Crescent Ave	WB	In	96	112	57	99	195	Ratio	162
	EB	Out	280	328	82	230	919	Ratio	320
	NB	In	395	462	0	0	462	Additive	462
	SB	In	177	207	240	620	535	Ratio	375
	NB	Out	415	486	413	465	547	Ratio	547
	SB	Out	113	132	0	0	132	Additive	132
W 5th @ Crescent Ave	WB	In	390	456	356	366	469	Ratio	430
	EB	Out	86	101	0	0	101	Additive	269
	NB	In	53	62	0	0	62	Additive	175
	SB	In	113	132	0	0	132	Additive	132
	NB	Out	395	462	0	0	462	Additive	428
	SB	Out	75	88	0	0	88	Additive	40
I 75 N ramp @ Pike St	EB	In	368	431	572	681	513	Ratio	513
	WB	In	559	654	729	879	804	Additive	777
	EB	Out	409	479	592	711	575	Ratio	575
	WB	Out	540	632	665	835	802	Additive	802
	NB	In	445	521	552	759	728	Additive	728
	NB	Out	423	495	596	772	641	Ratio	641
I 75 N ramp @ 12th St	EB	In	342	400	290	627	865	Ratio	865
	WB	In	537	628	850	867	645	Additive	645
	EB	Out	580	679	840	819	658	Additive	754
	WB	Out	285	333	735	678	308	Ratio	308
	NB	In	433	507	987	762	282	Additive	282
	NB	Out	447	523	552	759	730	Additive	730

Modeling Advisory Group
PM Traffic Assignments
August 30, 2004

Location	Direction	Direction @ Intersection	PM Raw Count	PM 30th Highest Hour	2003 PM OKI Assignments	2030 PM OKI Assignments	2030 Adjusted Assignment	Method Used	2030 Balanced Assignment
I 75 S ramp @ Pike St	EB	In	264	309	544	663	376	Ratio	376
	WB	In	590	690	665	835	860	Additive	860
	EB	Out	356	417	572	681	496	Ratio	496
	WB	Out	668	782	570	650	862	Additive	836
	SB	In	713	834	477	439	796	Additive	796
	SB	Out	543	635	543	608	700	Additive	700
I 75 S ramp @ 12th St	EB	In	119	139	229	503	306	Ratio	399
	WB	In	244	285	735	678	263	Ratio	325
	EB	Out	391	457	290	627	989	Ratio	850
	WB	Out	59	69	283	247	60	Ratio	60
	SB	In	539	631	543	608	696	Additive	696
	SB	Out	452	529	934	915	510	Additive	510

FINAL

BURGESS & NIPLE

To: Herb Mack, PE
Project Manager, Burgess & Niple

From: Randy Kill, PE
Project Engineer, Burgess & Niple
Paul Dorothy, PhD, PE, AICP
Director of Operational Modeling/Geometrics, Burgess & Niple

Date: October 15, 2004

Subject: Meeting Notes for: Brent Spence Bridge Feasibility and Constructability Study Modeling Advisory Group Meeting on August 30, 2004

Project Memorandum

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A modeling advisory group (MAG) meeting was held on 30 August 2004 for the Feasibility and Constructability Study for the Replacement/Rehabilitation of the Brent Spence Bridge.

Attendees at the meeting were:

Rob Bostrom	KYTC	rob.bostrom@ky.gov
David Hamilton	KYTC	david.a.hamilton@ky.gov
Kong Ee	KYTC	kong.ee@ky.gov
David Jones	KYTC	david.jones@ky.gov
Mike Bezold	KYTC	mike.bezold@ky.gov
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Ansen Wu	ODOT	ansen.wu@dot.state.oh.us
Bob Koehler	OKI	rkoehler@oki.org
Randy Kill	Burgess & Niple	rkill@burnip.com
Paul Dorothy	Burgess & Niple	pdorothy@burnip.com

Notes from the meetings are as follows:

- The results of the last conference call left the MAG with two outstanding issues to resolve. First, how would the 30th highest hour be determined? Second, based on previous review, a handful of the traffic counts and the truck percentage appeared low.

- To address the first of these outstanding issues, Randy Kill gave an overview of the information that had been distributed to the MAG in a memo titled "30th Highest Hour Traffic Assignments." This memo detailed how the 30th highest hour correction factor was developed. There were no questions or comments from the MAG regarding this process. The MAG approved the procedures for calculating the 30th highest hour as outlined.

- To address the second of the outstanding concerns, Randy Kill gave an overview of the information that had been distributed to the MAG in a memo titled “New Traffic Counts.” This memo detailed traffic counts that had been taken at four locations and compared these new counts to previous counts. Both sets of counts were comparable in magnitude. After discussion, the MAG agreed that since the counts were comparable, the previous counts were accurate. Further, it was decided that using the previous counts, which were slightly higher, would be the more conservative approach.

- Randy Kill then referred the MAG to the new information regarding truck percentages in the memo. Rob Bostrom commented that the new truck percentages are more in line with what would be expected for this corridor. The MAG agreed that these new truck percentages would be used for corridor analysis.

- Rob Bostrom questioned if ADT numbers could be developed for all count locations in addition to the peak hour counts shown. Randy explained that most of the counts taken in support of this study are peak hour counts only. Thus, to derive ADT’s these peak hour counts would need to be factored using the k-factor that could be determined from the counts taken by KYTC. Based on this discussion, the MAG determined that an ADT would be developed for the Brent Spence Bridge only.

- Randy Kill then referred the MAG to the spreadsheet titled “Brent Spence Bridge Study-Existing Traffic Counts” and the volume plots where the same data was spatially represented. He highlighted locations where counts were taken, where counts were derived from adjacent locations and where counts had to be assumed. A copy of the volume plots was given to each core group of the MAG.

- Randy Kill then referred the MAG to the spreadsheets titled “Brent Spence Bridge Study-AM Traffic Assignments” and “Brent Spence Bridge Study-PM Traffic Assignments” and the volume plots where the same data was spatially represented. A copy of the volume plots was given to each core group of the MAG. Ansen Wu requested that columns be added to the spreadsheets that quantify the link capacity and number of lanes for each location from the travel demand model for both 2003 and 2030 conditions.

- Mike Bezold questioned why most ramp volumes in the northbound direction in Kentucky during the AM and PM peak hours are lower for the 2030 OKI travel demand model assignment than for the 2003 OKI travel demand model assignment. After discussion, the MAG asked Burgess & Niple to make a cursory level analysis of this trend.

- Rob Bostrom requested that a select link analysis be performed on the bridge links for the existing condition, future (baseline) condition and all alternative conditions.

- Rob Bostrom requested that any exhibits that may be shown to the public in the future only show rounded volume numbers (nearest 50 or 100 vehicles) to eliminate the "false precision" associated with exact figures (e.g. 4500 vs. 4513).

- Randy Kill suggested that for the alternative analysis we assign the 2030 baseline traffic to the alternative alignments based on change in access and forgo further travel demand model runs. Bob Koehler commented that OKI ran the 5 alternatives in the travel demand model. He stated that the ADT on the bridge varied from a low of 219,000 to a high of 234,000. During the discussion it was determined that this represented a delta of approximately 500 vehicles in the peak period. Because of this small peak hour difference, the MAG felt that the proposed volume assignment would be sufficient. However, sensitivity testing may need to be done at a few key locations based on alternative performance.

- Mike Bezold questioned if 2030 was a good choice for design year. He commented that using a 25 year horizon window that did not match the expected life of the bridge (40 to 50 years) may not be the best approach. Further, the proposed eastern alignment alternative is in an area of constricted right-of-way which would preclude any potential future widening. After discussion, the MAG determined that 2030 would stay the future year.

- Randy Kill presented the extent of the CORSIM model network. The MAG agreed that the network area selected will satisfy the analysis needs of this study.

- Mark Byram questioned if the travel demand model numbers for the future year (2030) are appropriate for this study. His concern was that by modeling a capacity constrained I-75 corridor, a bridge solution may be arrived at that precludes a future capacity increase in the I-75 corridor. During discussion, it was determined that the maximum possible cross-section that could be considered for the I-75 corridor would be 5 lanes in each direction. This would result in a maximum cross-section for the bridge of 7 lanes. These additional lanes on the bridge would drop to I-71 on the Ohio side and to local ramps on the Kentucky side. The MAG agreed that modeling the I-75 corridor as 5-lanes for the alternative analysis was appropriate.

- Mike Bezold requested that Burgess & Niple e-mail KYTC all CORSIM models when completed. Rob Bostrom further suggested that ARTIMIS speed data may be useful for validation of the 2003 CORSIM model.

- Diana Martin suggested that ODOT District 8 and KYTC District 6 personnel in attendance at the MAG stay after the meeting to discuss steps necessary to finish the study.

Future Products

- An ADT will be calculated for the Brent Spence Bridge utilizing the k-factor determined from counts taken by KYTC.
- The “Brent Spence Bridge Study-AM Traffic Assignments” and “Brent Spence Bridge Study-PM Traffic Assignments” spreadsheets will be updated to include columns quantifying: 2003 travel demand link capacity, 2003 travel demand number of lanes, 2030 travel demand link capacity and 2030 travel demand number of lanes.
- Cursory analysis of the exhibited trend of northbound ramp volumes in the AM and PM peaks on the Kentucky side of the river being lower in the 2030 than 2003 projected travel demand volumes.
- AM and PM peak period CORSIM models for 2003 existing conditions and 2030 future (baseline) conditions.

Meeting Addendum

- At the meeting between ODOT District 8 and KYTC District 6, it was determined that the maximum possible cross-section for the I-75 corridor to be considered would be 5 lanes in each direction. Further, it was determined that 7 lanes in each direction would be provided on the bridge. On the Ohio side the additional 2 lanes would add/drop from I-71 and on the Kentucky side they would add/drop from local interchanges. Because of this decision, it was decided that alternative analysis would not be necessary to complete the study as this recommended cross-section would be sufficient. Burgess & Niple was directed to complete the existing and future conditions analysis (2003 and 2030 CORSIM models) as directed by the MAG and to suspend alternative analysis until the next project.

Modeling Advisory Group
AM Traffic Assignments
October 7, 2004

Location	Direction	Direction @ Intersection	AM Raw Count	AM 30th Highest Hour	2003 AM OKI Assignments	2003 AM OKI Link Capacity	2003 AM OKI Link # of Lanes	2030 AM OKI Assignments	2030 AM OKI Link Capacity	2030 AM OKI Link # of Lanes	2030 Adjusted Assignment	Method Used	2030 Balanced Assignments
Southbound I-75													
I-75 ML, N of Ezzard Charles off-ramp	SB		7938	9287	8922	8976	4	10353	8976	4	10718	Additive	11014
Ezzard Charles off-ramp	SB		501	586	600	910	1	309	910	1	295	Additive	295
I-75 ML, N of Gest St off-ramp	SB		7437	8701	8321	7884	4	10043	7884	4	10423	Additive	10719
Gest St off-ramp	SB		851	996	705	910	1	531	910	1	822	Additive	822
I-75 ML, N of Ezzard Charles on-ramp	SB		6586	7706	7617	7544	4	9512	7544	4	9601	Additive	9897
Ezzard Charles on-ramp	SB		173	202	464	1000	1	522	1000	1	228	Ratio	228
I-75 ML, N of 7th St off-ramp	SB		6759	7908	8081	7544	4	10035	7544	4	9862	Additive	10125
7th St off-ramp	SB		1349	1578	996	910	1	881	910	1	1463	Additive	1463
I-75 ML, N of I-71/5th off-ramp	SB		5410	6330	7086	7544	4	9153	7544	4	8397	Additive	8662
I-71/5th off-ramp	SB		3112	3641	3316	3864	2	3820	3864	2	4145	Additive	4145
5th St off-ramp	SB		1005	1176	807	910	1	830	910	1	1198	Additive	1198
I-75 ramp to I-71/Second	SB		2107	2465	2509	3864	2	2990	3864	2	2946	Additive	2946
I-75 ramp to I-71	SB		1221	1429	796			1205			1837	Additive	1837
I-75 ramp to Second	SB		886	1037	1713			1784			1108	Additive	1108
I-75 ML, N of 9th St on-ramp	SB		2298	2689	3770	3942	2	5335	3942	2	4253	Additive	4467
9th St on-ramp	SB		12	14	386	910	1	609	910	1	22	Ratio	22
I-75 ML, N of 6th St on-ramp	SB		2310	2703	4156	3942	2	5943	3942	2	4490	Additive	4490
6th St. on-ramp	SB		459	537	572	1000	1	740	1000	1	705	Additive	705
I-75 SB to I-71/75 SB	SB		2769	3240	4728	3942	2	6683	3942	2	5195	Additive	5195
I-71 on-ramp to I-75	SB		1711	2002	2368	1800	2	2713	1800	2	2347	Additive	2347
I-71/75 on Brent Spence Bridge	SB		4480	5242	7095	7884	4	9395	7884	4	7541	Additive	7541
I-71/75 off-ramp to 5th St	SB		772	903	925	910	1	967	910	1	945	Additive	945
I-71/75 ML, N of off-ramp to Pike/12th	SB		3708	4338	6170	7884	4	8428	7884	4	6596	Additive	6596
Off-ramp to Pike/12th	SB		267	312	400	910	1	536	910	1	419	Ratio	419
I-71/75 ML, N of 4th St on-ramp (Covington)	SB		3441	4026	5771	7884	4	7892	7884	4	6147	Additive	6177
5th St on-ramp (Covington)	SB		401	469	401	1000	1	699	1000	1	817	Ratio	817
I-71/75 ML, N of 12th St on-ramp	SB		3842	4495	6171	7884	4	8591	7884	4	6915	Additive	6994
12th St on-ramp	SB		300	351	756	1000	1	827	1000	1	384	Ratio	384
I-71/75 ML, S of 12th St on-ramp	SB		4142	4846	6928	6900	4	9417	6900	4	7335	Additive	7378
Off ramp at Kyles	SB		437	511	489	910	1	488	910	1	510	Additive	510
I-75 S of off ramp at Kyles	SB		3705	4335	6439	7884	4	8930	7884	4	6826	Additive	6868
On ramp at Kyles	SB		389	455	604	1000	1	697	1000	1	525	Ratio	525
End link I-75	SB		4094	4790	7042	7884	4	9627	7884	4	7375	Additive	7393
Northbound I-75													
Entry Link I-75	NB		5784	6767	7154	5913	3	8542	5913	3	8155	Additive	8402
Off ramp at Kyles	NB		359	420	685	910	1	491	910	1	301	Ratio	301
I-75 N of Kyle off ramp	NB		5425	6347	6470	5913	3	8053	5913	3	7930	Additive	8101
On ramp at Kyles	NB		769	900	709	1000	1	443	1000	1	634	Additive	634
I-71/75 ML, S of 12th St off-ramp	NB		6194	7247	7178	5175	3	8495	5175	3	8564	Additive	8735
12th St off-ramp	NB		281	329	823	910	1	535	910	1	214	Ratio	214
I-71/75 ML, S of 5th St off-ramp (Covington)	NB		5913	6918	6355	5913	3	7959	5913	3	8522	Additive	8522
5th St off-ramp (Covington)	NB		1109	1298	639	910	1	528	910	1	1186	Additive	1186
I-71/75 ML, S of Pike On-ramp	NB		4804	5621	5719	5913	3	7431	5913	3	7333	Additive	7333
Pike St on-ramp	NB		660	772	857	1000	1	902	1000	1	817	Additive	817
I-71/75 ML, S of 4th St on-ramp (Covington)	NB		5464	6393	6575	5913	3	8334	5913	3	8152	Additive	8152
4th St on-ramp (Covington)	NB		1154	1350	896	1000	1	737	1000	1	1191	Additive	1191
I-71/75 on Brent Spence Bridge	NB		6618	7743	7471	7884	4	9071	7884	4	9343	Additive	9343
I-71/75 off-ramp to I-71/Second	NB		3228	3777	2375	1800	2	2699	1800	2	4100	Additive	4100

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I-75 ML, S of 5th St off-ramp	NB		3390	3966	5096	3942	2	6373	5913	3	5244	Additive	5244
5th St off-ramp	NB		601	703	1499	1820	2	1412	1820	2	616	Additive	616
I-75 ML, S of 6th St off-ramp	NB		2789	3263	3596	3942	2	4961	3942	2	4628	Additive	4628
6th St off-ramp	NB		742	868	573	910	1	575	910	1	870	Additive	870
I-75 ML, S of C-D Road on-ramp	NB		2047	2395	3023	3942	2	4386	3942	2	3758	Additive	3758
C-D Road on-ramp	NB		1410	1650	1347	6732	3	1669	6732	3	1972	Additive	1972
I-75 ML, S of 9th St on-ramp	NB		3457	4045	4370	7544	4	6056	7544	4	5731	Additive	5731
9th St on-ramp	NB		169	198	115	1000	1	119	1000	1	205	Ratio	205
I-75 ML, S of Gest St on-ramp	NB		3626	4242	4485	7544	4	6175	7544	4	5932	Additive	5932
Gest St on-ramp	NB		708	828	659	1000	1	493	1000	1	662	Additive	662
I-75 ML, S of Ezzard Charles on-ramp	NB		4334	5071	5145	7884	4	6668	7884	4	6594	Additive	6594
Ezzard Charles on-ramp	NB		106	124	183	1000	1	153	1000	1	104	Ratio	104
I-75 ML, N of Ezzard Charles on-ramp	NB		4440	5195	5328	7884	4	6821	7884	4	6688	Additive	6700
Southbound I-71													
I-71 ML, N of NB I-75 off-ramp	SB		3832	4483	3343	6752	4	4182	6752	4	5323	Additive	5105
I-71 ramp to I-71/75, N of 3rd St on-ramp	SB		1558	1823	1870	3376	2	2544	3376	2	2497	Additive	2290
3rd St on-ramp to I-71/75	SB		153	179	498	1440	1	159	1440	1	57	Ratio	57
I-71 ramp to NB I-75	SB		2274	2661	1473	3864	2	1627	3376	2	2815	Additive	2815
I-71 SB ramp to 6th St	NB		992	1161	879	910	1	908	910	1	1190	Additive	1190
Northbound I-71													
I-75 S/6th Combined to I-71	SB		2622	3068	2233	3864	2	2548	3864	2	3383	Additive	3383
I-71/75 ramp to Second	NB		863	1010	671	1638	2	428	1638	2	767	Additive	767
I-71/75 off-ramp to I-71	NB		2365	2767	1704	1800	2	2271	1800	2	3334	Additive	3334
I-71 ML end link	EB		4987	5835	3937	6752	4	4819	6752	4	6717	Additive	6717
Northbound I-75 C-D Road													
C-D Road, S of 4th on-ramp	NB		1282	1500	594	3864	2	719	3864	2	1625	Additive	1625
4th St on-ramp to C-D Road	NB		268	314	635	1000	1	780	1000	1	385	Ratio	385
C-D Road, S of 6th St on-ramp	NB		1550	1814	1230	3864	2	1499	3864	2	2083	Additive	2010
6th St on ramp to C-D Road	NB		170	199	551	2000	2	526	2000	2	190	Ratio	190
C-D Road, S of NB I-75 off-ramp	NB		1720	2012	1780	3787	4	2025	8080	4	2257	Additive	2200
C-D Road, N of NB I-75 off-ramp	NB		310	363	432	910	1	355	910	1	298	Ratio	228
9th St on-ramp to C-D Road	NB		159	186	125	1000	1	124	1000	1	185	Ratio	185
C-D Road, S of NB I-75 off-ramp (9th)	NB		469	549	558	2000	2	479	2000	2	470	Additive	413
C-D Road, S of Gest on-ramp	NB		300	351	443	910	1	360	910	1	285	Ratio	208
Gest St on-ramp to C-D Road	NB		122	143	40	1820	2	38	1820	2	136	Ratio	136
C-D Road, N of Gest on-ramp	NB		422	494	483	2730	3	397	2730	3	406	Ratio	344
Misc. Cincinnati Ramps													
9th St, E of SB I-75 off-ramp	WB		428	501	513	4400	5	738	4400	5	726	Additive	730
9th St, W of SB I-75 off-ramp	WB		416	487	127	3520	4	128	3520	4	491	Ratio	708
8th to 7th	EB		820	959	653	1860	2	613	1860	2	919	Additive	919
6th to I-75 and 5th St	EB		2681	3137	3241	6060	3	3495	6060	3	3391	Additive	3391
6th to 5th	EB		564	660	1232	4040	2	1413	4040	2	841	Additive	841
6th to I-75 S/Second St	EB		716	838	572	1000	1	740	1000	1	1005	Additive	1005
6th to Second	SB		257	301	0	1000	1	0	1000	1	301	Additive	301
6th to I-71 N	EB		1401	1639	1436	1000	1	1343	1000	1	1546	Additive	1546
6th to 6th	WB		145	170	679	6060	3	738	6060	3	184	Ratio	166
NB I-75/I-71 Combined to 6th	NB		1734	2029	1452	2000	2	1483	2000	2	2059	Additive	2059

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6th/I-75 N Combined to 6th	WB		1879	2198	2130	6060	3	2222	6060	3	2290	Additive	2226
I-75 S/6th Combined to 5th	EB		1569	1836	2040	4140	3	2242	4140	3	2038	Additive	2038
I-75 S/6th Combined to Second	SB		1143	1337	1713	1800	2	1784	1800	2	1409	Additive	1409
2nd St Entry link	EB		200	234	0	819	1	568	819	1	802	Ratio	802
2nd St, W of NB I-71/75 on-ramp	EB		1343	1571	1713	2457	3	2352	2457	3	2211	Additive	2211
Eastbound Approach to 2nd & Elm Intersection	EB		2206	2581	2384	4400	5	2780	4400	5	2977	Additive	2977
Misc. Covington Ramps													
4th St, E of NB I-71/75 off-ramp	WB		1653	1934	1402	1560	2	1570	1560	2	2102	Additive	2102
4th St, W of NB I-71/75 off-ramp	WB		499	584	505	880	1	831	880	1	910	Additive	910
4th St to SB I-71/75 C-D Road	SB		450	527	332	1000	1	621	1000	1	816	Additive	897
4th St, E of Crescent	WB		49	57	173	1160	1	210	1160	1	70	Ratio	13
Crescent to SB I-71/75 C-D at 4th	SB		28	33	77	1160	1	92	1160	1	39	Ratio	45
Combined 4th St/Crescent to SB I-71/75 C-D Road	SB		478	559	409	1000	1	713	1000	1	863	Additive	942
SB C-D Road between SB I-71/75 on-ramp and off-ramp	SB		745	872	807	1820	2	1250	1820	2	1314	Additive	1361
SB C-D Road, S of SB I-71/75 off-ramp	SB		344	402	408	910	1	551	910	1	544	Ratio	544
SB I-71/75 off-ramp to WB 5th St.	WB		219	256	255	910	1	529	910	1	532	Ratio	486
SB I-71/75 off-ramp to EB 5th St.	EB		553	647	670	910	1	438	910	1	415	Additive	461
5th St E of Crescent	EB		90	105	114	1760	2	340	1760	2	315	Ratio	291
5th St, E of SB I-71/75 off-ramp	EB		643	752	784	1760	2	779	1760	2	747	Additive	752
5th St, E of NB I-71/75 off-ramp	EB		1752	2050	1420	1560	2	1308	1560	2	1938	Additive	1938
2nd St @ Elm St	EB	In	2206	2581	2384			2780			2977	Additive	2977
	EB	Out	1640	1919	2196			2623			2346	Additive	2250
	NB	In	42	49	124			816			323	Ratio	323
	NB	Out	629	736	314			974			1396	Additive	1000
	SB	Out	42	49	0			0			49	Additive	49
9th St @ Central Ave	SB	In	28	33	0			0			33	Additive	33
	WB	In	469	549	618			889			820	Additive	820
	WB	Out	587	687	642			870			915	Additive	915
	NB	In	633	741	822			737			656	Additive	656
	NB	Out	543	635	798			756			593	Additive	593
7th St @ Central Ave	EB	In	2169	2538	1649			1495			2384	Additive	2384
	EB	Out	2038	2384	2048			2046			2382	Additive	2382
	NB	In	478	559	1221			1289			627	Additive	627
	NB	Out	609	713	822			737			628	Additive	628
6th St @ Central Ave	WB	In	516	604	1133			1269			740	Additive	740
	WB	Out	296	346	1230			1265			356	Ratio	356
	NB	In	507	593	1414			1455			634	Additive	634
	NB	Out	565	661	1221			1289			729	Additive	683
	SB	Out	162	190	96			170			336	Ratio	336
5th St @ Central Ave	EB	In	2170	2539	3538			3655			2656	Additive	2656
	EB	Out	2059	2409	2222			2321			2508	Additive	2608
	NB	In	386	452	198			246			560	Ratio	520
	SB	In	152	178	96			170			315	Ratio	315
	NB	Out	507	593	1414			1455			634	Additive	634
	SB	Out	142	166	196			295			249	Ratio	249

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4th St @ Central	WB	Out	272	318	635			780			391	Ratio	391
	WB	In	362	424	274			392			607	Ratio	607
	NB	In	352	412	587			687			482	Ratio	482
	NB	Out	363	425	225			292			551	Ratio	510
	SB	In	147	172	69			170			426	Ratio	426
	SB	Out	226	264	69			177			682	Ratio	614
3rd St @ Elm St	WB	In	933	1092	1335			1293			1050	Additive	1100
	WB	Out	689	806	1143			1522			1185	Additive	1117
	WB	Out	153	179	498			159			57	Ratio	57
	NB	In	629	736	314			974			1396	Additive	1000
	NB	Out	720	842	504			587			926	Additive	926
W 4th St @ Philadelphia St	WB	In	916	1072	1318			1387			1141	Additive	1250
	WB	Out	1536	1797	1402			1570			1966	Additive	2102
	NB	In	449	525	363			297			459	Additive	459
	SB	In	704	824	400			433			856	Additive	856
	NB	Out	352	412	376			525			575	Ratio	475
	SB	Out	181	212	303			23			16	Ratio	16
W 5th St @ Philadelphia	EB	In	1615	1890	1420			1308			1777	Additive	1938
	EB	Out	1378	1612	971			976			1617	Additive	1617
	NB	In	123	144	0			0			144	Additive	144
	SB	In	176	206	63			97			317	Ratio	80
	NB	Out	459	537	514			430			453	Additive	453
	SB	Out	77	90	0			0			90	Additive	90
W 4th @ Crescent Ave	WB	In	45	53	173			210			64	Ratio	13
	EB	Out	26	30	77			92			36	Ratio	36
	NB	In	238	278	0			0			278	Additive	278
	SB	In	102	119	190			432			272	Ratio	272
	NB	Out	272	318	429			737			547	Ratio	425
	SB	Out	87	102	0			0			102	Additive	102
W 5th @ Crescent Ave	WB	In	200	234	255			529			486	Ratio	486
	EB	Out	86	101	0			0			101	Additive	291
	NB	In	53	62	0			0			62	Additive	41
	SB	In	87	102	0			0			102	Additive	102
	NB	Out	238	278	0			0			278	Additive	278
	SB	Out	16	19	0			0			19	Additive	60
I 75 N ramp @ Pike St	EB	In	690	807	715			781			873	Additive	873
	WB	In	198	232	443			729			381	Ratio	381
	EB	Out	529	619	653			744			710	Additive	710
	WB	Out	196	229	429			718			384	Ratio	384
	NB	In	497	581	783			854			652	Additive	652
	NB	Out	660	772	857			902			817	Additive	817
I 75 N ramp @ 12th St	EB	In	320	374	505			941			698	Ratio	617
	WB	In	460	538	812			816			542	Additive	542
	EB	Out	394	461	702			735			483	Ratio	483
	WB	Out	190	222	653			705			240	Ratio	240
	NB	In	281	329	823			535			214	Ratio	214
	NB	Out	477	558	783			854			629	Additive	650

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I 75 S ramp @ Pike St	EB	In	680	796	669			740			866	Additive	866
	WB	In	220	257	429			718			431	Ratio	431
	EB	Out	756	885	715			781			950	Additive	909
	WB	Out	195	228	426			547			293	Ratio	293
	SB	In	344	402	408			551			544	Ratio	544
	SB	Out	293	343	365			680			639	Ratio	639
I 75 S ramp @ 12th St	EB	In	152	178	409			696			303	Ratio	200
	WB	In	190	222	653			705			240	Ratio	240
	EB	Out	322	377	505			941			702	Ratio	650
	WB	Out	12	14	165			313			27	Ratio	45
	SB	In	293	343	365			680			639	Ratio	639
	SB	Out	300	351	756			827			384	Ratio	384

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Southbound I-75													
I-75 ML, N of Ezzard Charles off-ramp	SB		4996	5845	6168	8976	4	8156	8976	4	7833	Additive	7808
Ezzard Charles off-ramp	SB		177	207	244	910	1	190	910	1	161	Ratio	161
I-75 ML, N of Gest St off-ramp	SB		4819	5638	5923	7884	4	7965	7884	4	7680	Additive	7647
Gest St off-ramp	SB		553	647	823	910	1	585	910	1	409	Additive	409
I-75 ML, N of Ezzard Charles on-ramp	SB		4266	4991	5100	7544	4	7380	7544	4	7271	Additive	7238
Ezzard Charles on-ramp	SB		396	463	533	1000	1	341	1000	1	296	Ratio	296
I-75 ML, N of 7th St off-ramp	SB		4662	5455	5632	7544	4	7721	7544	4	7544	Additive	7507
7th St off-ramp	SB		115	135	519	910	1	569	910	1	148	Ratio	148
I-75 ML, N of I-71/5th off-ramp	SB		4547	5320	5113	7544	4	7153	7544	4	7360	Additive	7360
I-71/5th off-ramp	SB		2543	2975	1991	3864	2	2478	3864	2	3462	Additive	3462
5th St off-ramp	SB		385	450	463	910	1	427	910	1	415	Ratio	415
I-75 ramp to I-71/Second	SB		2158	2525	1529	3864	2	2051	3864	2	3047	Additive	3047
I-75 ramp to I-71	SB		1684	1970	774			1264			2460	Additive	2460
I-75 ramp to Second	SB		474	555	755			787			587	Additive	587
I-75 ML, N of 9th St on-ramp	SB		2004	2345	3122	3942	2	4674	3942	2	3897	Additive	3897
9th St on-ramp	SB		761	890	799	910	1	849	910	1	940	Additive	940
I-75 ML, N of 6th St on-ramp	SB		2765	3235	3922	3942	2	5524	3942	2	4837	Additive	4837
6th St. on-ramp	SB		723	846	512	1000	1	585	1000	1	919	Additive	919
I-75 SB to I-71/75 SB	SB		3488	4081	4433	3942	2	6109	3942	2	5757	Additive	5757
I-71 on-ramp to I-75	SB		3787	4431	2444	1800	2	2684	1800	2	4671	Additive	4671
I-71/75 on Brent Spence Bridge	SB		7275	8512	6877	7884	4	8793	7884	4	10428	Additive	10428
I-71/75 off-ramp to 5th St	SB		901	1054	939	910	1	852	910	1	967	Additive	967
I-71/75 ML, N of off-ramp to Pike/12th	SB		6374	7458	5939	7884	4	7940	7884	4	9459	Additive	9459
Off-ramp to Pike/12th	SB		506	592	421	910	1	420	910	1	591	Additive	591
I-71/75 ML, N of 4th St on-ramp (Covington)	SB		5868	6866	5517	7884	4	7521	7884	4	8870	Additive	8870
4th St on-ramp (Covington)	SB		952	1114	724	1000	1	854	1000	1	1244	Additive	1244
I-71/75 ML, N of 12th St on-ramp	SB		6820	7979	6241	7884	4	8375	7884	4	10113	Additive	10113
12th St on-ramp	SB		452	529	934	1000	1	915	1000	1	510	Additive	510
I-71/75 ML, S of 12th St on-ramp	SB		7272	8508	7174	6900	4	9290	6900	4	10624	Additive	10624
Off ramp at Kyles	SB		939	1099	682	910	1	528	910	1	945	Additive	945
I-75 S of off ramp at Kyles	SB		6333	7410	6492	7884	4	8762	7884	4	9680	Additive	9680
On ramp at Kyles	SB		475	556	552	1000	1	734	1000	1	738	Additive	738
End link I-75	SB		6808	7965	7044	7884	4	9497	7884	4	10418	Additive	10418
Northbound I-75													
Entry Link I-75	NB		5324	6229	6495	5913	3	8234	5913	3	7968	Additive	7999
Off ramp at Kyles	NB		640	749	602	910	1	608	910	1	755	Additive	755
I-75 N of Kyle off ramp	NB		4684	5480	5892	5913	3	7627	5913	3	7215	Additive	7244
On ramp at Kyles	NB		529	619	569	1000	1	392	1000	1	442	Additive	442
I-71/75 ML, S of 12th St off-ramp	NB		5213	6099	6461	5175	3	8018	5175	3	7656	Additive	7686
12th St off-ramp	NB		433	507	987	910	1	762	910	1	282	Additive	282
I-71/75 ML, S of 5th St off-ramp (Covington)	NB		4780	5593	5474	5913	3	7257	5913	3	7376	Additive	7404
5th St off-ramp (Covington)	NB		589	689	503	910	1	379	910	1	565	Additive	565
I-71/75 ML, S of Pike On-ramp	NB		4191	4903	4971	5913	3	6877	5913	3	6809	Additive	6839
Pike St on-ramp	NB		423	495	596	1000	1	772	1000	1	641	Ratio	641
I-71/75 ML, S of 4th St on-ramp (Covington)	NB		4614	5398	5567	5913	3	7648	5913	3	7479	Additive	7479
4th St on-ramp (Covington)	NB		941	1101	1027	1000	1	1284	1000	1	1358	Additive	1358
I-71/75 on Brent Spence Bridge	NB		5555	6499	6595	7884	4	8934	7884	4	8838	Additive	8838
I-71/75 off-ramp to I-71/Second	NB		2174	2544	2111	1800	2	2576	1800	2	3009	Additive	3009
I-75 ML, S of 5th St off-ramp	NB		3381	3956	4484	3942	2	6357	5913	3	5829	Additive	5829

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5th St off-ramp	NB		199	233	729	1820	2	920	1820	2	294	Ratio	294
I-75 ML, S of 6th St off-ramp	NB		3182	3723	3756	3942	2	5436	3942	2	5403	Additive	5535
6th St off-ramp	NB		726	849	680	910	1	713	910	1	882	Additive	882
I-75 ML, S of C-D Road on-ramp	NB		2456	2874	3076	3942	2	4723	3942	2	4521	Additive	4653
C-D Road on-ramp	NB		2845	3329	2718	6732	3	2830	6732	3	3441	Additive	3441
I-75 ML, S of 9th St on-ramp	NB		5301	6202	5794	7544	4	7553	7544	4	7961	Additive	8094
9th St on-ramp	NB		780	913	480	1000	1	425	1000	1	858	Additive	858
I-75 ML, S of Gest St on-ramp	NB		6081	7115	6274	7544	4	7979	7544	4	8820	Additive	8952
Gest St on-ramp	NB		701	820	626	1000	1	519	1000	1	713	Additive	713
I-75 ML, S of Ezzard Charles on-ramp	NB		6782	7935	6899	7884	4	8498	7884	4	9534	Additive	9665
Ezzard Charles on-ramp	NB		369	432	336	1000	1	235	1000	1	302	Ratio	302
I-75 ML, N of Ezzard Charles on-ramp	NB		7151	8367	7236	7884	4	8733	7884	4	9864	Additive	9967
Southbound I-71													
I-71 ML, N of NB I-75 off-ramp	SB		5472	6402	3349	6752	4	3835	6752	4	6888	Additive	6888
I-71 ramp to I-71/75, N of 3rd St on-ramp	SB		2807	3284	1605	3376	2	2068	3376	2	3747	Additive	3747
3rd St on-ramp to I-71/75	SB		980	1147	839	1440	1	615	1440	1	923	Additive	923
I-71 ramp to NB I-75	SB		2665	3118	1744	3864	2	1766	3864	2	3140	Additive	3140
I-71 SB ramp to 6th St	NB		1487	1740	1166	910	1	1176	910	1	1750	Additive	1750
Northbound I-71													
I-75 S/6th Combined to I-71	SB		2940	3440	2107	3864	2	2587	3864	2	3920	Additive	3920
I-71/75 ramp to Second	NB		167	195	323	1638	2	223	1638	2	135	Ratio	135
I-71/75 off-ramp to I-71	NB		2007	2348	1787	1800	2	2354	1800	2	2915	Additive	2874
I-71 ML end link	EB		4947	5788	3894	6752	4	4941	6752	4	6835	Additive	6794
Northbound I-75 C-D Road													
C-D Road, S of 4th on-ramp	NB		1178	1378	579	3864	2	590	3864	2	1389	Additive	1389
4th St on-ramp to C-D Road	NB		1313	1536	1257	1000	1	1292	1000	1	1571	Additive	1571
C-D Road, S of 6th St on-ramp	NB		2491	2914	1836	3864	2	1882	3864	2	2960	Additive	2960
6th St on ramp to C-D Road	NB		521	610	1290	2000	2	1313	2000	2	633	Additive	633
C-D Road, S of NB I-75 off-ramp	NB		3012	3524	3126	8080	4	3196	8080	4	3594	Additive	3594
C-D Road, N of NB I-75 off-ramp	NB		167	195	407	910	1	365	910	1	175	Ratio	152
9th St on-ramp to C-D Road	NB		854	999	505	1000	1	442	1000	1	936	Additive	936
C-D Road, S of NB I-75 off-ramp (9th)	NB		1021	1195	911	2000	2	808	2000	2	1092	Additive	1088
C-D Road, S of Gest on-ramp	NB		241	282	432	910	1	383	910	1	250	Ratio	230
Gest St on-ramp to C-D Road	NB		125	146	40	1820	2	73	1820	2	267	Ratio	267
C-D Road, N of Gest on-ramp	NB		366	428	472	2730	3	456	2730	3	414	Ratio	497
Misc. Cincinnati Ramps													
9th St, E of SB I-75 off-ramp	WB		1151	1347	1437	4400	5	1442	4400	5	1352	Additive	1441
9th St, W of SB I-75 off-ramp	WB		390	456	637	3520	4	592	3520	4	424	Ratio	501
8th to 7th	EB		513	600	315	1860	2	260	1860	2	545	Additive	583
6th to I-75 and 5th St	EB		2142	2506	2311	6060	3	2364	6060	3	2559	Additive	2529
6th to 5th	EB		35	41	466	4040	2	456	4040	2	40	Ratio	161
6th to I-75 S/Second St	EB		851	996	512	1000	1	585	1000	1	1069	Additive	1069
6th to Second	SB		128	150	0	1000	1	0	1000	1	150	Additive	150
6th to I-71 N	EB		1256	1470	1333	1000	1	1323	1000	1	1460	Additive	1460
6th to 6th	WB		858	1004	1452	6060	3	1423	6060	3	975	Additive	1007
NB I-75/I-71 Combined to 6th	NB		2213	2589	1845	2000	2	1890	2000	2	2634	Additive	2634
6th/I-75 N Combined to 6th	WB		3071	3593	3297	6060	3	3312	6060	3	3608	Additive	3639
I-75 S/6th Combined to 5th	EB		420	491	929	4140	3	883	4140	3	467	Ratio	576

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I-75 S/6th Combined to Second	SB		602	704	755	1800	2	787	1800	2	736	Additive	736
2nd St Entry link	EB		100	117	0	819	1	447	819	1	564	Ratio	525
2nd St, W of NB I-71/75 on-ramp	EB		702	821	755	2457	3	1234	2457	3	1300	Additive	1261
Eastbound Approach to 2nd & Elm Intersection	EB		869	1017	1078	4400	5	1457	4400	5	1396	Additive	1396
Misc. Covington Ramps													
4th St, E of NB I-71/75 off-ramp	WB		2054	2403	1782	1560	2	2028	1560	2	2649	Additive	2649
4th St, W of NB I-71/75 off-ramp	WB		1113	1302	755	880	1	744	880	1	1291	Additive	1291
4th St to SB I-71/75 C-D Road	SB		1010	1182	698	1000	1	645	1000	1	1129	Additive	1129
4th St, E of Crescent	WB		103	121	57	1160	1	99	1160	1	209	Ratio	162
Crescent to SB I-71/75 C-D at 4th	SB		149	174	82	1160	1	230	1160	1	489	Ratio	320
Combined 4th St/Crescent to SB I-71/75 C-D Road	SB		1159	1356	780	1000	1	874	1000	1	1450	Additive	1450
SB C-D Road between SB I-71/75 on-ramp and off-ramp	SB		1665	1948	1201	1820	2	1294	1820	2	2041	Additive	2041
SB C-D Road, S of SB I-71/75 off-ramp	SB		713	834	477	910	1	439	910	1	796	Additive	796
SB I-71/75 off-ramp to WB 5th St.	WB		419	490	356	910	1	366	910	1	504	Ratio	430
SB I-71/75 off-ramp to EB 5th St.	EB		482	564	583	910	1	486	910	1	467	Additive	541
5th St E of Crescent	EB		93	109	158	1760	2	391	1760	2	269	Ratio	269
5th St, E of SB I-71/75 off-ramp	EB		575	673	740	1760	2	877	1760	2	810	Additive	810
5th St, E of NB I-71/75 off-ramp	EB		1164	1362	1243	1560	2	1257	1560	2	1376	Additive	1376
2nd St @ Elm St	EB	In	869	1017	1078			1457			1396	Additive	1396
	EB	Out	654	765	1015			1384			1134	Additive	934
	NB	In	106	124	217			580			331	Ratio	331
	NB	Out	304	356	280			653			829	Ratio	761
	SB	Out	27	32	0			0			32	Additive	32
9th St @ Central Ave	SB	In	140	164	0			0			164	Additive	164
	WB	In	1484	1736	1720			1793			1809	Additive	1809
	WB	Out	2005	2346	1715			1746			2377	Additive	2377
	NB	In	758	887	454			438			871	Additive	871
	NB	Out	377	441	459			486			467	Ratio	467
7th St @ Central Ave	EB	In	628	735	834			830			731	Additive	731
	EB	Out	661	773	1012			1070			831	Additive	831
	NB	In	485	567	632			680			615	Additive	615
	NB	Out	452	529	454			438			513	Additive	513
6th St @ Central Ave	WB	In	1490	1743	1932			1930			1741	Additive	1858
	WB	Out	1407	1646	2742			2736			1640	Additive	1640
	NB	In	524	613	1495			1559			677	Additive	677
	NB	Out	423	495	632			680			532	Ratio	532
	SB	Out	218	255	52			74			363	Ratio	363
5th St @ Central Ave	EB	In	619	724	1657			1803			870	Additive	870
	EB	Out	798	934	1101			1146			979	Additive	1026
	NB	In	634	742	1007			981			716	Additive	686
	SB	In	218	255	52			74			363	Ratio	363
	NB	Out	540	632	1495			1559			696	Additive	696
	SB	Out	133	156	121			153			197	Ratio	197
4th St @ Central	WB	Out	1255	1468	1257			1292			1503	Additive	1571
	WB	In	980	1147	1117			1283			1313	Additive	1313
	NB	In	982	1149	1093			981			1037	Additive	1037
	NB	Out	605	708	942			920			686	Additive	686
	SB	In	135	158	69			104			238	Ratio	238
	SB	Out	237	277	79			156			548	Ratio	331

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3rd St @ Elm St	WB	In	1571	1838	2066			1782			1554	Additive	1554
	WB	Out	543	635	1213			1438			860	Additive	830
	WB	Out	980	1147	839			615			923	Additive	923
	NB	In	304	356	280			653			829	Ratio	761
	NB	Out	352	412	265			382			594	Ratio	564
W 4th St @ Philadelphia St	WB	In	1443	1688	1507			1530			1711	Additive	1875
	WB	Out	1919	2245	1782			2028			2491	Additive	2649
	NB	In	403	472	486			423			410	Ratio	430
	SB	In	534	625	455			610			780	Additive	780
	NB	Out	301	352	456			535			413	Ratio	413
	SB	Out	160	187	209			0			0	Additive	23
W 5th St @ Philadelphia	EB	In	1077	1260	1243			1257			1274	Additive	1376
	EB	Out	905	1059	1149			1283			1193	Additive	1143
	NB	In	164	192	0			0			192	Additive	192
	SB	In	195	228	238			340			326	Ratio	200
	NB	Out	393	460	331			314			436	Ratio	436
	SB	Out	164	192	0			0			192	Additive	192
W 4th @ Crescent Ave	WB	In	96	112	57			99			195	Ratio	162
	EB	Out	280	328	82			230			919	Ratio	320
	NB	In	395	462	0			0			462	Additive	462
	SB	In	177	207	240			620			535	Ratio	375
	NB	Out	415	486	413			465			547	Ratio	547
	SB	Out	113	132	0			0			132	Additive	132
W 5th @ Crescent Ave	WB	In	390	456	356			366			469	Ratio	430
	EB	Out	86	101	0			0			101	Additive	269
	NB	In	53	62	0			0			62	Additive	175
	SB	In	113	132	0			0			132	Additive	132
	NB	Out	395	462	0			0			462	Additive	428
	SB	Out	75	88	0			0			88	Additive	40
I 75 N ramp @ Pike St	EB	In	368	431	572			681			513	Ratio	513
	WB	In	559	654	729			879			804	Additive	777
	EB	Out	409	479	592			711			575	Ratio	575
	WB	Out	540	632	665			835			802	Additive	802
	NB	In	445	521	552			759			728	Additive	728
	NB	Out	423	495	596			772			641	Ratio	641
I 75 N ramp @ 12th St	EB	In	342	400	290			627			865	Ratio	865
	WB	In	537	628	850			867			645	Additive	645
	EB	Out	580	679	840			819			658	Additive	754
	WB	Out	285	333	735			678			308	Ratio	308
	NB	In	433	507	987			762			282	Additive	282
	NB	Out	447	523	552			759			730	Additive	730
I 75 S ramp @ Pike St	EB	In	264	309	544			663			376	Ratio	376
	WB	In	590	690	665			835			860	Additive	860
	EB	Out	356	417	572			681			496	Ratio	496
	WB	Out	668	782	570			650			862	Additive	836
	SB	In	713	834	477			439			796	Additive	796
	SB	Out	543	635	543			608			700	Additive	700

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I 75 S ramp @ 12th St	EB	In	119	139	229			503			306	Ratio	399
	WB	In	244	285	735			678			263	Ratio	325
	EB	Out	391	457	290			627			989	Ratio	850
	WB	Out	59	69	283			247			60	Ratio	60
	SB	In	539	631	543			608			696	Additive	696
	SB	Out	452	529	934			915			510	Additive	510

APPENDIX E
LOAD RATING AND FATIGUE STUDY

BRENT SPENCE BRIDGE
(I-75/I-71 Over OHIO RIVER)

Report On

Load Capacity Rating and Fatigue Life Analysis

Submitted to
Kentucky Transportation Cabinet

Ohio Department of Transportation

Prepared by

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June 2004

BURGESS & NIPLE

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Introduction

Purpose

This is a report of the load capacity rating and fatigue life analysis of the main truss members of the Brent Spence Bridge. It is to assist the Constructibility and Feasibility Study team as they identify various alternatives for the future of this bridge. Over 20 years ago, in 1983, a similar study of this bridge was made by Modjeski and Masters. The primary goals of this study are to verify the results of the 1983 load capacity rating and to predict the remaining fatigue life of the primary truss members of the main river spans. This study also installed electronic strain gages at key locations on the primary truss members to verify the mathematical analysis with actual response to traffic loads.

Location

The Brent Spence Bridge carries I-75 and I-71 between Covington, Kentucky and Cincinnati, Ohio over the Ohio River (Figure 1). The bridge number is 06-059-0075-B00046 (MP 191.411).

General Description

The main spans consist of a three span, double deck, cantilevered through truss 1736'-6" in length (453' anchor spans and 830'-6" main span). The trusses are spaced 53'-0" on center with 46'-0" clear between parapets. The truss spans are currently configured to carry four 11'-0" lanes of traffic on each of the upper (southbound) and lower (northbound) decks. The majority of the truss members are riveted or bolted built-up steel members. Steel eyebars are present in the upper chords over the towers (See Figures 2 and 3A – 3C).

History

The bridge was designed by Modjeski and Masters, Harrisburg, Pennsylvania in 1961, and erection was completed in 1963. The truss and approach structures were originally configured to carry six lanes of traffic, and the design load was HS20-44. The original deck received an overlay in 1977. In 1985, the Kentucky approach spans were widened and the roadway reconfigured to carry an additional lane of traffic on both decks. Some truss members were strengthened at that time. The deck received a second overlay in 1998.

Figure 1. Elevation of main truss spans of Brent Spence Bridge facing upstream

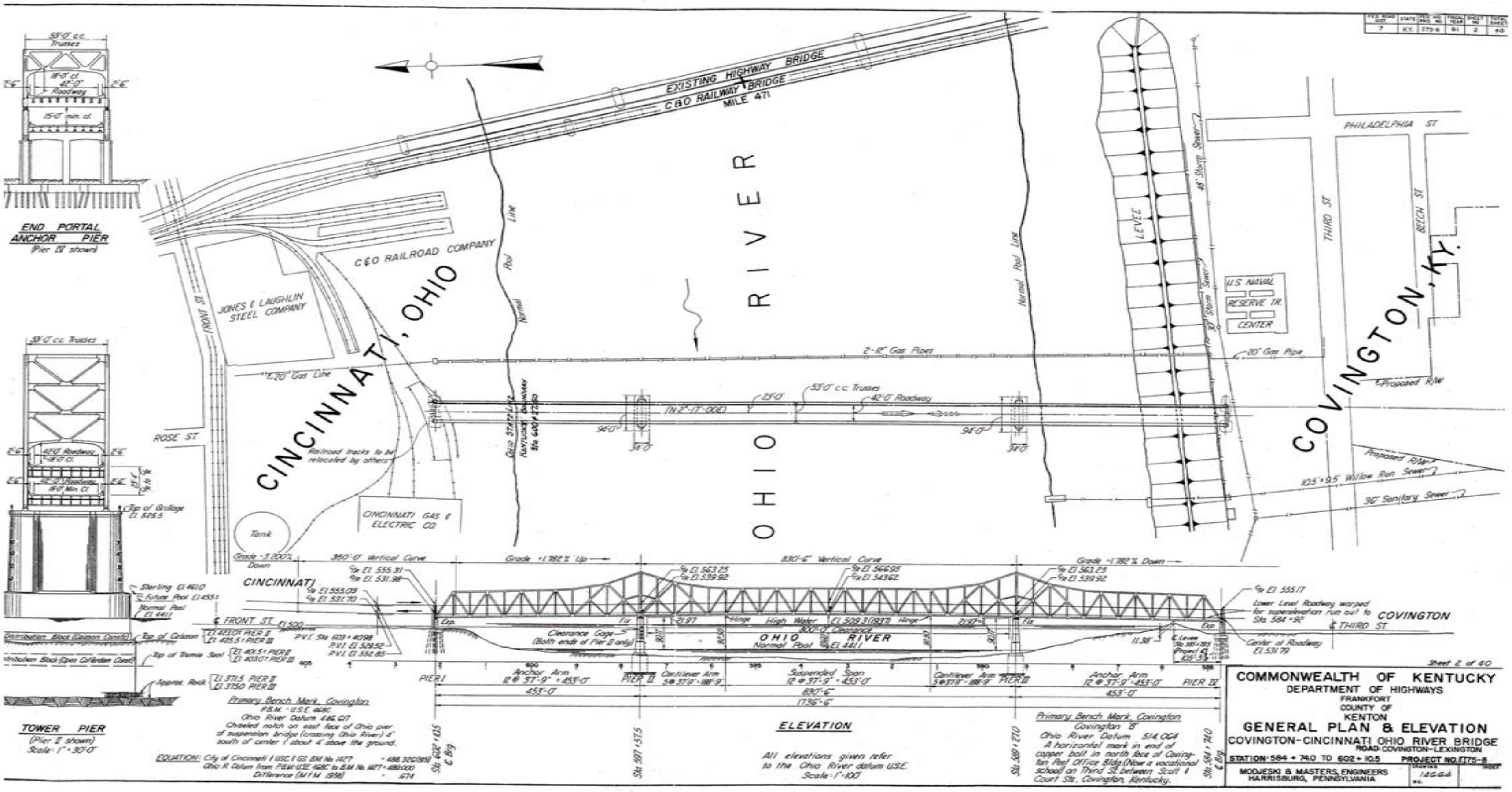

Figure 2. Plan and elevation of truss spans

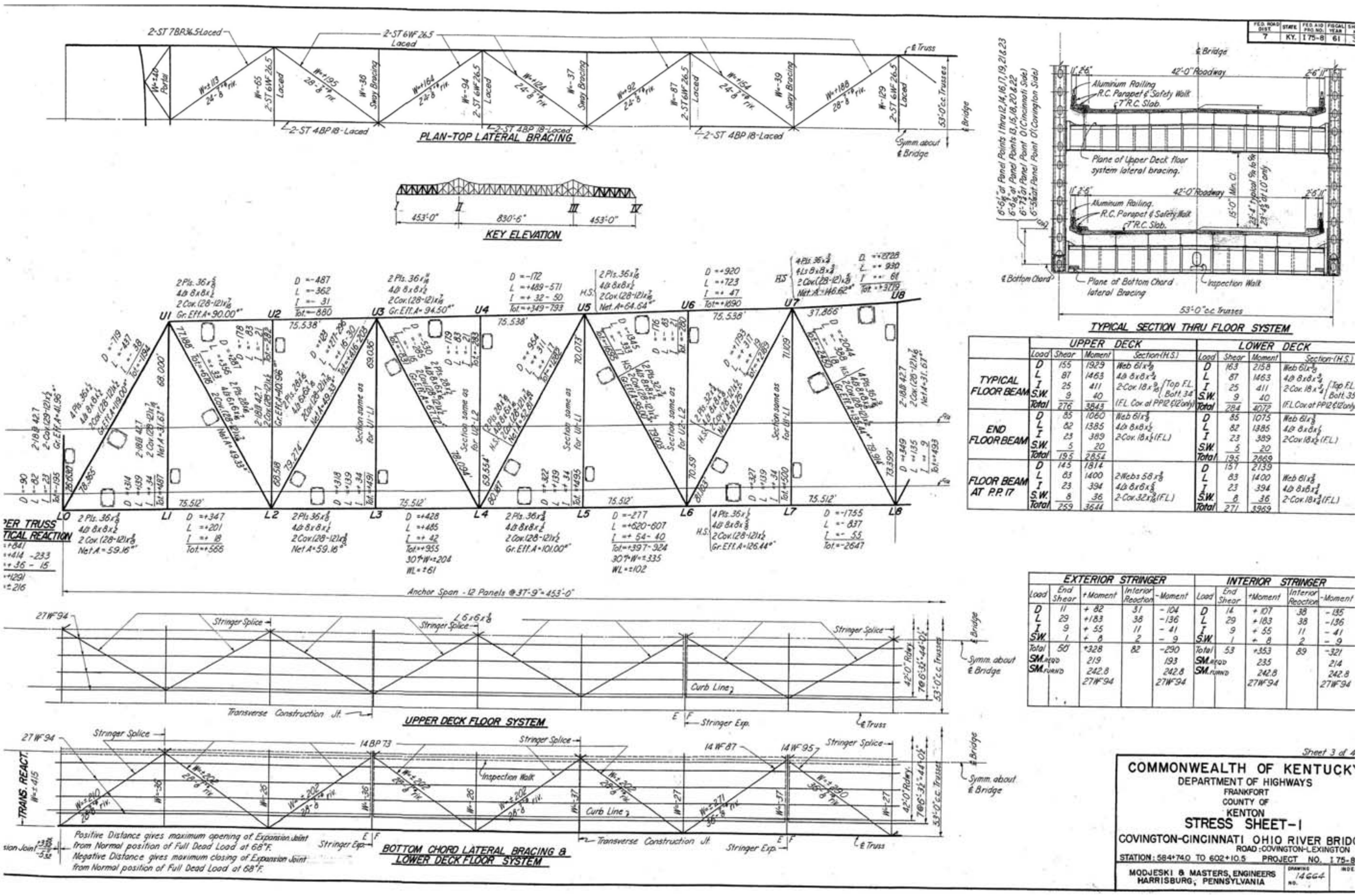

Figure 3A. Stress sheet for truss anchor spans

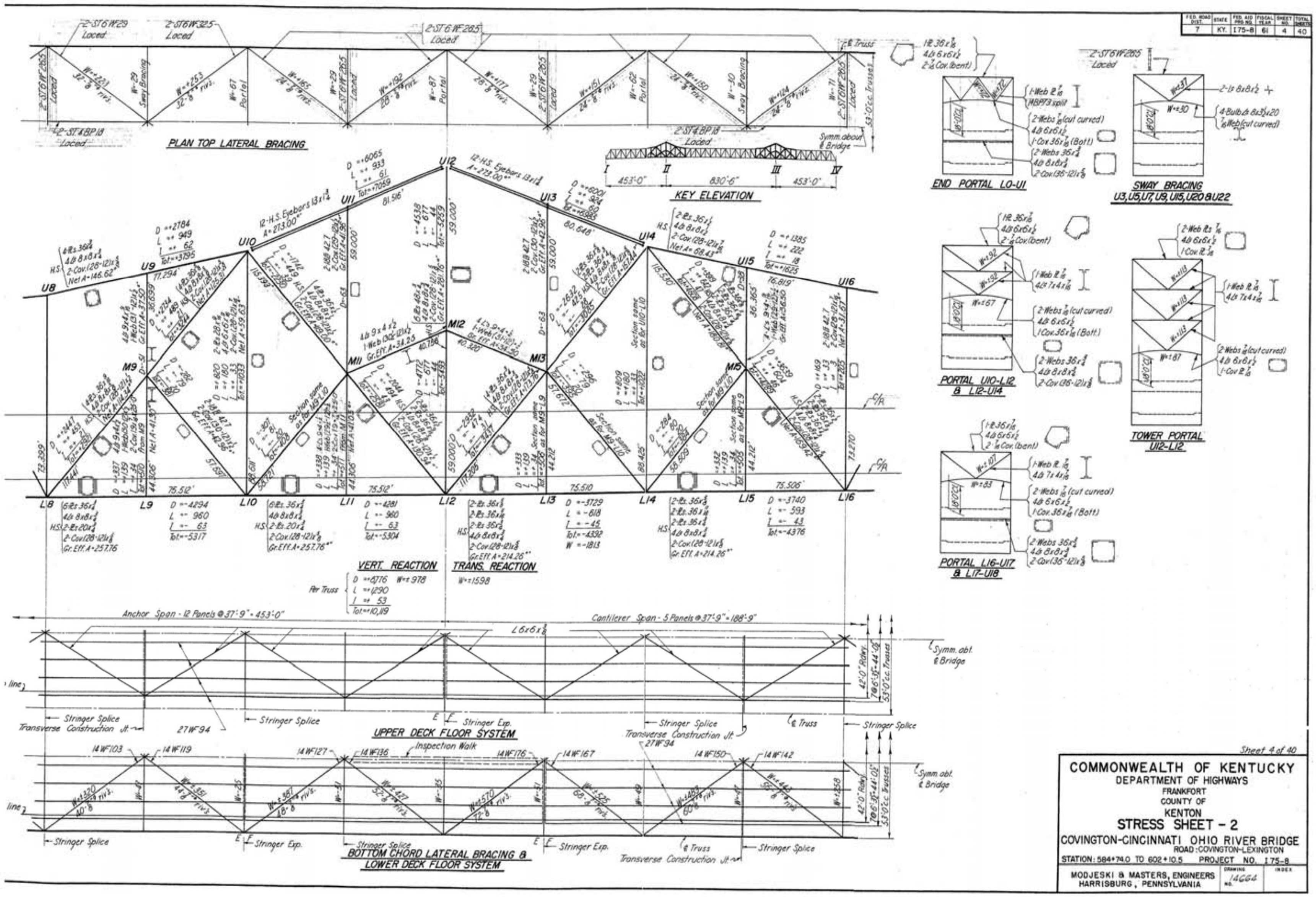

Figure 3B. Stress sheet for truss cantilever spans

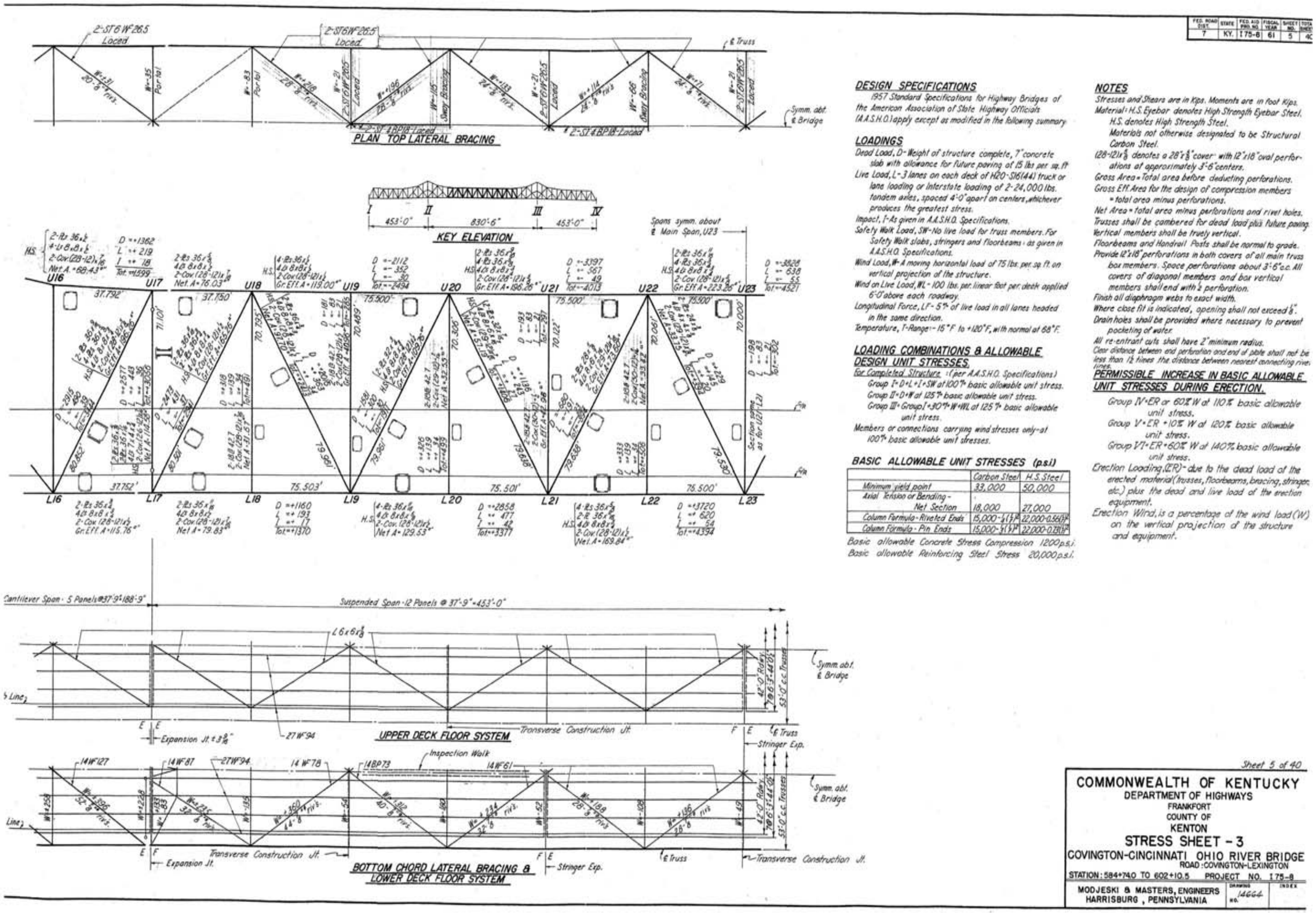

Figure 3C. Stress sheet for truss suspended span

Study Scope

Load Capacity Rating

- Load capacity rating is a mathematical process which calculates the loads applied to the various members of a bridge. These loads are compared with the safe capacity of that member. Load capacity ratings for individual members are expressed as the "HS" number. The generally accepted "HS" number for the design of new bridges that carry interstate highways is 20. That live loading (traffic load) is designated "HS20-44." It consists of either a standard truck in each traffic lane or a concentrated load plus uniform lane load. For each member of a bridge analyzed, the maximum live traffic load is computed and reported as an "HS" number. Thus, a member rated as "HS-10" would be capable of carrying traffic loads 50 percent of the standard HS20-44 loading. A member rated as "HS-24" would be capable of carrying traffic loads 120 percent of the standard HS20-44 loading.
- The load capacity rating was performed in accordance with the guidelines in *AASHTO Standard Specifications for Highway Bridges, 17th Edition* (2002), *AASHTO Manual for Condition Evaluation of Bridges* (1994) and applicable interim revisions, and *AASHTO Guide Specifications for Strength Design of Truss Bridges (Load Factor Design) (1985)* and applicable interim revisions.
- Load capacity rating results are provided for each of the main truss members using the Load Factor Method. The floor system, secondary members, substructure, and approaches were not RATED.
- The truss members are rated in relation to the HS 20-44 vehicle and lane loads. Light rail and other types of vehicle loads were not considered.
- A mathematical model of the trusses was generated to perform the load capacity rating. This model was also used to generate stress ranges and other information for use in the fatigue analysis. STAAD computer software was used to perform the computations.
- Member section properties are based on the design, shop, and rehabilitation drawings. Inspection reports indicated that no significant section loss exists that reduces the capacity of the truss members. The relevant drawing sets are the 1961 Superstructure Drawings (KYTC Bridge Drawing Number 14664), the 1962 Superstructure Shop Drawings, and the 1985 Superstructure Rehabilitation Drawings (KYTC Bridge Drawing Number 20950).

Fatigue Life Analysis

- Fatigue is defined as the tendency of a member to fail at a lower stress when subjected to cyclic loading than when subjected to static loading. Failure by fatigue is the cracking of steel after the application of many cycles of stress. Two primary factors are involved, namely the number of stress cycles and the range of the stress. The configuration of the steel detail, such as a riveted joint, is also an important consideration.
- Using the mathematical model for load capacity rating, truss members with the highest stress ranges were identified.
- Electronic strain gages were installed on these members.
- For elastic materials like steel, strain is directly proportional to stress, thus measured changes in strain relates directly to changes in stress.
- Calibration load tests were performed using two trucks of known weight while the bridge was closed to other traffic.
- The strain gage data was compiled and used to predict the remaining fatigue life in accordance with *AASHTO Guide Specifications for Fatigue Evaluation of Existing Steel Bridges*.
- Strain gage readings were collected for two weeks under normal traffic, after calibration.

Subconsultants

Two subconsultants assisted Burgess & Niple (B&N) in performing the work. Drexel Infrastructure Institute (Drexel University, Philadelphia) furnished the strain gage data acquisition equipment and processed the strain gage data. Intech Contracting, LLC, furnished AC power and the two loaded dump trucks used as calibration vehicles.

Truss Load Capacity Rating

Analysis Methodology

Dead loads were calculated based on 1961 contract drawings and 1962 shop drawings and adjusted for changes indicated by the 1985 rehabilitation plans. In addition, an allowance for future paving of 15 pounds per square feet was included. HS20-44 live loads were applied in accordance with *AASHTO Standard Specifications for Highway Bridges* (AASHTO). Two, three, and four lanes of live load were considered for each deck. As these equate to four, six, and eight lanes on the bridge, a 25 percent reduction was imposed per AASHTO 3.12.1 to account for the improbability of all of the lanes being loaded concurrently with trucks. The lanes were loaded so as to generate the maximum stresses in the truss members. Appendix A contains the calculations for the distribution factors used in this analysis. Impact factors were generated per the provisions of AASHTO 3.8.2.

A plane frame mathematical computer model was generated using “STAAD” software. The lower and upper deck members were modeled as beams with member end releases so only vertical loads were transmitted to the truss members. Truss members were designated as such in the model, permitting only axial tensile and compressive forces in those members. Releases were used to model the sliding lower and upper chord members at the ends of the suspended span.

Bearings were modeled as pin and roller supports. Although the truss geometry is symmetric about the middle of the bridge, the full truss was modeled to avoid any unintended consequences from presumed mid span boundary conditions. Dead loads were applied at lower and upper chord panel points. Truck and lane loads were modeled on the lower and upper deck members. Member properties were based on what the original contract drawings referred to as gross effective areas (gross area minus the area of perforations). The load rating results are based on either the gross effective area or effective net area (gross effective area minus the area of bolt and/or rivet holes) for compression and tension-controlled members, respectively.

The axial compressive and tensile capacities of the members were calculated in accordance with the *Manual for Condition Evaluation of Bridge*s and the *Guide Specifications for Strength Design of Truss Bridge*s. Bending due to self-weight was not used to evaluate member capacity since axial forces due to applied dead and live loads were significantly greater than such secondary effects.

The load rating results were generated with the following equations:

$$\text{Inventory Rating Number:} \quad \frac{(\text{Member Capacity} - 1.3 \times \text{Dead Load})}{(1.3 \times 5/3 \times \text{Live and Impact Loads})} \times (20), \text{ and}$$

$$\text{Operating Rating Number:} \quad \frac{(\text{Member Capacity} - 1.3 \times \text{Dead Load})}{(1.3 \times \text{Live and Impact Loads})} \times (20),$$

where the Live and Impact Loads are due to the HS20-44 traffic loads.

These equations follow the rating methodology of the Load Factor Design Method. For both Inventory and Operating rating levels, dead loads are increased by 30 percent. Live loads are increased by 117 percent at the Inventory level and 30 percent at the Operating level. It should be noted that the method followed in the Modjeski and Masters report used a 50 percent increase for dead loads and a 100 percent increase for live loads. Due to the differences in load factors, members resisting a greater portion of dead load rate higher under the methodology followed in this report than in the 1983 report, and members resisting a greater portion of live load rate lower in this report.

Load Capacity Rating Results

The load capacity rating analyses indicate the structure is adequate for two, three, or four lanes of HS20-44 traffic per deck at both Inventory and Operating levels. Ratings are given in terms of HS20-44 ratings, i.e., a member with a rating number of 20.0 can safely carry an HS20-44 vehicle at the desired Inventory or Operating rating level. Inventory ratings indicate the largest vehicle that can safely utilize the structure for an indefinite period of time. An Operating rating is the maximum permissible vehicle load that may utilize the structure. These vehicles would likely cause deterioration to the bridge if permitted to cross frequently. Both Inventory and Operating ratings are measures of the strength of the bridge and do not indicate fatigue characteristics.

Appendix B contains the Inventory and Operating ratings for the four-lanes-per-deck alternative. Ratings for the two-and three-lanes-per-deck option are not provided, as they are significantly greater than the four-lanes-per-deck arrangement.

These results indicate that the members of the truss possess sufficient strength to safely carry four lanes of traffic per deck.

Fatigue Life Analysis

Introduction

The objective of this task was to determine the remaining fatigue life of the main truss span members through a field measurement of actual live load strains. A structural analysis per *AASHTO Guide Specifications for Fatigue Evaluation of Existing Steel Bridges* (AASHTO Guide Specifications) was initiated. In accordance with the scope of services, main truss members identified to be fatigue critical (those with the highest computed stress ranges) from the load capacity rating analysis were to be instrumented. The governing fatigue detail for these members is rivet holes classified as Category D.

Previous studies performed on a variety of bridge types have shown that live load stress ranges can be substantially overestimated. This is due to load paths that are not accounted for in the analysis. The purpose of this field measurement was to obtain and measure the actual live load stress variations under traffic. This method is recognized as one of the alternative methods in the AASHTO Guide Specifications for determining the nominal stress range of bridge members for fatigue evaluation. Alternative 1 in Section 2.1 of the AASHTO Guide Specifications was used. This method involves using field measured stresses to develop stress range histograms for critical details. More information about this methodology is described below.

Previous Studies

A previous structural rating and fatigue analysis, dated 1983, was performed by Modjeski and Masters (M&M) for H. W. Lochner, Inc. This analysis was performed in accordance with the fatigue specifications applying to new bridges and was prior to the issuance of the AASHTO Guide

Specifications, which was issued for the first time in 1990. The analysis performed by M&M indicated that Truss Members L2-L4, L4-L6, U3-U5, U5-U7, U1-L2, and L2-U3 had the highest live load stress ranges and, using the methodology at the time, exceeded the allowable stress ranges for riveted members. It was recommended that these members be closely inspected in the future and also that the rivets in Member U5-U7 be replaced with high-strength bolts. The rivet replacement work was subsequently performed. (See Figure 4 for truss member identification.) It was also recommended that member U5-U7 be instrumented. The instrumentation work was subsequently performed by the University of Kentucky and reported January 31, 1985. The results of the instrumentation were considered inconclusive due to equipment problems encountered during field measurement.

Analysis Methodology

The evaluation of the remaining fatigue life for any steel bridge detail is based on the following three factors:

- Fatigue strength of the detail.
- Measurement of cyclic loading to which the detail is subjected.
- Loading history prior to time of evaluation.

The fatigue strengths of various steel details are specified by the AASHTO S_r-N curves where S_r is the constant-amplitude stress range and N is the total fatigue life in terms of the number of stress cycles. For each fatigue detail under the constant-amplitude cyclic loading, there is a stress range threshold named the "fatigue limit," or S_{FL}, below which the detail can survive for an infinite number of stress cycles without failure. For details that are subjected to variable-amplitude cyclic loading, an equivalent, or effective, constant amplitude stress range, S_{re}, is determined to represent the stress-range histogram that measures the variable amplitude cyclic loading.

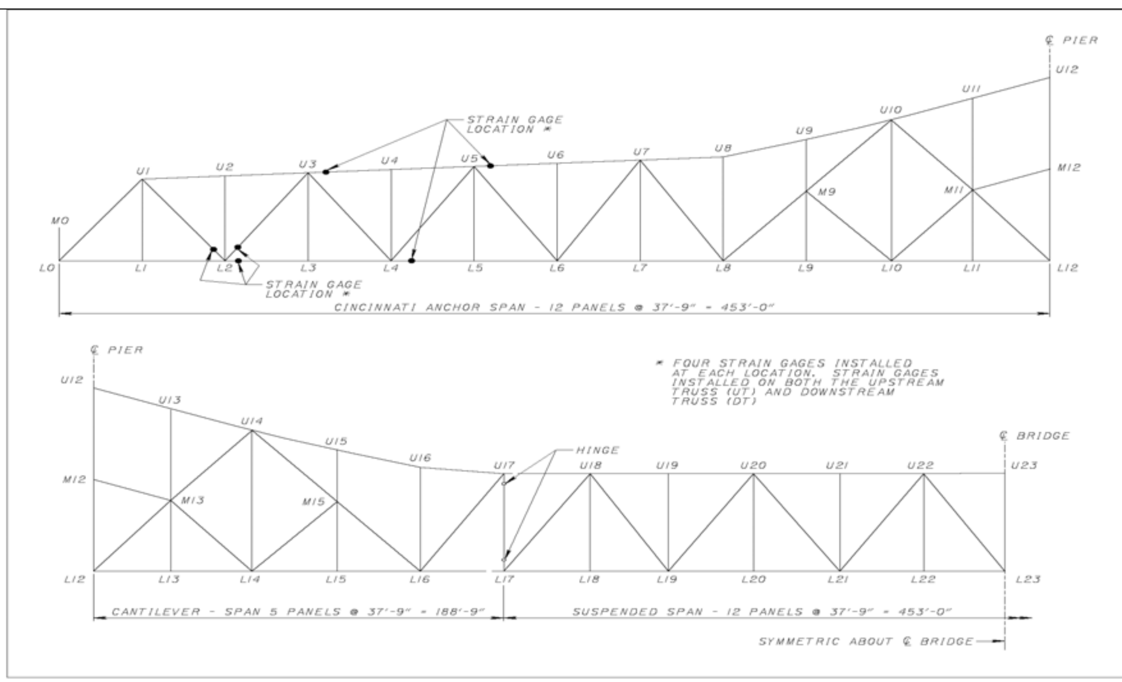

Figure 4. Truss member identification with strain gage locations noted.

In the AASHTO Guide Specifications, the equivalent stress range is specified as the root-mean-cube of the stress range histogram:

$S_{re} = [(\sum f_i S_{ri}^3)]^{1/3}$
Where S_{ri} is the i^{th} stress range in the stress range histogram
$f_i = n_i/N$, fraction of occurrence of stress range S_{ri} in the histogram
n_i = number of occurrence of stress range S_{ri}
N = total number of occurrence of all stress ranges in the histogram.

The procedure for determining the remaining fatigue life and typical form of a stress range histogram for highway bridge members is as shown on Figure 5. The cycle count generally decreases as the magnitude of the stress range increases in the histogram. Additionally, the cycle count of the smallest stress range is usually significantly higher than that of all other stress ranges.

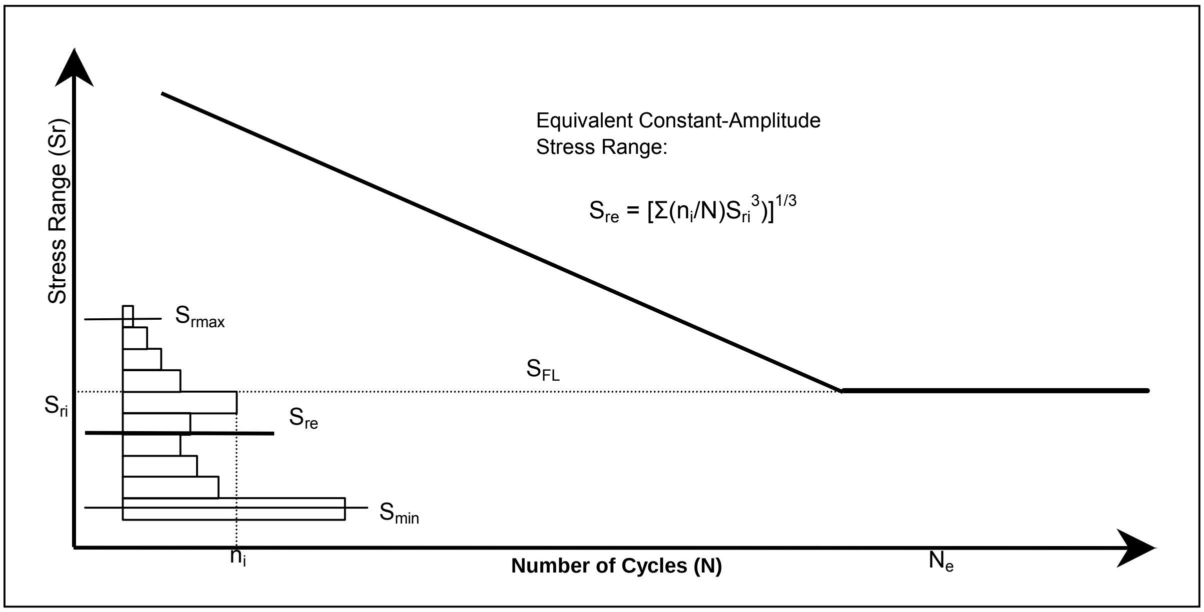

Figure 5. Fatigue Life Schematic

The actual output from strain gages includes many high-frequency, low-amplitude fluctuations due to electrical noises, secondary vibrations or light vehicles. Inclusion of cycle count for these signals in the stress range histogram will result in a lower equivalent stress range, and hence, overestimate the fatigue life. Therefore, the stress range histogram needs to be truncated at a certain level of stress range so that the cycles of smaller magnitude are excluded for fatigue evaluation.

A careful examination of the strain recordings from the calibration test indicates that the magnitude of noise signal fluctuation not caused by the live load is approximately 8 microstrain. This corresponds to 0.25 kilo pounds per square inch (ksi) of stress range. The truncation stress range chosen was 0.25 ksi.

After the equivalent constant-amplitude stress range, S_{re}, is determined from a measured stress range histogram for a member, the total fatigue life of the member can be determined based on a suitable S_r-N curve specified by AASHTO. Since all bridge elements in this fatigue evaluation are riveted members (except for Member U5-U7, where the rivets have been replaced with bolts), Category D is the governing type of fatigue detail.

In accordance with the AASHTO Guide Specifications, the remaining fatigue life is infinite and no further fatigue calculations are required if:

(a) $R_sS_{re} > S_{FL}$, or
(b) $2R_sS_t > S_c$

where: R_s = reliability factor associated with calculation of stress range
S_{re} = root-mean-cube equivalent constant-amplitude stress range from a measured stress range histogram under normal traffic
S_{FL} = limiting stress range for infinite fatigue life
S_t = tension portion of stress range
S_c = compressive dead load stress

The AASHTO Guide Specifications specify 2.6 ksi as the limiting stress range for infinite fatigue life for Category D detail. The reliability factor for non redundant members through field measurements under normal traffic is specified as $R_s = (0.85)(1.75) = 1.4875$. Since all the members considered in this study are primarily in tension under the dead and live loads, the remaining fatigue life of a riveted member is infinite if:

$$1.4875S_{re} < 2.6 \text{ ksi}$$

or

$$S_{re} < 1.74 \text{ ksi.}$$

Field Test

Strain Gage Layout

Critical members for instrumentation were selected based on an analysis that computed member stress ranges for AASHTO HS20-44. The analysis indicated that members near the end of the truss anchor spans, including those identified by Modjeski and Masters in 1983, are subjected to the highest stress ranges under live loads. Therefore, the field measurement was limited to these members. The truss portion of the bridge is symmetric, so members at the Ohio or Kentucky ends of the bridge could be selected for instrumentation. It was decided to install the instrumentation at the Ohio end of the bridge because of ease of access, availability of AC power, and line of sight for wireless transmission of data to B&N's Cincinnati office. Strain gages were installed on the corresponding members of the upstream (east) and downstream (west) trusses.

Weldable strain gages with a nominal resistance of 350 Ω were used in quarter-bridge configuration for the strain measurements (Figure 6). A total of four gages was installed on each truss member. Each set of four gages was installed near the end-point of the truss member, with each gage attached to one of the four interior faces of the box-shaped member. The top and bottom faces of the member are designated as "flange" members. These faces contain 12" x 18" perforations at 3'-6" centers. On these faces, the strain gages were installed between the perforations. On the side faces of the truss members, designated the "webs," the strain gages were installed along the mid point of the web plate. The web plates do not contain perforations. Since the purpose of the instrumentation was to measure the nominal average tensile or compressive strain and stress ranges in the truss members, the installation of one gage per truss member would have been acceptable. It was decided to install two web gages to confirm the uniformity of strain and stress across the member cross section. Flange strain gages were also installed to measure stress variations around the perforations. A photograph of the typical strain gage layout on a truss member is shown on Figure 7.

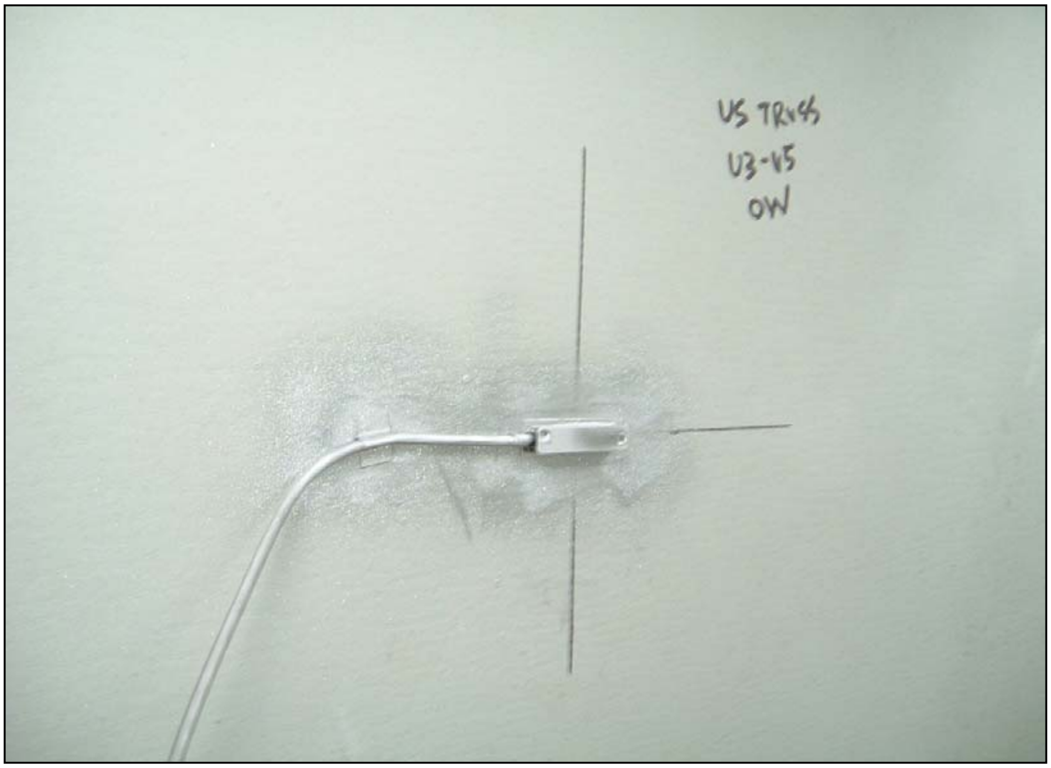

Figure 6. Typical Weldable Strain Gage

Figure 7. Weldable Strain Gages in Diagonal Truss Member

Instrumentation and Data Acquisition

Strain gage installation was performed from April 19 through April 28, 2004. Access to the strain gage installation locations was made using a manlift from below the bridge and using climbing methods. All of the strain gage and wiring installation was made without lane closures or otherwise disrupting traffic. All gages were connected to a data acquisition system placed on the lower chord under the bridge deck near Panel Point 3 (Figure 8). The data acquisition system used was a Model MEGADAC 3415 unit from Optim Electronics, Inc. A wireless local area network (WLAN) was set up between the data acquisition unit and a host computer at B&N's Cincinnati office. Aironet 350 wireless bridges from Cisco Systems were used to create the WLAN. The WLAN enabled the strain gage data to be transferred from the data acquisition unit to the host computer for processing and archival. A schematic of the data collection system is shown on Figure 9.

Strain signals from all channels were recorded in a time history format, or strain variation versus time. Data recording under normal traffic started on May 3 and ended on May 19, 2004. AC power was supplied throughout the test period.

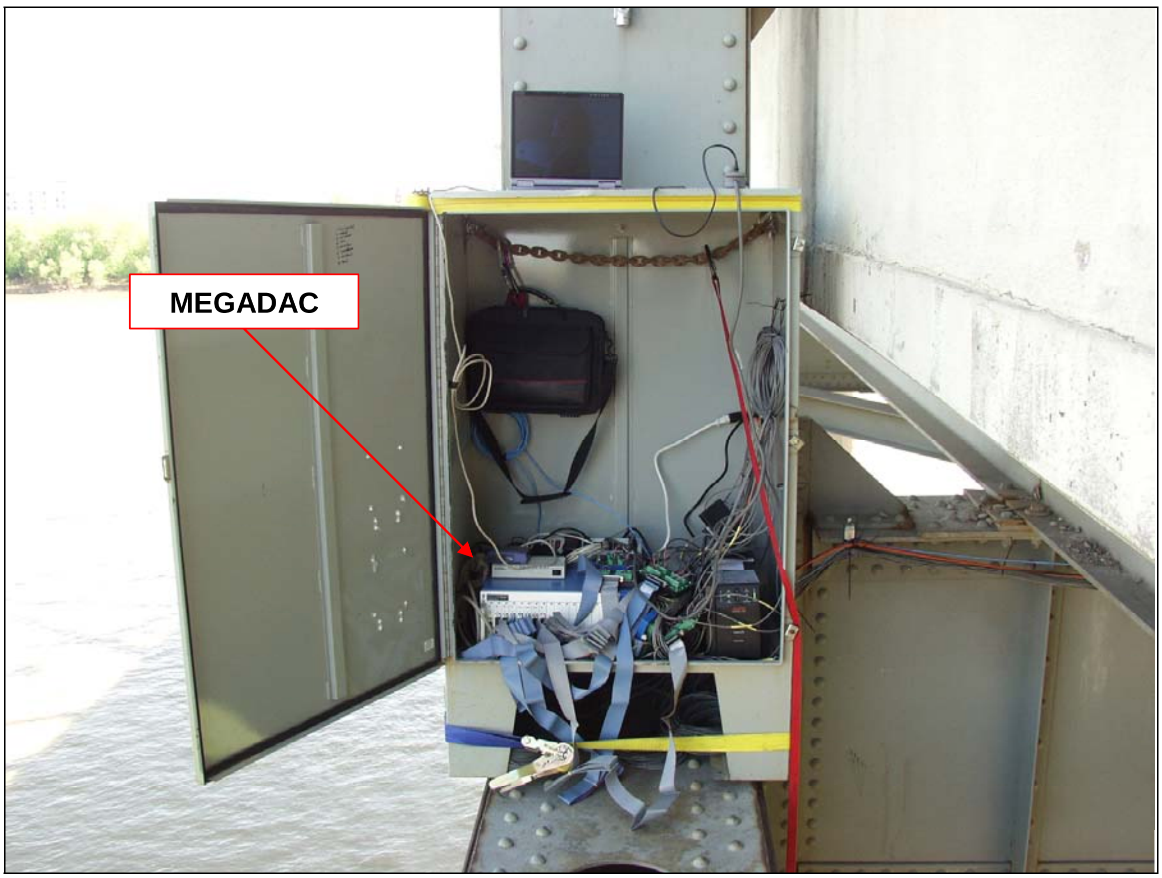

Figure 8: Data Acquisition Cabinet on Lower Chord

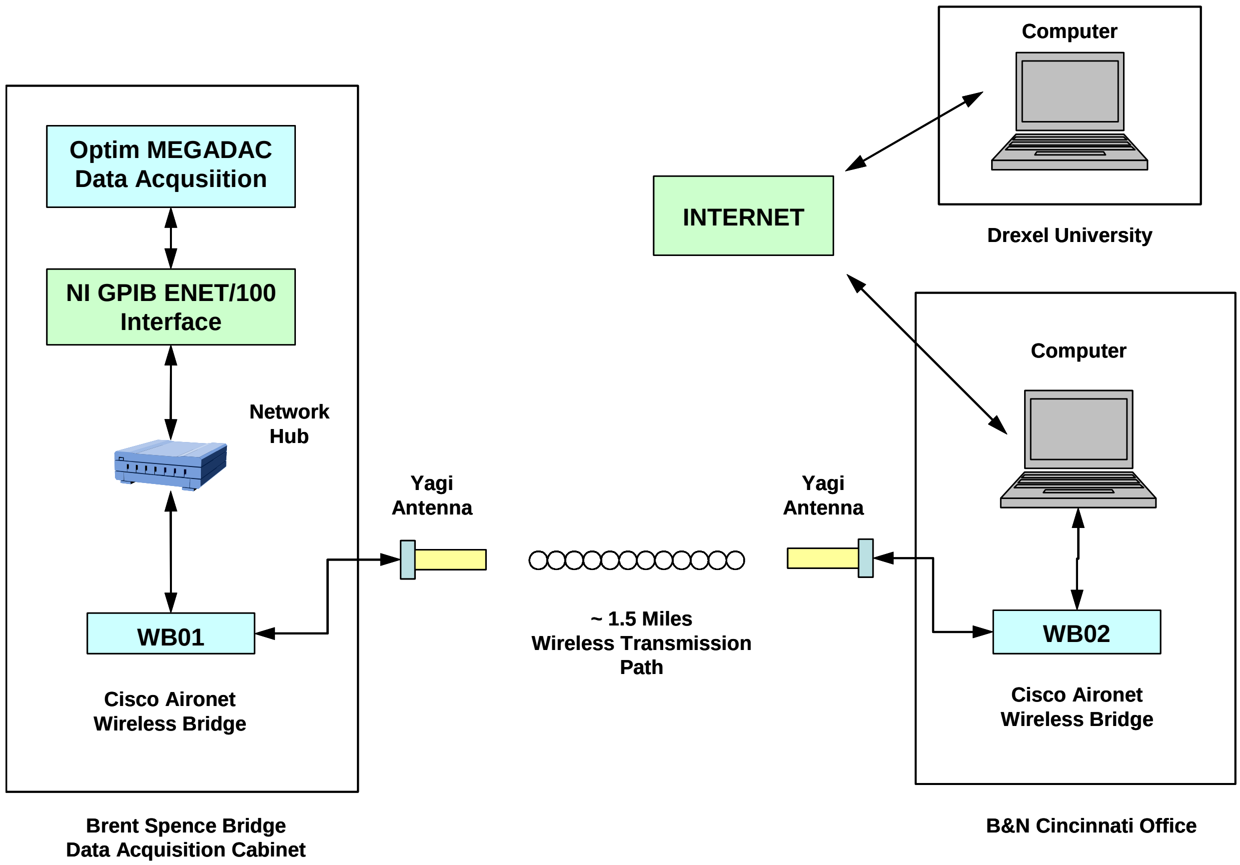

Figure 9. Data Acquisition Schematic

Calibration Test Runs

The strain gages record actual strain variations in the instrumented members under normal traffic. The vehicles crossing the bridge vary in weight and lateral positions as well as combinations. Consequently, a relationship between the measured strain in the member and the vehicular loading on the bridge deck is nearly impossible to establish without calibration tests using test trucks of known weight and axle configuration.

Calibration tests were performed during the evening of April 29, 2004. Two loaded dump trucks were used as the calibration vehicles**.** The gross weights of the trucks were 65,220 and 68,700 pounds, respectively. Each was a four-axle truck with the forward rear axle raised. Truck dimensions are shown in Appendix C.

The calibration test was performed from approximately 12 a.m. to 3 a.m. on April 30, 2004, in two phases. During each test phase, Covington and Cincinnati Police Departments blocked all traffic except the two test vehicles. The first phase was conducted on the upper deck. The first test consisted of four test runs of a single calibration truck crossing the bridge in each of the four upper deck lanes. The calibration truck crossed the bridge at a speed of approximately 35 mph in each test run. The second test was a quasi-static load test utilizing both test trucks. Both trucks traveled the length of the truss spans at a very slow speed, stopping at every other panel point for approximately five seconds. The trucks were positioned side by side and traveled first in the two western lanes followed by the two eastern lanes. The second phase was conducted on the lower deck with identical tests as on the upper deck. Graphic depictions of the calibration load test runs are shown in Appendix C.

Field Test Results

Calibration Tests

Dynamic Load Tests

Results from the dynamic load tests are shown in Appendix D. Each plot represents live load stress readings from the four gages at a member during the passage of one loaded test truck across the bridge in one of the eight travel lanes. The stress plots are useful to establish the distribution of loads among the various members during the passage of a test truck of known weight and additionally the magnitude of the highest live load stress.

Several conclusions can be drawn through examination of the calibration test results:

- The “web” plate live load stresses are higher than the “flange” plate stresses. This is an indication that the axial stress flow tends to bypass the portion of the member between the perforations. As a result of this information, only the (higher) web plate stress range readings are included in the formulation of the stress range histograms.
- The live load stresses are significantly lower for a single truck loading than would be computed by conventional analysis. The maximum recorded live load stress range in any of the truss members for a single 65,000+ pound test truck is less than 1 ksi.
- The relative magnitude of measured live load stresses among the primary truss members is comparable to those that were computed.

Quasi-Static Load Tests

Four sets of results are presented in Appendix E. Each set of results summarizes the data collected in each of the four quasi-static load tests. Each test consisted of two loaded dump trucks side-by-side, stopping at every other panel point. Four such tests were run, two on the upper deck and two on the lower deck, with the two trucks positioned side by side in the outside two lanes.

The tests results are presented as influence lines, showing the average live load stress measured for each of the four gages on each truss member.

While the magnitude and position of the loads from the quasi-static load tests are different than the dynamic tests, examination of the live load stress results indicates that the same conclusions can be drawn.

Comparison of Predicted and Field Test Results

A comparison was made of predicted and field test results. The computed average stresses in each truss member were compared with the web plate stresses measured from the quasi-static load test results. The computed stresses were derived from the same mathematical truss model used for the load rating, but using the same truck weights and positions as used in the quasi-static load tests (two loaded dump trucks side-by-side). In order to remove influences of load distribution between the two truss lines, stresses from like members from the upstream and downstream trusses were added, and then compared. Results from these comparisons are shown in Appendix F, and are summarized below.

	Stress Ratio Predicted / Measured		
Member Type	**High**	**Low**	**Average**
Lower Chord	2.08	1.51	1.80
Diagonal	1.39	1.02	1.15
Upper Chord	1.24	1.05	1.13

Differences between the predicted and measured stress results are expected and can be attributed to limitations and assumptions inherent in the mathematical model. The most notable differences are in the lower chord members. These differences are probably due to the significant participation of the upper and lower deck systems in carrying load, which is not accounted for in the mathematical model.

Stress Range Histograms

As previously described, the determination of fatigue life is made by measuring truss member strains under normal traffic and establishing stress range histograms from the collected data. Strain gage readings were collected for approximately two weeks under normal traffic. Stress range histograms were established for each instrumented truss member, representing approximately 311 hours of data measurement.

The stress range histogram categorizes measured stress ranges into a discrete number of ranges, or "bins." Peaks and valleys in the strain history are detected using an algorithm called the rainflow counting method. This method determines the cycle counts associated with each stress range measurement. Twenty bins with a bin size of 0.25 ksi were established, ranging from a minimum of 0.25 ksi to a maximum of 5.25 ksi. After reviewing the stress range, truck count and calibrations test data, it was decided to not count any stress ranges less than 0.25 ksi, as these would be associated with automobile traffic and member vibrations associated with general atraffic along the length of the bridge.

Table 1 contains the stress range cumulative results for all of the gages for entire data collection period of 311 hours. The root-mean-cube (RMC) equivalent constant-amplitude stress range, S_{re}, is shown for each gage. The maximum equivalent stress range computed from the field measurements occurred in Member U5-U7 and is 1.34 ksi. This stress range is less than the AASHTO Guide Specifications limit of 1.74 ksi for infinite fatigue life.

After the April 30, 2004 testing with known live loads, data due to actual traffic was collected for two more weeks. This data confirms the results of the fatigue life analysis and shows that the primary members of the main truss have an indefinite fatigue life. No fatigue failure with the current stress ranges is predicted to occur in the foreseeable future.

Conclusions

The results of the load rating indicate that the primary truss members are suitable for safely carrying four lanes of HS20-44 loading on each deck. The lowest inventory rating is Member U5-U7 with a rating of HS21.0-44. All truss members exceeded a rating of HS25-44 except Members U5-U7, L2-L4, and L6-L8.

Results of the instrumentations and fatigue analysis indicate that the primary truss members have an infinite fatigue life.

Units = ksi												
CENTER OF STRESS RANGE BIN	CUMMULATIVE CYCLE COUNTS											
	UT_L2L4	DT_L2L4	UT_L4L6	DT_L4L6	UT_U1L2	DT_U1L2	UT_L2U3	DT_L2U3	UT_U3U5	DT_U3U5	UT_U5U7	DT_U5U7
0.25	8822	8939	6743	7100	11719	12245	14997	12157	6860	7034	4907	5283
0.50	10279	10882	9130	9690	11179	12161	14575	14398	9083	8941	6463	6707
0.75	5185	5093	4564	5780	6663	7369	8287	8103	6186	6224	5046	5078
1.00	2170	1942	1816	2795	3961	4554	4477	4068	3748	3883	4248	4265
1.25	739	564	636	1144	2168	2451	2098	1844	2073	2250	3222	3239
1.50	216	163	208	417	984	1297	911	758	949	1121	2240	2355
1.75	70	40	62	169	421	620	373	272	436	547	1470	1622
2.00	16	19	21	56	196	242	136	93	206	244	907	992
2.25	2	6	4	45	58	107	48	25	85	101	598	681
2.50	2	4	4	26	22	42	23	14	51	40	352	407
2.75	0	1	2	15	7	17	3	11	35	20	181	230
3.00	0	1	1	20	1	4	4	7	29	16	120	130
3.25	1	3	4	15	0	1	2	2	10	7	64	92
3.50	1	2	2	7	0	0	0	3	11	2	35	48
3.75	0	1	2	9	1	0	1	0	14	4	19	25
4.00	0	1	1	3	1	1	3	1	7	5	7	11
4.25	0	1	4	3	1	0	1	2	11	4	4	5
4.50	1	0	0	7	1	0	0	3	12	0	0	5
4.75	0	0	1	6	0	1	0	2	8	4	0	2
5.00	0	0	0	2	0	0	0	0	4	2	0	1
Total Cycles	**27504**	**27662**	**23205**	**27309**	**37383**	**41112**	**45939**	**41763**	**29818**	**30449**	**29883**	**31178**
RMC Effective Stress	**0.697**	**0.686**	**0.740**	**0.863**	**0.843**	**0.882**	**0.790**	**0.792**	**0.998**	**0.963**	**1.307**	**1.342**

Table 1. Stress Range Histogram Data

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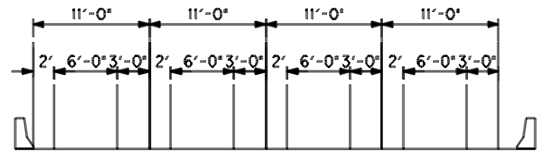
APPENDIX A

Truck Positions for Load Rating Load Distribution

Exhibit A-1. Truck Positions for Load Distribution.

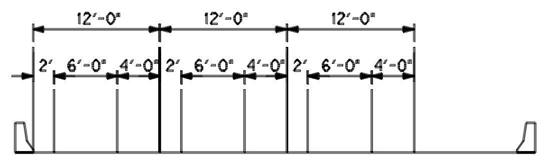
Case 1
4 11'-0" lanes, all shifted to one side (8 lanes total)

Lane	C/C of trusses	Lane to left truss	To left of lane Wheel 1	To left of lane Wheel 2	To CL left truss Wheel 1	To CL left truss Wheel 2	Portion of load to left truss Wheel 1	Portion of load to left truss Wheel 2	Portion of load to right truss Wheel 1	Portion of load to right truss Wheel 2
1	53	3.604	2	8	5.604	11.604	0.447	0.391	0.053	0.109
2	53	14.604	2	8	16.604	22.604	0.343	0.287	0.157	0.213
3	53	25.604	2	8	27.604	33.604	0.240	0.183	0.260	0.317
4	53	36.604	2	8	38.604	44.604	0.136	0.079	0.364	0.421
						Total	1.166	0.939	0.834	1.061
						Reduction factor per 3.12.1	0.75	0.75	0.75	0.75
						Total applied	0.874	0.705	0.626	0.795
						Total applied to left truss	**1.579** (for one deck)			
						Total applied to right truss	1.421			



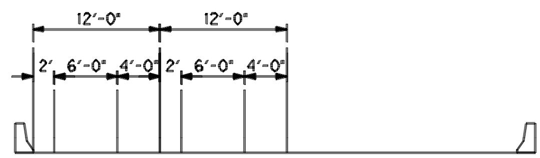
Case 2
3 12'-0" lanes, all shifted to one side (6 lanes total)

Lane	C/C of trusses	Lane to left truss	To left of lane Wheel 1	To left of lane Wheel 2	To CL left truss Wheel 1	To CL left truss Wheel 2	Portion of load to left truss Wheel 1	Portion of load to left truss Wheel 2	Portion of load to right truss Wheel 1	Portion of load to right truss Wheel 2
1	53	3.604	2	8	5.604	11.604	0.447	0.391	0.053	0.109
2	53	15.604	2	8	17.604	23.604	0.334	0.277	0.166	0.223
3	53	27.604	2	8	29.604	35.604	0.221	0.164	0.279	0.336
						Total	1.002	0.832	0.498	0.668
						Reduction factor per 3.12.1	0.75	0.75	0.75	0.75
						Total applied	0.751	0.624	0.374	0.501
						Total applied to left truss	**1.375** (for one deck)			
						Total applied to right truss	0.875			



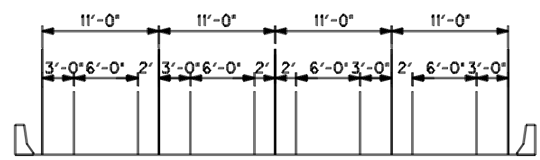
Case 3
2 12'-0" lanes, both shifted to one side (4 lanes total)

Lane	C/C of trusses	Lane to left truss	To left of lane Wheel 1	To left of lane Wheel 2	To CL left truss Wheel 1	To CL left truss Wheel 2	Portion of load to left truss Wheel 1	Portion of load to left truss Wheel 2	Portion of load to right truss Wheel 1	Portion of load to right truss Wheel 2
1	53	3.604	2	8	5.604	11.604	0.447	0.391	0.053	0.109
2	53	15.604	2	8	17.604	23.604	0.334	0.277	0.166	0.223
						Total	0.781	0.668	0.219	0.332
						Reduction factor per 3.12.1	0.75	0.75	0.75	0.75
						Total applied	0.586	0.501	0.164	0.249
						Total applied to left truss	**1.087** (for one deck)			
						Total applied to right truss	0.413			



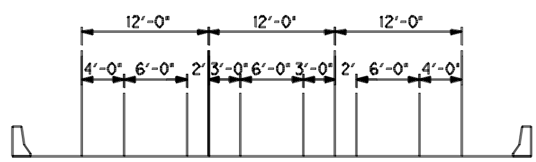
Case 4
4 11'-0" lanes, all shifted to center (8 lanes total)

Lane	C/C of trusses	Lane to left truss	To left of lane Wheel 1	To left of lane Wheel 2	To CL left truss Wheel 1	To CL left truss Wheel 2	Portion of load to left truss Wheel 1	Portion of load to left truss Wheel 2	Portion of load to right truss Wheel 1	Portion of load to right truss Wheel 2
1	53	4.5	4	10	8.5	14.5	0.420	0.363	0.080	0.137
2	53	15.5	4	10	19.5	25.5	0.316	0.259	0.184	0.241
3	53	26.5	2	8	28.5	34.5	0.231	0.175	0.269	0.325
4	53	37.5	2	8	39.5	45.5	0.127	0.071	0.373	0.429
						Total	1.094	0.868	0.906	1.132
						Reduction factor per 3.12.1	0.75	0.75	0.75	0.75
						Total applied	0.821	0.651	0.679	0.849
						Total applied to left truss	**1.472** (for one deck)			
						Total applied to right truss	1.528			



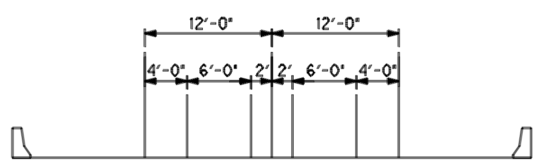
Case 5
3 12'-0" lanes, all shifted to center (6 lanes total)

Lane	C/C of trusses	Lane to left truss	To left of lane Wheel 1	To left of lane Wheel 2	To CL left truss Wheel 1	To CL left truss Wheel 2	Portion of load to left truss Wheel 1	Portion of load to left truss Wheel 2	Portion of load to right truss Wheel 1	Portion of load to right truss Wheel 2
1	53	8.5	4	10	12.5	18.5	0.382	0.325	0.118	0.175
2	53	20.5	3	9	23.5	29.5	0.278	0.222	0.222	0.278
3	53	32.5	2	8	34.5	40.5	0.175	0.118	0.325	0.382
						Total	0.835	0.665	0.665	0.835
						Reduction factor per 3.12.1	0.75	0.75	0.75	0.75
						Total applied	0.626	0.499	0.499	0.626
						Total applied to left truss	**1.125** (for one deck)			
						Total applied to right truss	1.125			



Case 6
2 12'-0" lanes, both shifted to center (4 lanes total)

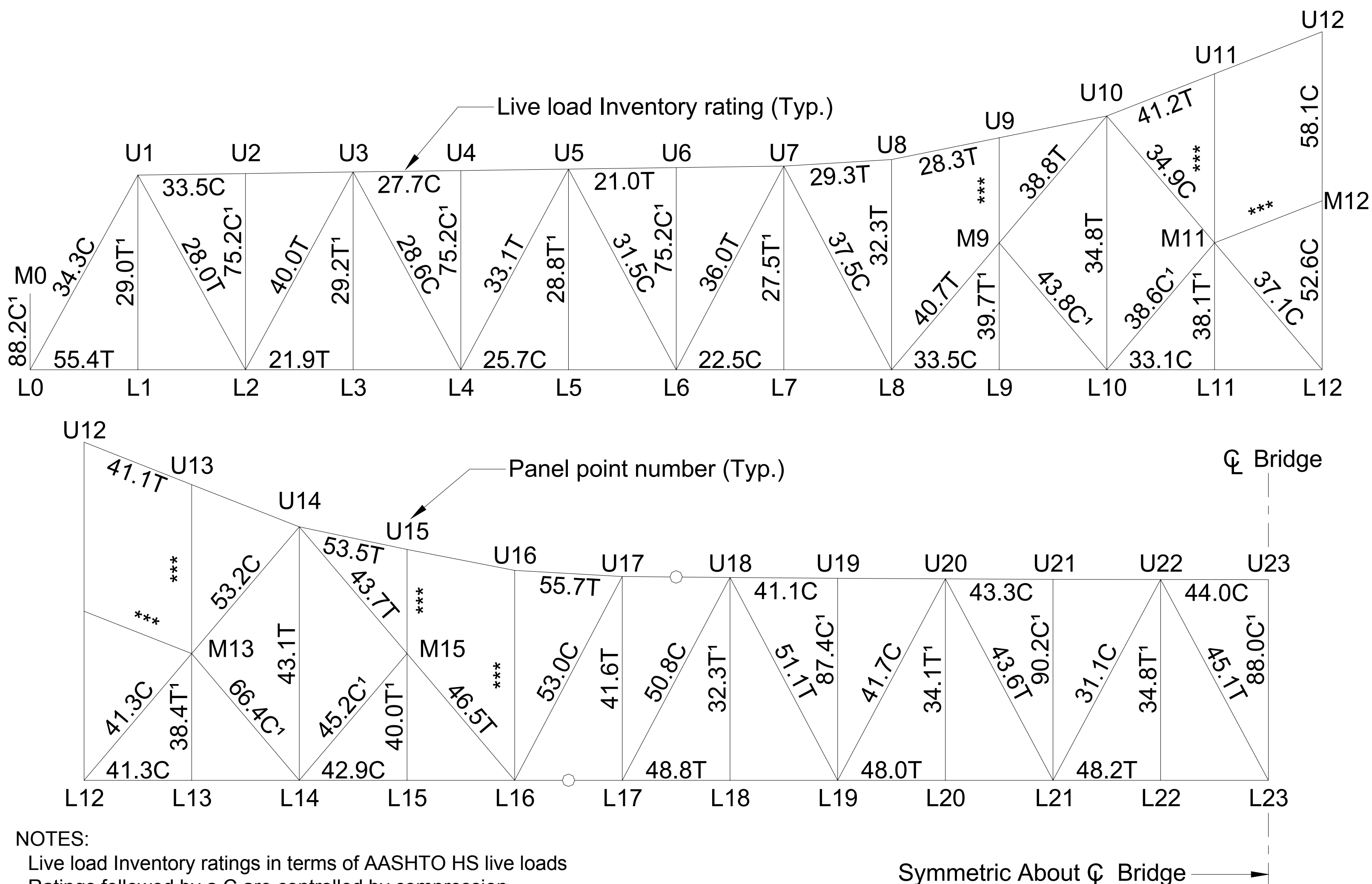
Lane	C/C of trusses	Lane to left truss	To left of lane Wheel 1	To left of lane Wheel 2	To CL left truss Wheel 1	To CL left truss Wheel 2	Portion of load to left truss Wheel 1	Portion of load to left truss Wheel 2	Portion of load to right truss Wheel 1	Portion of load to right truss Wheel 2
1	53	14.5	4	10	18.5	24.5	0.325	0.269	0.175	0.231
2	53	26.5	2	8	28.5	34.5	0.231	0.175	0.269	0.325
						Total	0.557	0.443	0.443	0.557
						Reduction factor per 3.12.1	0.75	0.75	0.75	0.75
						Total applied	0.417	0.333	0.333	0.417
						Total applied to left truss	**0.750** (for one deck)			
						Total applied to right truss	0.750			



APPENDIX B

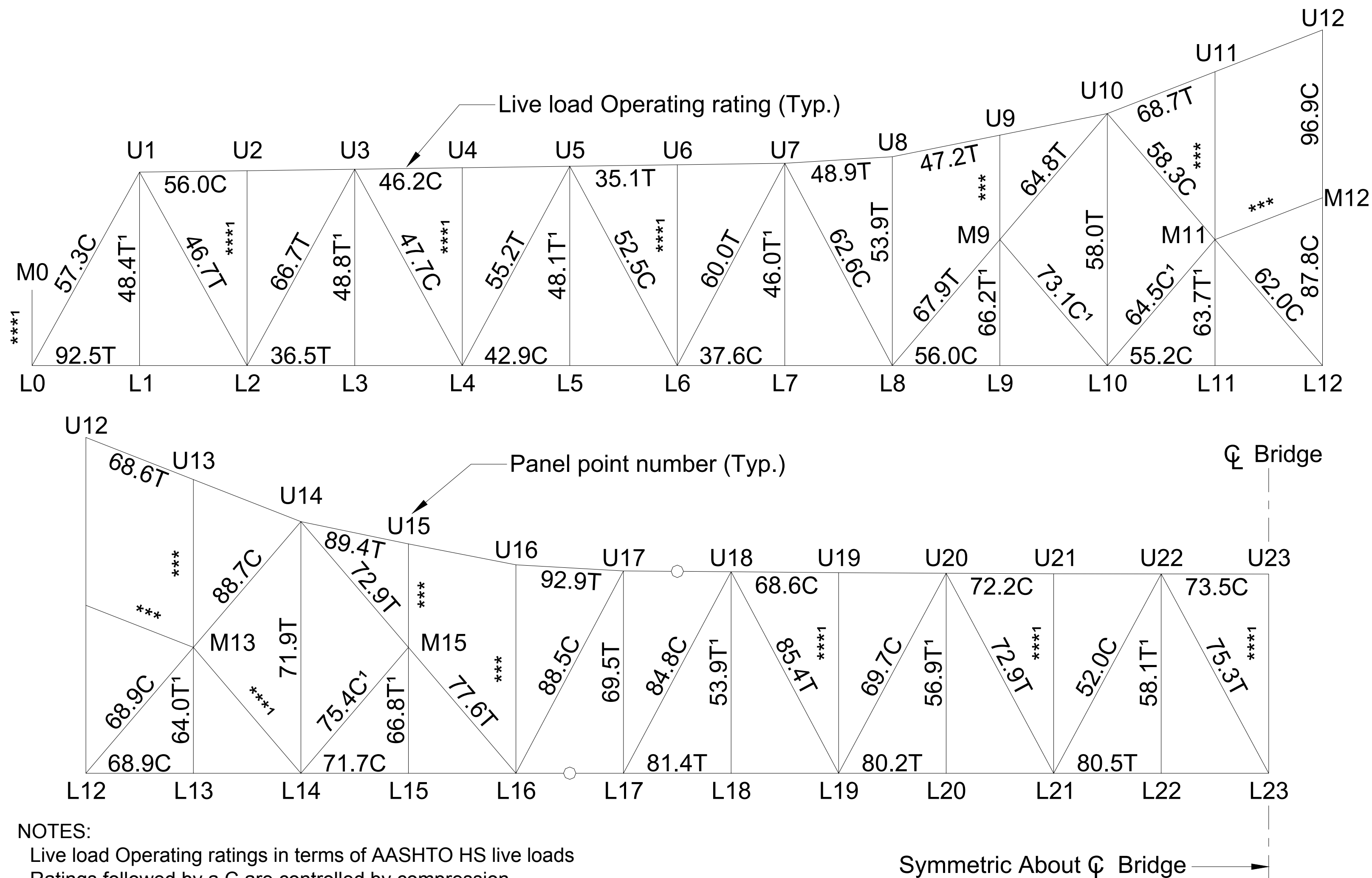
Inventory and Operating Rating Results

Exhibit B-1. Inventory Rating Results for 4 lanes of traffic on each deck.



NOTES:

Live load Inventory ratings in terms of AASHTO HS live loads
Ratings followed by a C are controlled by compression
Ratings followed by a T are controlled by tension
*** indicates members that rate about HS 100.0
○ indicates a sliding pin in the truss
[1] indicates members controlled by truck loads. All other members controlled by lane loads.

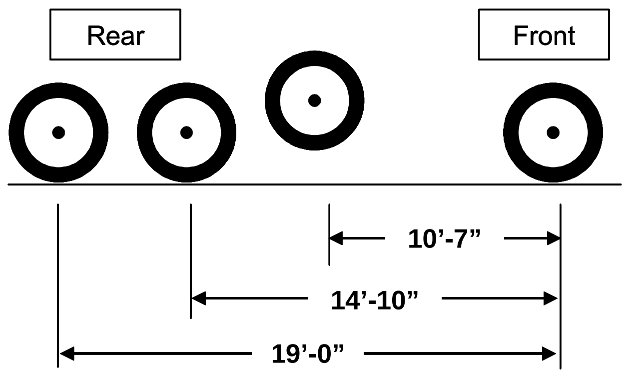


NOTES:
Live load Operating ratings in terms of AASHTO HS live loads
Ratings followed by a C are controlled by compression
Ratings followed by a T are controlled by tension
*** indicates members that rate above HS 100.0
○ indicates a sliding pin in the truss
¹ indicates members controlled by truck loads. All other members controlled by lane loads.

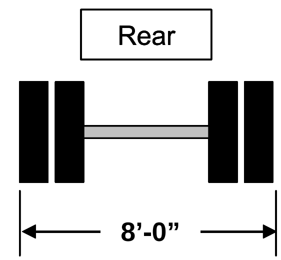
Exhibit B-2. Operating Rating Results for 4 lanes of traffic on each deck.

APPENDIX C

Calibration Load Test Layout



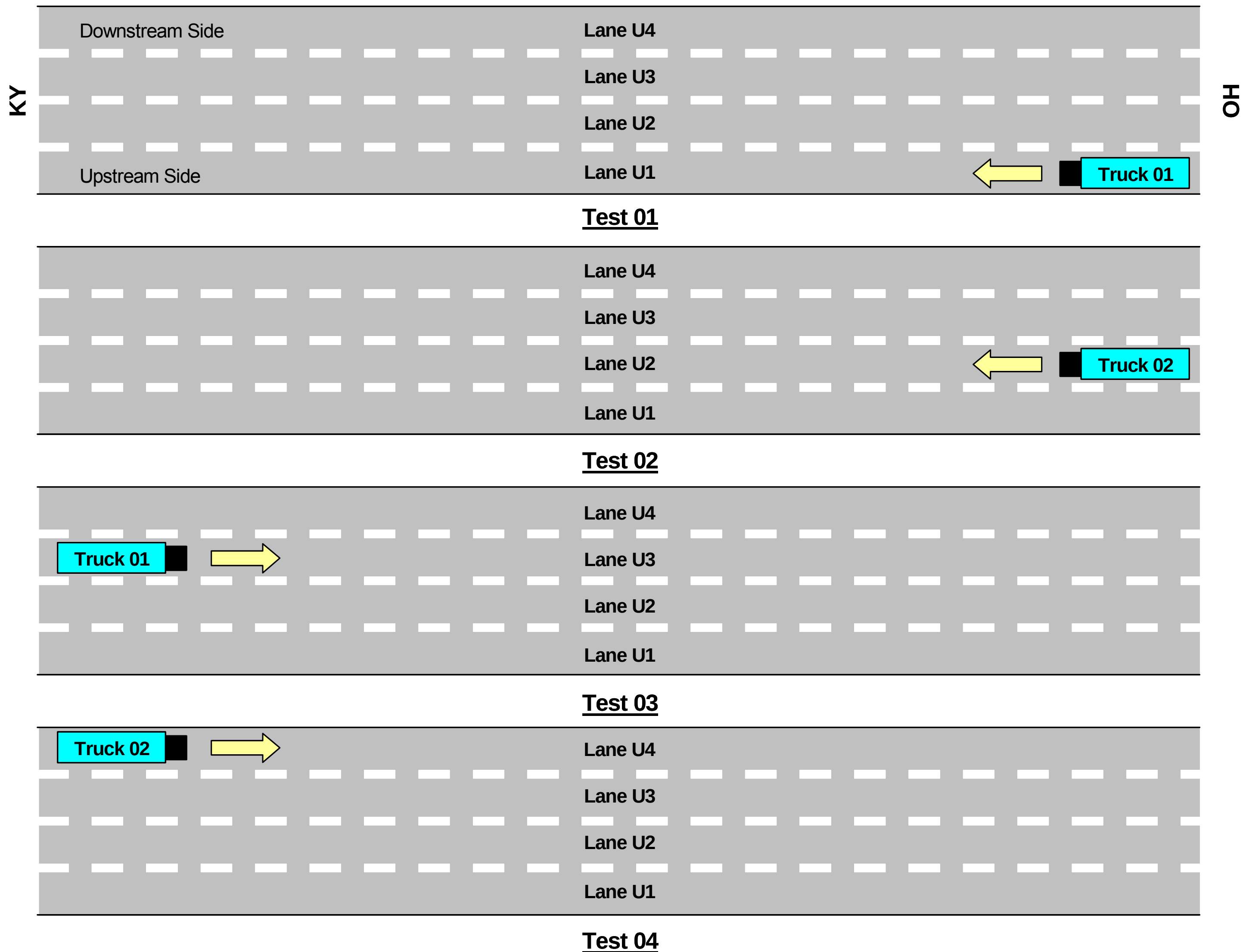
Side View



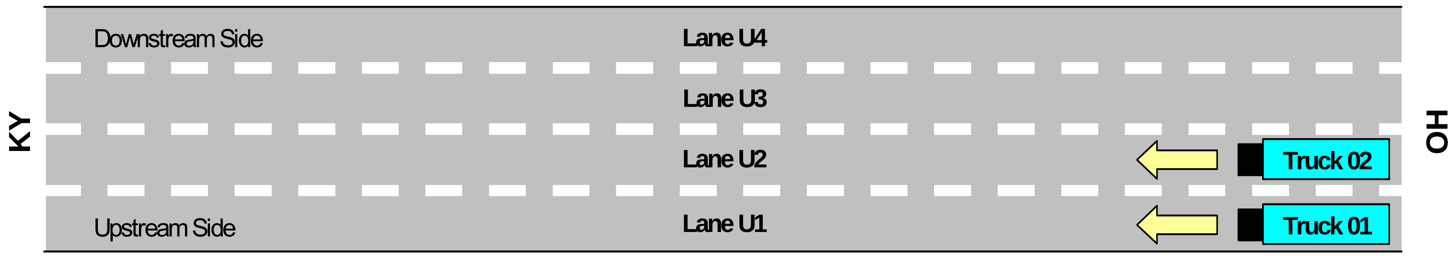
End View

Truck ID	Front Axle Weight	Rear Axles Weight	Gross Weight
Truck 01 (BT12)	13,960 lbs	48,360 lbs	65,220 lbs
Truck 02 (BT10)	19,900 lbs	47,940 lbs	68,700 lbs

UPPER DECK DYNAMIC LOAD TEST RUNS

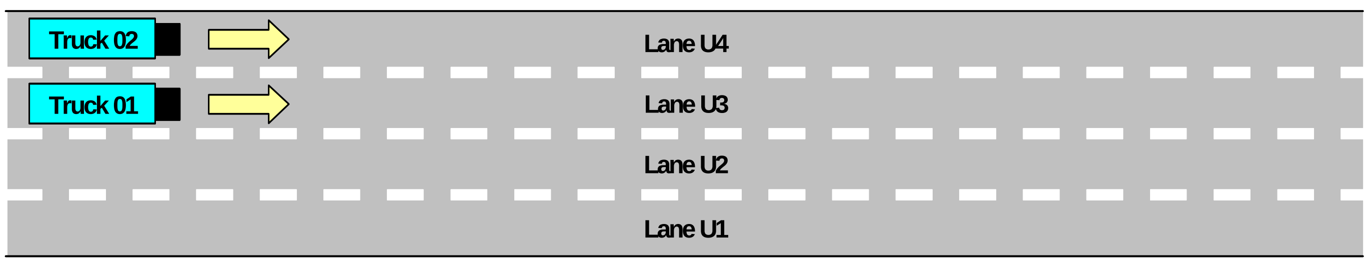


UPPER DECK QUASI-STATIC LOAD TEST RUNS



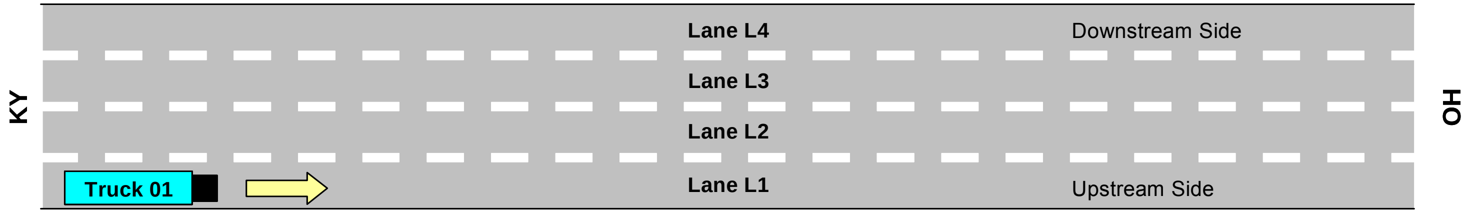
Test 05

Trucks 01 & 02 stop at every other panel point for ~5 seconds

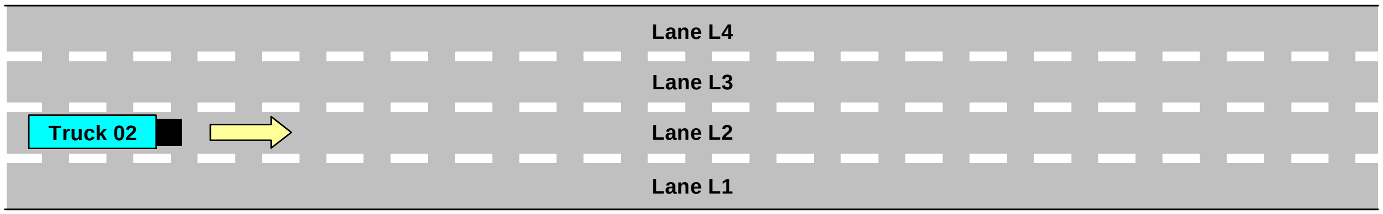


Test 06

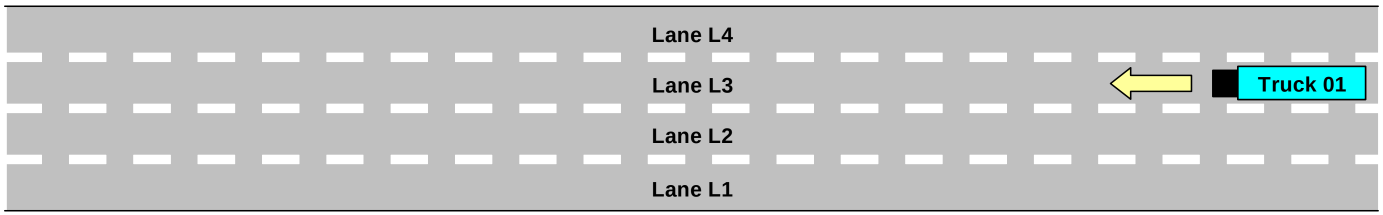
LOWER DECK DYNAMIC LOAD TEST RUNS



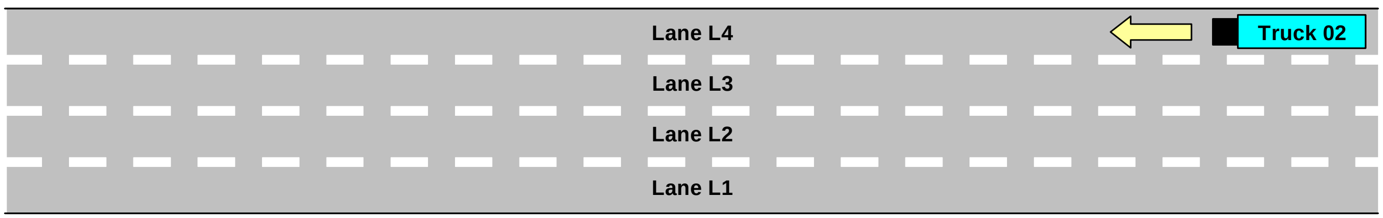
Test 07



Test 08

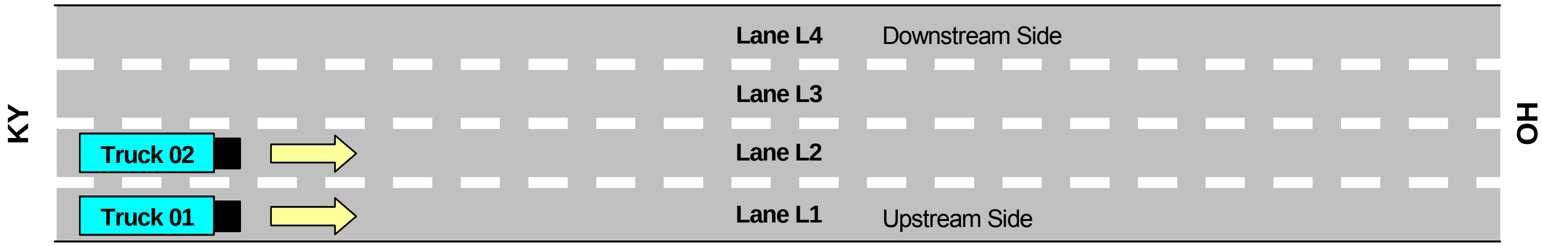


Test 09



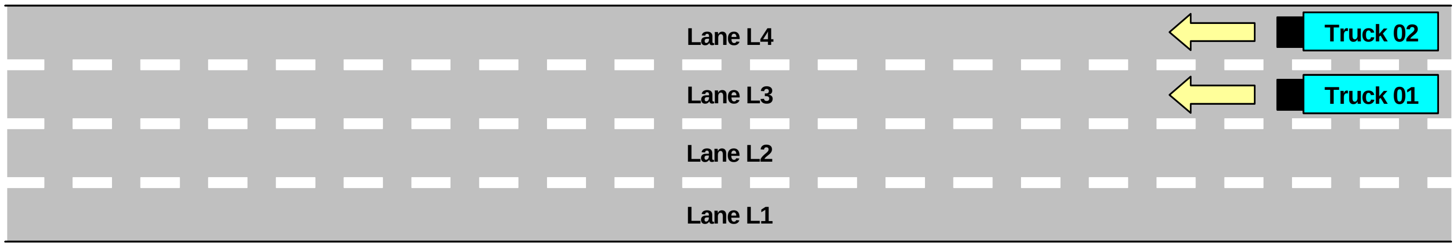
Test 10

LOWER DECK QUASI-STATIC LOAD TEST RUNS



Test 11

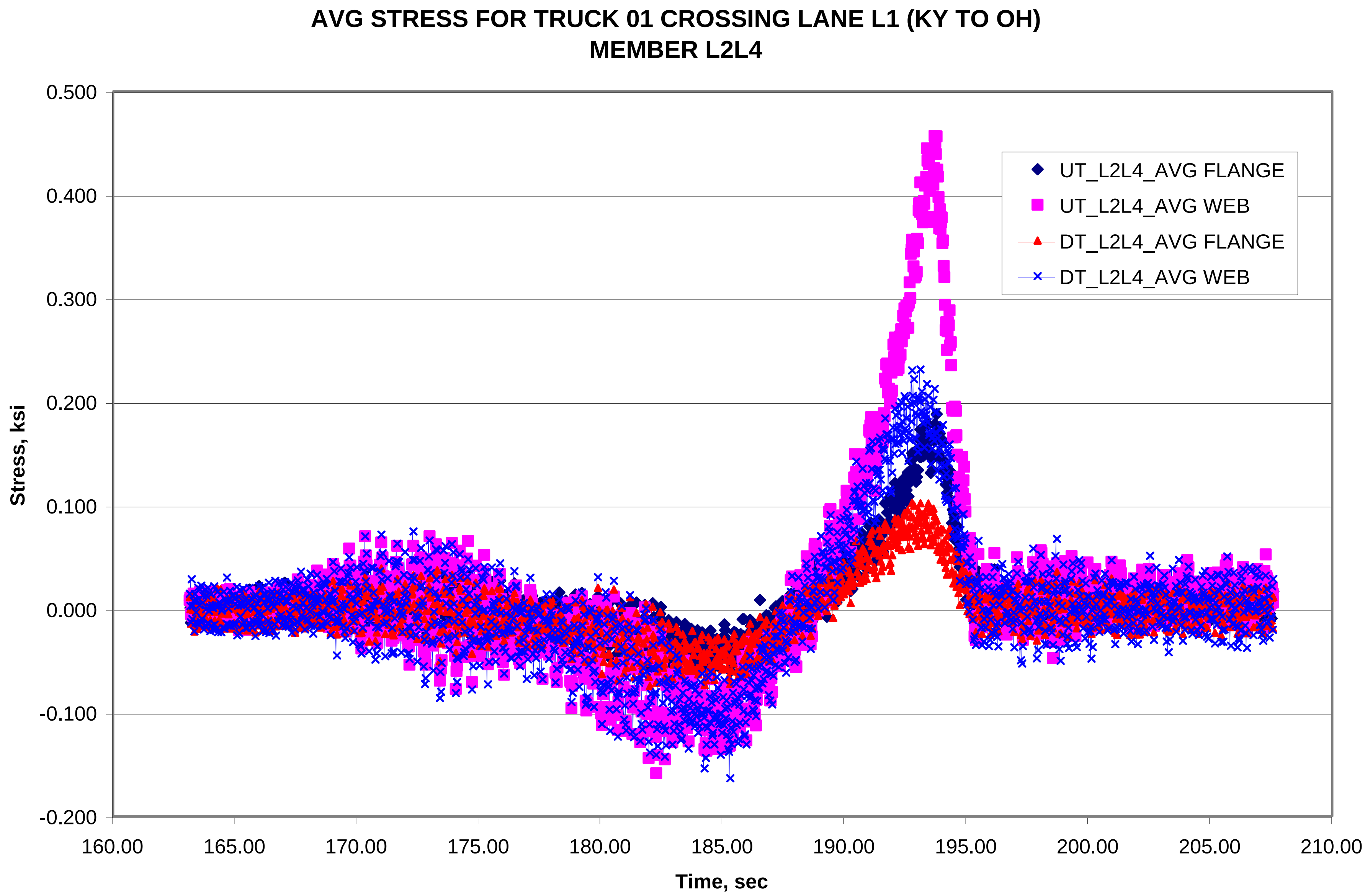
Trucks 01 & 02 stop at every other panel point for ~5 seconds



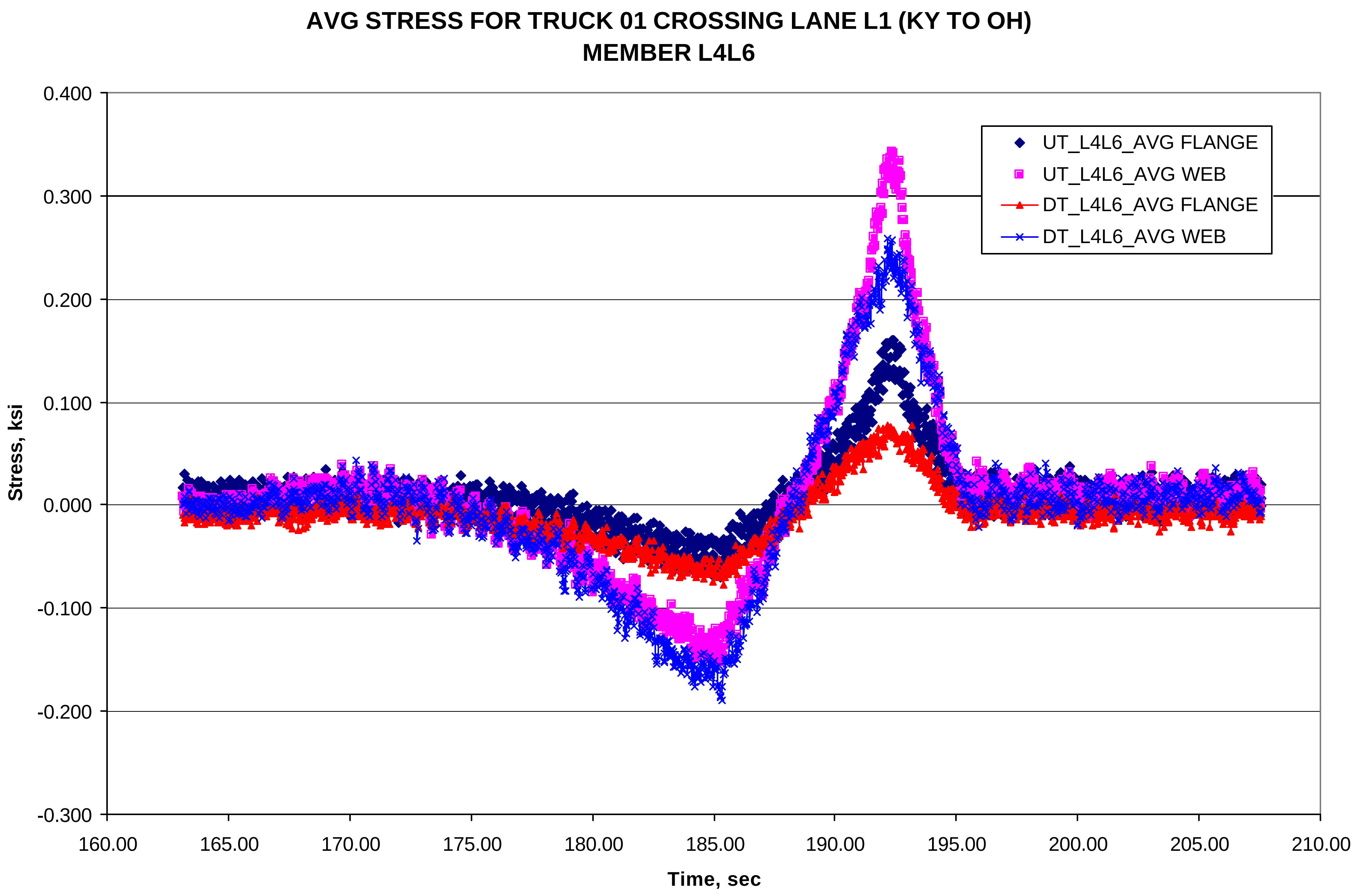
Test 12

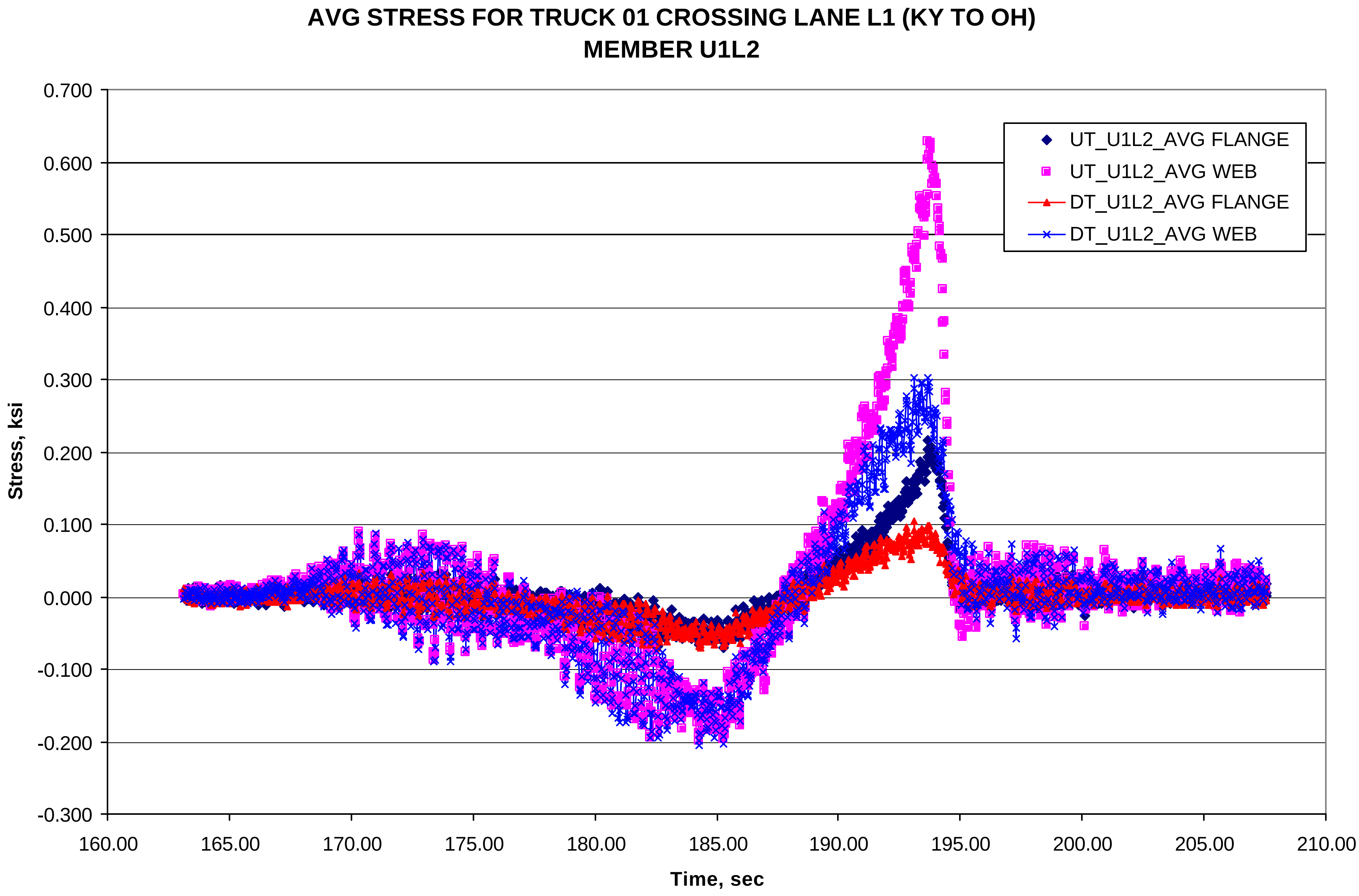
APPENDIX D

Dynamic Calibration Load Test Results

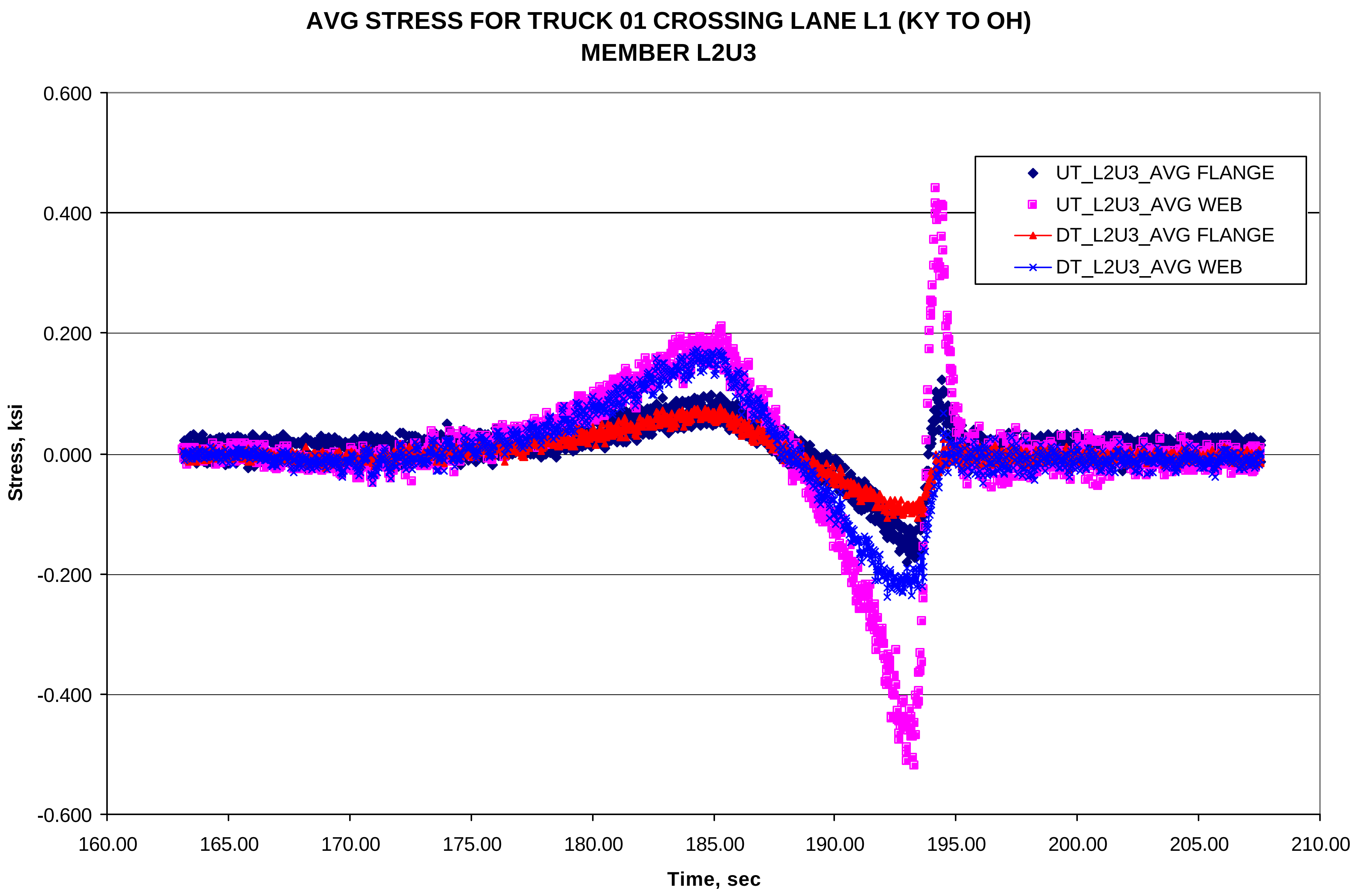


AVG STRESS FOR TRUCK 01 CROSSING LANE L1 (KY TO OH)
MEMBER L2L4
Stress, ksi
Time, sec
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
160.00
165.00
170.00
175.00
180.00
185.00
190.00
195.00
200.00
205.00
210.00
UT_L2L4_AVG FLANGE
UT_L2L4_AVG WEB
DT_L2L4_AVG FLANGE
DT_L2L4_AVG WEB

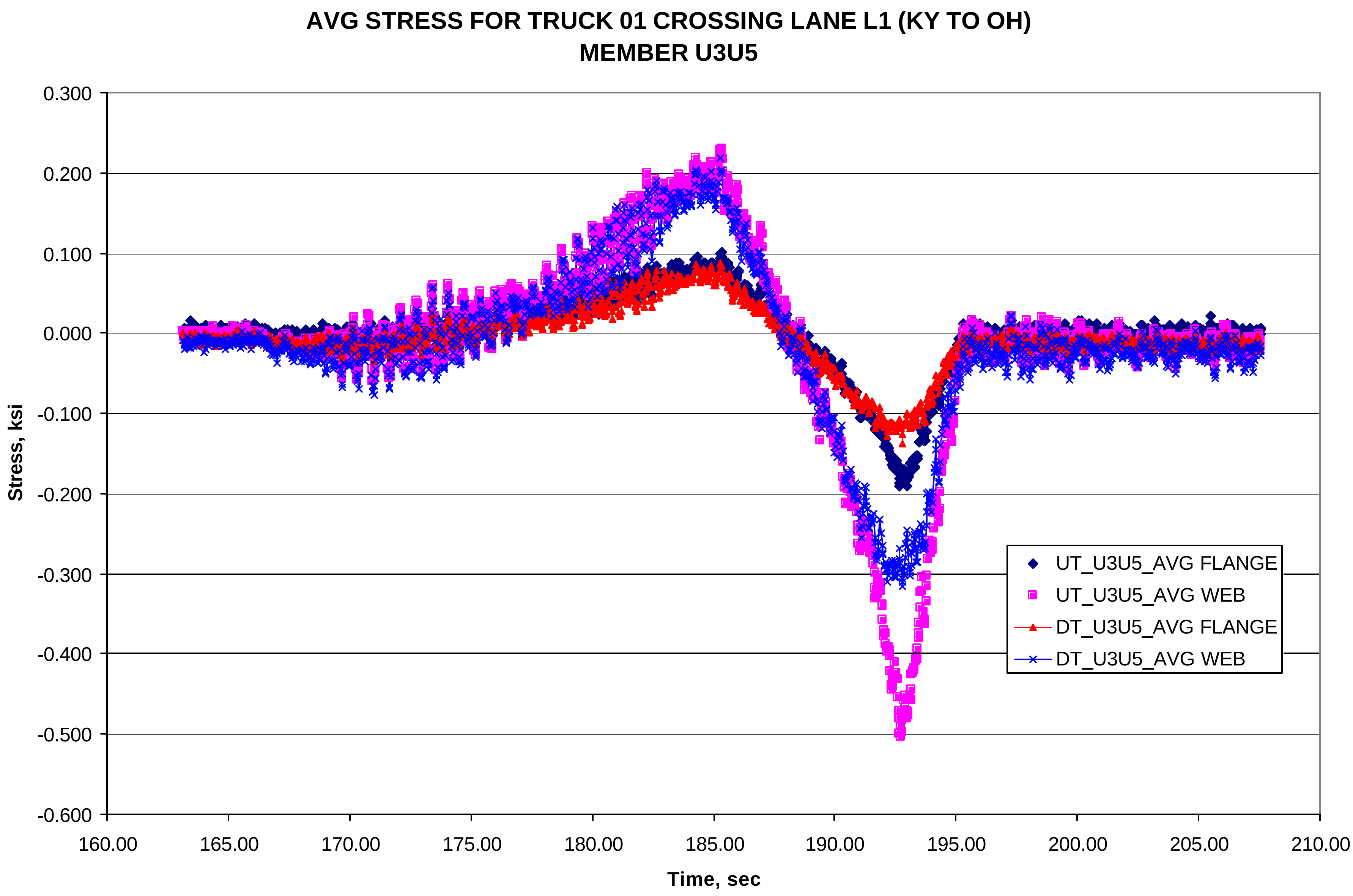

AVG STRESS FOR TRUCK 01 CROSSING LANE L1 (KY TO OH)
MEMBER L4L6
UT_L4L6_AVG FLANGE
UT_L4L6_AVG WEB
DT_L4L6_AVG FLANGE
DT_L4L6_AVG WEB
Stress, ksi
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
160.00
165.00
170.00
175.00
180.00
185.00
190.00
195.00
200.00
205.00
210.00
Time, sec

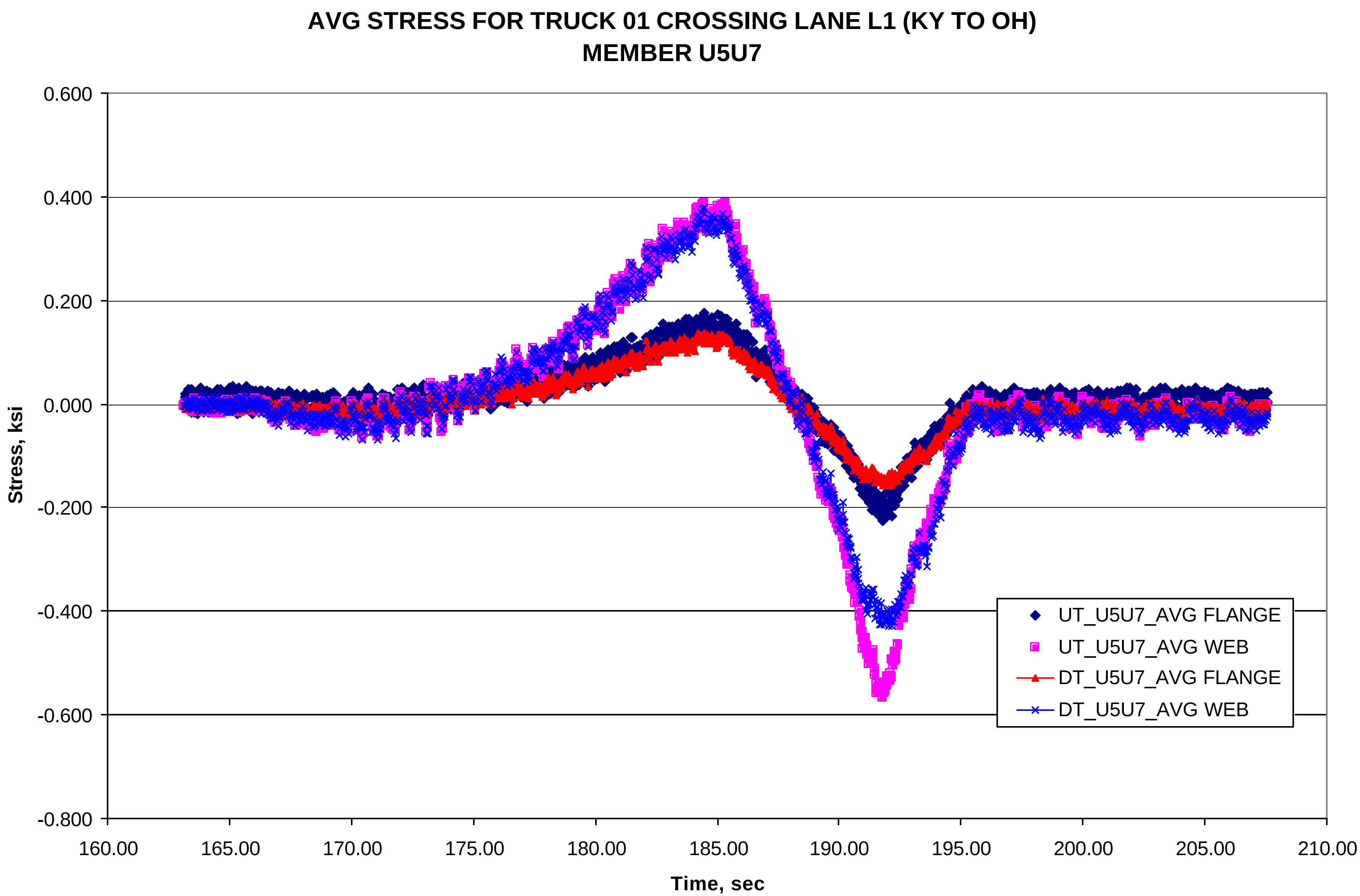


AVG STRESS FOR TRUCK 01 CROSSING LANE L1 (KY TO OH)
MEMBER U1L2
Stress, ksi
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
160.00
165.00
170.00
175.00
180.00
185.00
190.00
195.00
200.00
205.00
210.00
Time, sec
UT_U1L2_AVG FLANGE
UT_U1L2_AVG WEB
DT_U1L2_AVG FLANGE
DT_U1L2_AVG WEB

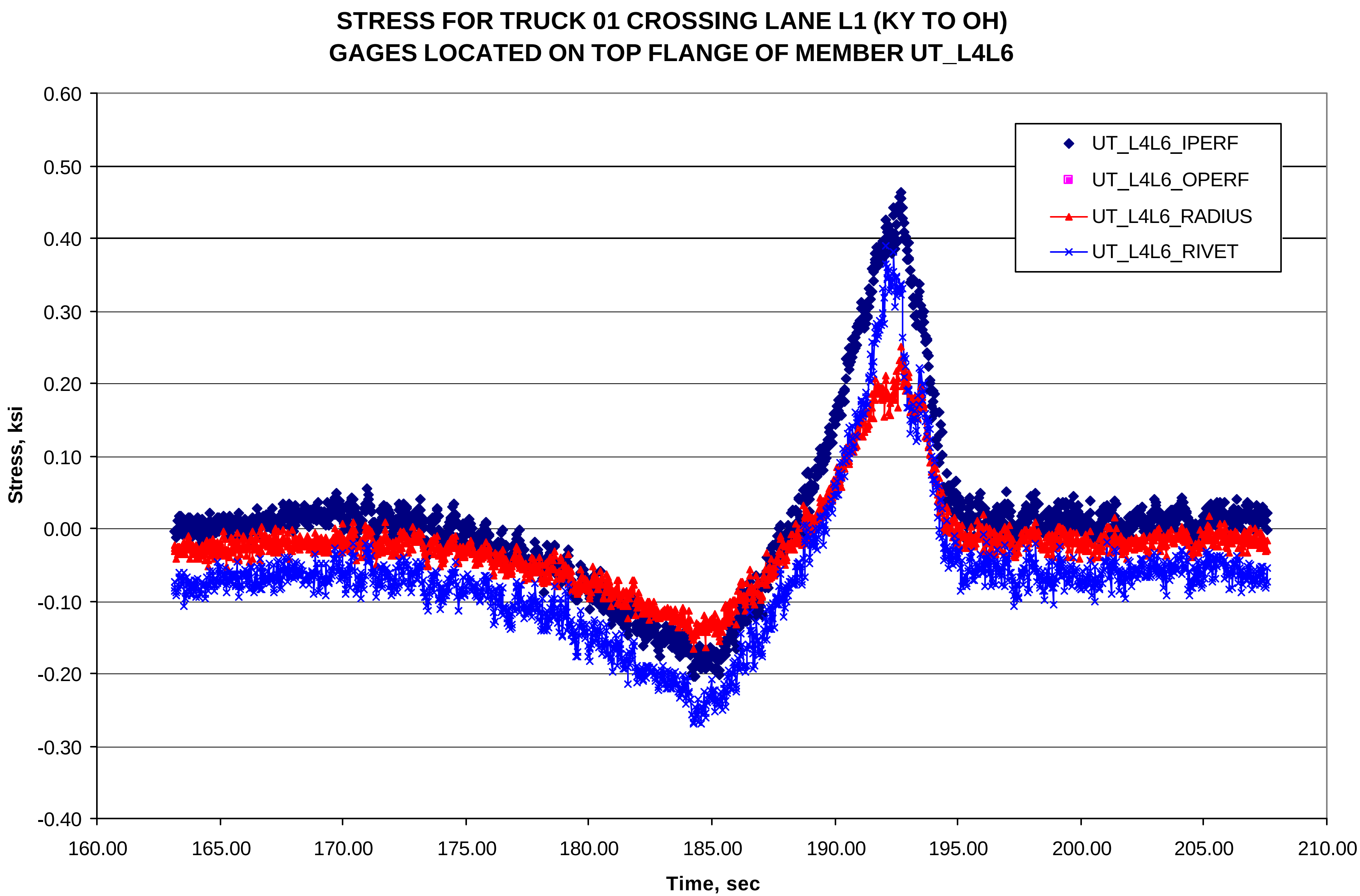


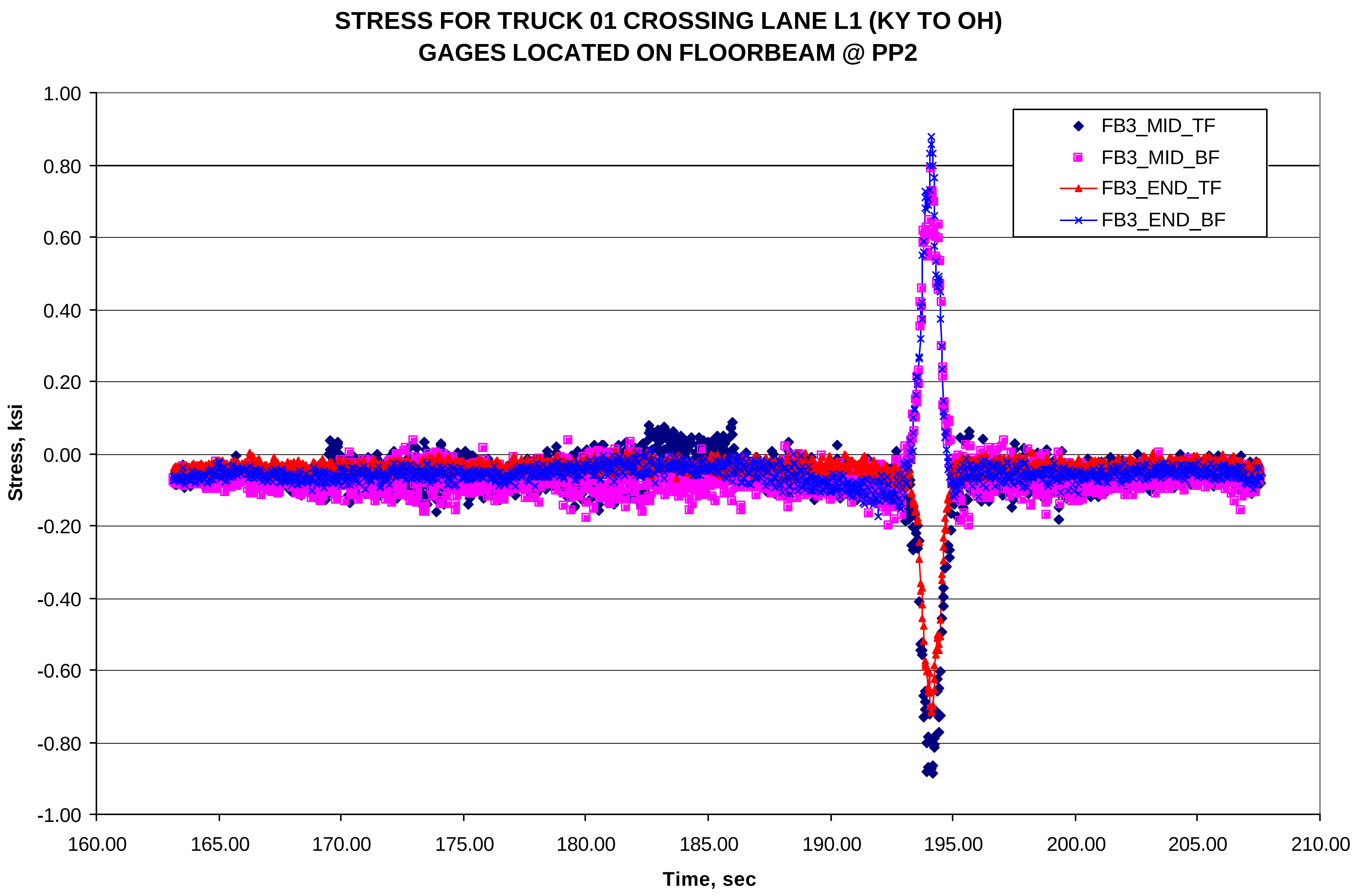
AVG STRESS FOR TRUCK 01 CROSSING LANE L1 (KY TO OH)
MEMBER L2U3
Stress, ksi
0.600
0.400
0.200
0.000
-0.200
-0.400
-0.600
160.00
165.00
170.00
175.00
180.00
185.00
190.00
195.00
200.00
205.00
210.00
Time, sec
UT_L2U3_AVG FLANGE
UT_L2U3_AVG WEB
DT_L2U3_AVG FLANGE
DT_L2U3_AVG WEB

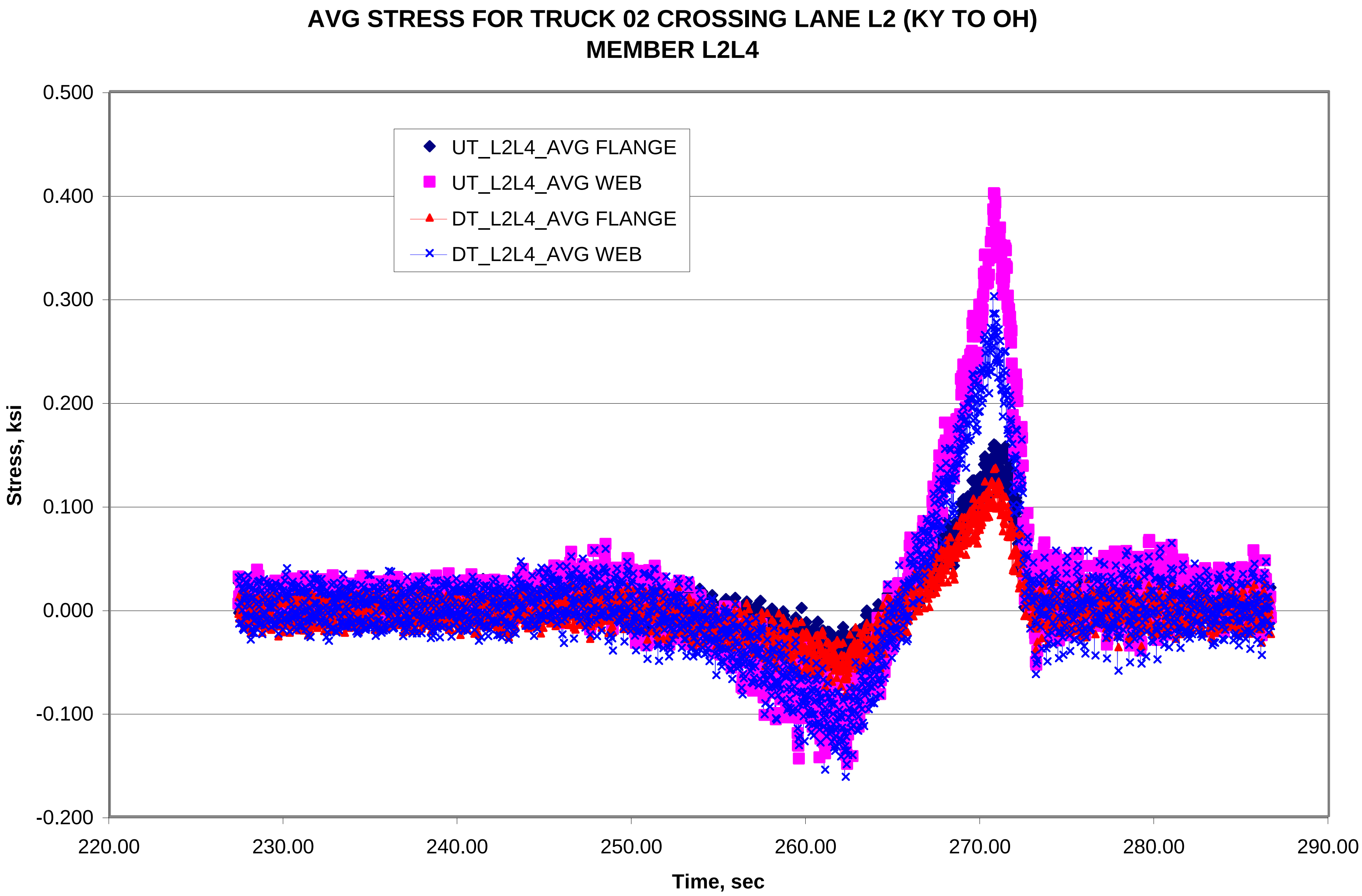

AVG STRESS FOR TRUCK 01 CROSSING LANE L1 (KY TO OH)
MEMBER U3U5
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
-0.600
Stress, ksi
160.00
165.00
170.00
175.00
180.00
185.00
190.00
195.00
200.00
205.00
210.00
Time, sec
UT_U3U5_AVG FLANGE
UT_U3U5_AVG WEB
DT_U3U5_AVG FLANGE
DT_U3U5_AVG WEB



AVG STRESS FOR TRUCK 01 CROSSING LANE L1 (KY TO OH)
MEMBER U5U7
Stress, ksi
0.600
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
160.00
165.00
170.00
175.00
180.00
185.00
190.00
195.00
200.00
205.00
210.00
Time, sec
UT_U5U7_AVG FLANGE
UT_U5U7_AVG WEB
DT_U5U7_AVG FLANGE
DT_U5U7_AVG WEB

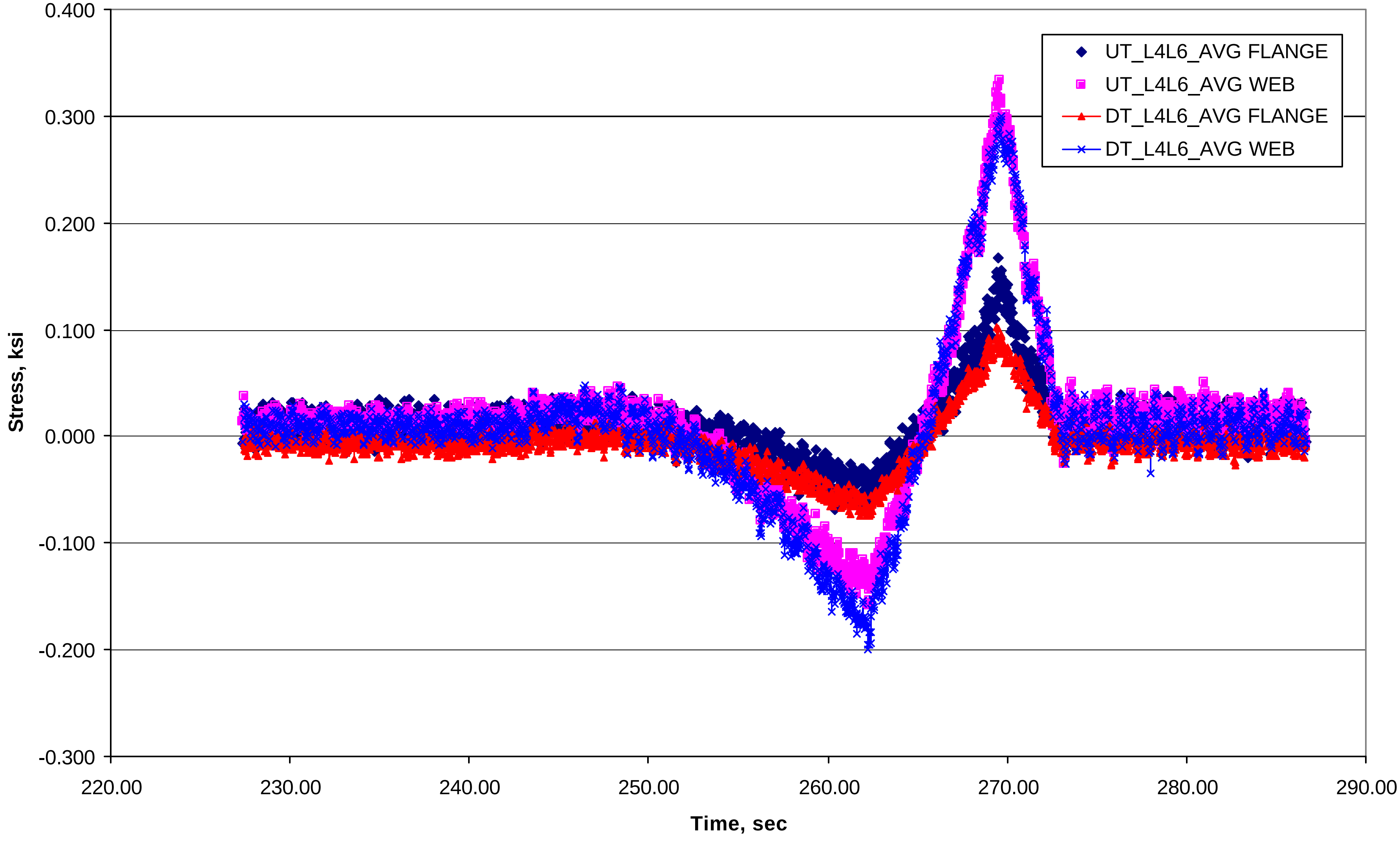

STRESS FOR TRUCK 01 CROSSING LANE L1 (KY TO OH)
GAGES LOCATED ON TOP FLANGE OF MEMBER UT_L4L6
UT_L4L6_IPERF
UT_L4L6_OPERF
UT_L4L6_RADIUS
UT_L4L6_RIVET
Stress, ksi
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
160.00
165.00
170.00
175.00
180.00
185.00
190.00
195.00
200.00
205.00
210.00
Time, sec

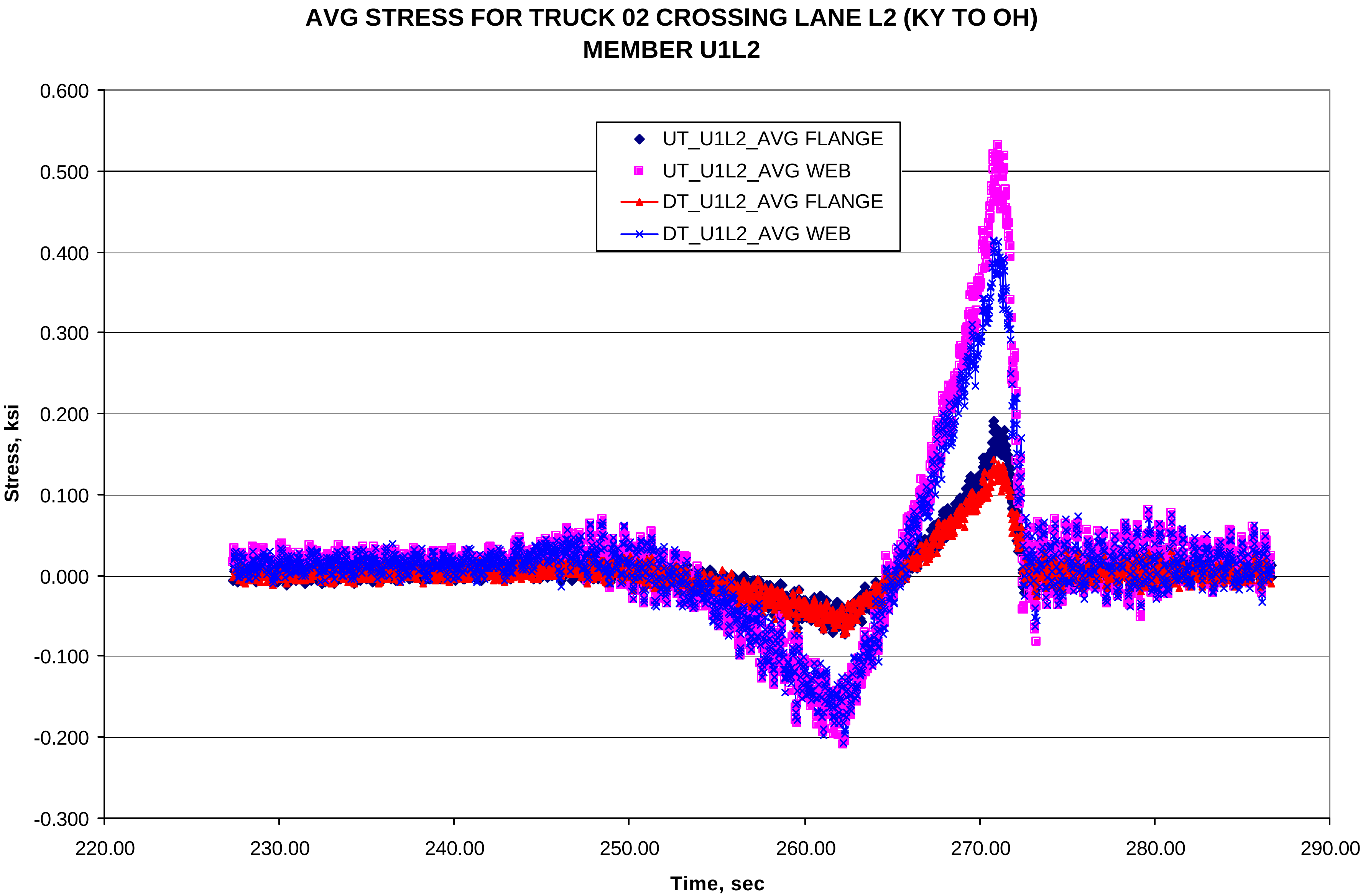

STRESS FOR TRUCK 01 CROSSING LANE L1 (KY TO OH)
GAGES LOCATED ON FLOORBEAM @ PP2
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
Stress, ksi
FB3_MID_TF
FB3_MID_BF
FB3_END_TF
FB3_END_BF
160.00
165.00
170.00
175.00
180.00
185.00
190.00
195.00
200.00
205.00
210.00
Time, sec



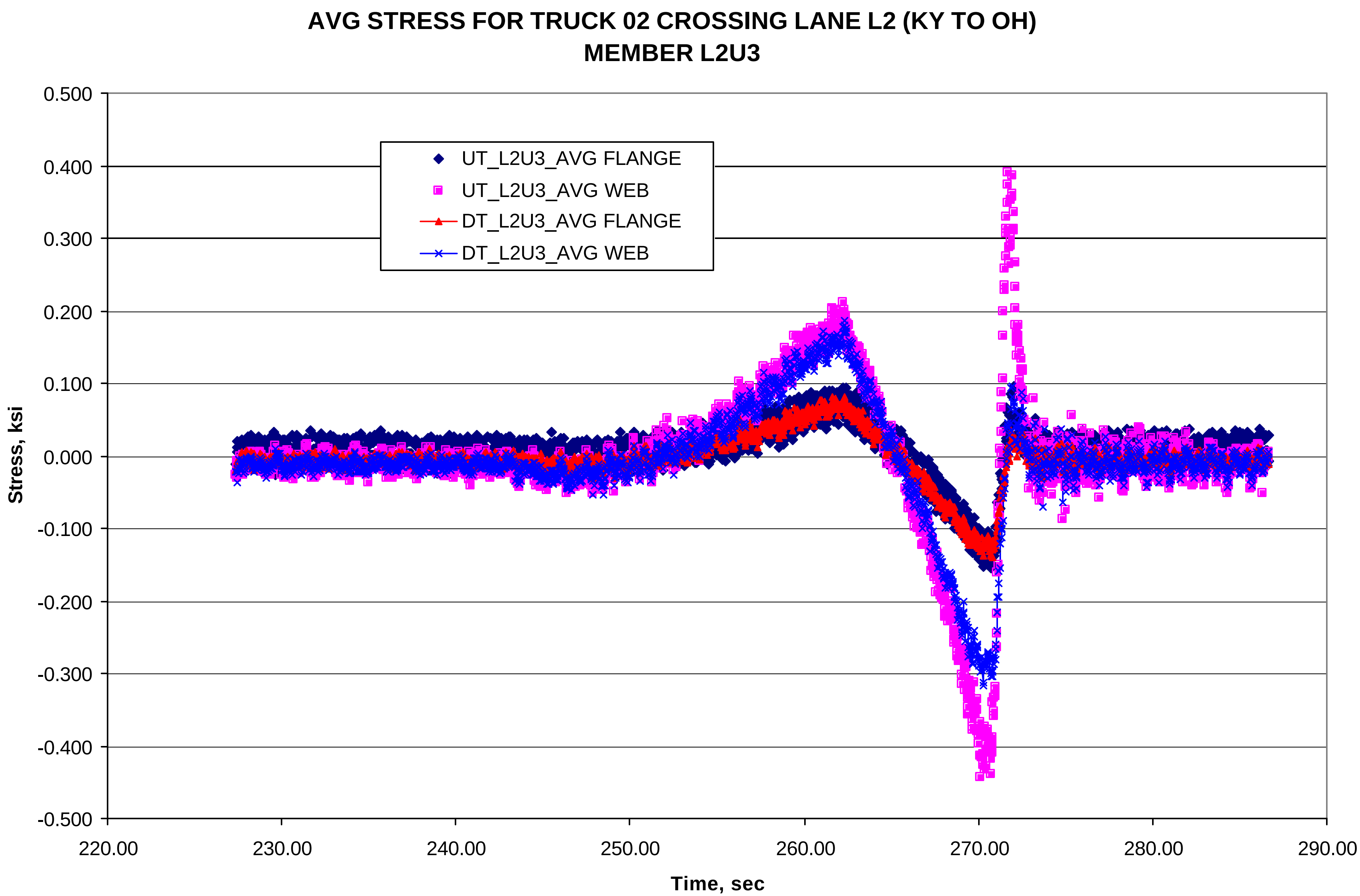
AVG STRESS FOR TRUCK 02 CROSSING LANE L2 (KY TO OH)
MEMBER L2L4
UT_L2L4_AVG FLANGE
UT_L2L4_AVG WEB
DT_L2L4_AVG FLANGE
DT_L2L4_AVG WEB
Stress, ksi
Time, sec
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
220.00
230.00
240.00
250.00
260.00
270.00
280.00
290.00

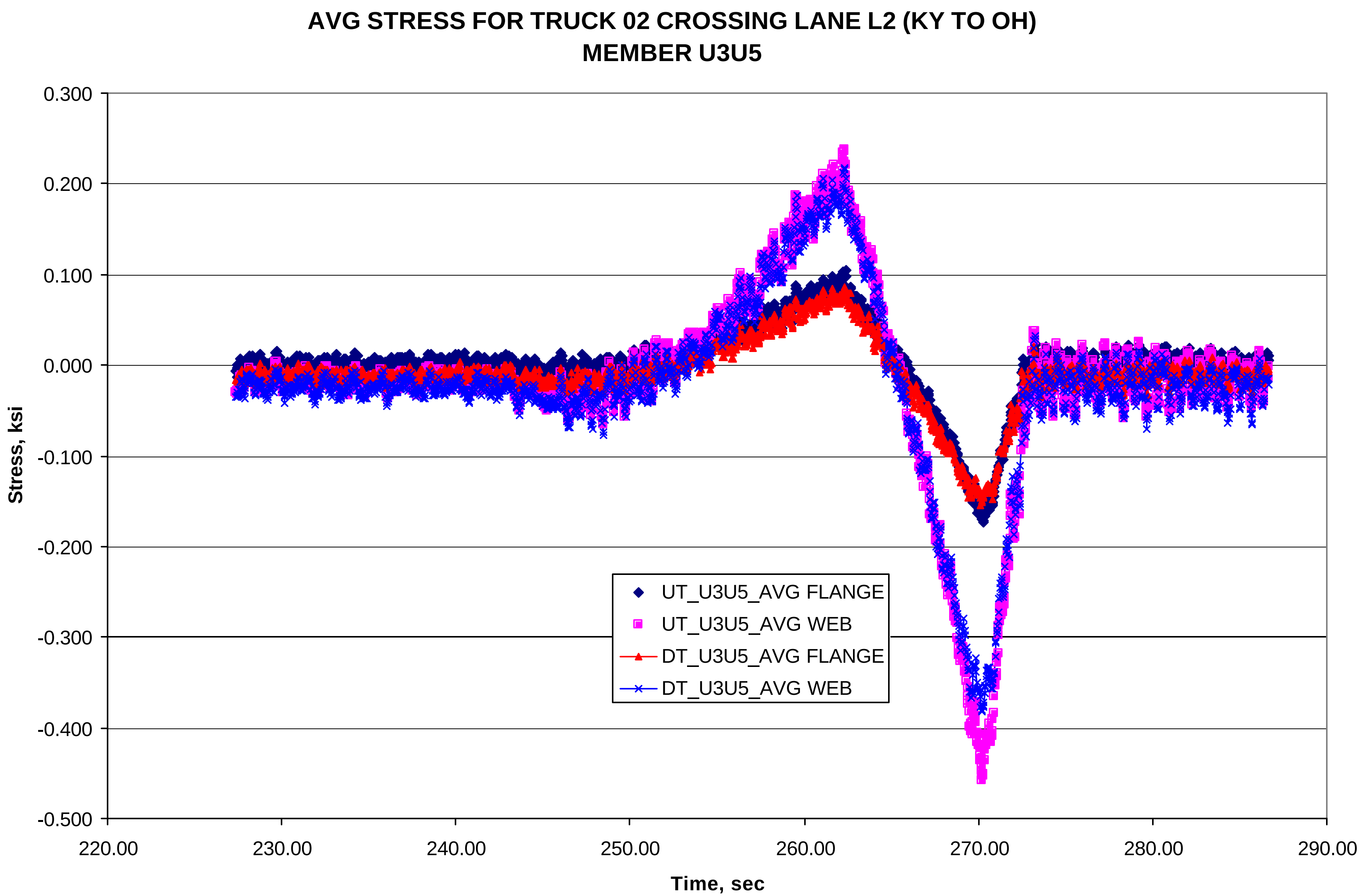
AVG STRESS FOR TRUCK 02 CROSSING LANE L2 (KY TO OH)
MEMBER L4L6



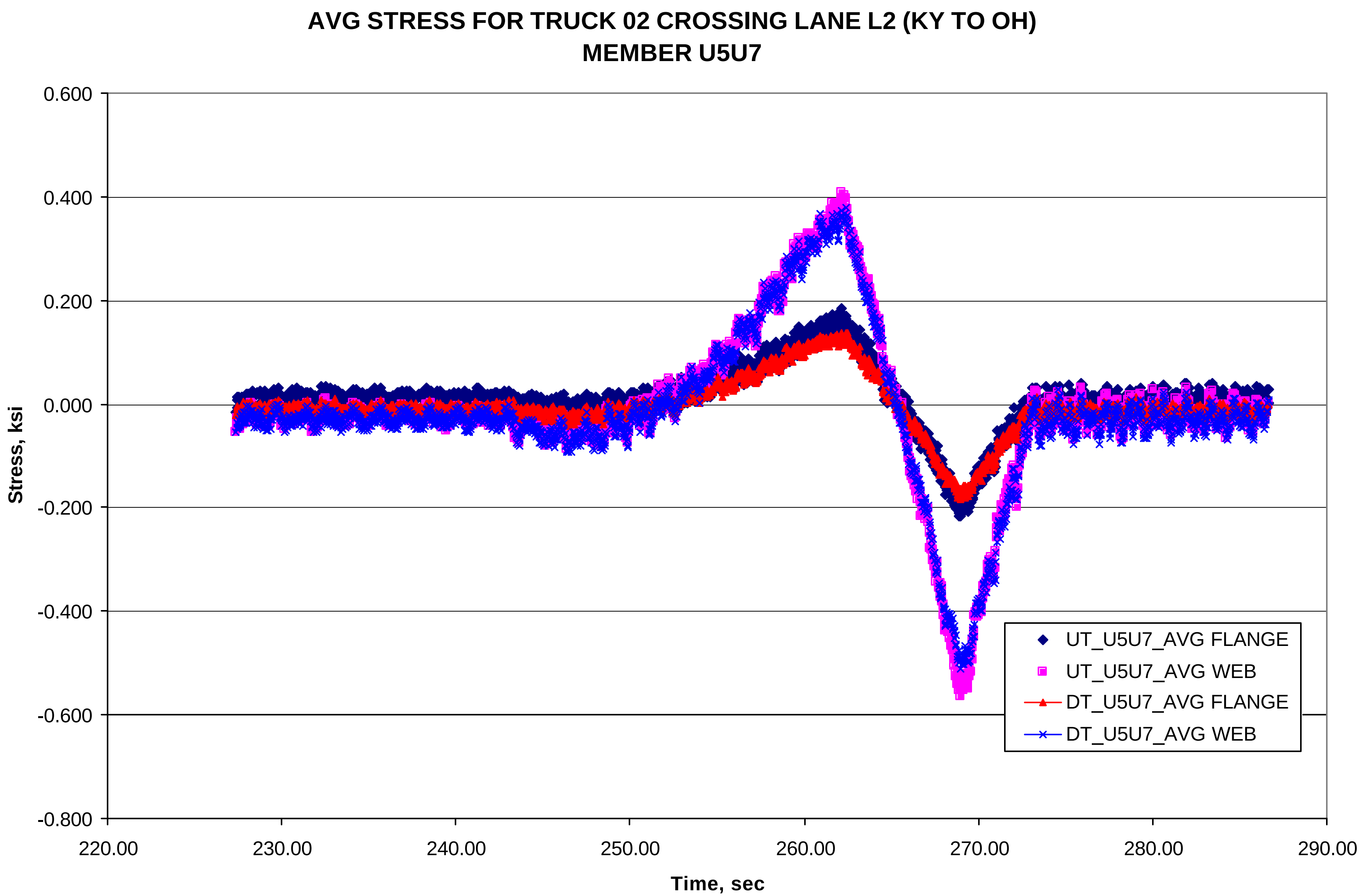


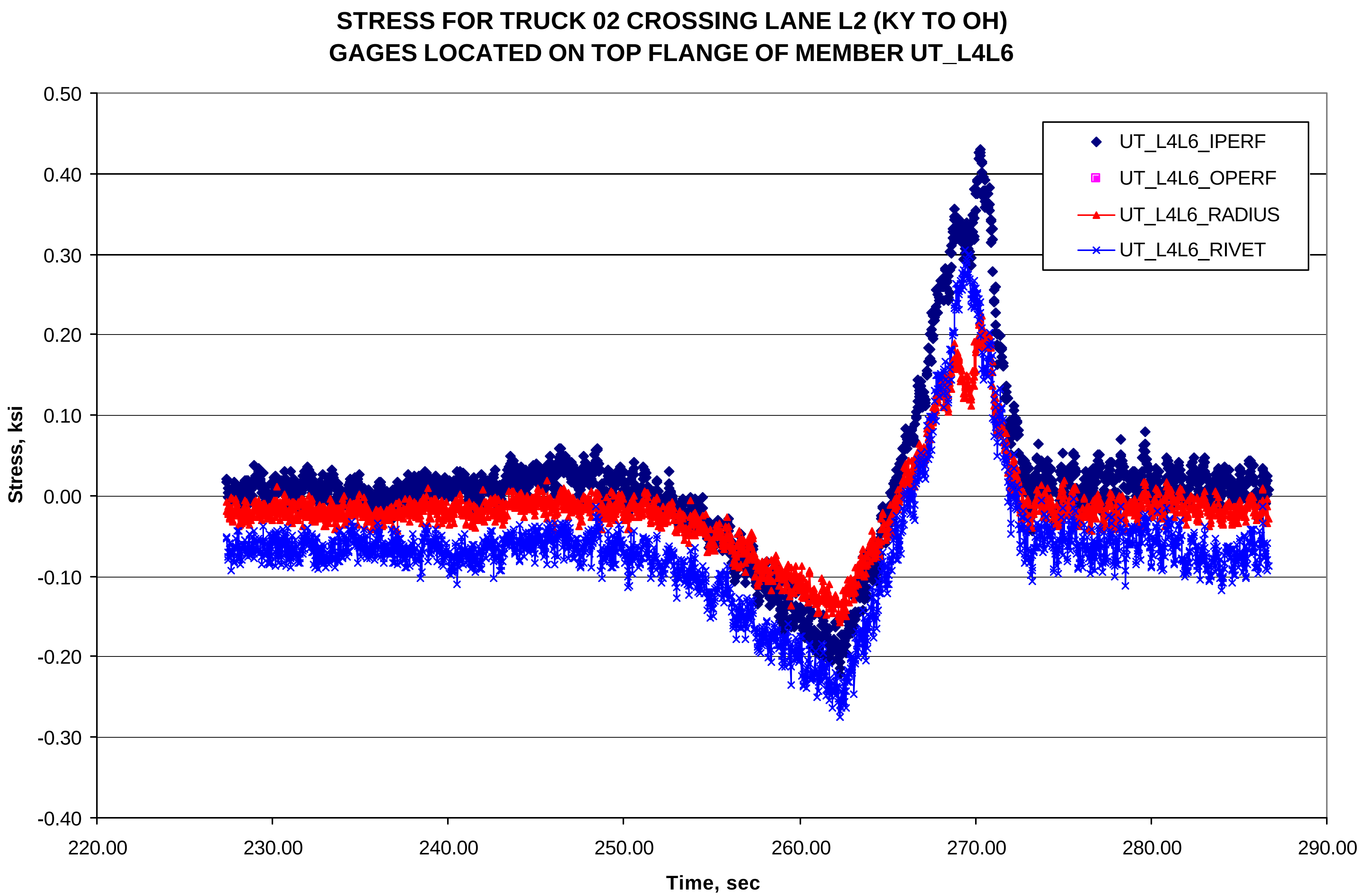
AVG STRESS FOR TRUCK 02 CROSSING LANE L2 (KY TO OH)
MEMBER U1L2
UT_U1L2_AVG FLANGE
UT_U1L2_AVG WEB
DT_U1L2_AVG FLANGE
DT_U1L2_AVG WEB
Stress, ksi
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
220.00
230.00
240.00
250.00
260.00
270.00
280.00
290.00
Time, sec

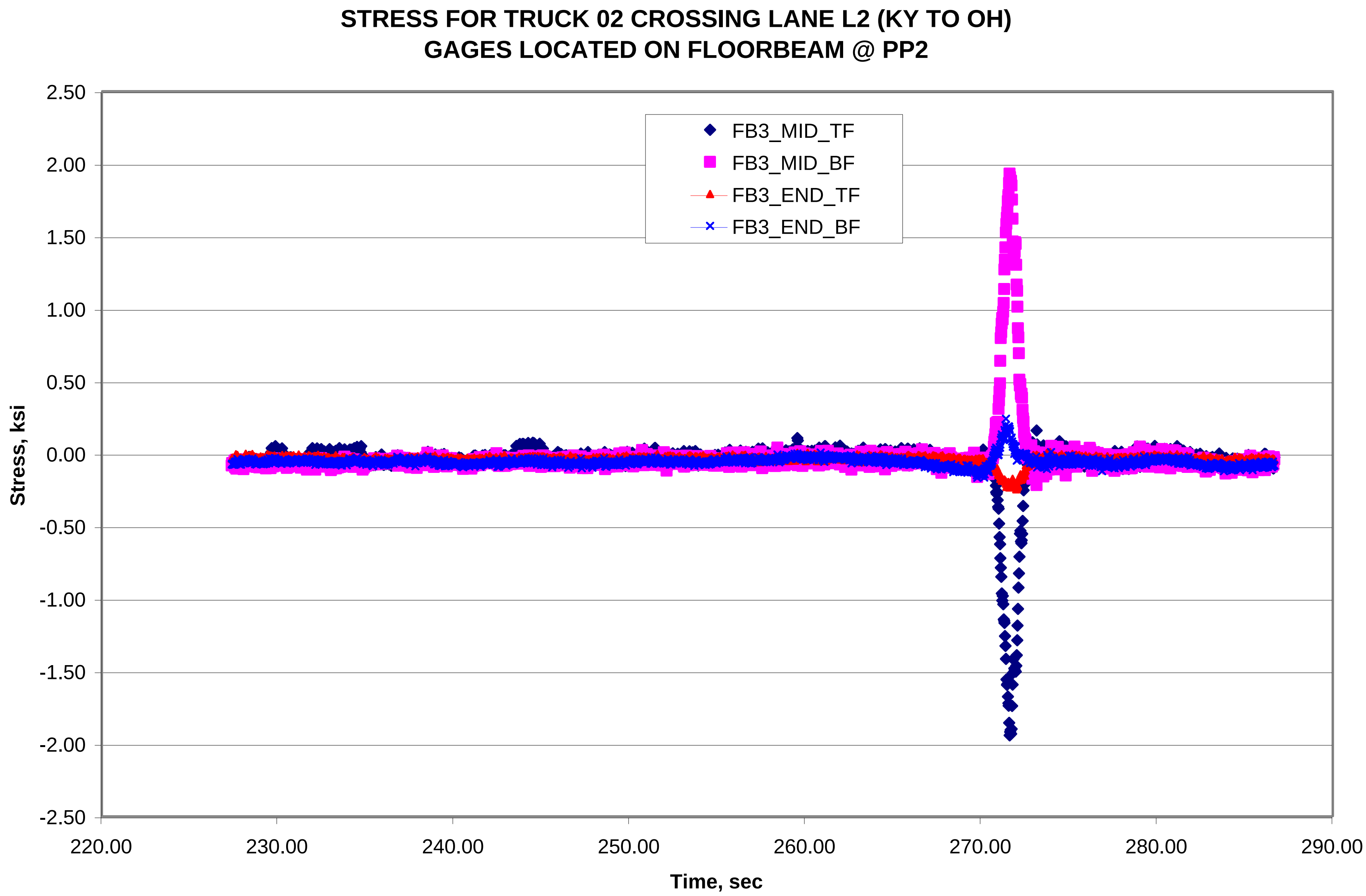

AVG STRESS FOR TRUCK 02 CROSSING LANE L2 (KY TO OH)
MEMBER L2U3
Stress, ksi
Time, sec
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
220.00
230.00
240.00
250.00
260.00
270.00
280.00
290.00
UT_L2U3_AVG FLANGE
UT_L2U3_AVG WEB
DT_L2U3_AVG FLANGE
DT_L2U3_AVG WEB

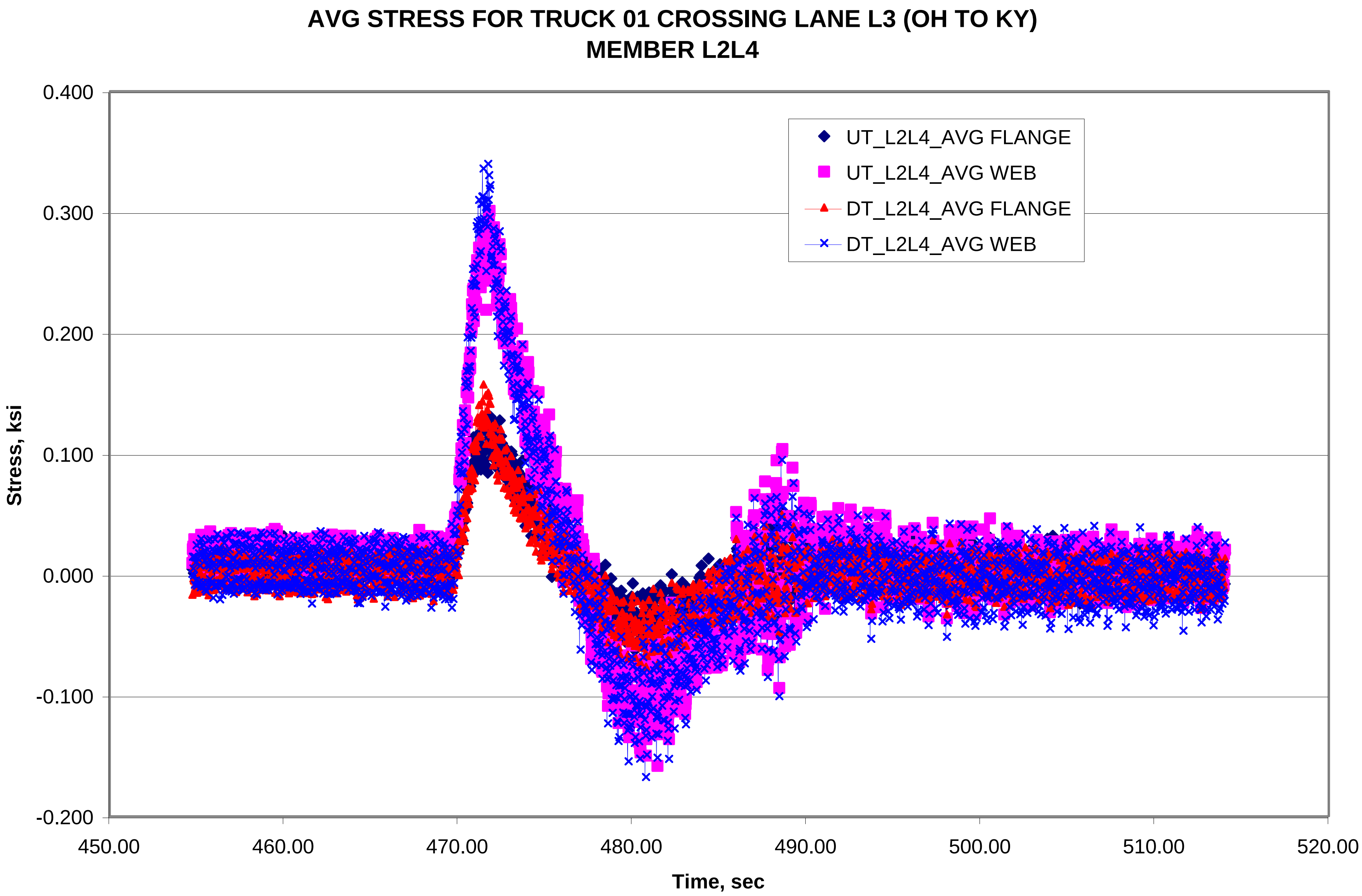


AVG STRESS FOR TRUCK 02 CROSSING LANE L2 (KY TO OH)
MEMBER U3U5
Stress, ksi
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
220.00
230.00
240.00
250.00
260.00
270.00
280.00
290.00
Time, sec
UT_U3U5_AVG FLANGE
UT_U3U5_AVG WEB
DT_U3U5_AVG FLANGE
DT_U3U5_AVG WEB

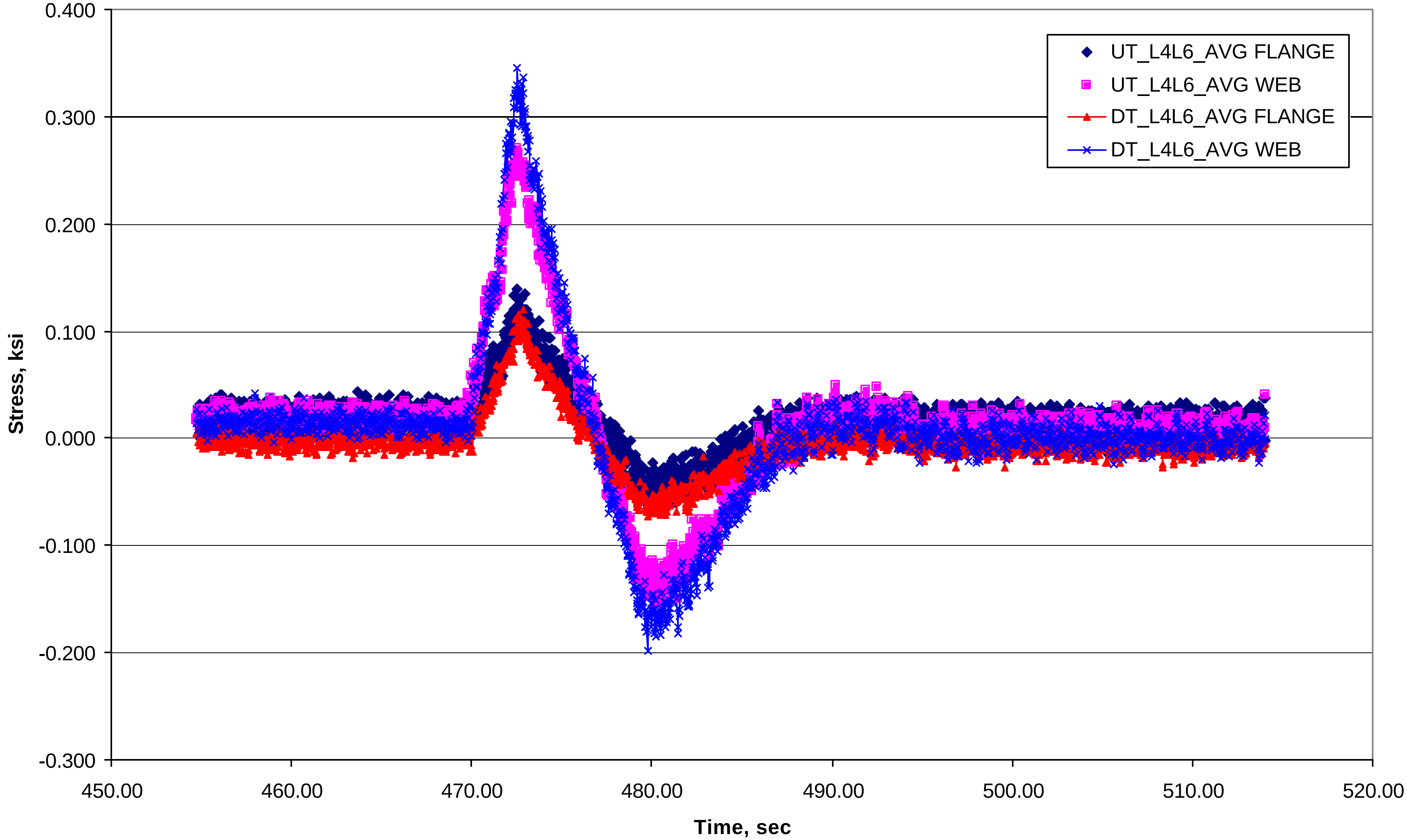

AVG STRESS FOR TRUCK 02 CROSSING LANE L2 (KY TO OH)
MEMBER U5U7
0.600
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
Stress, ksi
220.00
230.00
240.00
250.00
260.00
270.00
280.00
290.00
Time, sec
UT_U5U7_AVG FLANGE
UT_U5U7_AVG WEB
DT_U5U7_AVG FLANGE
DT_U5U7_AVG WEB

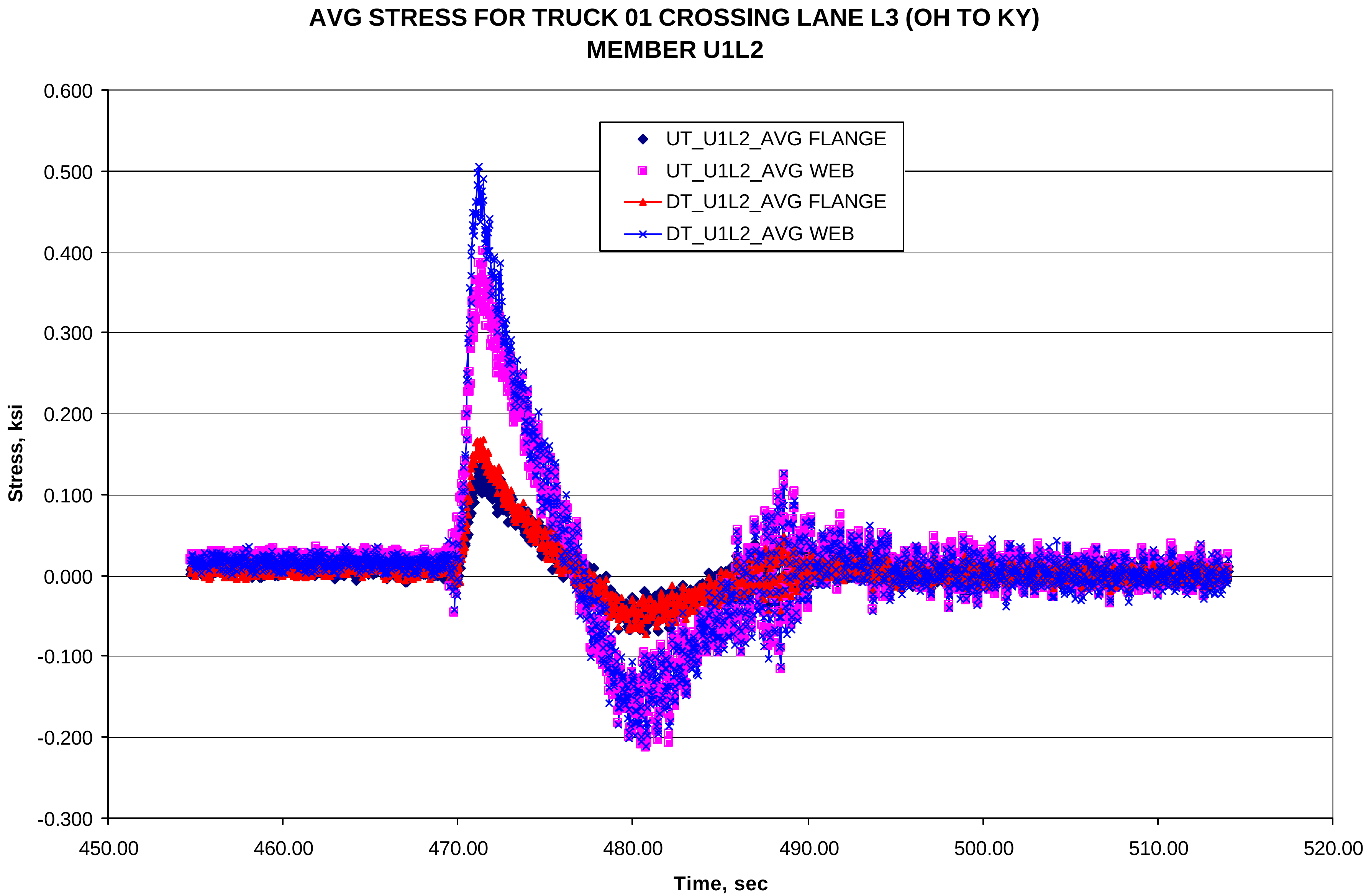

STRESS FOR TRUCK 02 CROSSING LANE L2 (KY TO OH)
GAGES LOCATED ON TOP FLANGE OF MEMBER UT_L4L6
Stress, ksi
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
220.00
230.00
240.00
250.00
260.00
270.00
280.00
290.00
Time, sec
UT_L4L6_IPERF
UT_L4L6_OPERF
UT_L4L6_RADIUS
UT_L4L6_RIVET

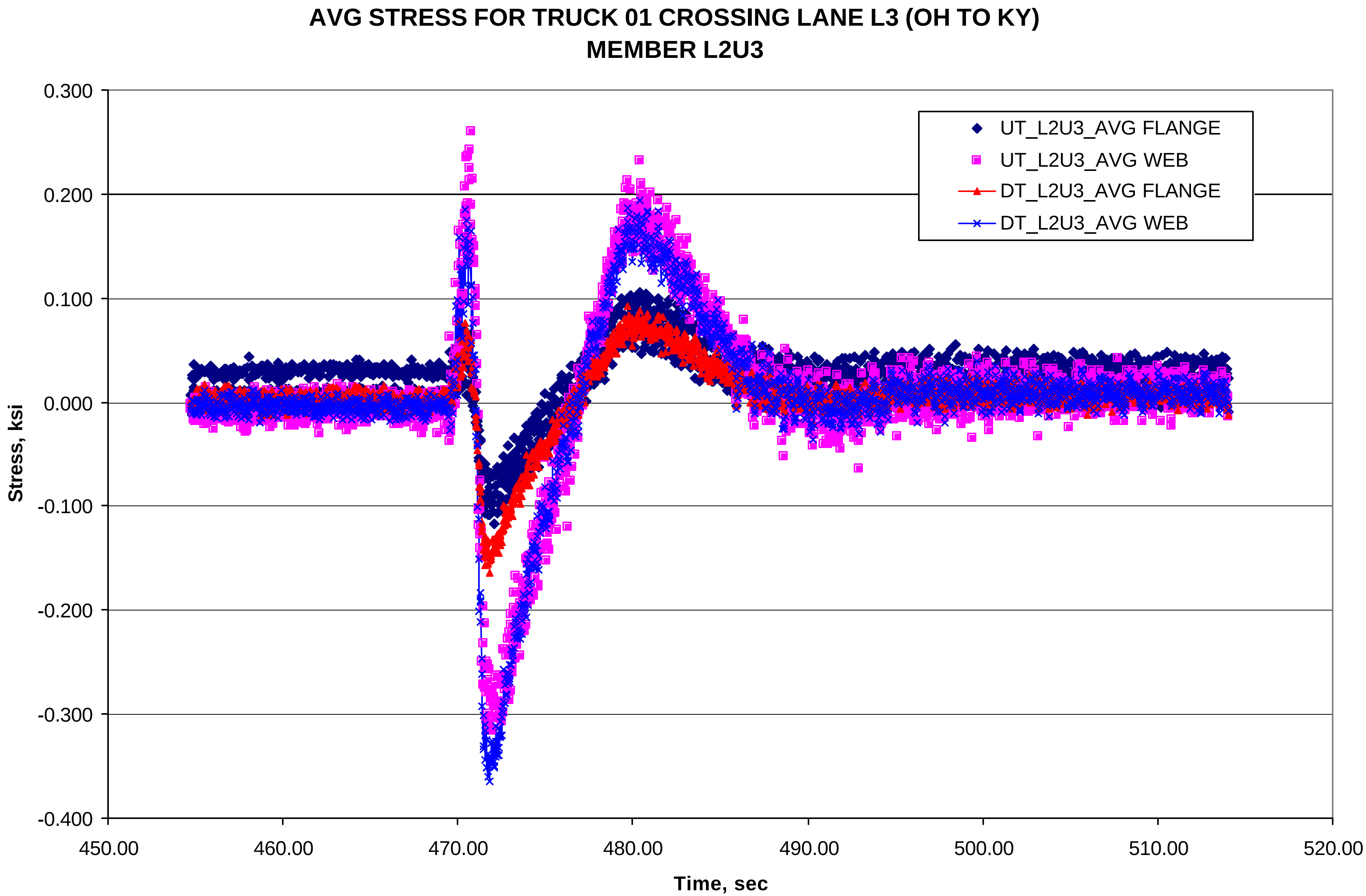

STRESS FOR TRUCK 02 CROSSING LANE L2 (KY TO OH)
GAGES LOCATED ON FLOORBEAM @ PP2
FB3_MID_TF
FB3_MID_BF
FB3_END_TF
FB3_END_BF
Stress, ksi
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
220.00
230.00
240.00
250.00
260.00
270.00
280.00
290.00
Time, sec


AVG STRESS FOR TRUCK 01 CROSSING LANE L3 (OH TO KY)
MEMBER L2L4
UT_L2L4_AVG FLANGE
UT_L2L4_AVG WEB
DT_L2L4_AVG FLANGE
DT_L2L4_AVG WEB
Stress, ksi
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
450.00
460.00
470.00
480.00
490.00
500.00
510.00
520.00
Time, sec

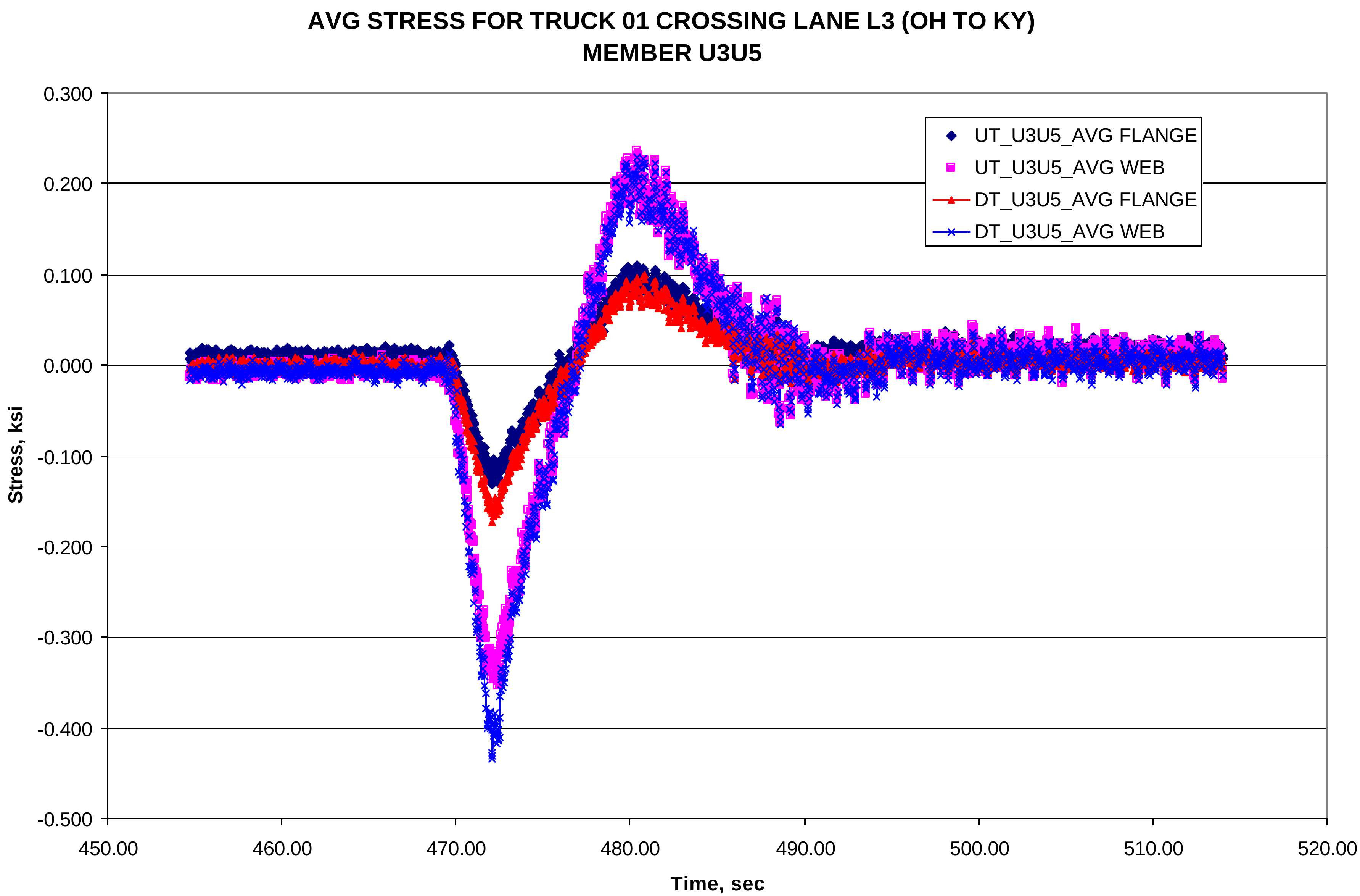
AVG STRESS FOR TRUCK 01 CROSSING LANE L3 (OH TO KY)
MEMBER L4L6



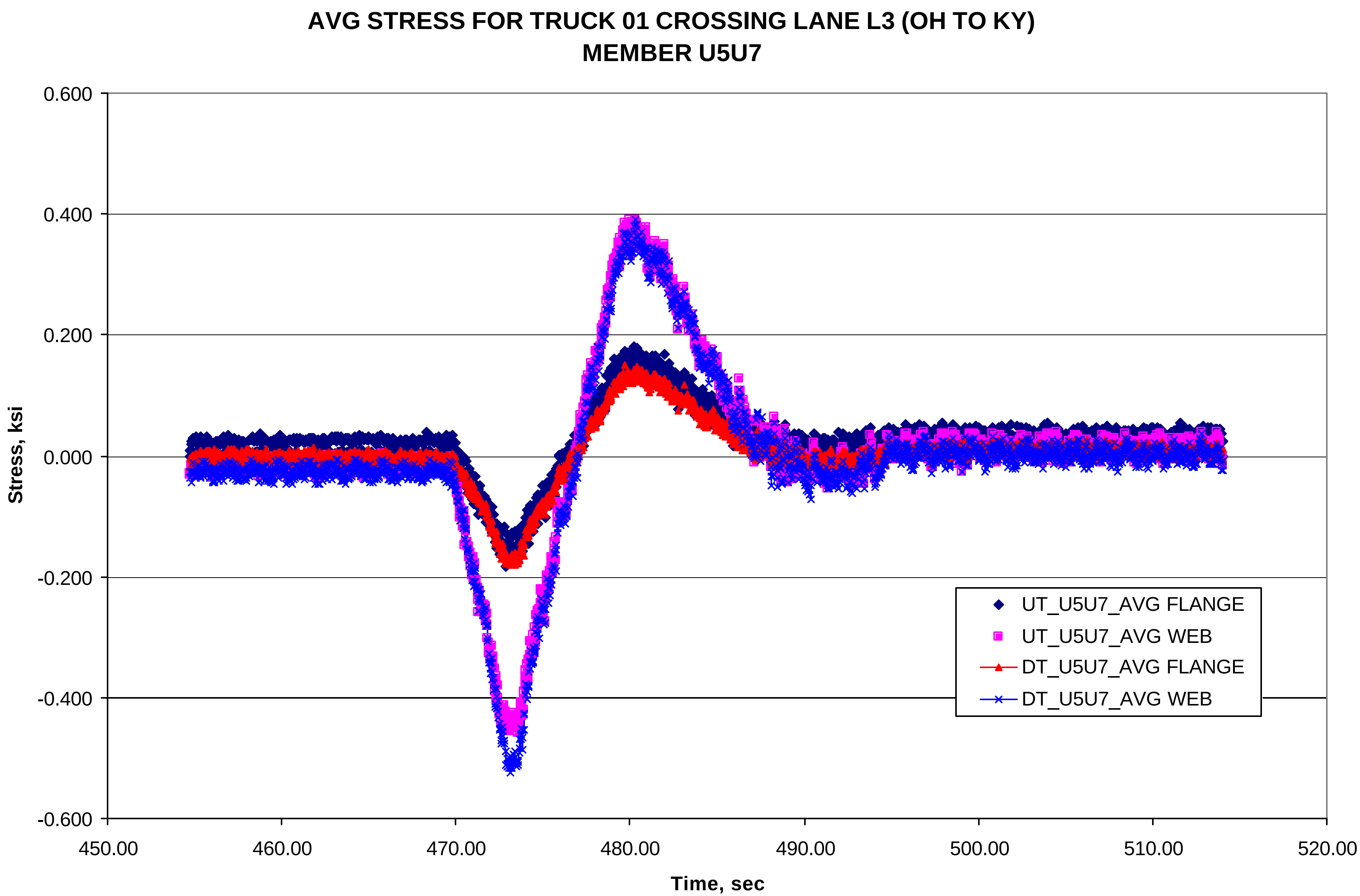

AVG STRESS FOR TRUCK 01 CROSSING LANE L3 (OH TO KY)
MEMBER U1L2
UT_U1L2_AVG FLANGE
UT_U1L2_AVG WEB
DT_U1L2_AVG FLANGE
DT_U1L2_AVG WEB
Stress, ksi
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
450.00
460.00
470.00
480.00
490.00
500.00
510.00
520.00
Time, sec

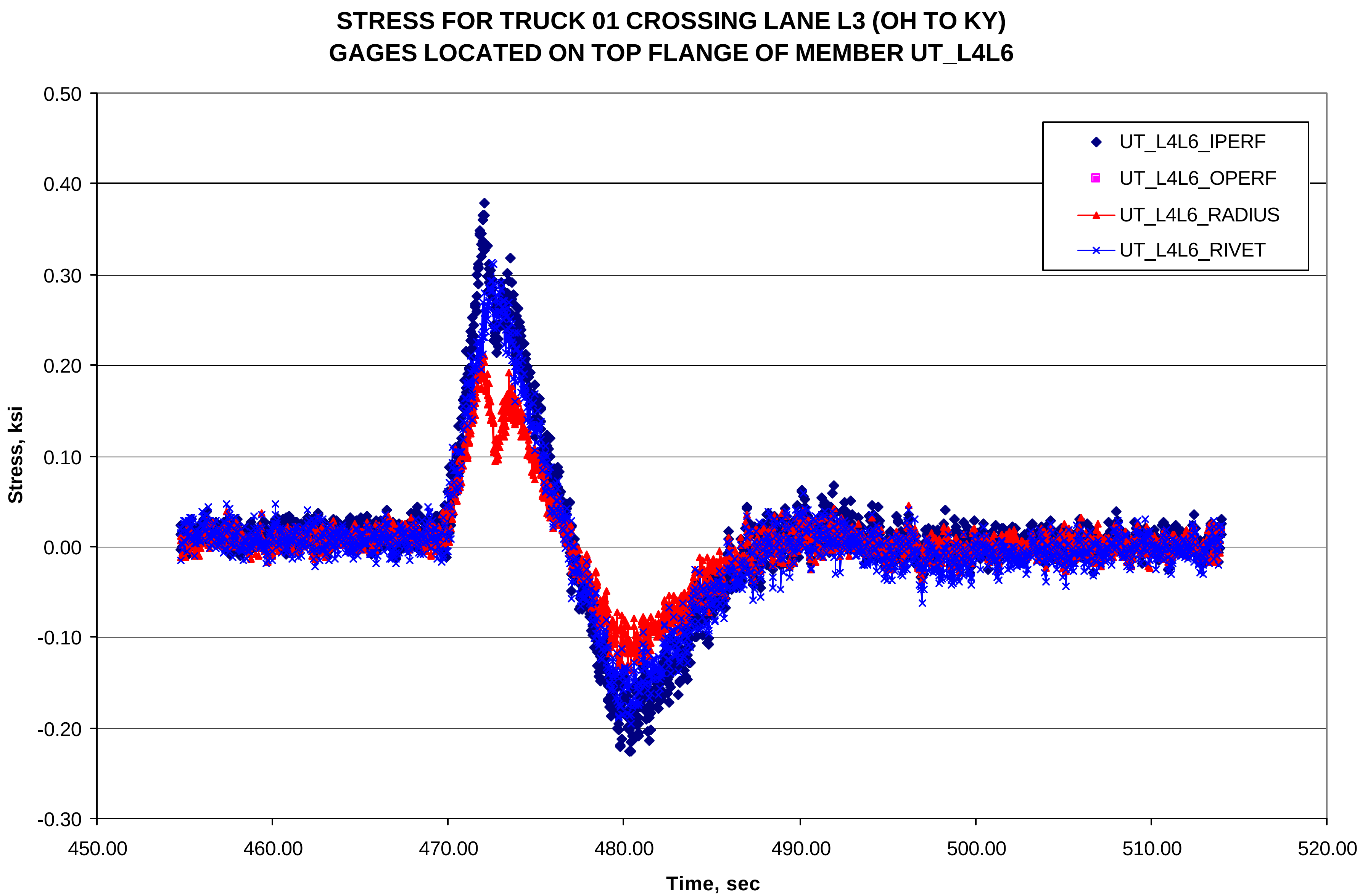


AVG STRESS FOR TRUCK 01 CROSSING LANE L3 (OH TO KY)
MEMBER L2U3
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
Stress, ksi
450.00
460.00
470.00
480.00
490.00
500.00
510.00
520.00
Time, sec
UT_L2U3_AVG FLANGE
UT_L2U3_AVG WEB
DT_L2U3_AVG FLANGE
DT_L2U3_AVG WEB

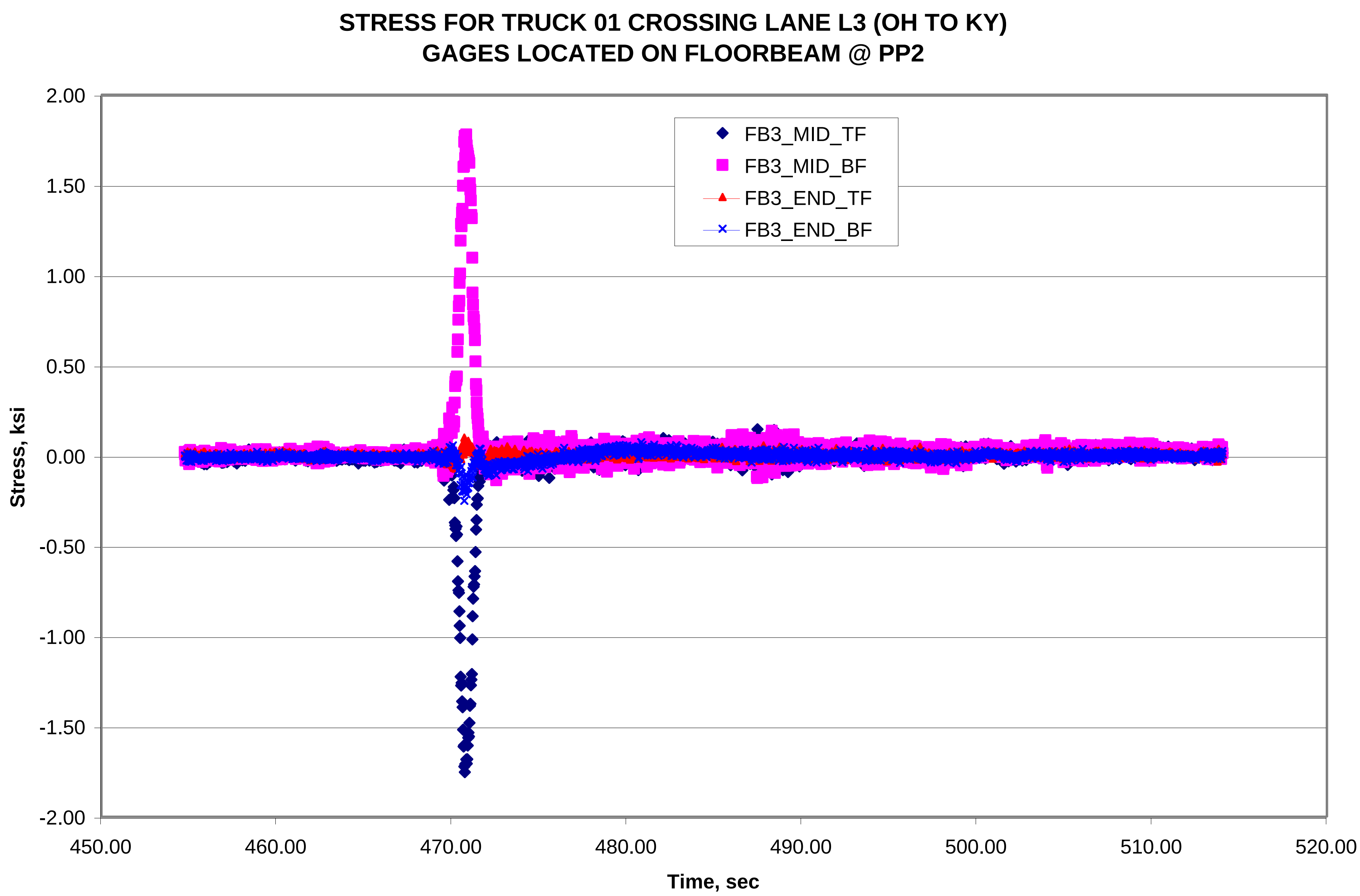


AVG STRESS FOR TRUCK 01 CROSSING LANE L3 (OH TO KY)
MEMBER U3U5
Stress, ksi
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
450.00
460.00
470.00
480.00
490.00
500.00
510.00
520.00
Time, sec
UT_U3U5_AVG FLANGE
UT_U3U5_AVG WEB
DT_U3U5_AVG FLANGE
DT_U3U5_AVG WEB

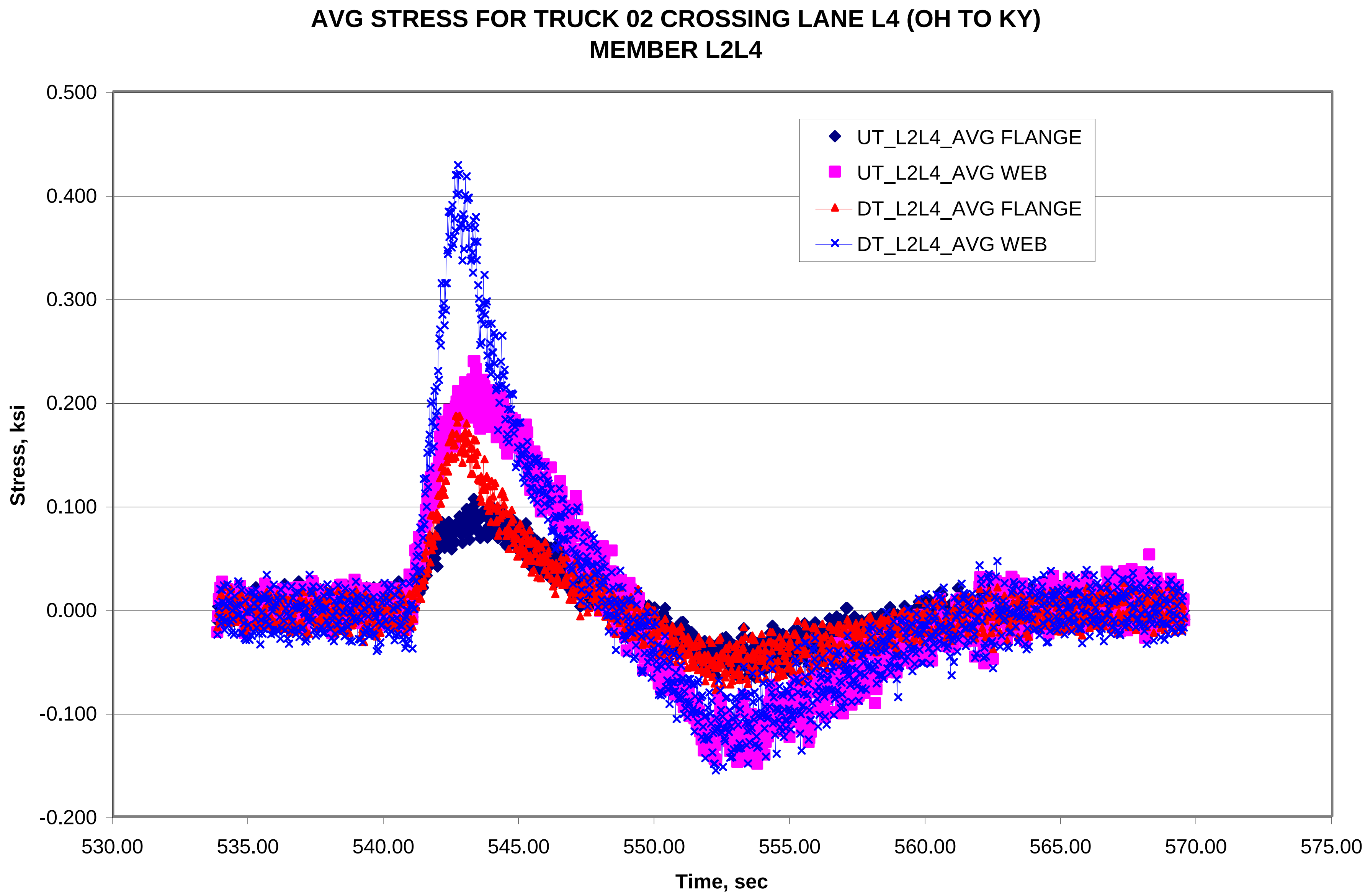

AVG STRESS FOR TRUCK 01 CROSSING LANE L3 (OH TO KY)
MEMBER U5U7
Stress, ksi
0.600
0.400
0.200
0.000
-0.200
-0.400
-0.600
450.00
460.00
470.00
480.00
490.00
500.00
510.00
520.00
Time, sec
UT_U5U7_AVG FLANGE
UT_U5U7_AVG WEB
DT_U5U7_AVG FLANGE
DT_U5U7_AVG WEB

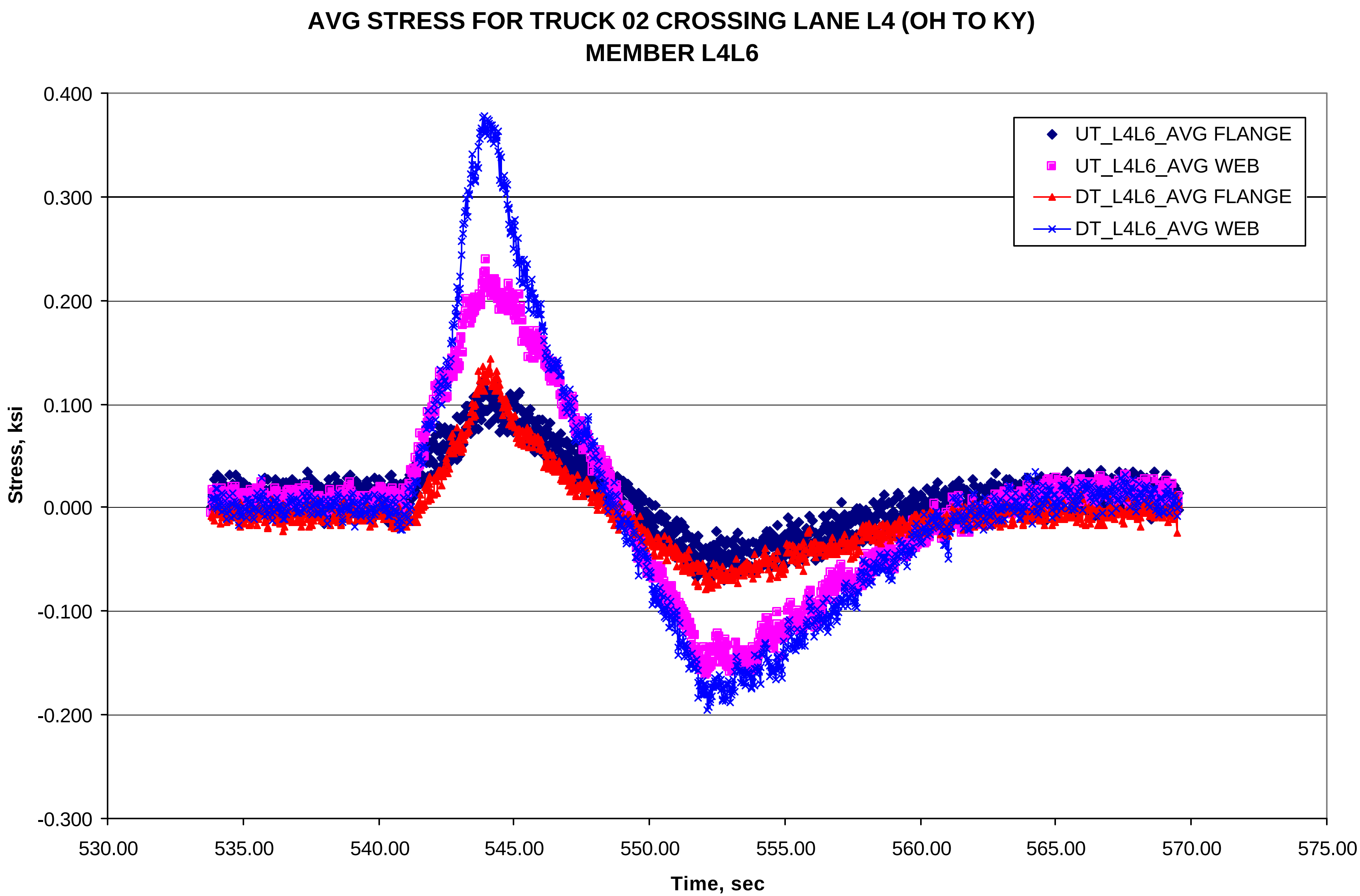


STRESS FOR TRUCK 01 CROSSING LANE L3 (OH TO KY)
GAGES LOCATED ON TOP FLANGE OF MEMBER UT_L4L6
Stress, ksi
Time, sec
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
450.00
460.00
470.00
480.00
490.00
500.00
510.00
520.00
UT_L4L6_IPERF
UT_L4L6_OPERF
UT_L4L6_RADIUS
UT_L4L6_RIVET

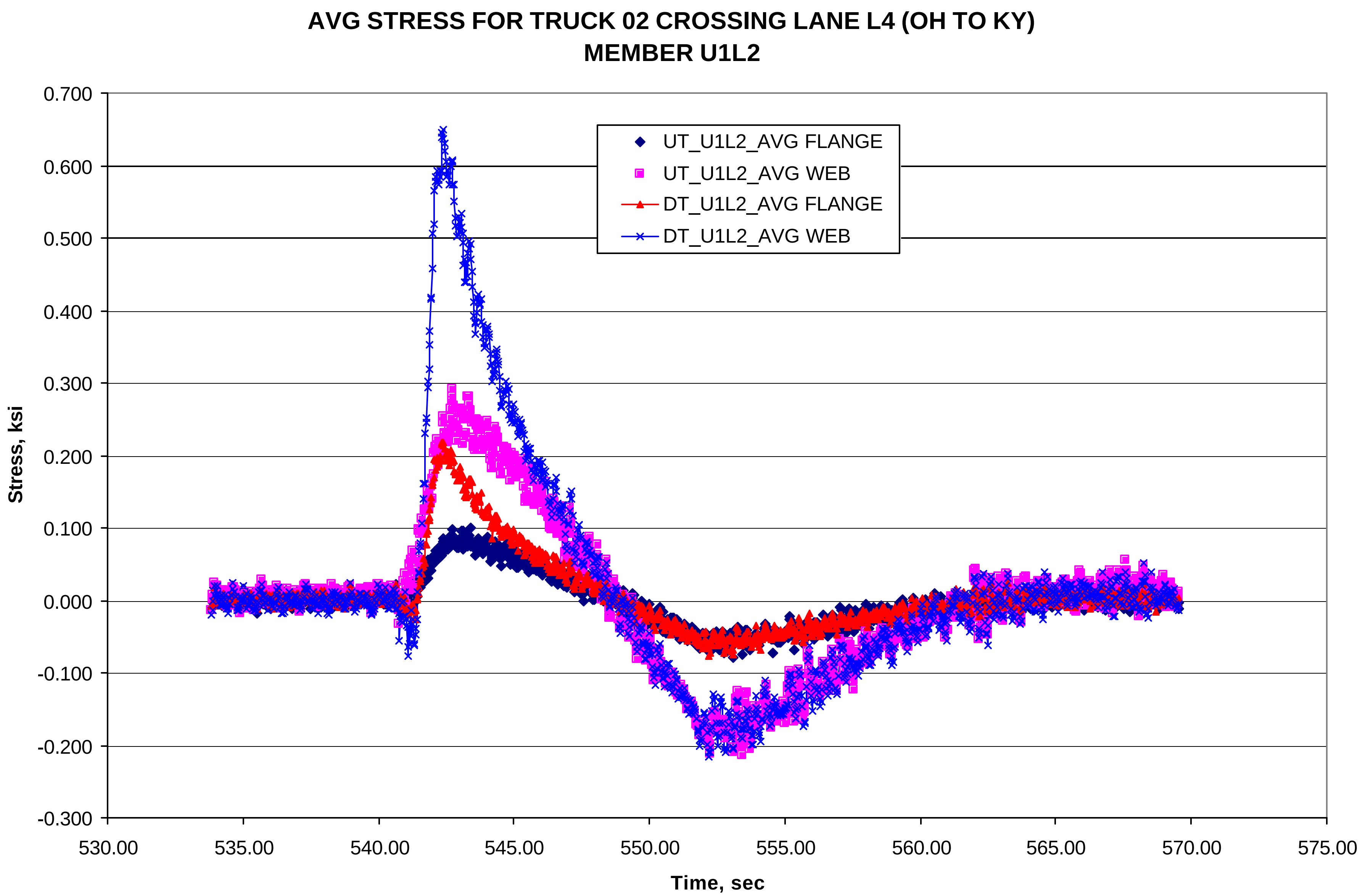


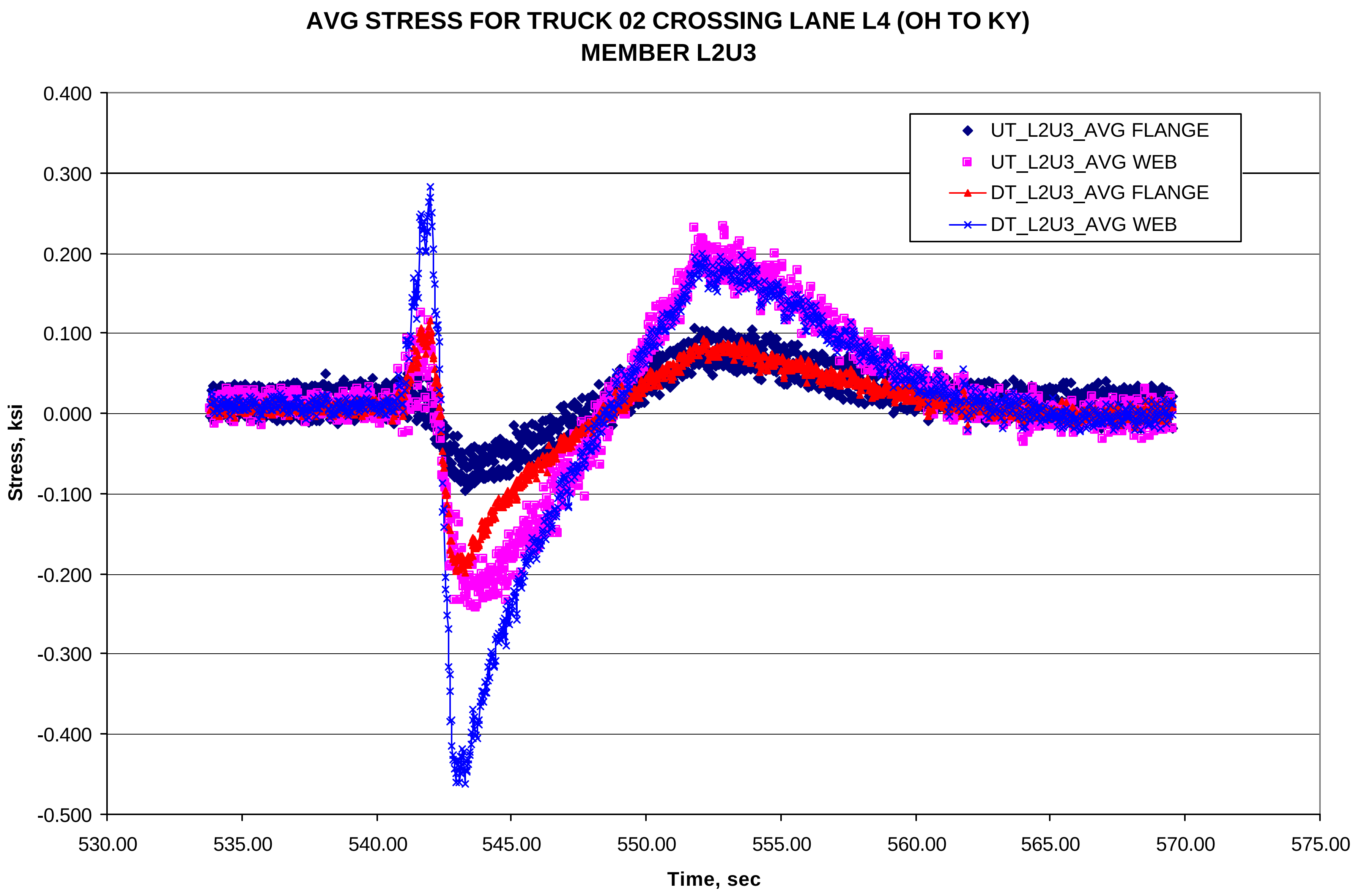
STRESS FOR TRUCK 01 CROSSING LANE L3 (OH TO KY)
GAGES LOCATED ON FLOORBEAM @ PP2
FB3_MID_TF
FB3_MID_BF
FB3_END_TF
FB3_END_BF
Stress, ksi
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
450.00
460.00
470.00
480.00
490.00
500.00
510.00
520.00
Time, sec


AVG STRESS FOR TRUCK 02 CROSSING LANE L4 (OH TO KY)
MEMBER L2L4
Stress, ksi
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
530.00
535.00
540.00
545.00
550.00
555.00
560.00
565.00
570.00
575.00
Time, sec
UT_L2L4_AVG FLANGE
UT_L2L4_AVG WEB
DT_L2L4_AVG FLANGE
DT_L2L4_AVG WEB

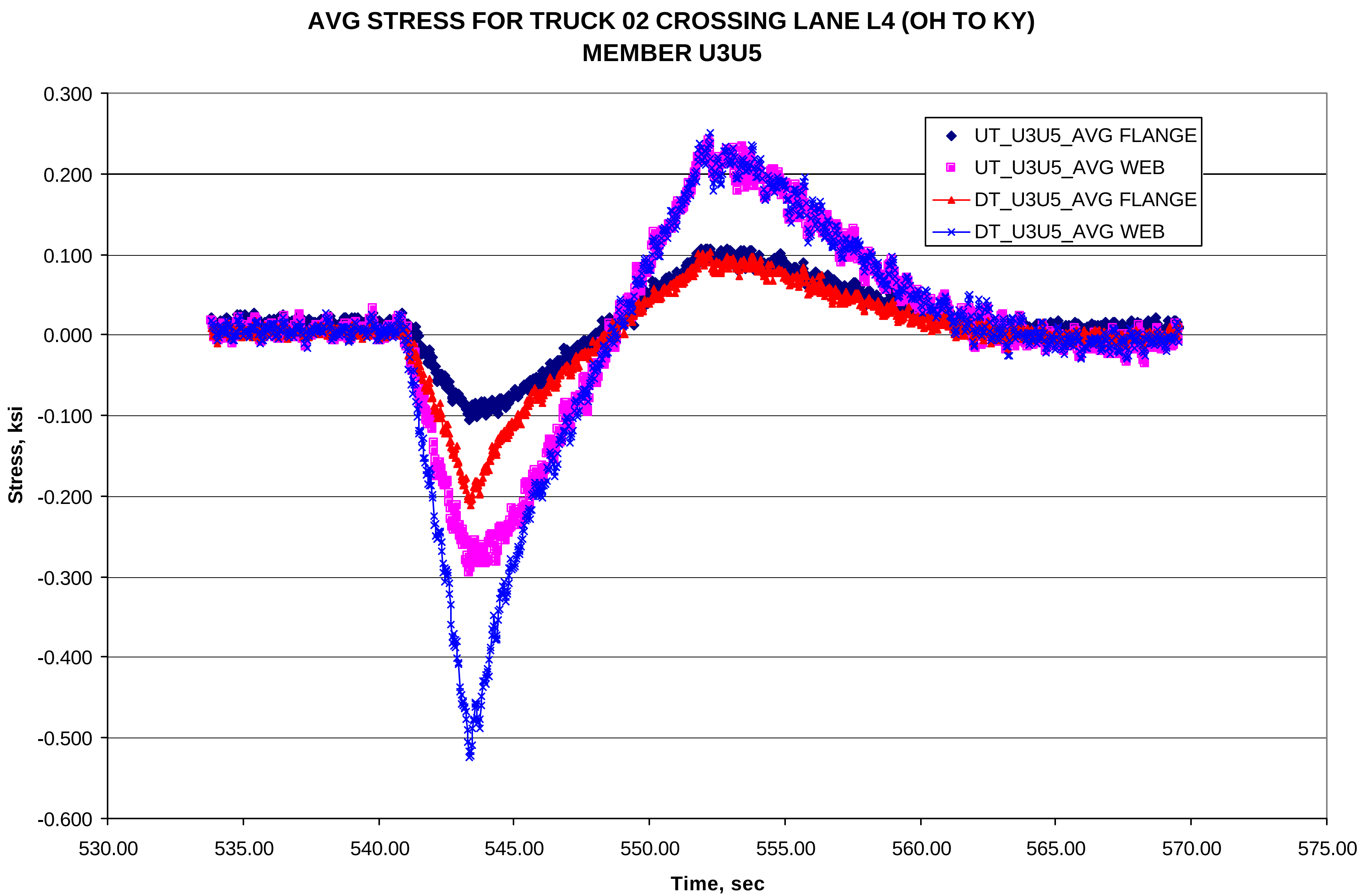


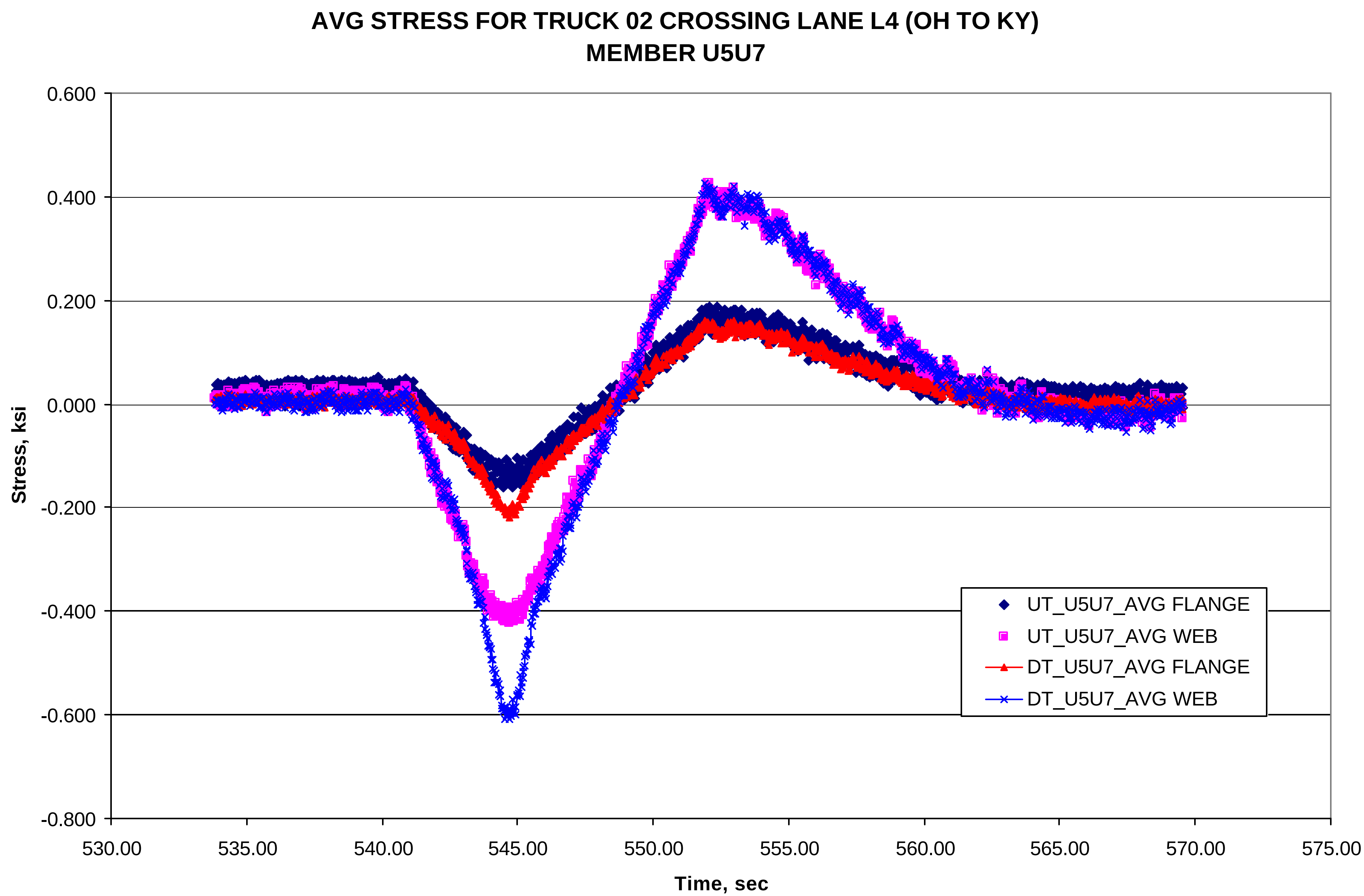
AVG STRESS FOR TRUCK 02 CROSSING LANE L4 (OH TO KY)
MEMBER L4L6
Stress, ksi
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
530.00
535.00
540.00
545.00
550.00
555.00
560.00
565.00
570.00
575.00
Time, sec
UT_L4L6_AVG FLANGE
UT_L4L6_AVG WEB
DT_L4L6_AVG FLANGE
DT_L4L6_AVG WEB

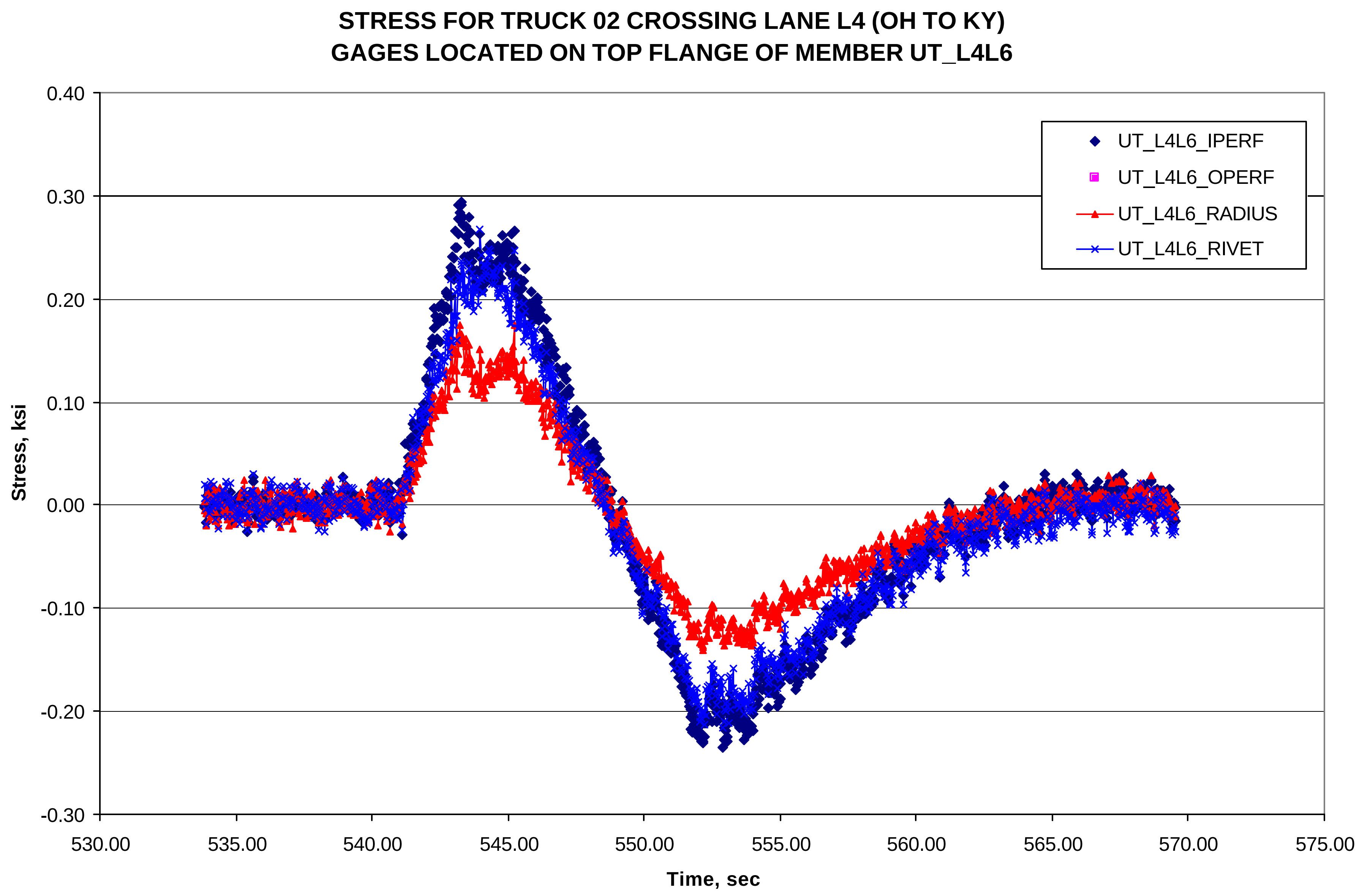

AVG STRESS FOR TRUCK 02 CROSSING LANE L4 (OH TO KY)
MEMBER U1L2
UT_U1L2_AVG FLANGE
UT_U1L2_AVG WEB
DT_U1L2_AVG FLANGE
DT_U1L2_AVG WEB
Stress, ksi
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
530.00
535.00
540.00
545.00
550.00
555.00
560.00
565.00
570.00
575.00
Time, sec



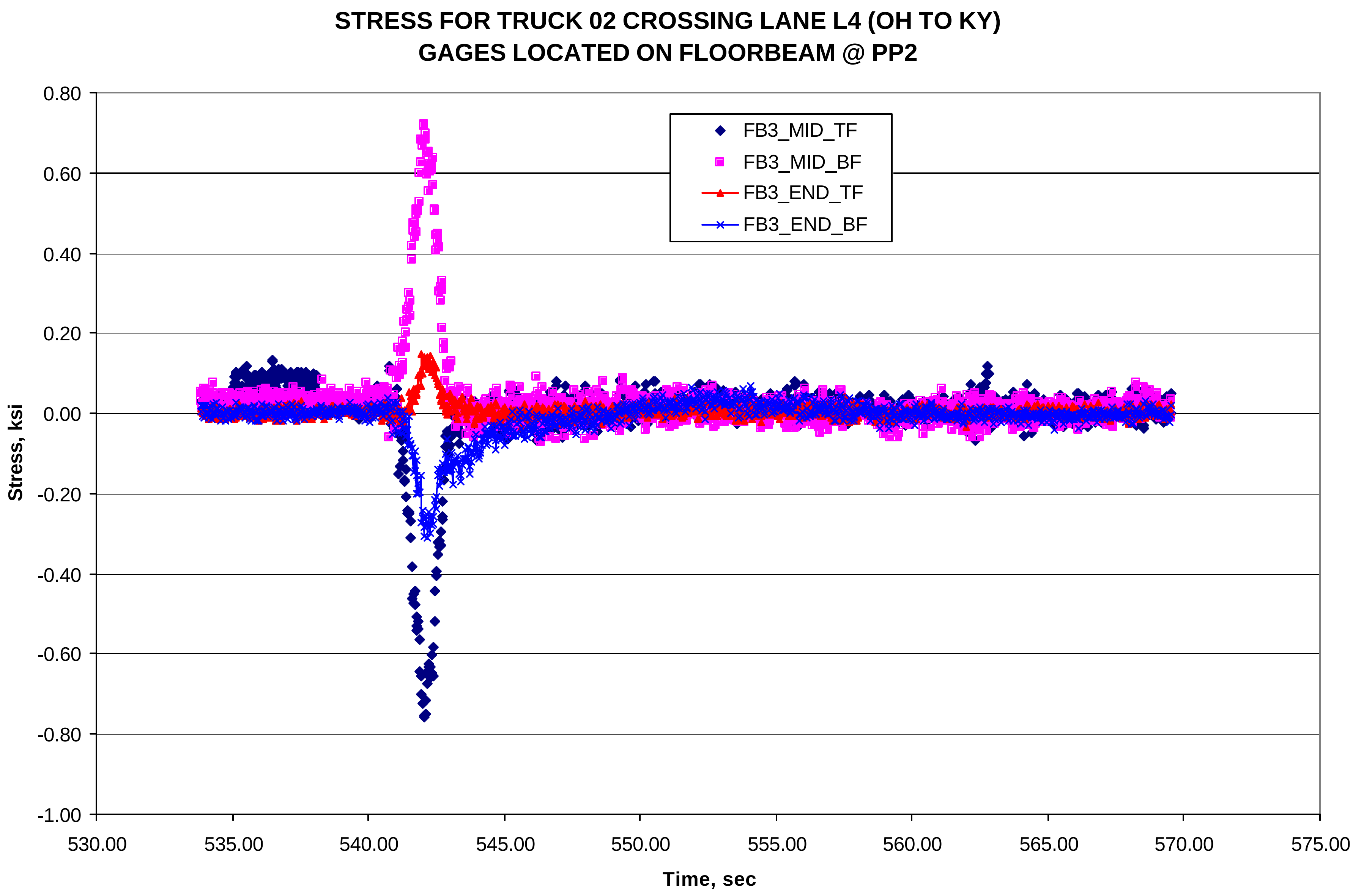
AVG STRESS FOR TRUCK 02 CROSSING LANE L4 (OH TO KY)
MEMBER L2U3
Stress, ksi
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
530.00
535.00
540.00
545.00
550.00
555.00
560.00
565.00
570.00
575.00
Time, sec
UT_L2U3_AVG FLANGE
UT_L2U3_AVG WEB
DT_L2U3_AVG FLANGE
DT_L2U3_AVG WEB

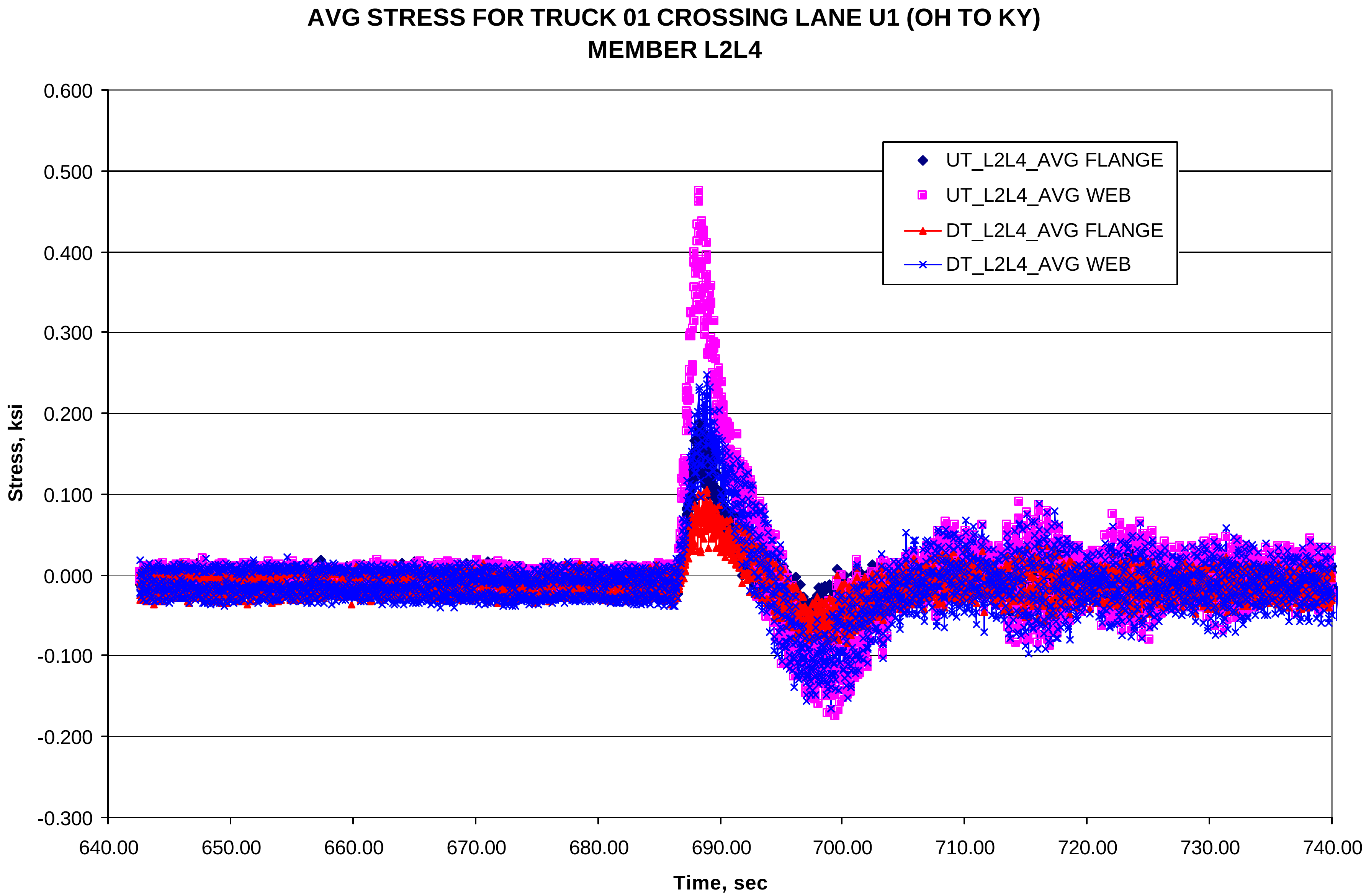

AVG STRESS FOR TRUCK 02 CROSSING LANE L4 (OH TO KY)
MEMBER U3U5
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
-0.600
Stress, ksi
530.00
535.00
540.00
545.00
550.00
555.00
560.00
565.00
570.00
575.00
Time, sec
UT_U3U5_AVG FLANGE
UT_U3U5_AVG WEB
DT_U3U5_AVG FLANGE
DT_U3U5_AVG WEB

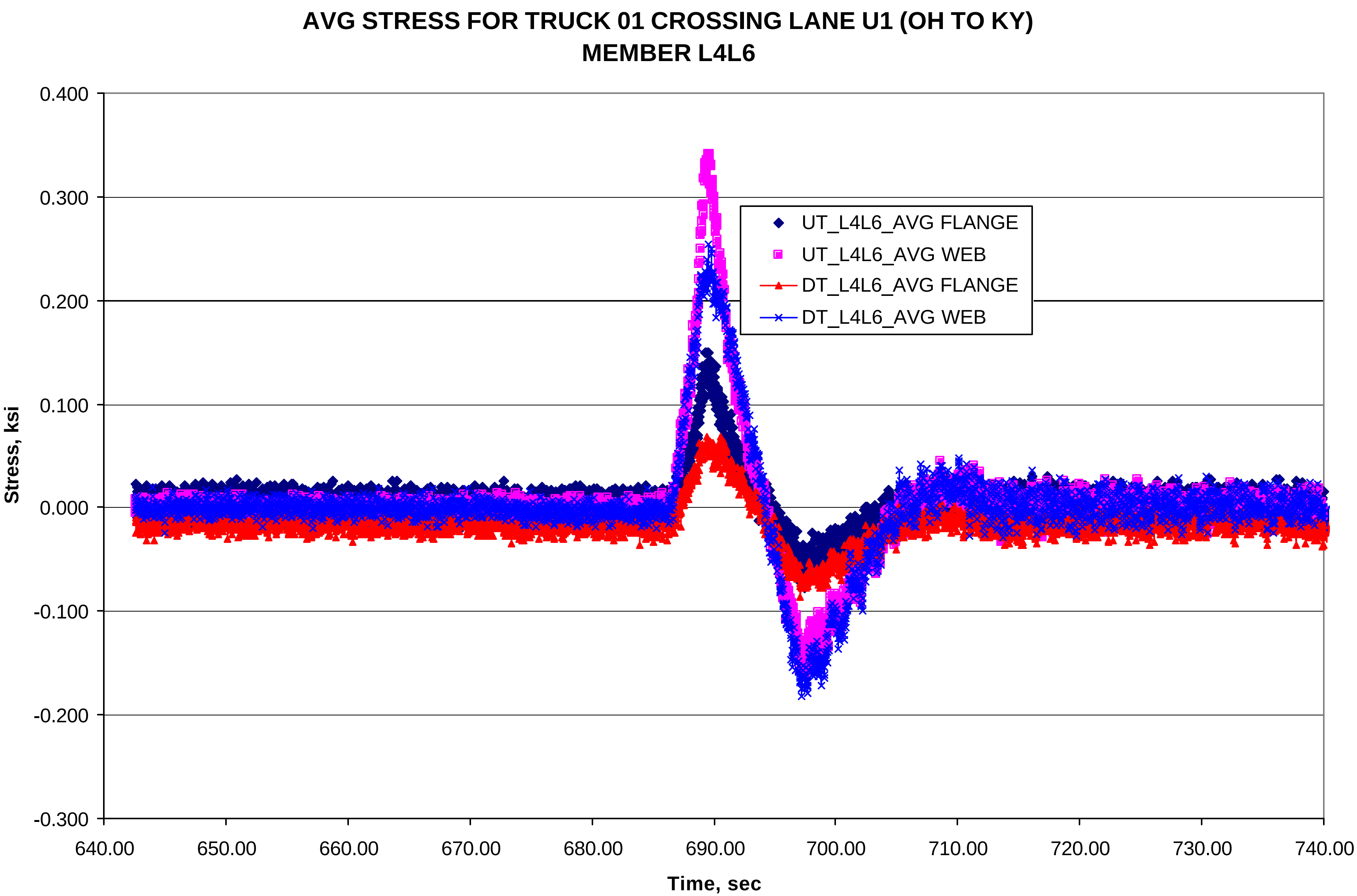

AVG STRESS FOR TRUCK 02 CROSSING LANE L4 (OH TO KY)
MEMBER U5U7
0.600
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
Stress, ksi
530.00
535.00
540.00
545.00
550.00
555.00
560.00
565.00
570.00
575.00
Time, sec
UT_U5U7_AVG FLANGE
UT_U5U7_AVG WEB
DT_U5U7_AVG FLANGE
DT_U5U7_AVG WEB

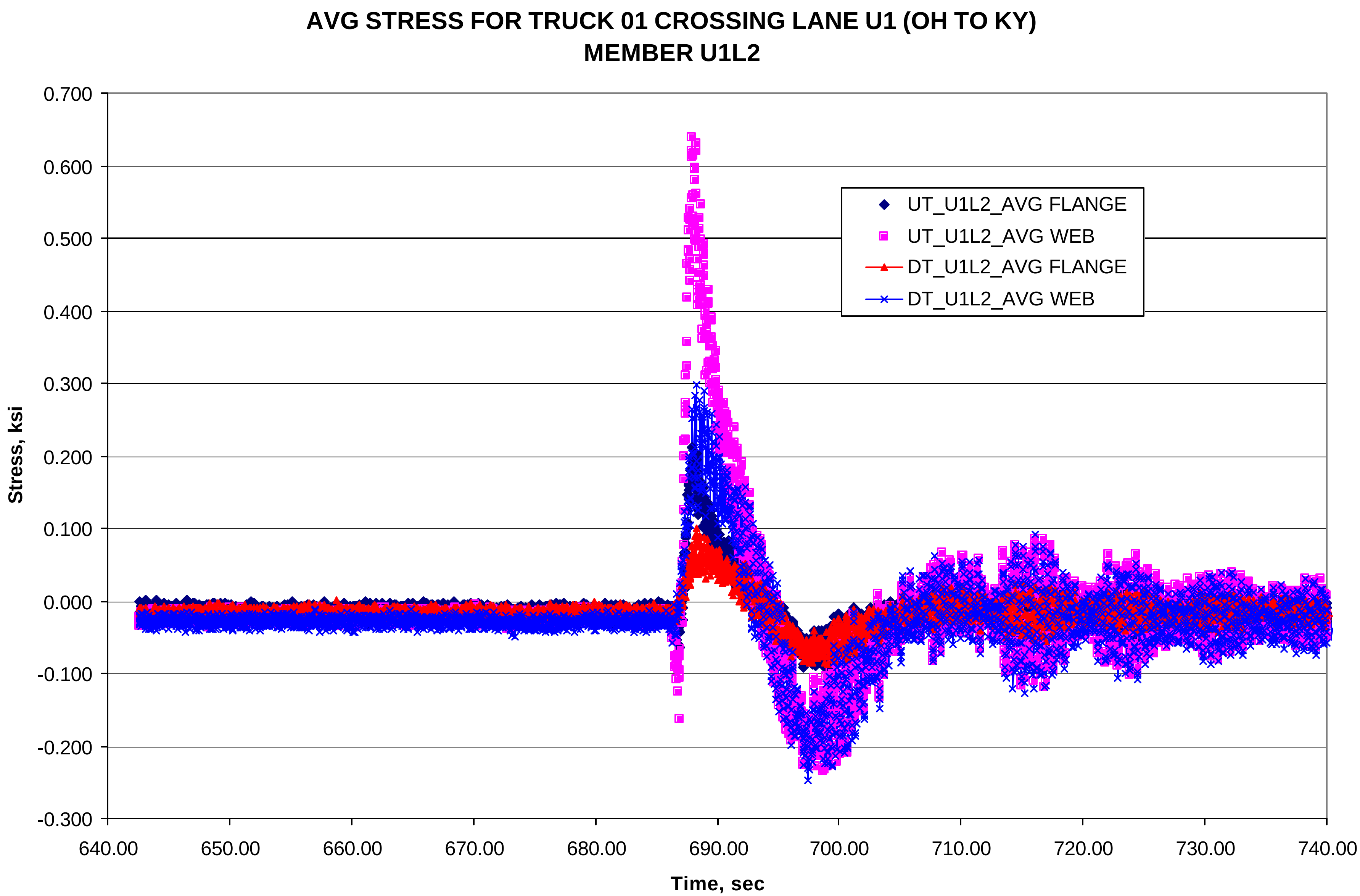


STRESS FOR TRUCK 02 CROSSING LANE L4 (OH TO KY)
GAGES LOCATED ON TOP FLANGE OF MEMBER UT_L4L6
Stress, ksi
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
530.00
535.00
540.00
545.00
550.00
555.00
560.00
565.00
570.00
575.00
Time, sec
UT_L4L6_IPERF
UT_L4L6_OPERF
UT_L4L6_RADIUS
UT_L4L6_RIVET

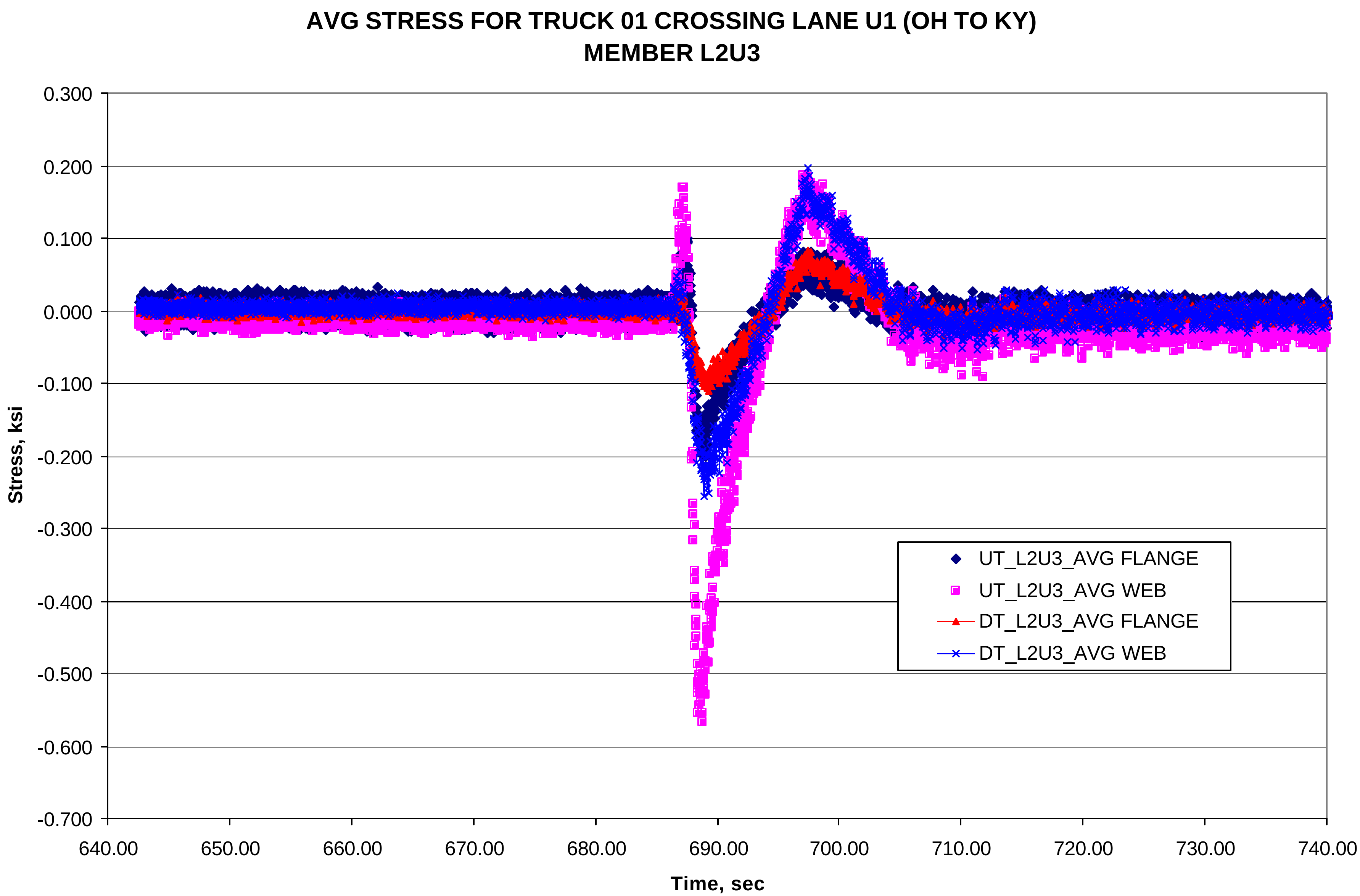

STRESS FOR TRUCK 02 CROSSING LANE L4 (OH TO KY)
GAGES LOCATED ON FLOORBEAM @ PP2
FB3_MID_TF
FB3_MID_BF
FB3_END_TF
FB3_END_BF
Stress, ksi
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
530.00
535.00
540.00
545.00
550.00
555.00
560.00
565.00
570.00
575.00
Time, sec

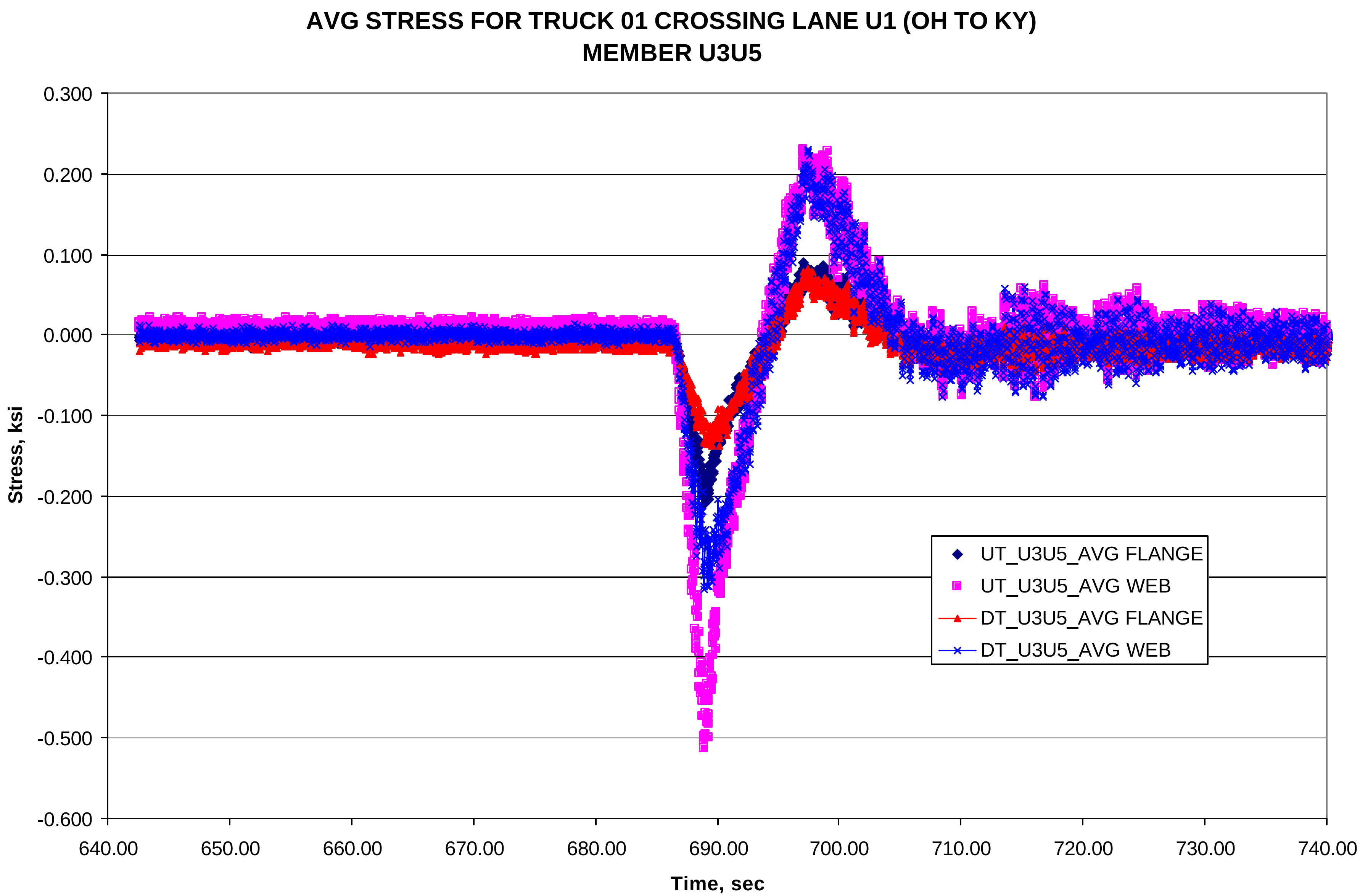

AVG STRESS FOR TRUCK 01 CROSSING LANE U1 (OH TO KY)
MEMBER L2L4
Stress, ksi
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
640.00
650.00
660.00
670.00
680.00
690.00
700.00
710.00
720.00
730.00
740.00
Time, sec
UT_L2L4_AVG FLANGE
UT_L2L4_AVG WEB
DT_L2L4_AVG FLANGE
DT_L2L4_AVG WEB

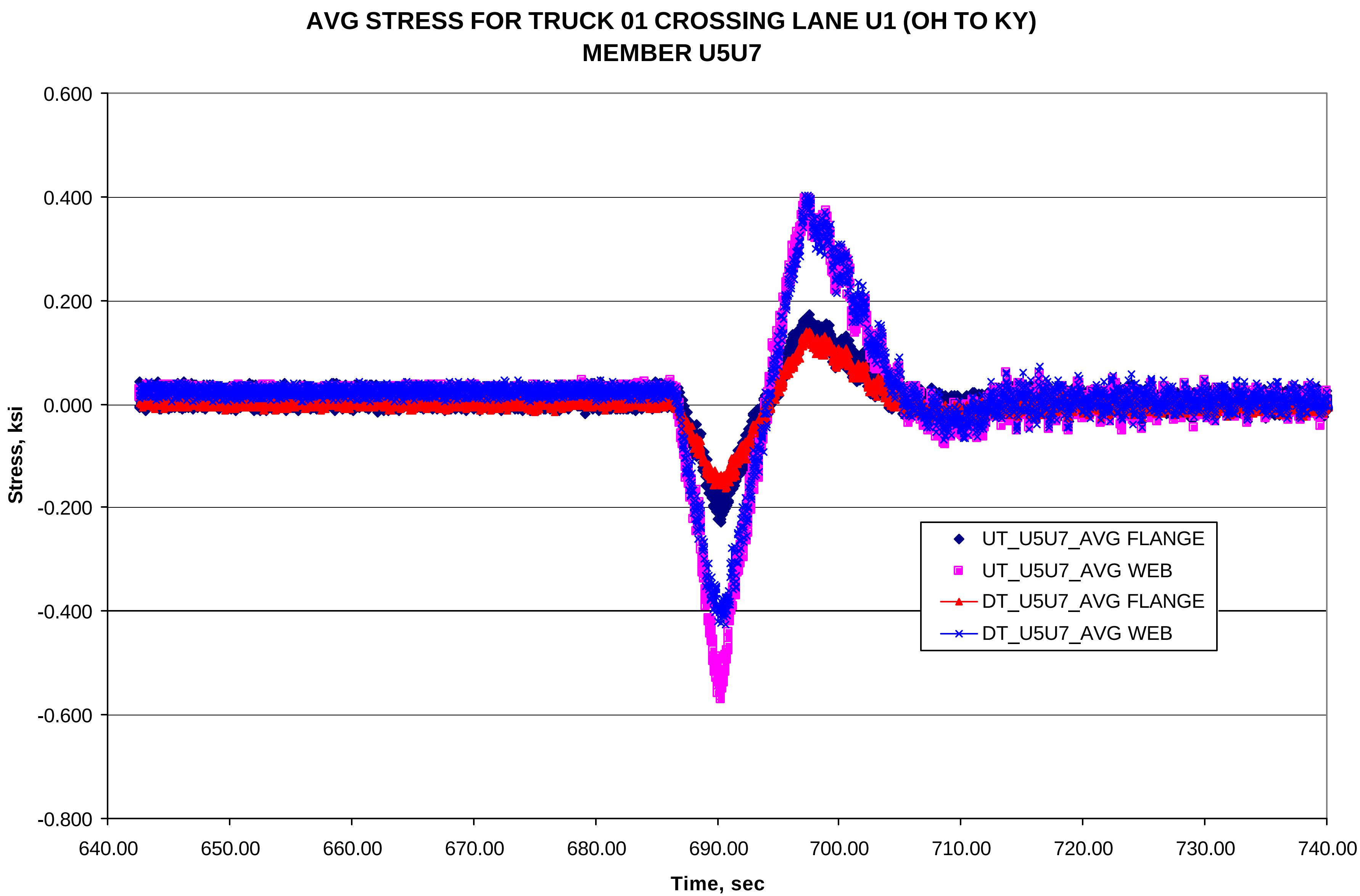

AVG STRESS FOR TRUCK 01 CROSSING LANE U1 (OH TO KY)
MEMBER L4L6
Stress, ksi
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
640.00
650.00
660.00
670.00
680.00
690.00
700.00
710.00
720.00
730.00
740.00
Time, sec
UT_L4L6_AVG FLANGE
UT_L4L6_AVG WEB
DT_L4L6_AVG FLANGE
DT_L4L6_AVG WEB

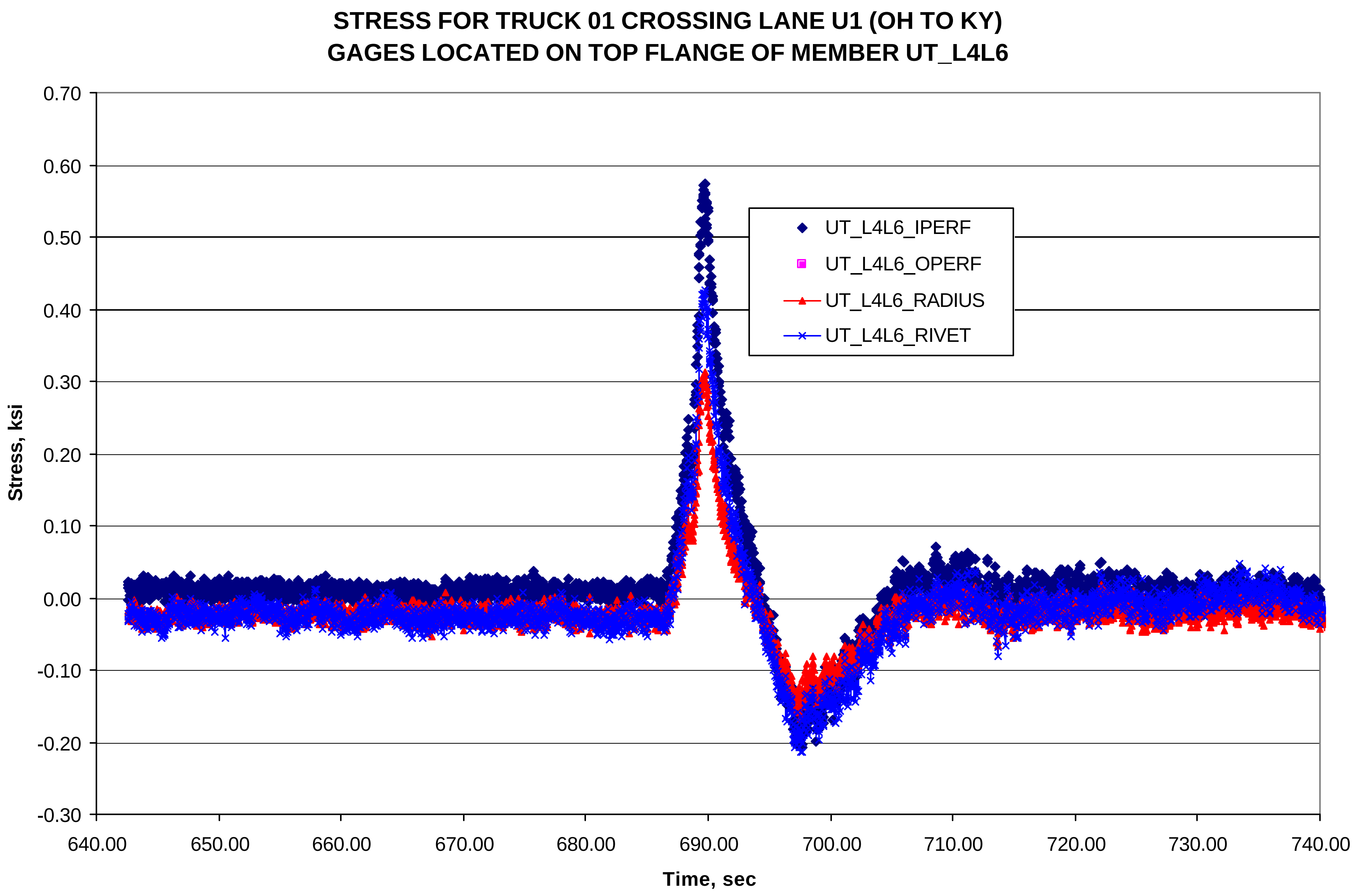


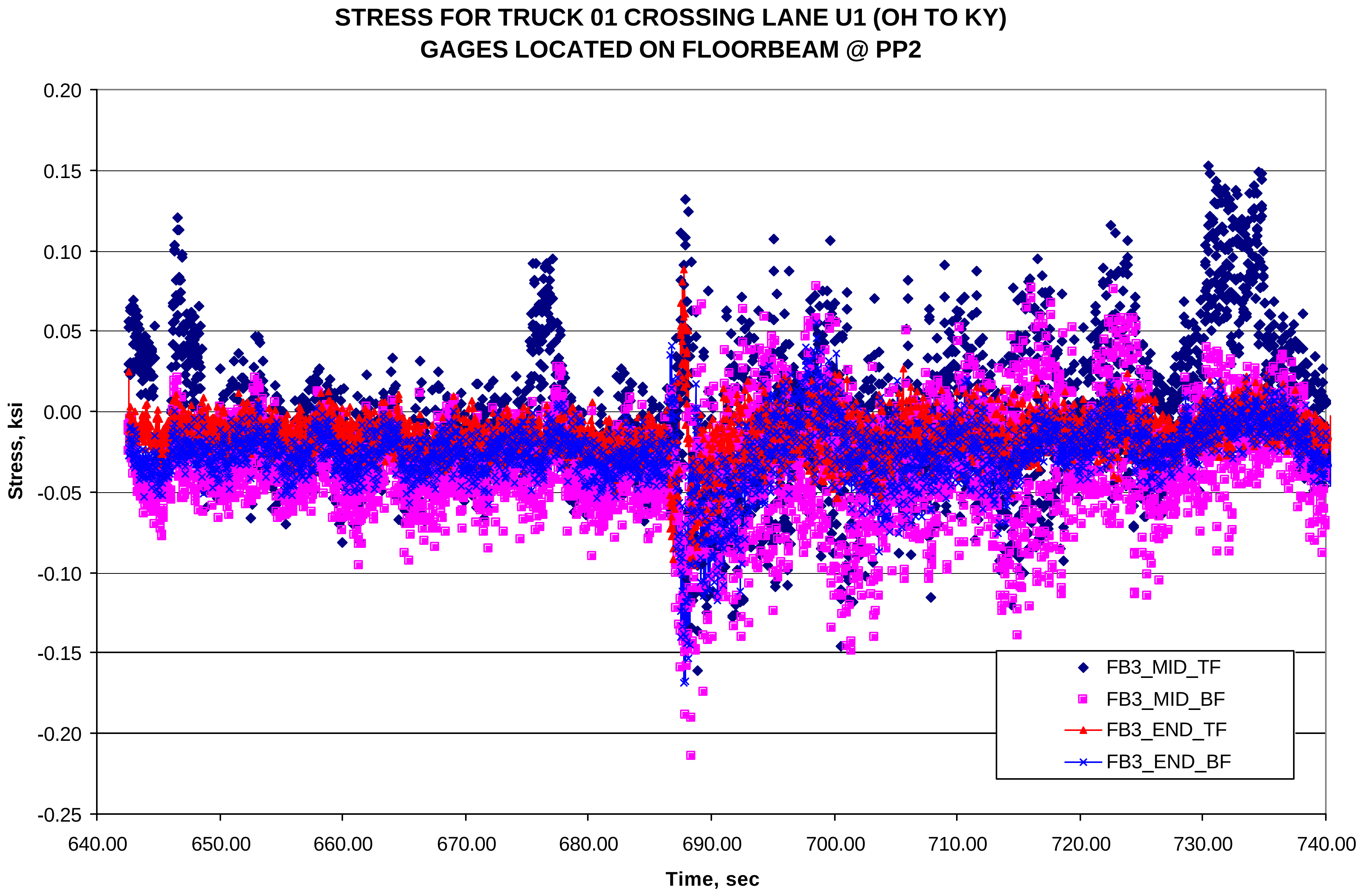
AVG STRESS FOR TRUCK 01 CROSSING LANE U1 (OH TO KY)
MEMBER U1L2
Stress, ksi
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
640.00
650.00
660.00
670.00
680.00
690.00
700.00
710.00
720.00
730.00
740.00
Time, sec
UT_U1L2_AVG FLANGE
UT_U1L2_AVG WEB
DT_U1L2_AVG FLANGE
DT_U1L2_AVG WEB

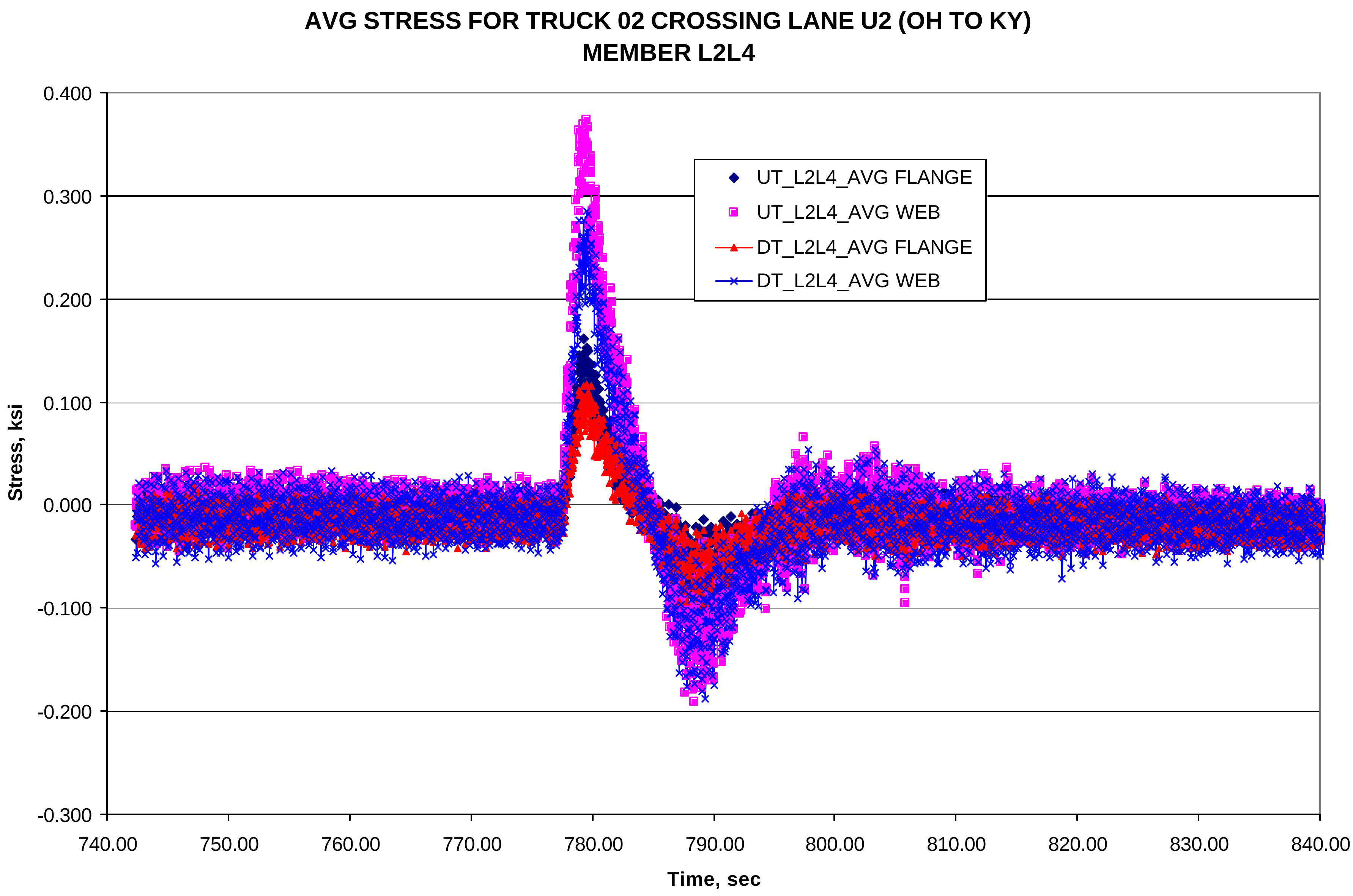

AVG STRESS FOR TRUCK 01 CROSSING LANE U1 (OH TO KY)
MEMBER L2U3
Stress, ksi
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
-0.600
-0.700
640.00
650.00
660.00
670.00
680.00
690.00
700.00
710.00
720.00
730.00
740.00
Time, sec
UT_L2U3_AVG FLANGE
UT_L2U3_AVG WEB
DT_L2U3_AVG FLANGE
DT_L2U3_AVG WEB

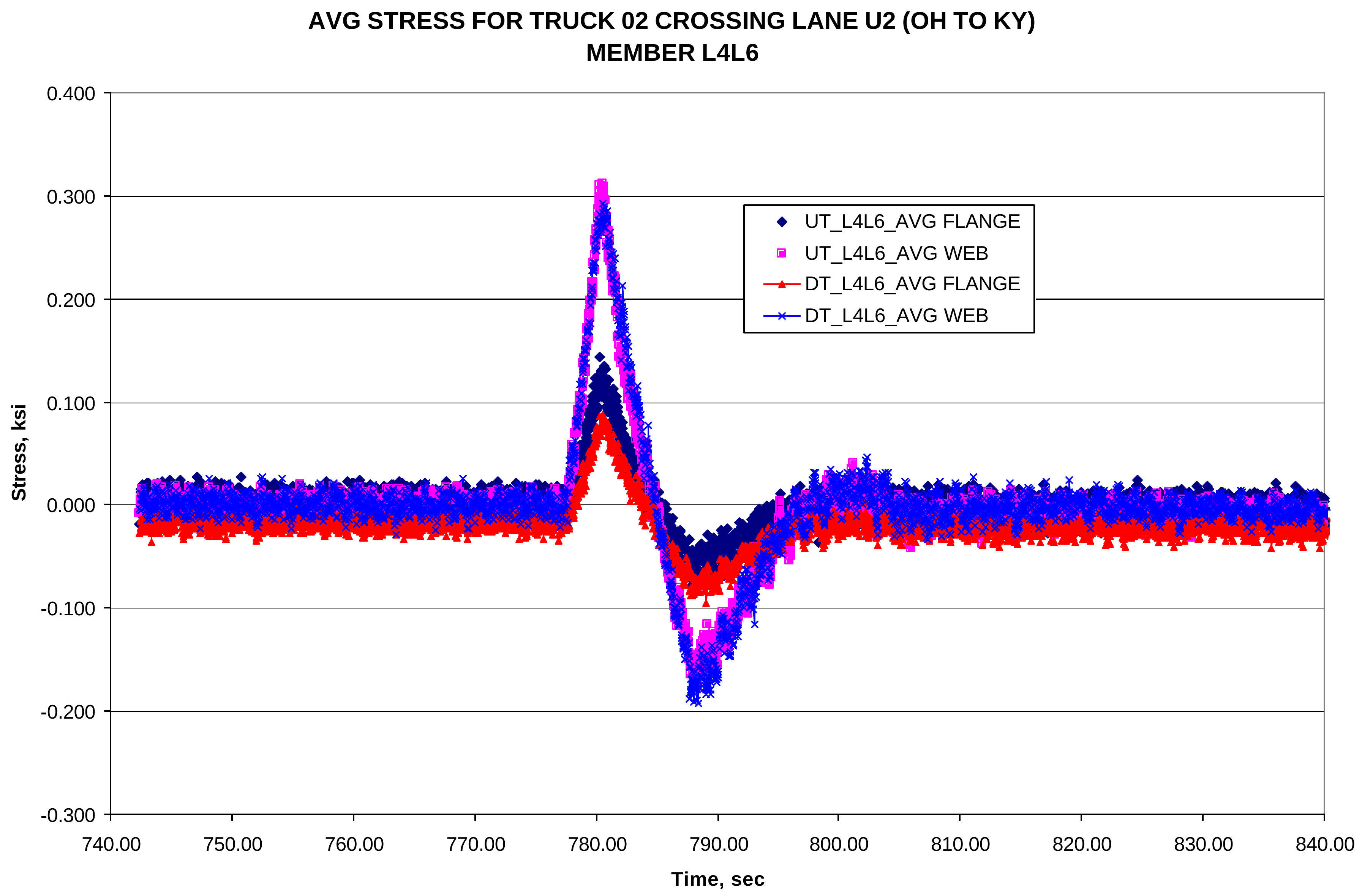

AVG STRESS FOR TRUCK 01 CROSSING LANE U1 (OH TO KY)
MEMBER U3U5
Stress, ksi
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
-0.600
640.00
650.00
660.00
670.00
680.00
690.00
700.00
710.00
720.00
730.00
740.00
Time, sec
UT_U3U5_AVG FLANGE
UT_U3U5_AVG WEB
DT_U3U5_AVG FLANGE
DT_U3U5_AVG WEB

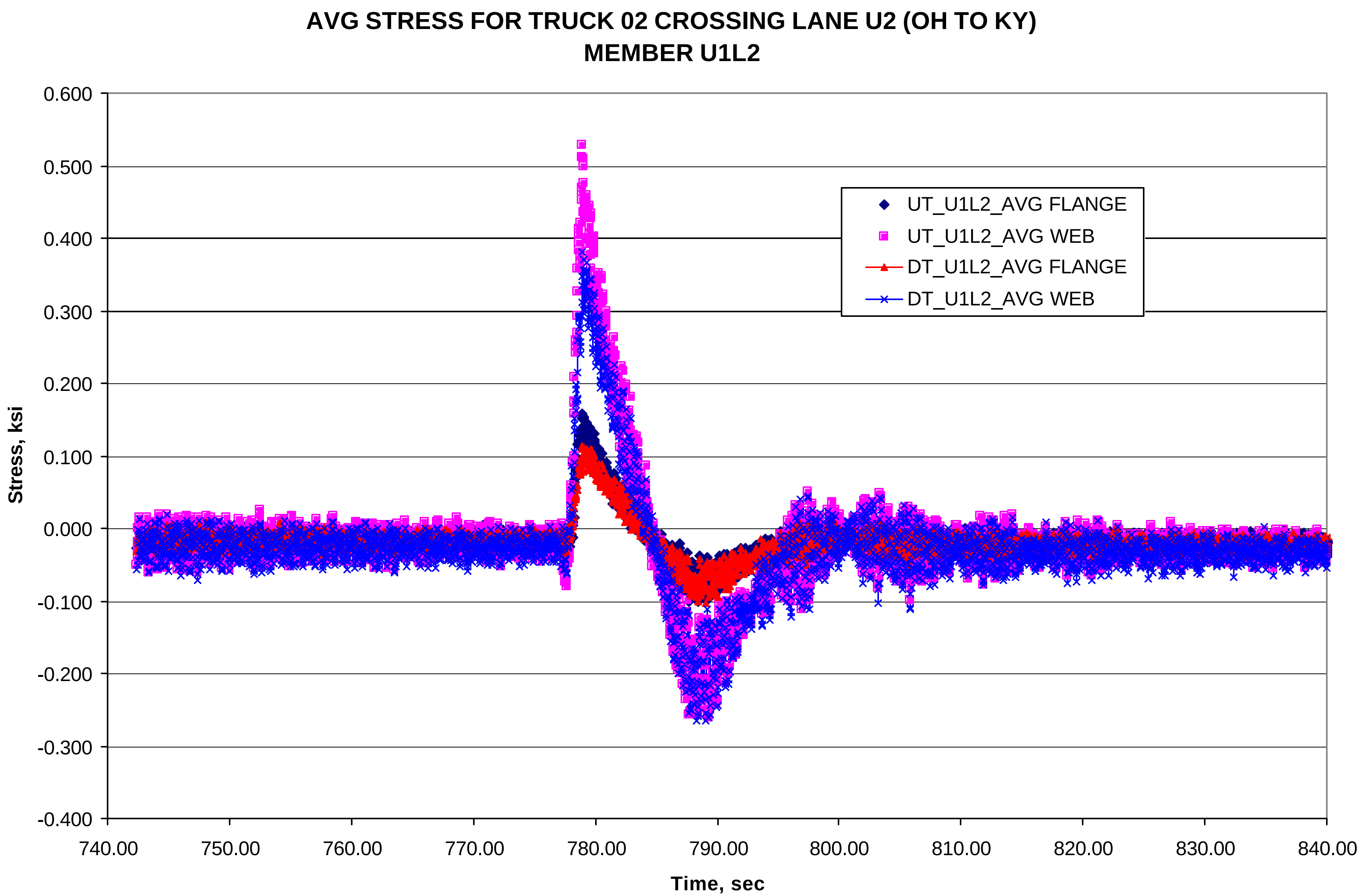

AVG STRESS FOR TRUCK 01 CROSSING LANE U1 (OH TO KY)
MEMBER U5U7
Stress, ksi
0.600
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
640.00
650.00
660.00
670.00
680.00
690.00
700.00
710.00
720.00
730.00
740.00
Time, sec
UT_U5U7_AVG FLANGE
UT_U5U7_AVG WEB
DT_U5U7_AVG FLANGE
DT_U5U7_AVG WEB


STRESS FOR TRUCK 01 CROSSING LANE U1 (OH TO KY)
GAGES LOCATED ON TOP FLANGE OF MEMBER UT_L4L6
Stress, ksi
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
640.00
650.00
660.00
670.00
680.00
690.00
700.00
710.00
720.00
730.00
740.00
Time, sec
UT_L4L6_IPERF
UT_L4L6_OPERF
UT_L4L6_RADIUS
UT_L4L6_RIVET

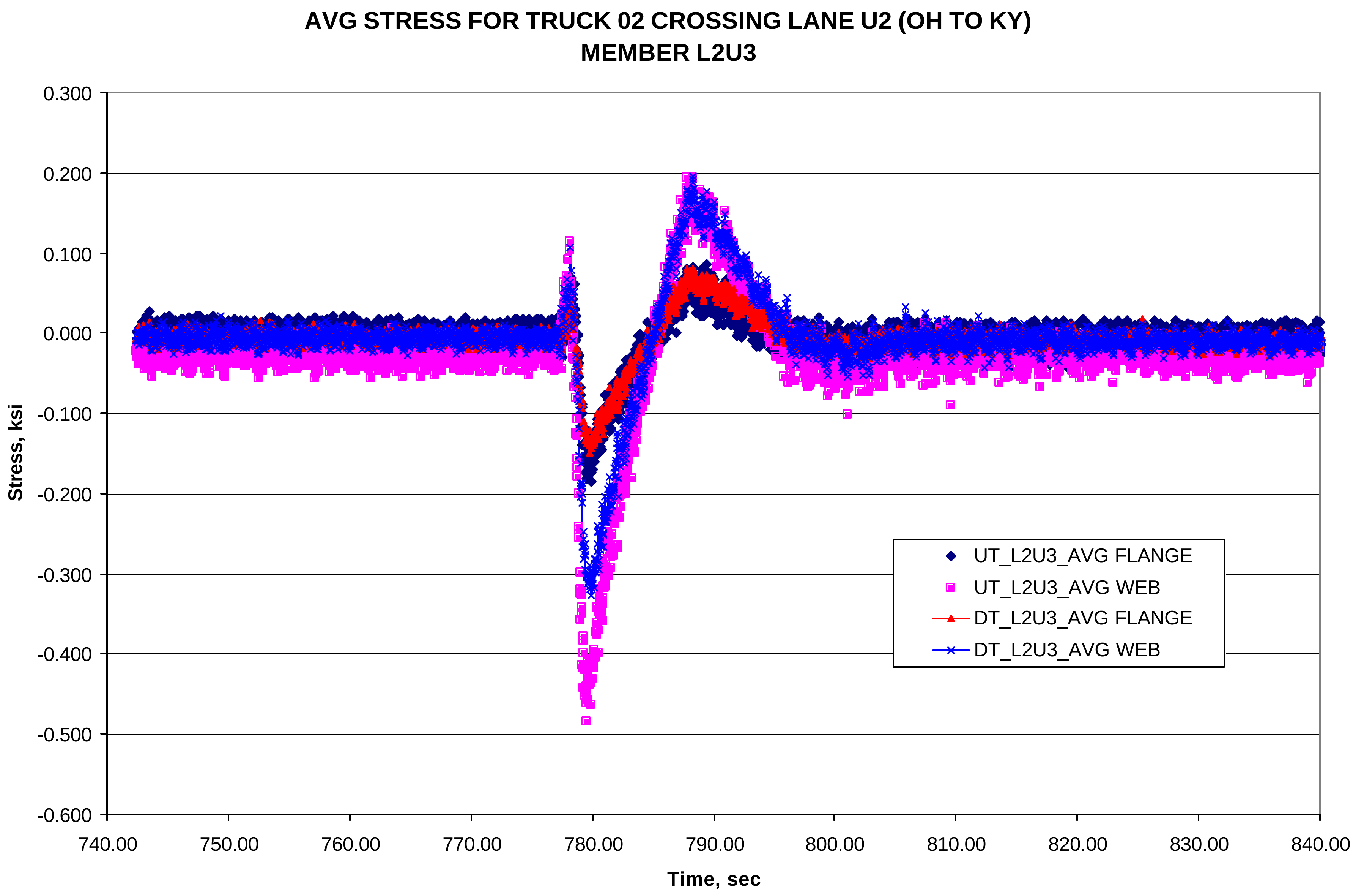

STRESS FOR TRUCK 01 CROSSING LANE U1 (OH TO KY)
GAGES LOCATED ON FLOORBEAM @ PP2
Stress, ksi
Time, sec
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
640.00
650.00
660.00
670.00
680.00
690.00
700.00
710.00
720.00
730.00
740.00
FB3_MID_TF
FB3_MID_BF
FB3_END_TF
FB3_END_BF

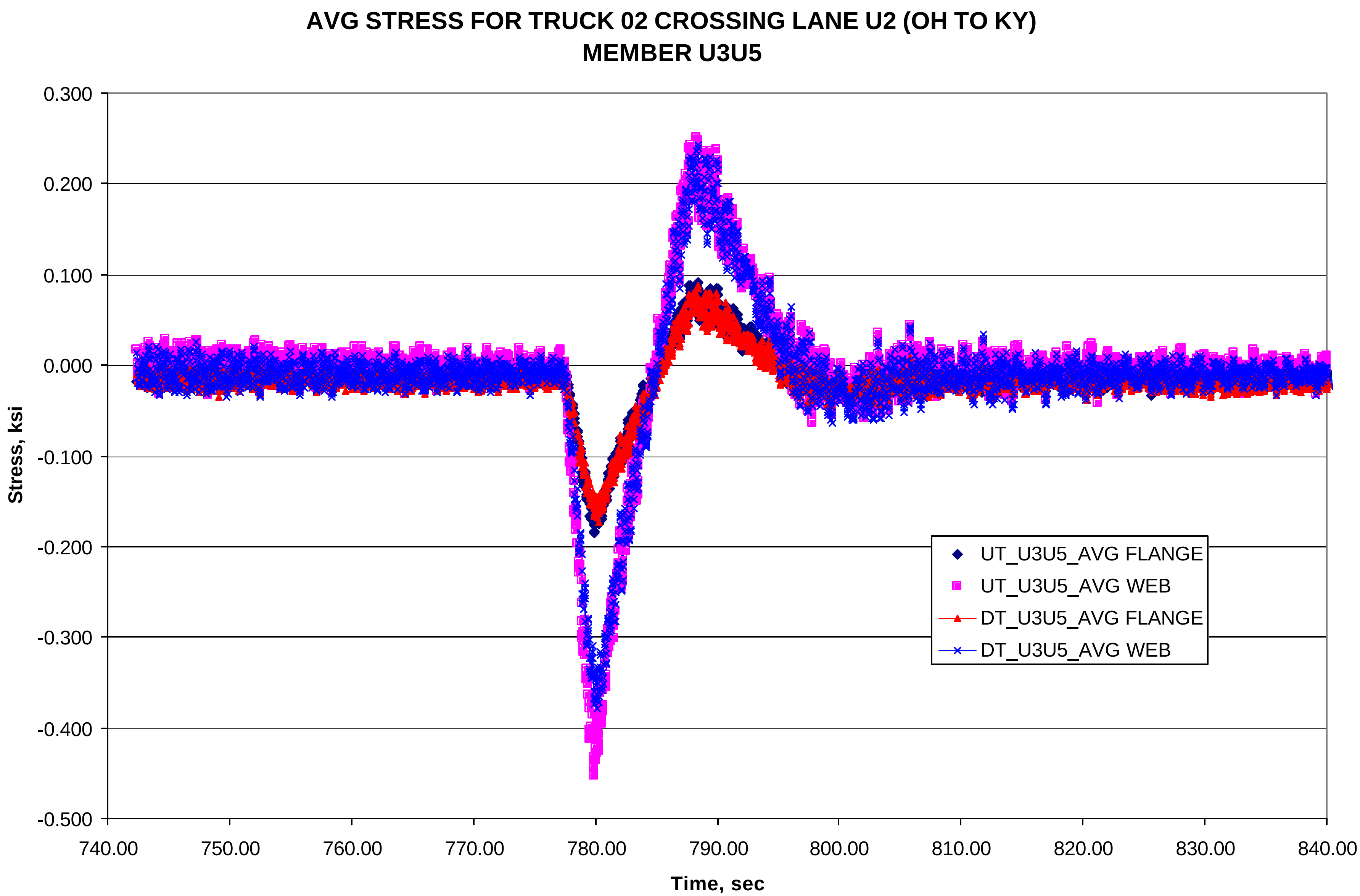

AVG STRESS FOR TRUCK 02 CROSSING LANE U2 (OH TO KY)
MEMBER L2L4
Stress, ksi
Time, sec
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
740.00
750.00
760.00
770.00
780.00
790.00
800.00
810.00
820.00
830.00
840.00
UT_L2L4_AVG FLANGE
UT_L2L4_AVG WEB
DT_L2L4_AVG FLANGE
DT_L2L4_AVG WEB

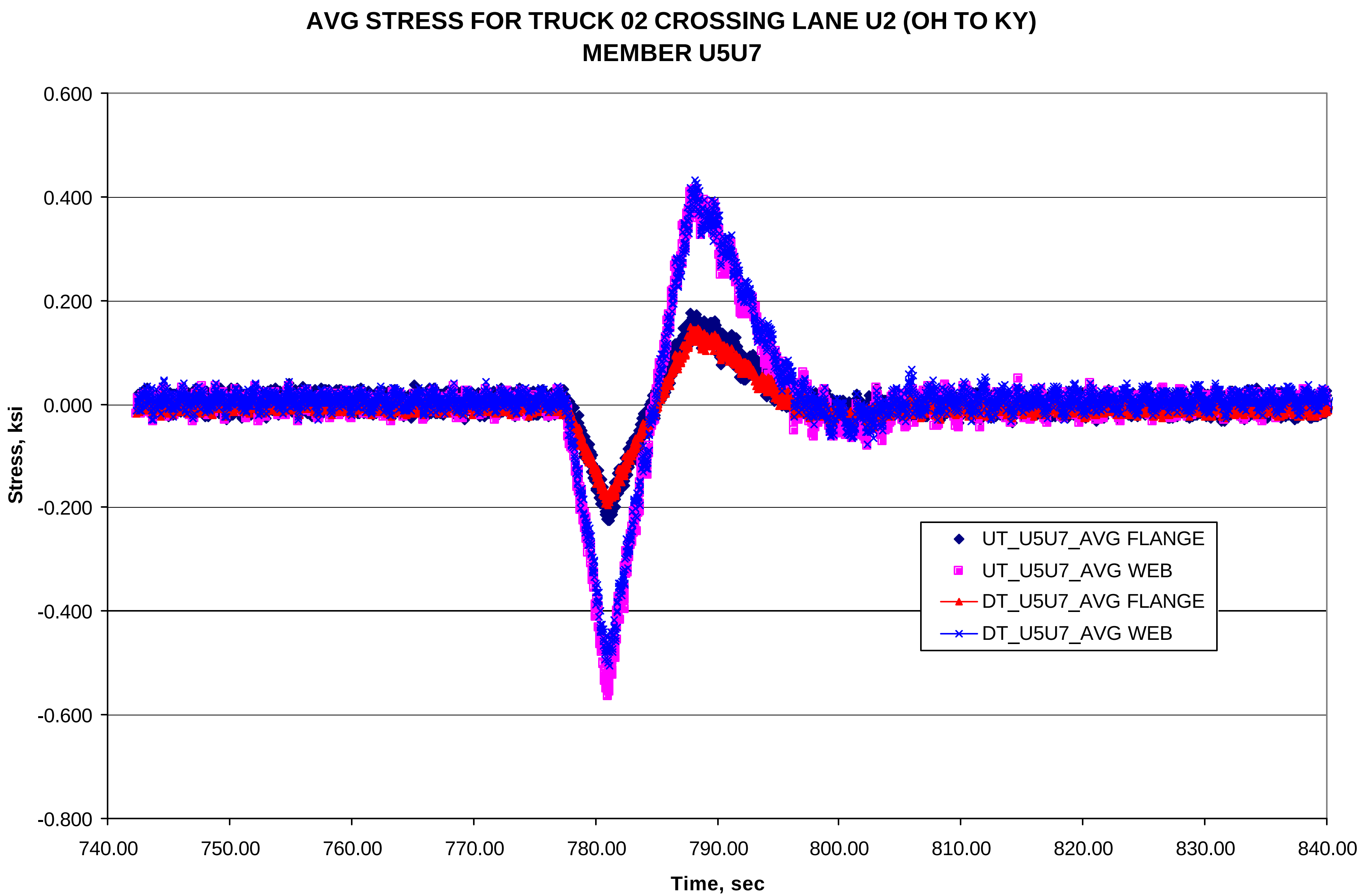

AVG STRESS FOR TRUCK 02 CROSSING LANE U2 (OH TO KY)
MEMBER L4L6
Stress, ksi
Time, sec
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
740.00
750.00
760.00
770.00
780.00
790.00
800.00
810.00
820.00
830.00
840.00
UT_L4L6_AVG FLANGE
UT_L4L6_AVG WEB
DT_L4L6_AVG FLANGE
DT_L4L6_AVG WEB

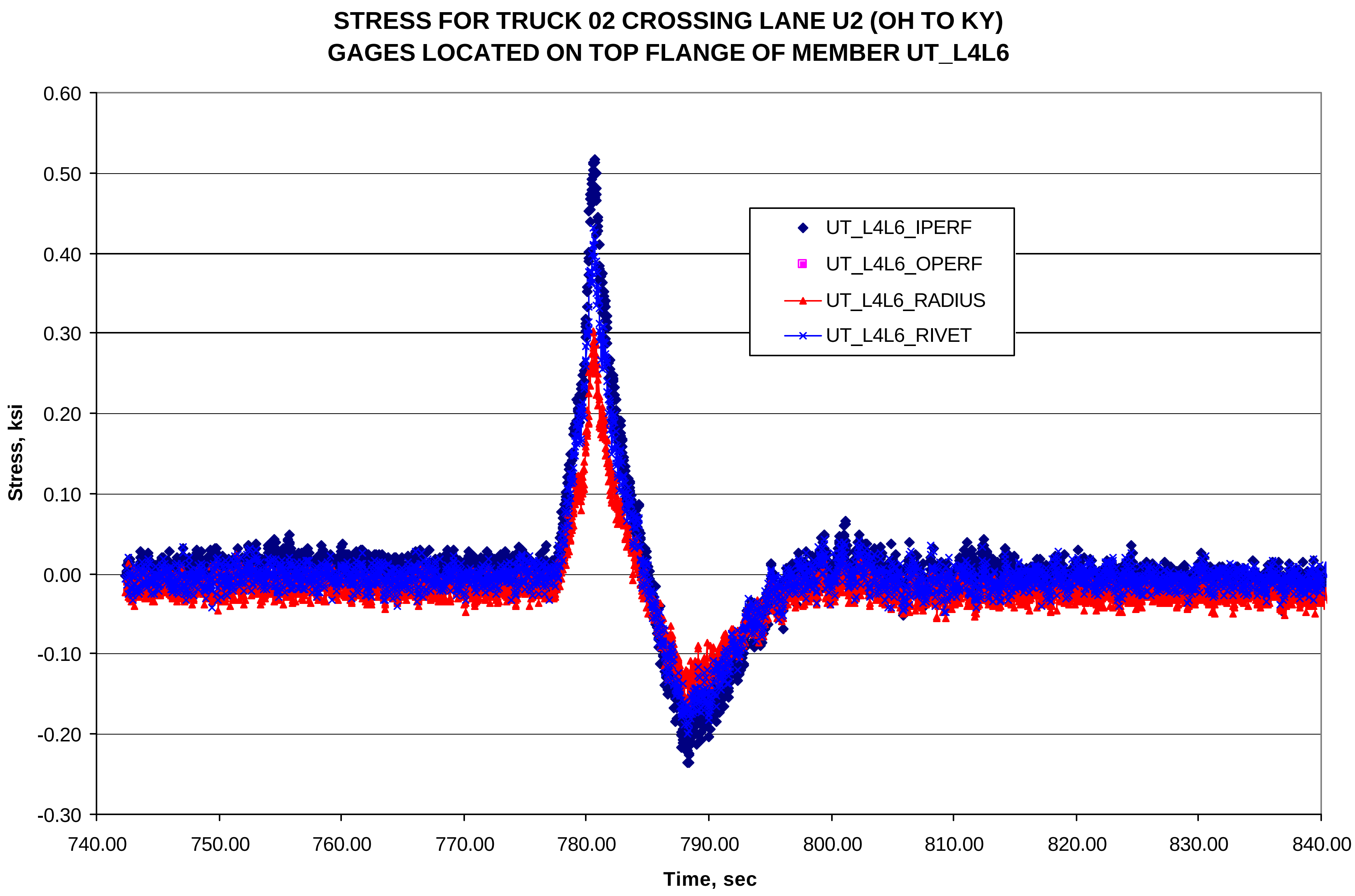


AVG STRESS FOR TRUCK 02 CROSSING LANE U2 (OH TO KY)
MEMBER U1L2
Stress, ksi
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
740.00
750.00
760.00
770.00
780.00
790.00
800.00
810.00
820.00
830.00
840.00
Time, sec
UT_U1L2_AVG FLANGE
UT_U1L2_AVG WEB
DT_U1L2_AVG FLANGE
DT_U1L2_AVG WEB

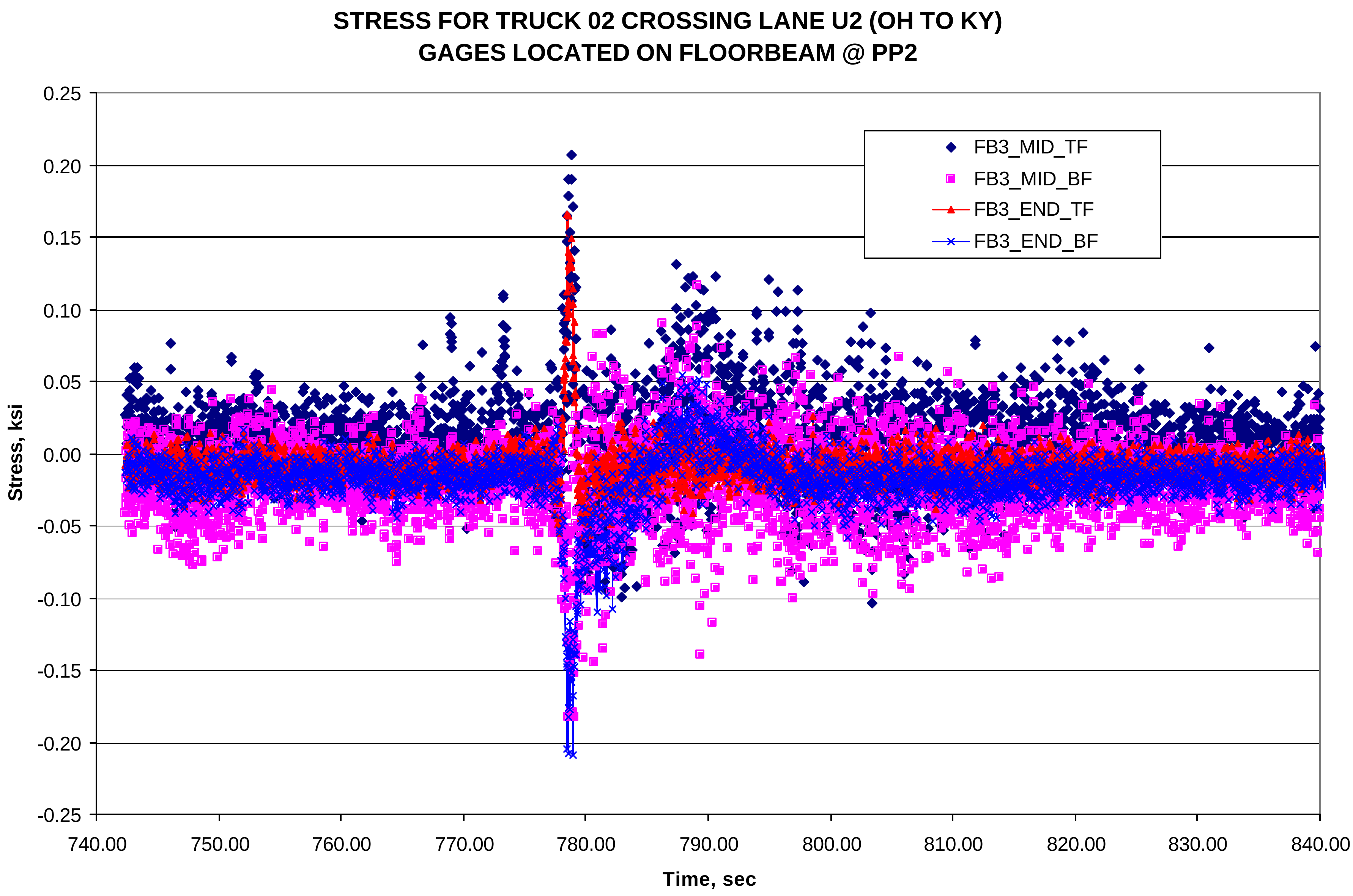

AVG STRESS FOR TRUCK 02 CROSSING LANE U2 (OH TO KY)
MEMBER L2U3
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
-0.600
Stress, ksi
740.00
750.00
760.00
770.00
780.00
790.00
800.00
810.00
820.00
830.00
840.00
Time, sec
UT_L2U3_AVG FLANGE
UT_L2U3_AVG WEB
DT_L2U3_AVG FLANGE
DT_L2U3_AVG WEB


AVG STRESS FOR TRUCK 02 CROSSING LANE U2 (OH TO KY)
MEMBER U3U5
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
Stress, ksi
740.00
750.00
760.00
770.00
780.00
790.00
800.00
810.00
820.00
830.00
840.00
Time, sec
UT_U3U5_AVG FLANGE
UT_U3U5_AVG WEB
DT_U3U5_AVG FLANGE
DT_U3U5_AVG WEB

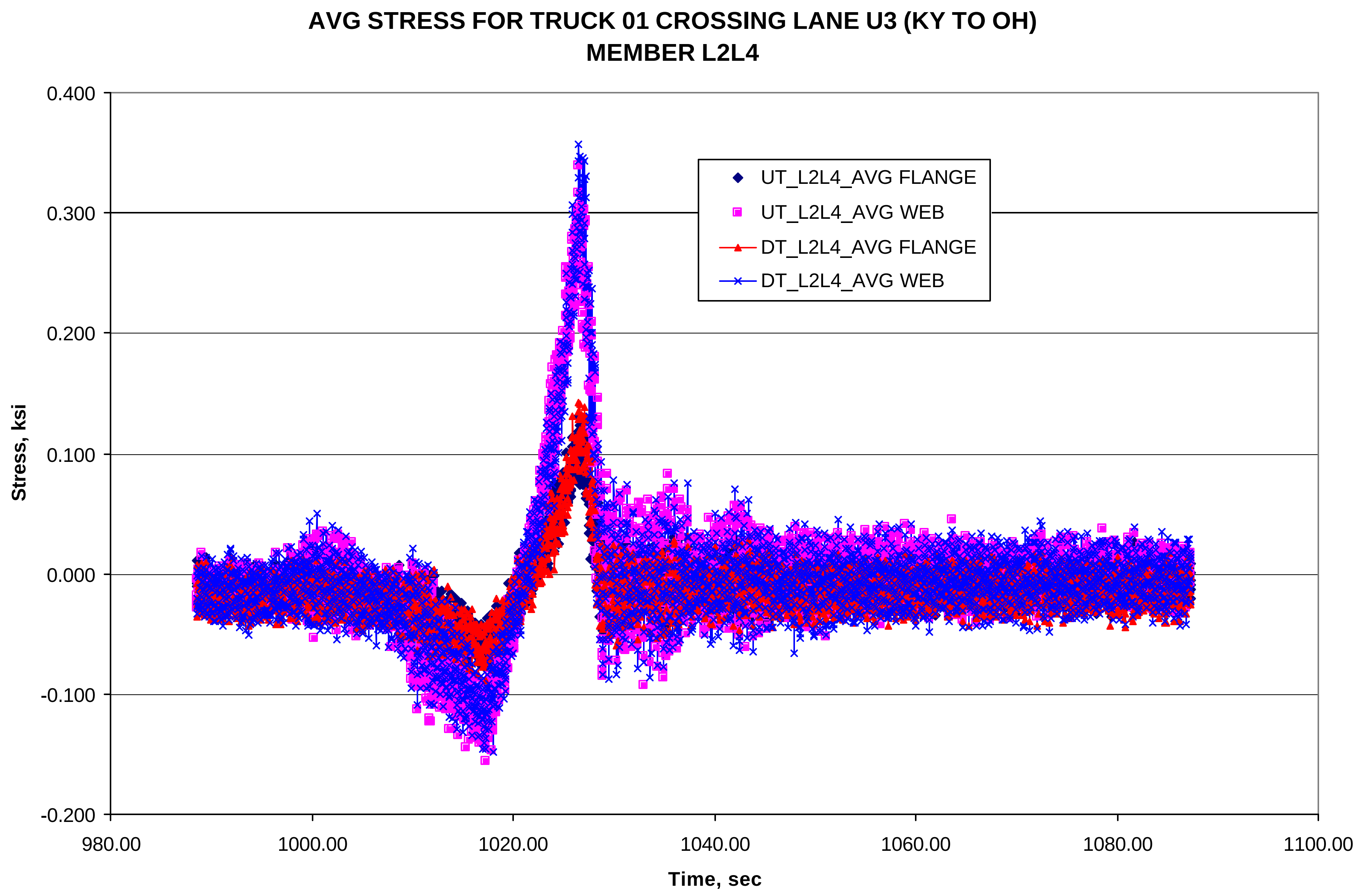

AVG STRESS FOR TRUCK 02 CROSSING LANE U2 (OH TO KY)
MEMBER U5U7
Stress, ksi
0.600
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
740.00
750.00
760.00
770.00
780.00
790.00
800.00
810.00
820.00
830.00
840.00
Time, sec
UT_U5U7_AVG FLANGE
UT_U5U7_AVG WEB
DT_U5U7_AVG FLANGE
DT_U5U7_AVG WEB

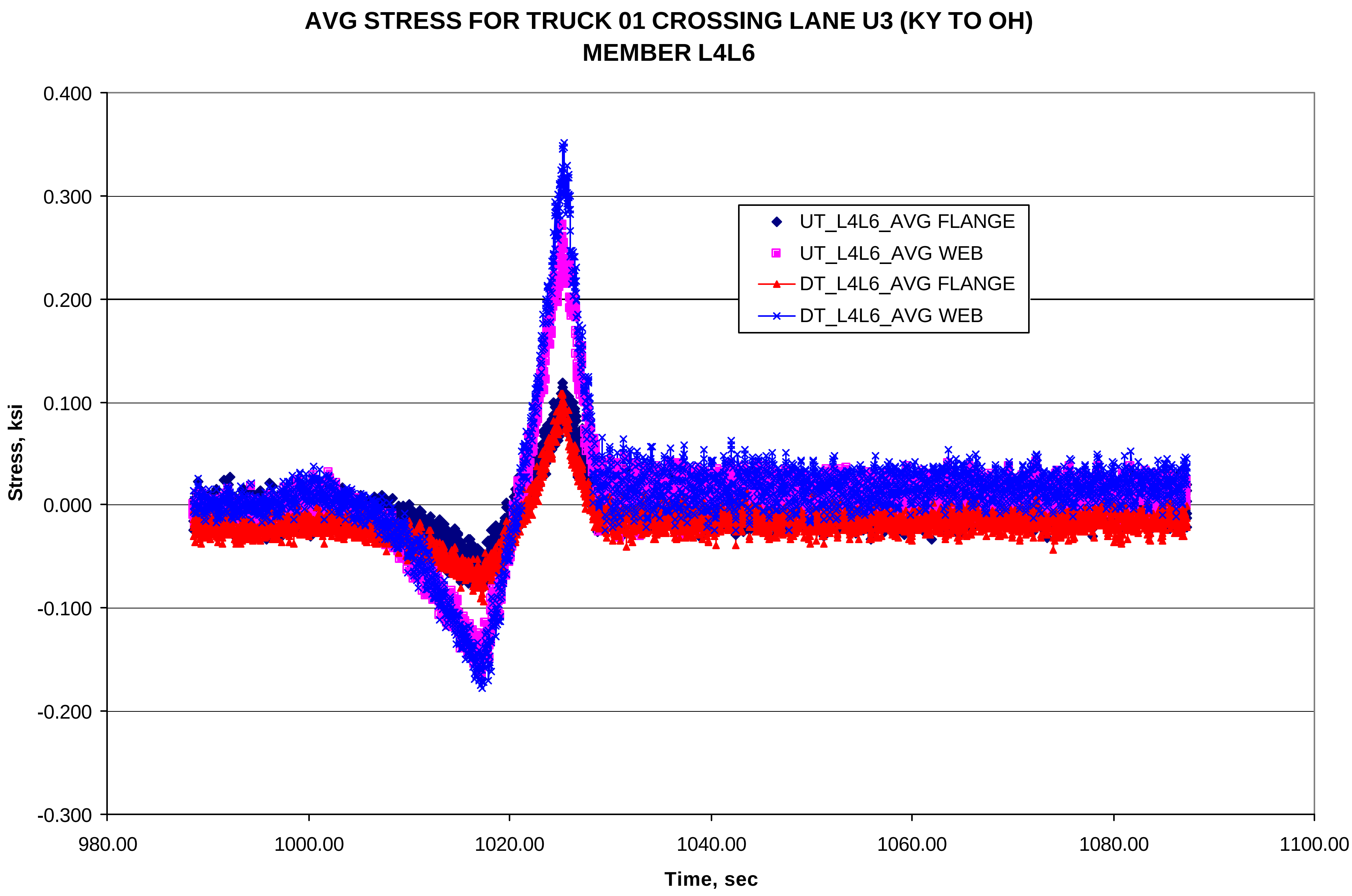


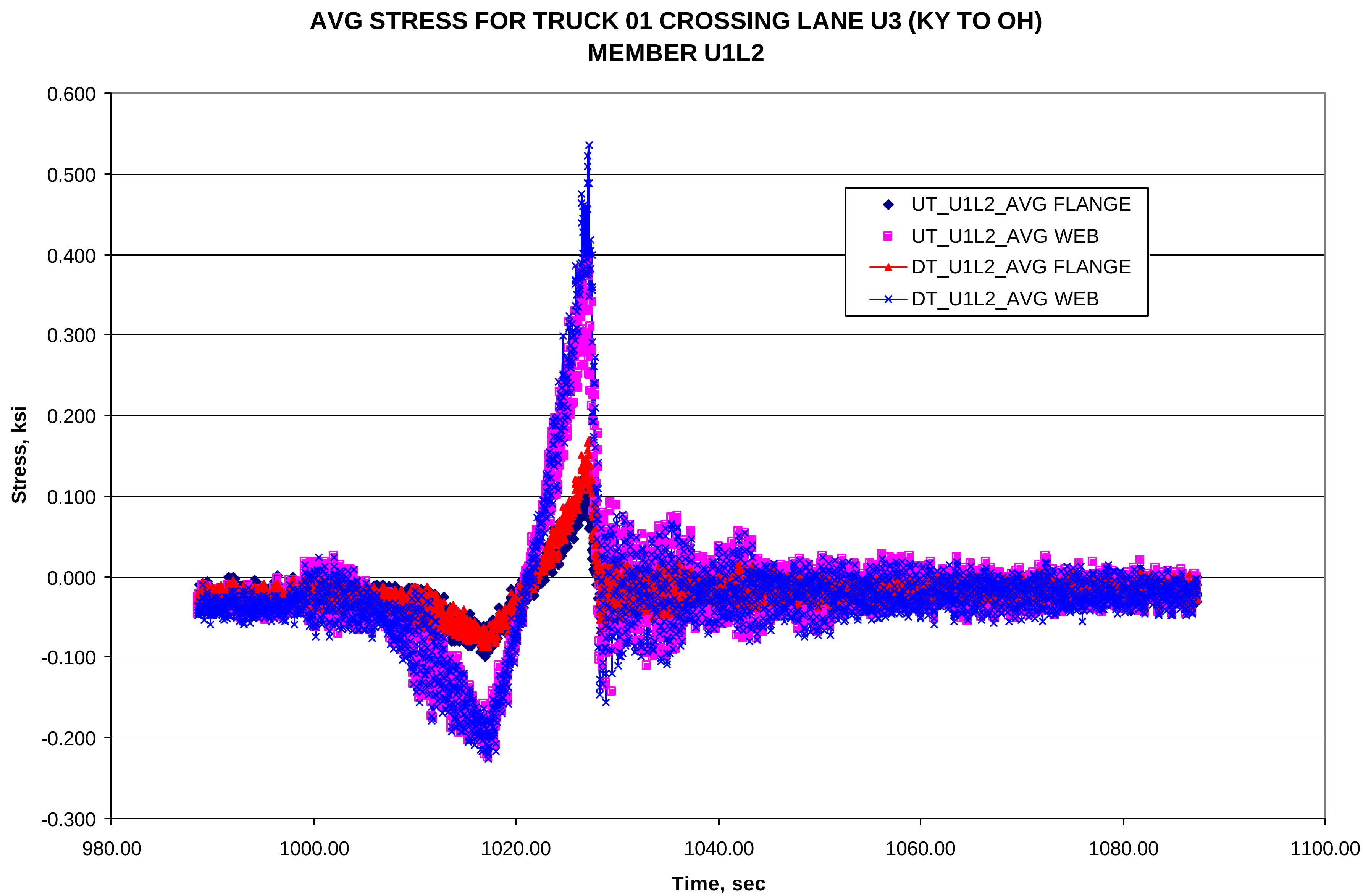
STRESS FOR TRUCK 02 CROSSING LANE U2 (OH TO KY)
GAGES LOCATED ON TOP FLANGE OF MEMBER UT_L4L6
Stress, ksi
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
740.00
750.00
760.00
770.00
780.00
790.00
800.00
810.00
820.00
830.00
840.00
Time, sec
UT_L4L6_IPERF
UT_L4L6_OPERF
UT_L4L6_RADIUS
UT_L4L6_RIVET

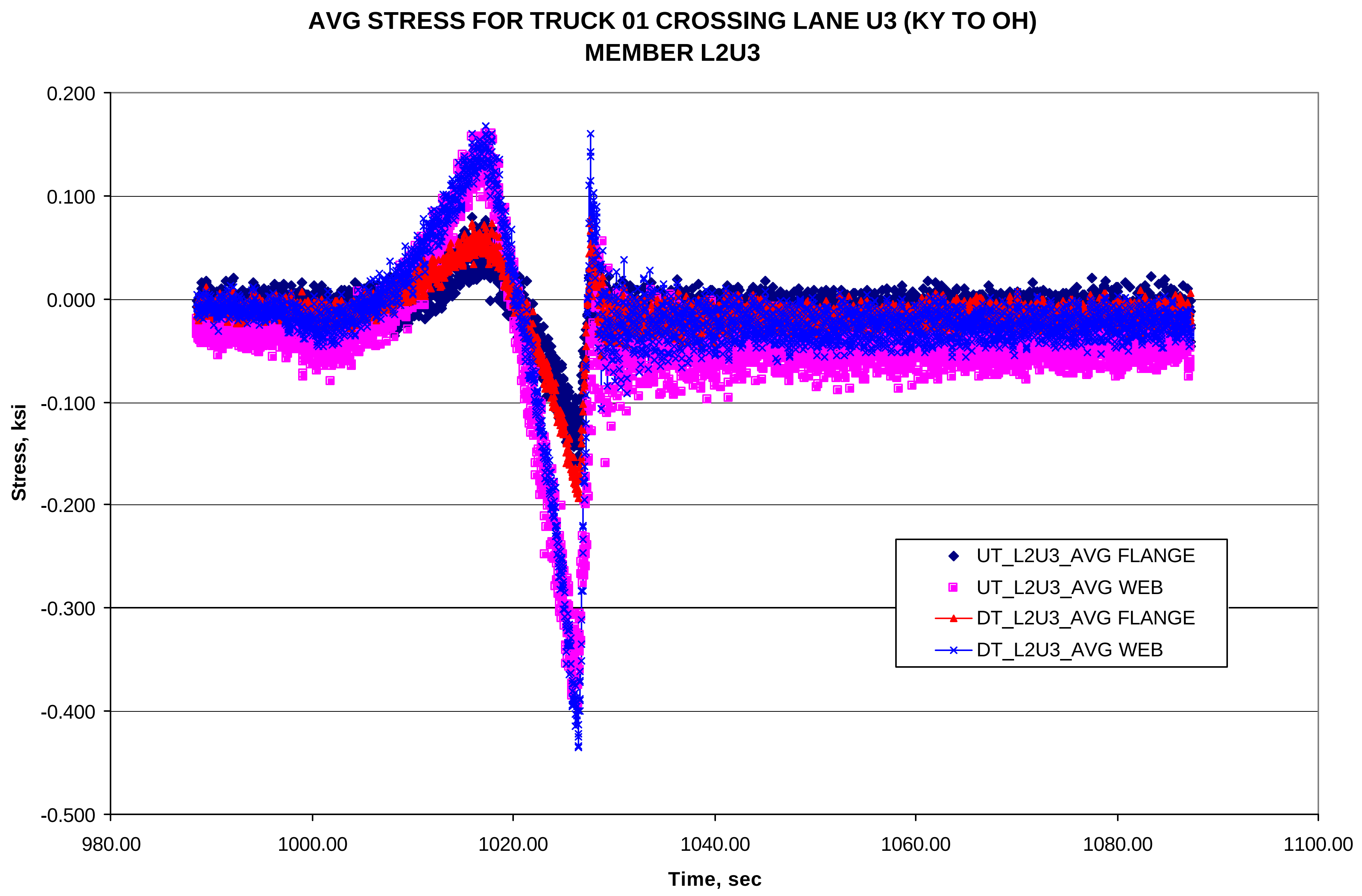


STRESS FOR TRUCK 02 CROSSING LANE U2 (OH TO KY)
GAGES LOCATED ON FLOORBEAM @ PP2
FB3_MID_TF
FB3_MID_BF
FB3_END_TF
FB3_END_BF
Stress, ksi
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
740.00
750.00
760.00
770.00
780.00
790.00
800.00
810.00
820.00
830.00
840.00
Time, sec

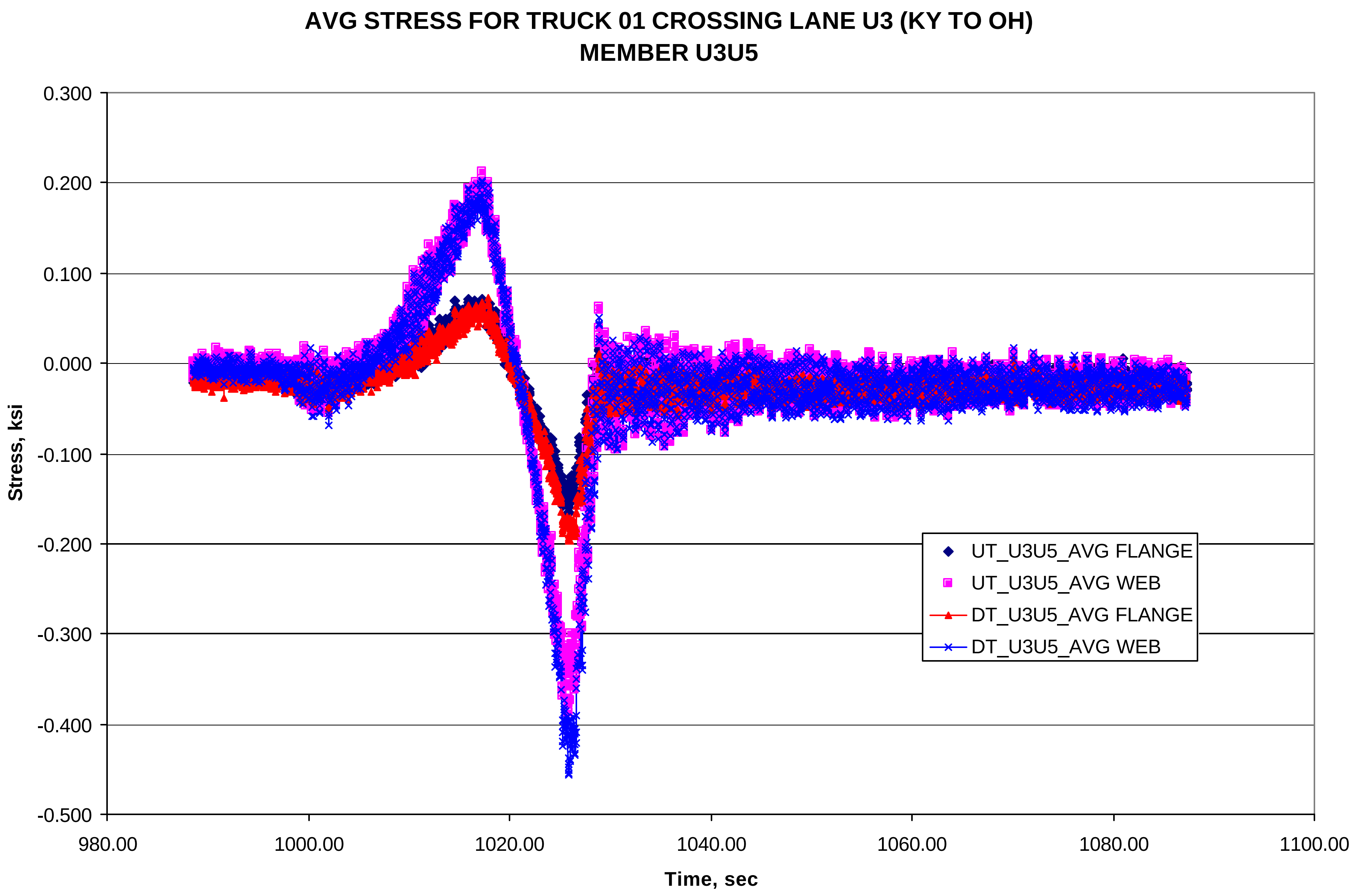

AVG STRESS FOR TRUCK 01 CROSSING LANE U3 (KY TO OH)
MEMBER L2L4
Stress, ksi
Time, sec
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
980.00
1000.00
1020.00
1040.00
1060.00
1080.00
1100.00
UT_L2L4_AVG FLANGE
UT_L2L4_AVG WEB
DT_L2L4_AVG FLANGE
DT_L2L4_AVG WEB

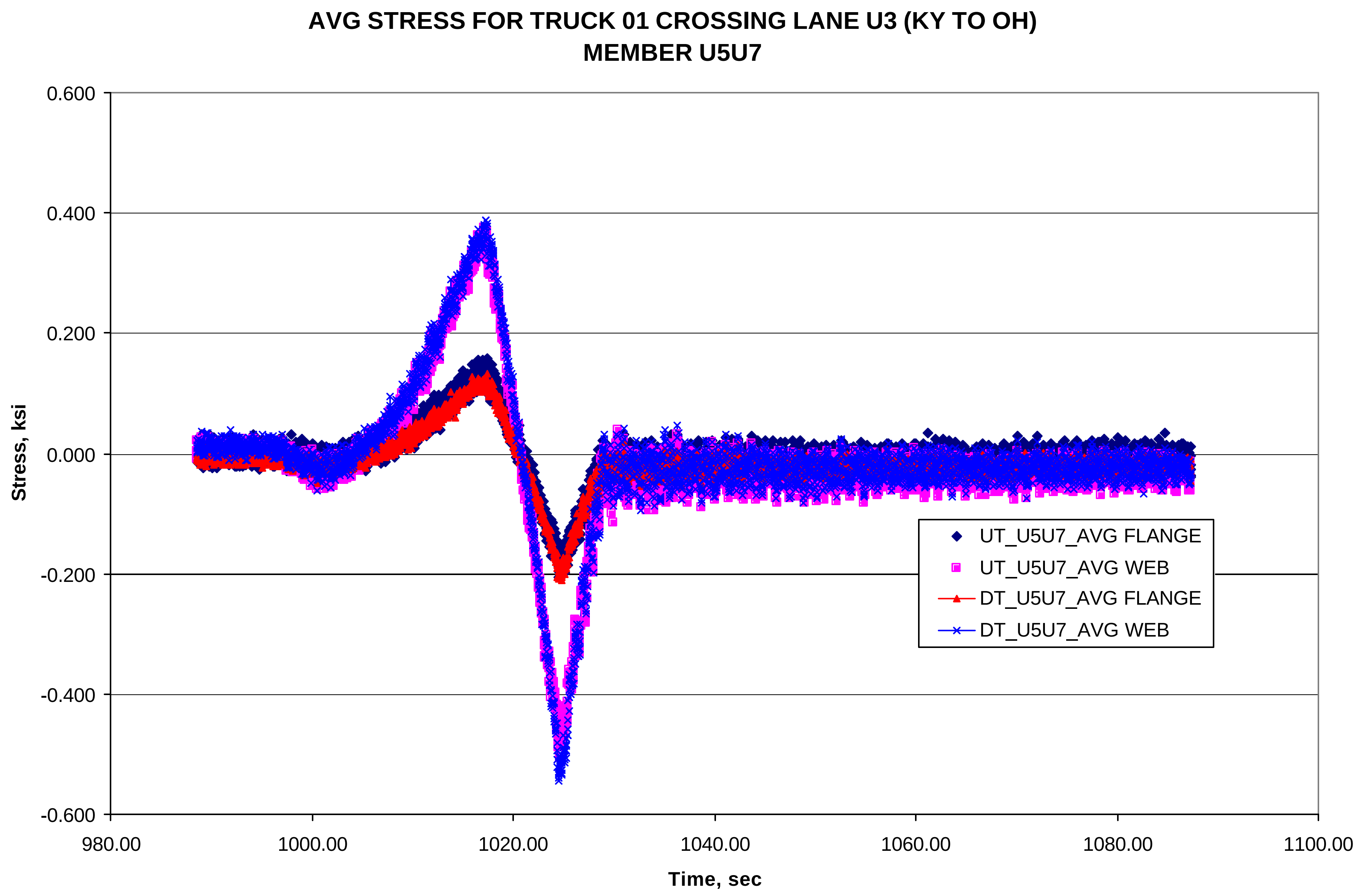

AVG STRESS FOR TRUCK 01 CROSSING LANE U3 (KY TO OH)
MEMBER L4L6
Stress, ksi
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
980.00
1000.00
1020.00
1040.00
1060.00
1080.00
1100.00
Time, sec
UT_L4L6_AVG FLANGE
UT_L4L6_AVG WEB
DT_L4L6_AVG FLANGE
DT_L4L6_AVG WEB


AVG STRESS FOR TRUCK 01 CROSSING LANE U3 (KY TO OH)
MEMBER U1L2
Stress, ksi
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
980.00
1000.00
1020.00
1040.00
1060.00
1080.00
1100.00
Time, sec
UT_U1L2_AVG FLANGE
UT_U1L2_AVG WEB
DT_U1L2_AVG FLANGE
DT_U1L2_AVG WEB

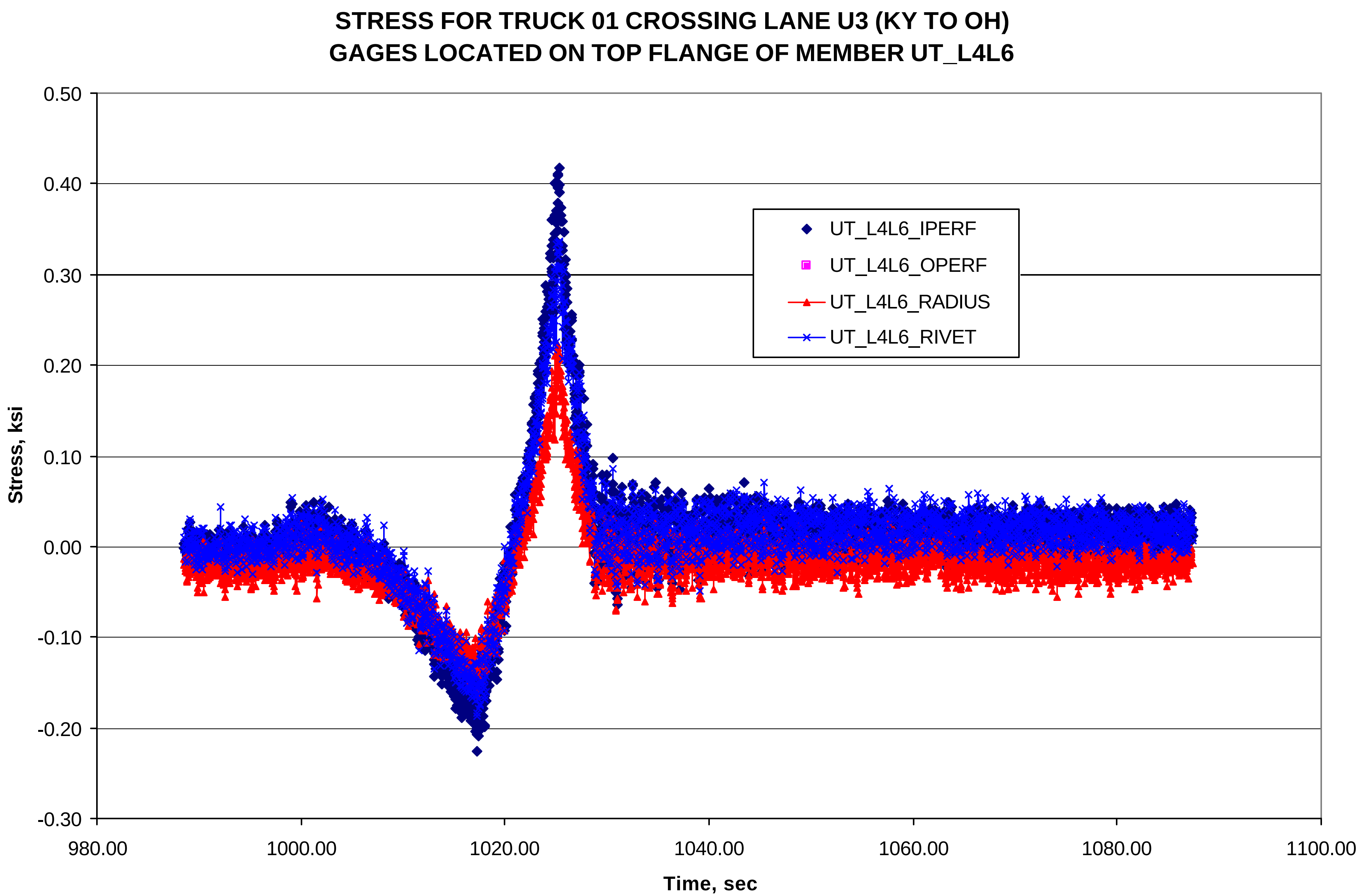


AVG STRESS FOR TRUCK 01 CROSSING LANE U3 (KY TO OH)
MEMBER L2U3
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
Stress, ksi
980.00
1000.00
1020.00
1040.00
1060.00
1080.00
1100.00
Time, sec
UT_L2U3_AVG FLANGE
UT_L2U3_AVG WEB
DT_L2U3_AVG FLANGE
DT_L2U3_AVG WEB

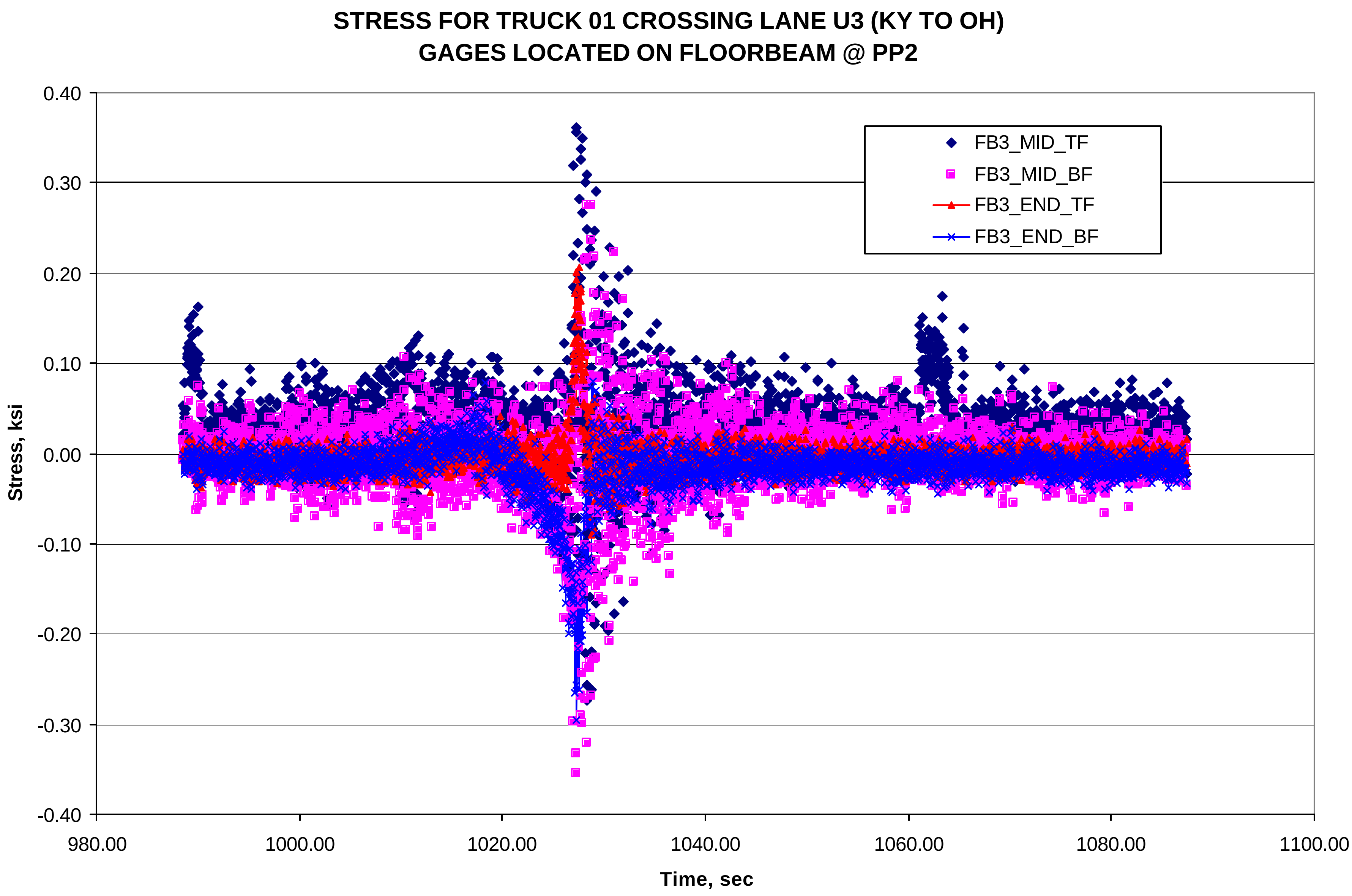

AVG STRESS FOR TRUCK 01 CROSSING LANE U3 (KY TO OH)
MEMBER U3U5
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
Stress, ksi
980.00
1000.00
1020.00
1040.00
1060.00
1080.00
1100.00
Time, sec
UT_U3U5_AVG FLANGE
UT_U3U5_AVG WEB
DT_U3U5_AVG FLANGE
DT_U3U5_AVG WEB



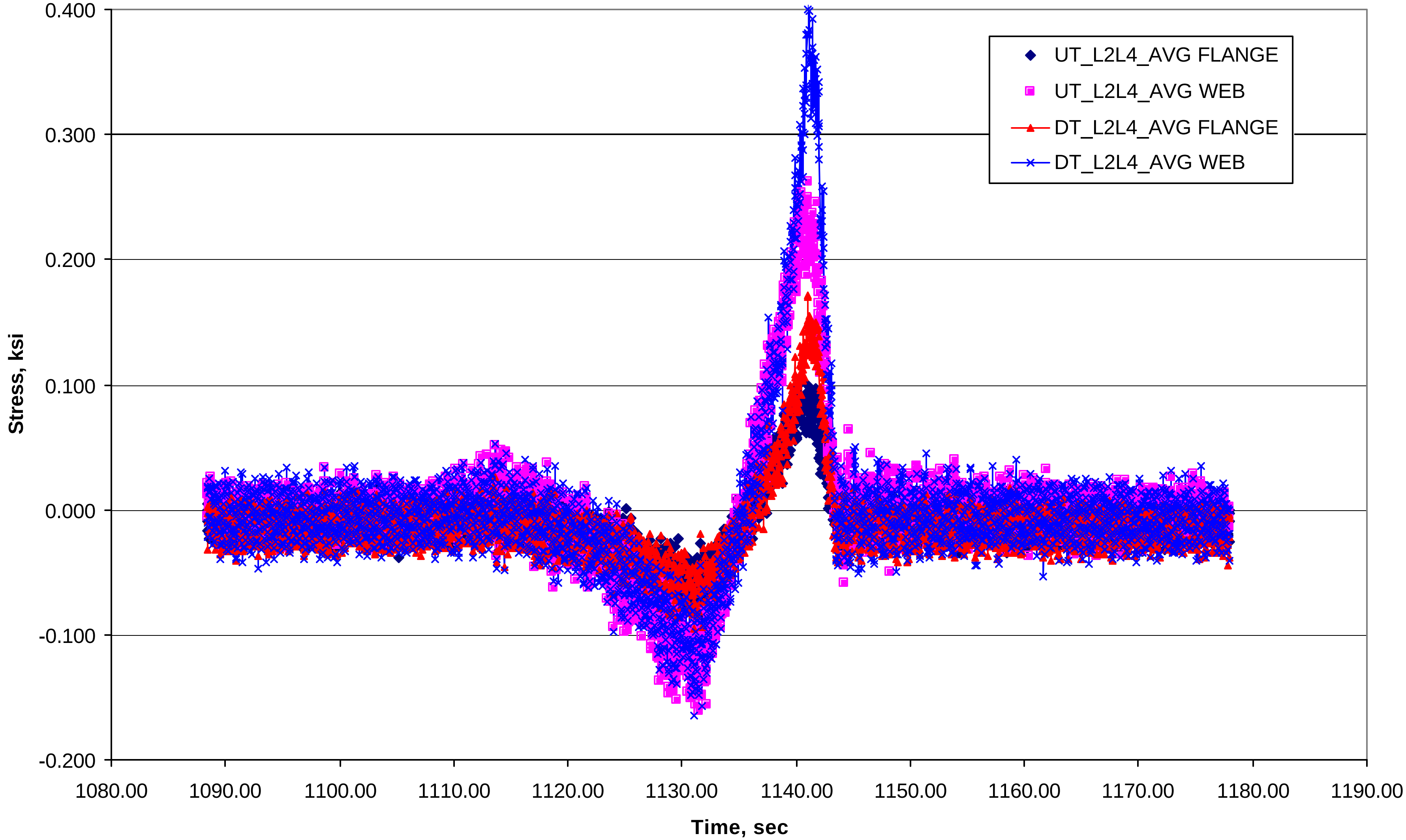
AVG STRESS FOR TRUCK 01 CROSSING LANE U3 (KY TO OH)
MEMBER U5U7
0.600
0.400
0.200
0.000
-0.200
-0.400
-0.600
Stress, ksi
980.00
1000.00
1020.00
1040.00
1060.00
1080.00
1100.00
Time, sec
UT_U5U7_AVG FLANGE
UT_U5U7_AVG WEB
DT_U5U7_AVG FLANGE
DT_U5U7_AVG WEB

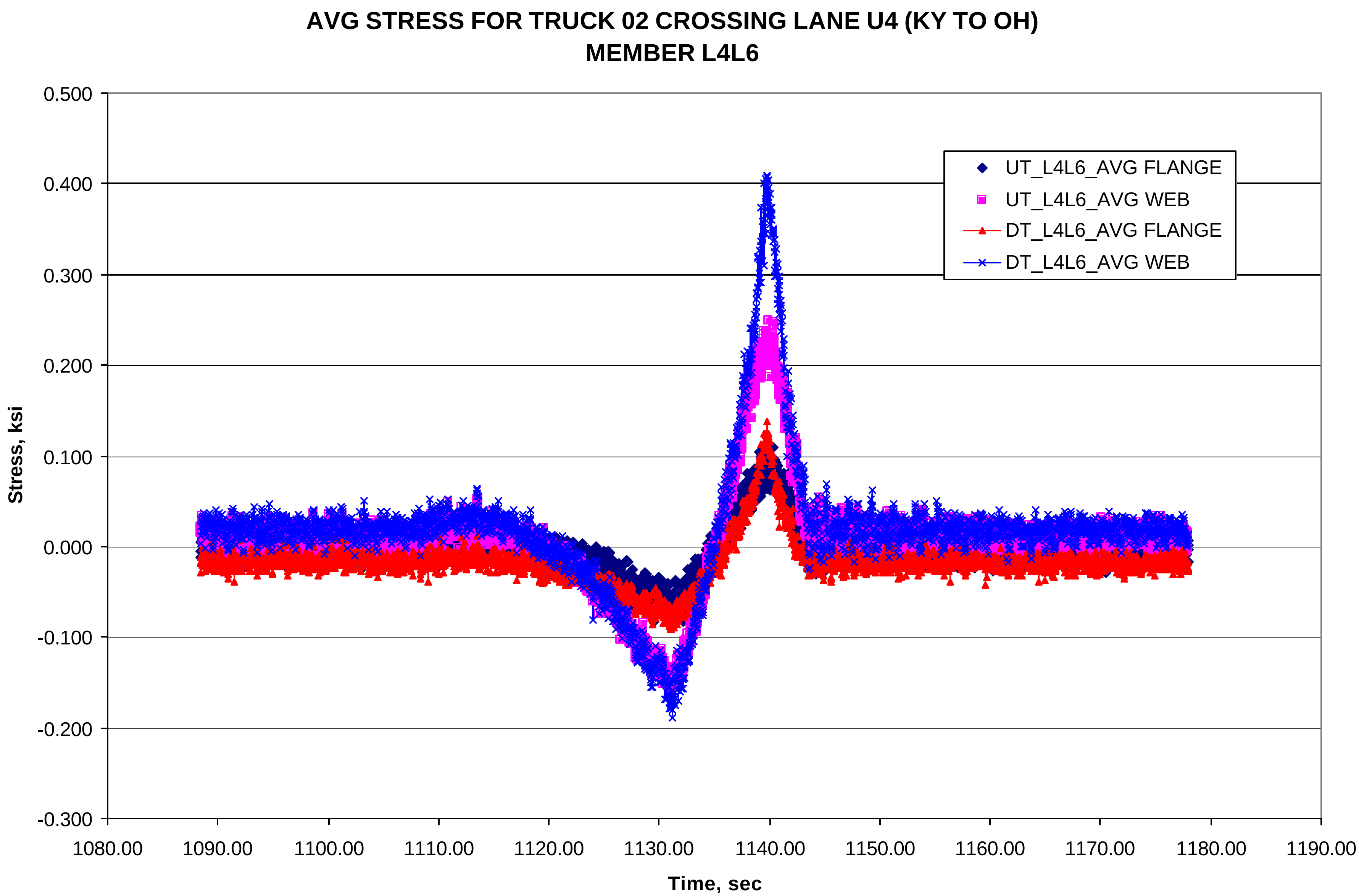


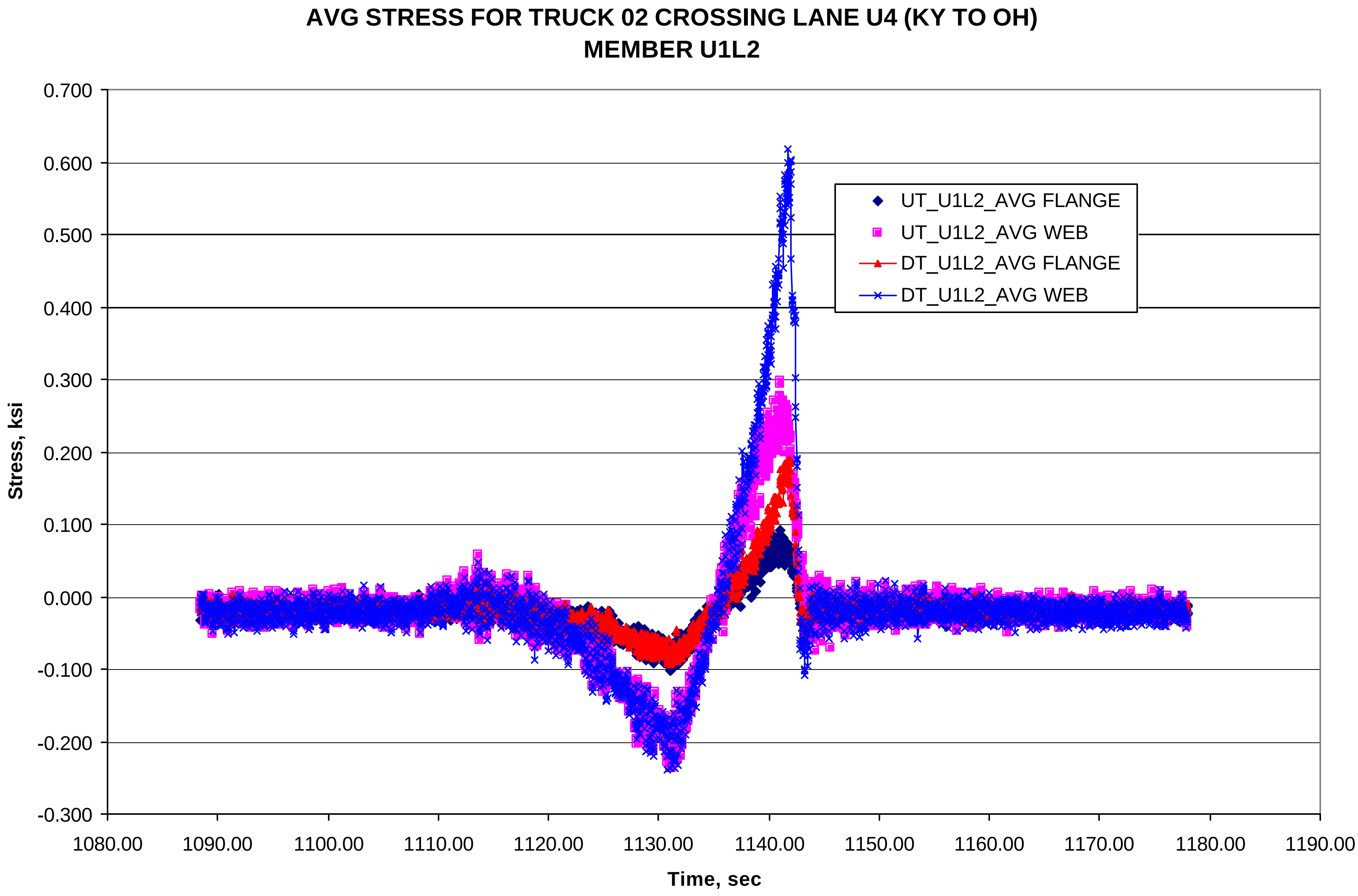
STRESS FOR TRUCK 01 CROSSING LANE U3 (KY TO OH)
GAGES LOCATED ON TOP FLANGE OF MEMBER UT_L4L6
Stress, ksi
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
980.00
1000.00
1020.00
1040.00
1060.00
1080.00
1100.00
Time, sec
UT_L4L6_IPERF
UT_L4L6_OPERF
UT_L4L6_RADIUS
UT_L4L6_RIVET

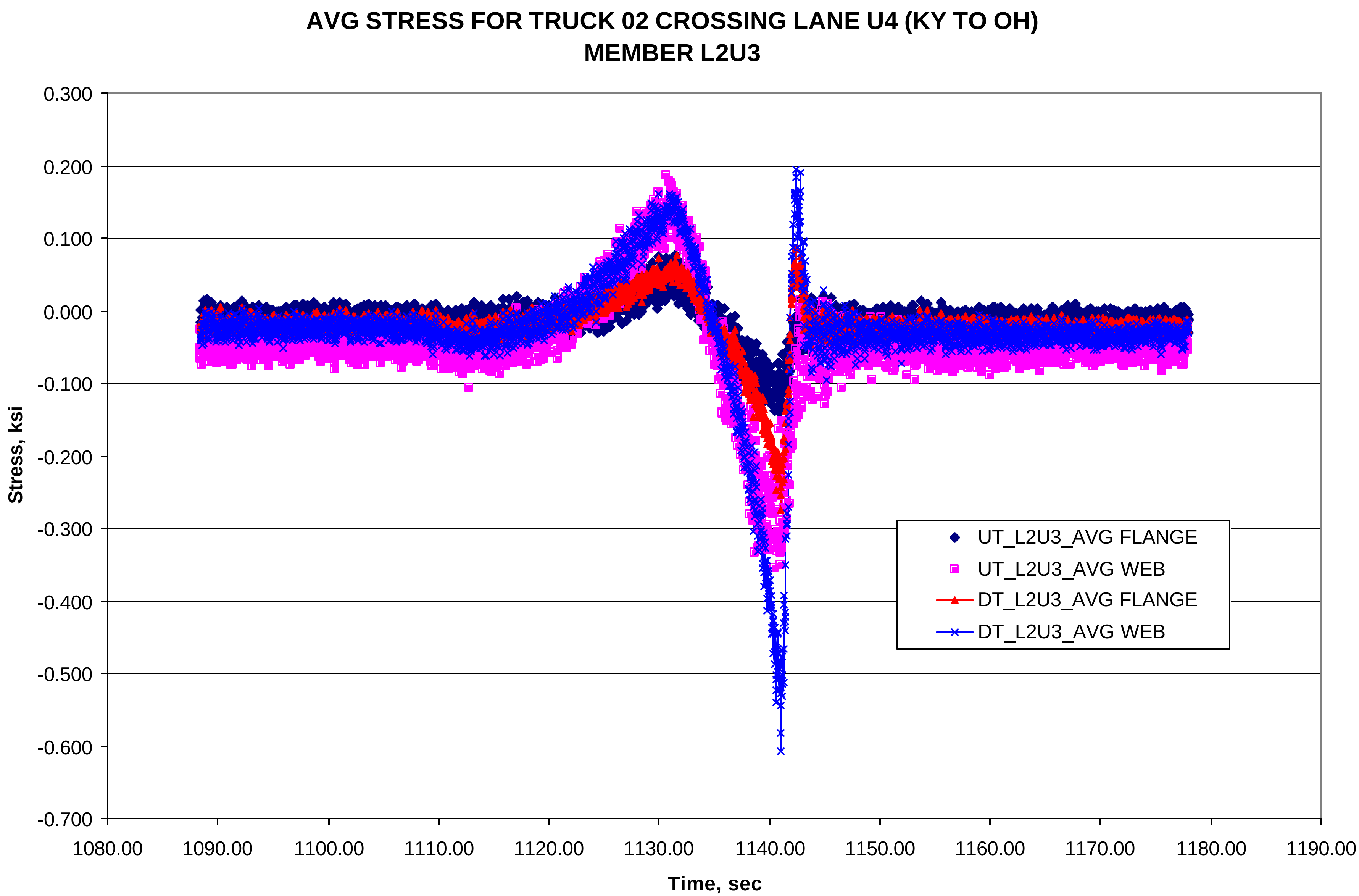

STRESS FOR TRUCK 01 CROSSING LANE U3 (KY TO OH)
GAGES LOCATED ON FLOORBEAM @ PP2
FB3_MID_TF
FB3_MID_BF
FB3_END_TF
FB3_END_BF
Stress, ksi
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
980.00
1000.00
1020.00
1040.00
1060.00
1080.00
1100.00
Time, sec

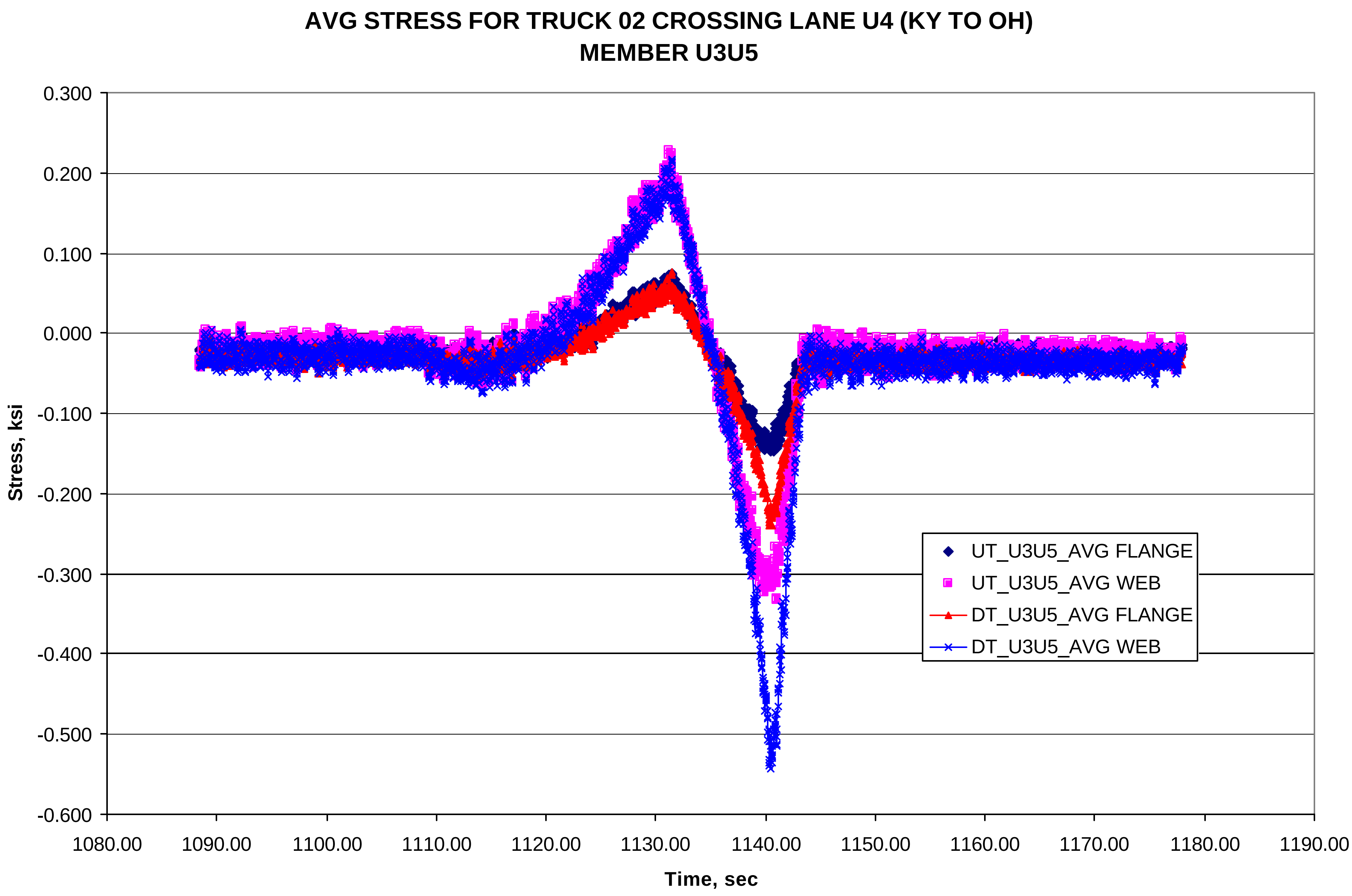
AVG STRESS FOR TRUCK 02 CROSSING LANE U4 (KY TO OH)
MEMBER L2L4

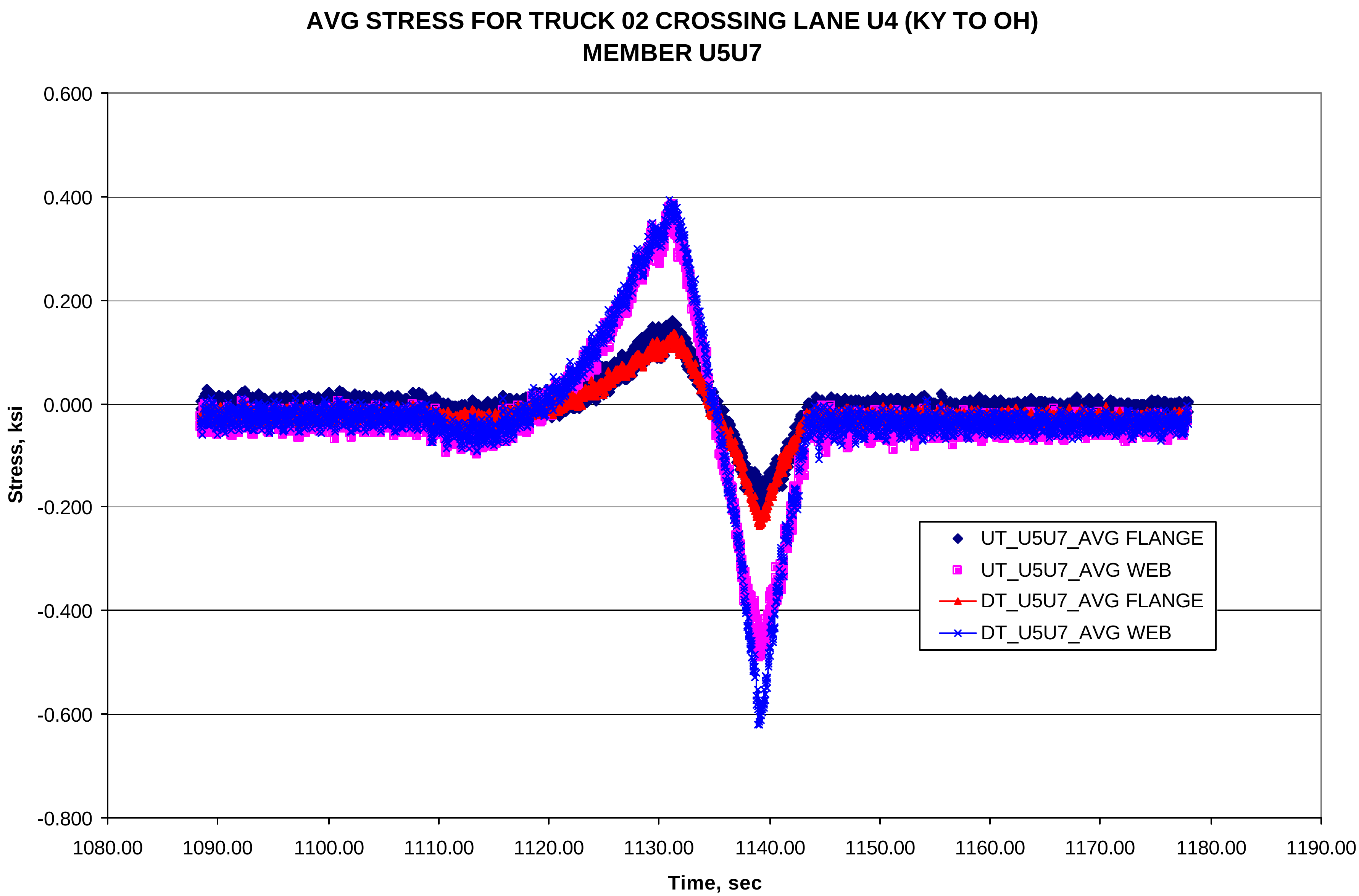


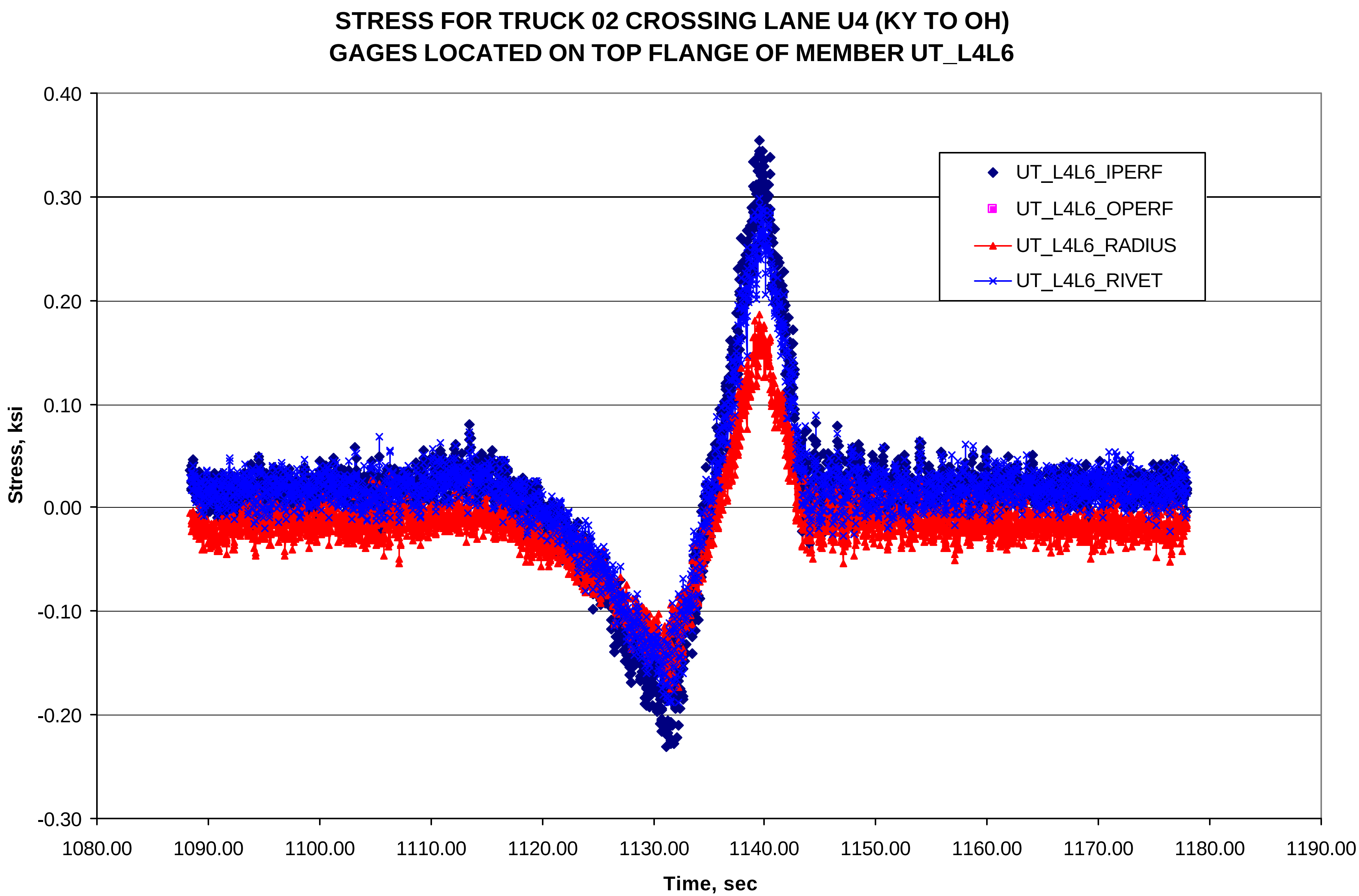

AVG STRESS FOR TRUCK 02 CROSSING LANE U4 (KY TO OH)
MEMBER L4L6
Stress, ksi
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
1080.00
1090.00
1100.00
1110.00
1120.00
1130.00
1140.00
1150.00
1160.00
1170.00
1180.00
1190.00
Time, sec
UT_L4L6_AVG FLANGE
UT_L4L6_AVG WEB
DT_L4L6_AVG FLANGE
DT_L4L6_AVG WEB

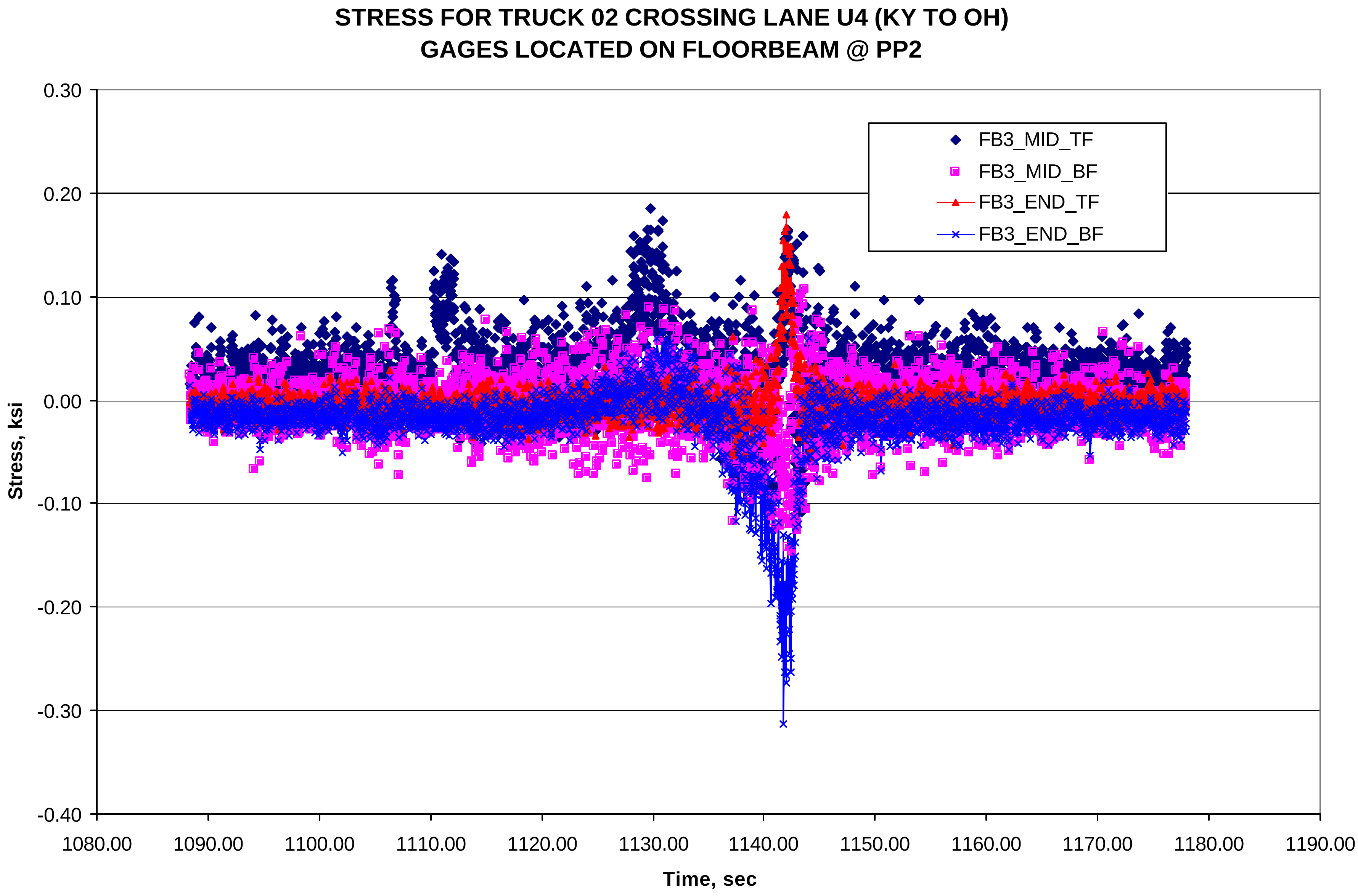

AVG STRESS FOR TRUCK 02 CROSSING LANE U4 (KY TO OH)
MEMBER U1L2
Stress, ksi
Time, sec
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
1080.00
1090.00
1100.00
1110.00
1120.00
1130.00
1140.00
1150.00
1160.00
1170.00
1180.00
1190.00
UT_U1L2_AVG FLANGE
UT_U1L2_AVG WEB
DT_U1L2_AVG FLANGE
DT_U1L2_AVG WEB


AVG STRESS FOR TRUCK 02 CROSSING LANE U4 (KY TO OH)
MEMBER L2U3
Stress, ksi
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
-0.600
-0.700
Time, sec
1080.00
1090.00
1100.00
1110.00
1120.00
1130.00
1140.00
1150.00
1160.00
1170.00
1180.00
1190.00
UT_L2U3_AVG FLANGE
UT_L2U3_AVG WEB
DT_L2U3_AVG FLANGE
DT_L2U3_AVG WEB


AVG STRESS FOR TRUCK 02 CROSSING LANE U4 (KY TO OH)
MEMBER U3U5
Stress, ksi
0.300
0.200
0.100
0.000
-0.100
-0.200
-0.300
-0.400
-0.500
-0.600
1080.00
1090.00
1100.00
1110.00
1120.00
1130.00
1140.00
1150.00
1160.00
1170.00
1180.00
1190.00
Time, sec
UT_U3U5_AVG FLANGE
UT_U3U5_AVG WEB
DT_U3U5_AVG FLANGE
DT_U3U5_AVG WEB


AVG STRESS FOR TRUCK 02 CROSSING LANE U4 (KY TO OH)
MEMBER U5U7
0.600
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
Stress, ksi
1080.00
1090.00
1100.00
1110.00
1120.00
1130.00
1140.00
1150.00
1160.00
1170.00
1180.00
1190.00
Time, sec
UT_U5U7_AVG FLANGE
UT_U5U7_AVG WEB
DT_U5U7_AVG FLANGE
DT_U5U7_AVG WEB


STRESS FOR TRUCK 02 CROSSING LANE U4 (KY TO OH)
GAGES LOCATED ON TOP FLANGE OF MEMBER UT_L4L6
UT_L4L6_IPERF
UT_L4L6_OPERF
UT_L4L6_RADIUS
UT_L4L6_RIVET
Stress, ksi
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
1080.00
1090.00
1100.00
1110.00
1120.00
1130.00
1140.00
1150.00
1160.00
1170.00
1180.00
1190.00
Time, sec



STRESS FOR TRUCK 02 CROSSING LANE U4 (KY TO OH)
GAGES LOCATED ON FLOORBEAM @ PP2
FB3_MID_TF
FB3_MID_BF
FB3_END_TF
FB3_END_BF
Stress, ksi
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
1080.00
1090.00
1100.00
1110.00
1120.00
1130.00
1140.00
1150.00
1160.00
1170.00
1180.00
1190.00
Time, sec

APPENDIX E

Quasi-Static Calibration Load Test Results

BRENT SPENCE BRIDGE

STRESS RESULTS FROM QUASI-STATIC LOAD TEST

LOWER DECK LEVEL

TRUCK 01 IN LANE L1
TRUCK 02 IN LANE L2

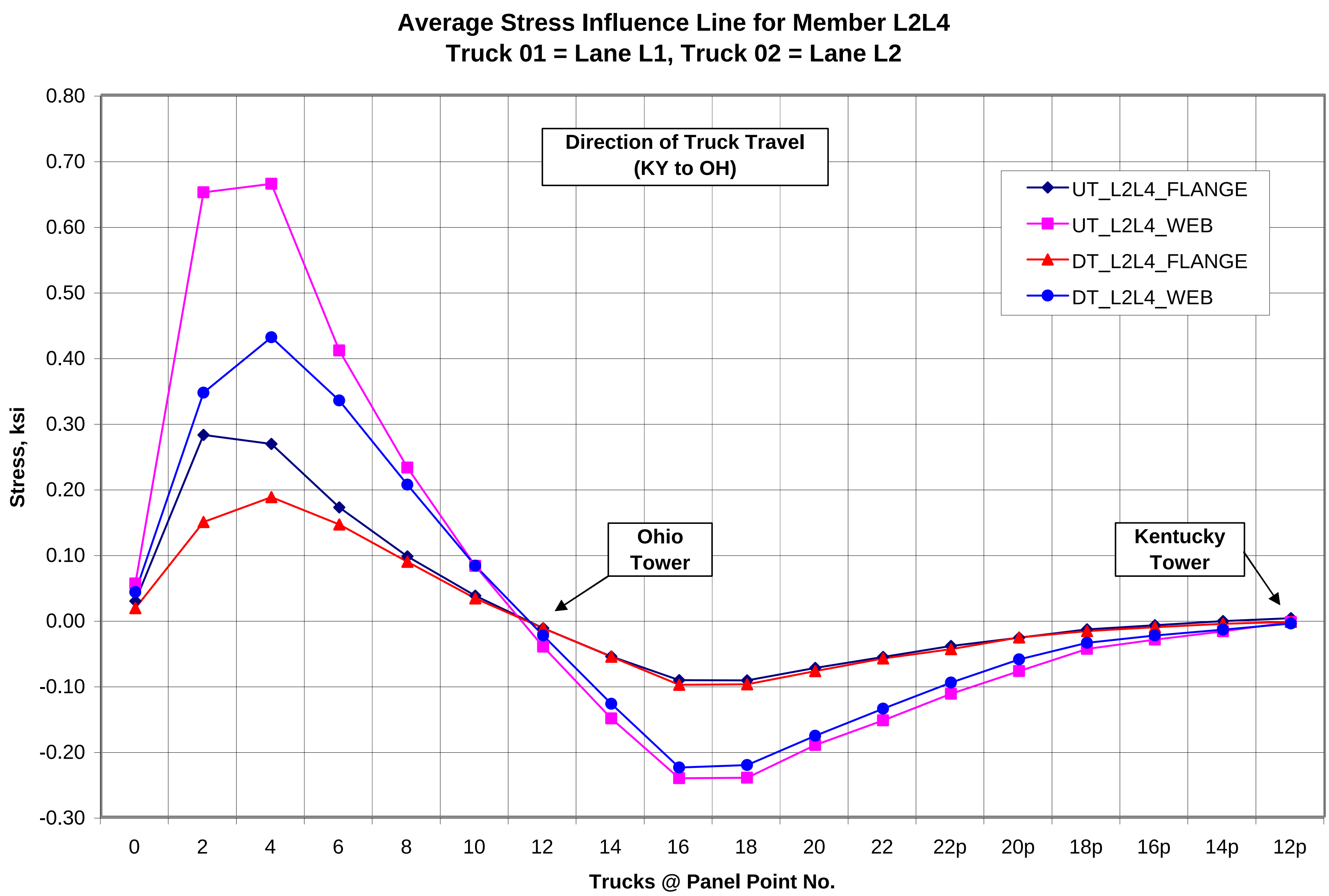
TRAVEL DIRECTION OF TRUCKS IS KENTUCKY TO OHIO

DATA SET TAKEN FROM TEST 05
TWO TRUCKS SIDE BY SIDE
STOP @ EVEN PANEL POINTS FOR 5 SECONDS

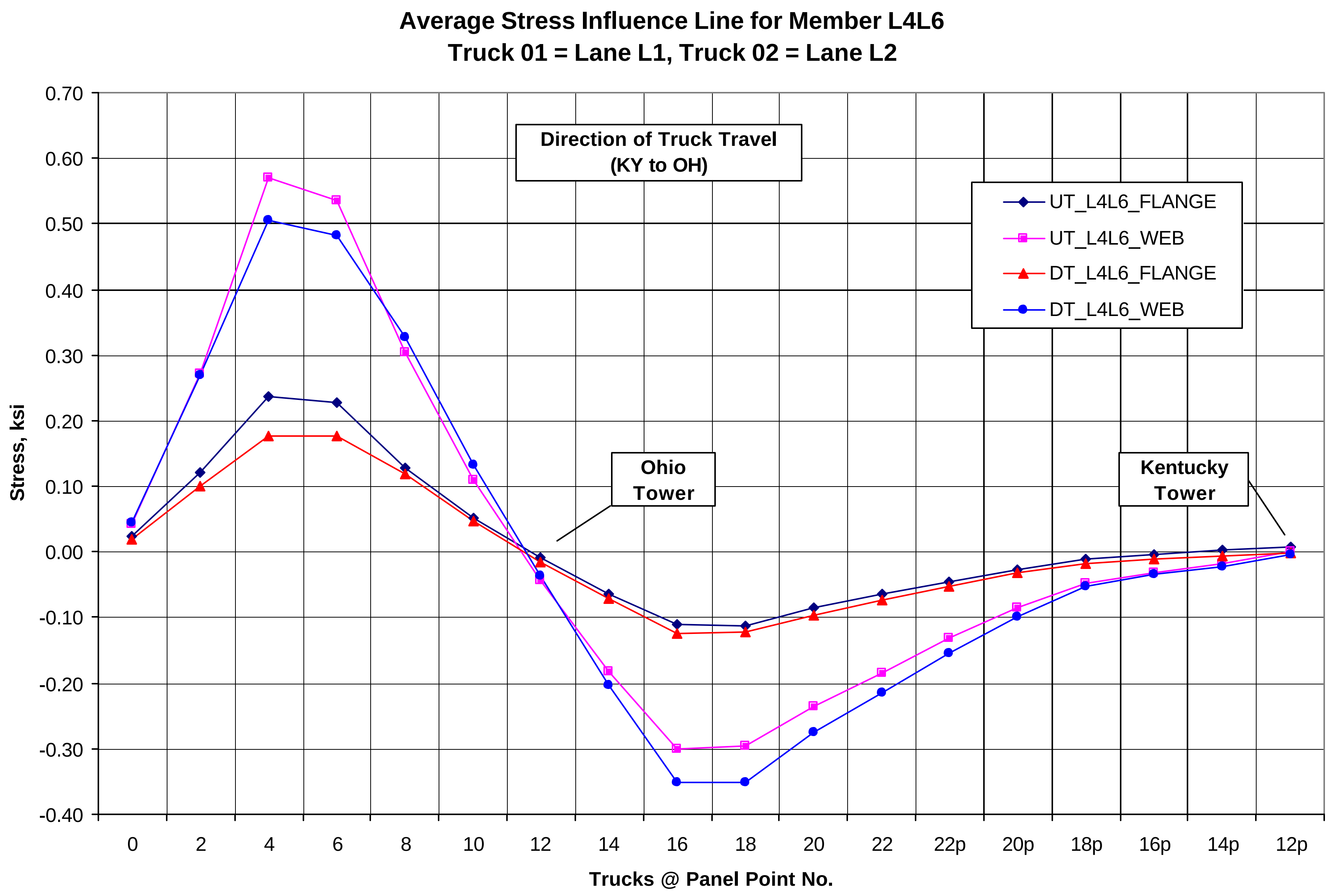
Processed By: Kirk A. Grimmelsman

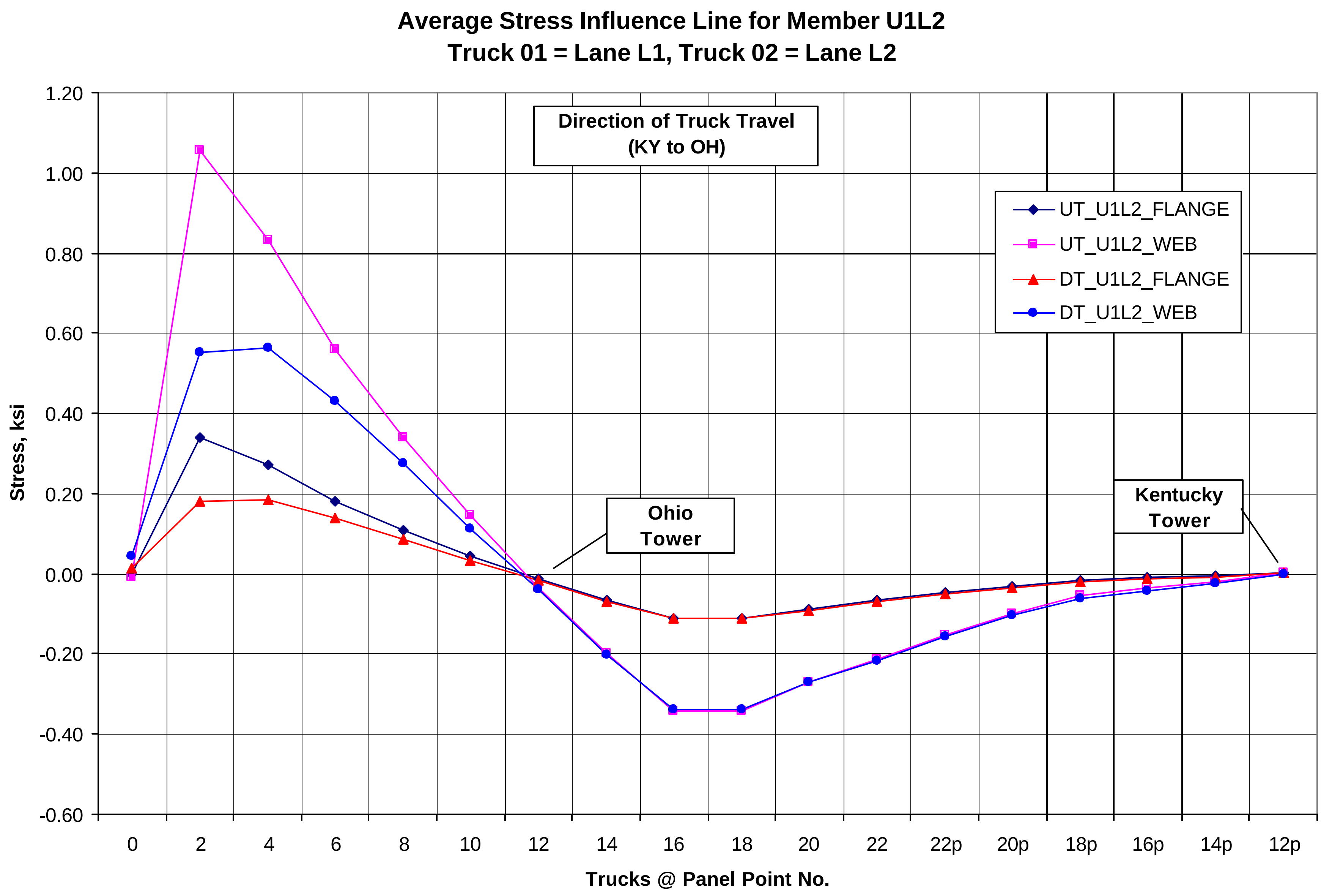
Drexel UNIVERSITY

May 16, 2004

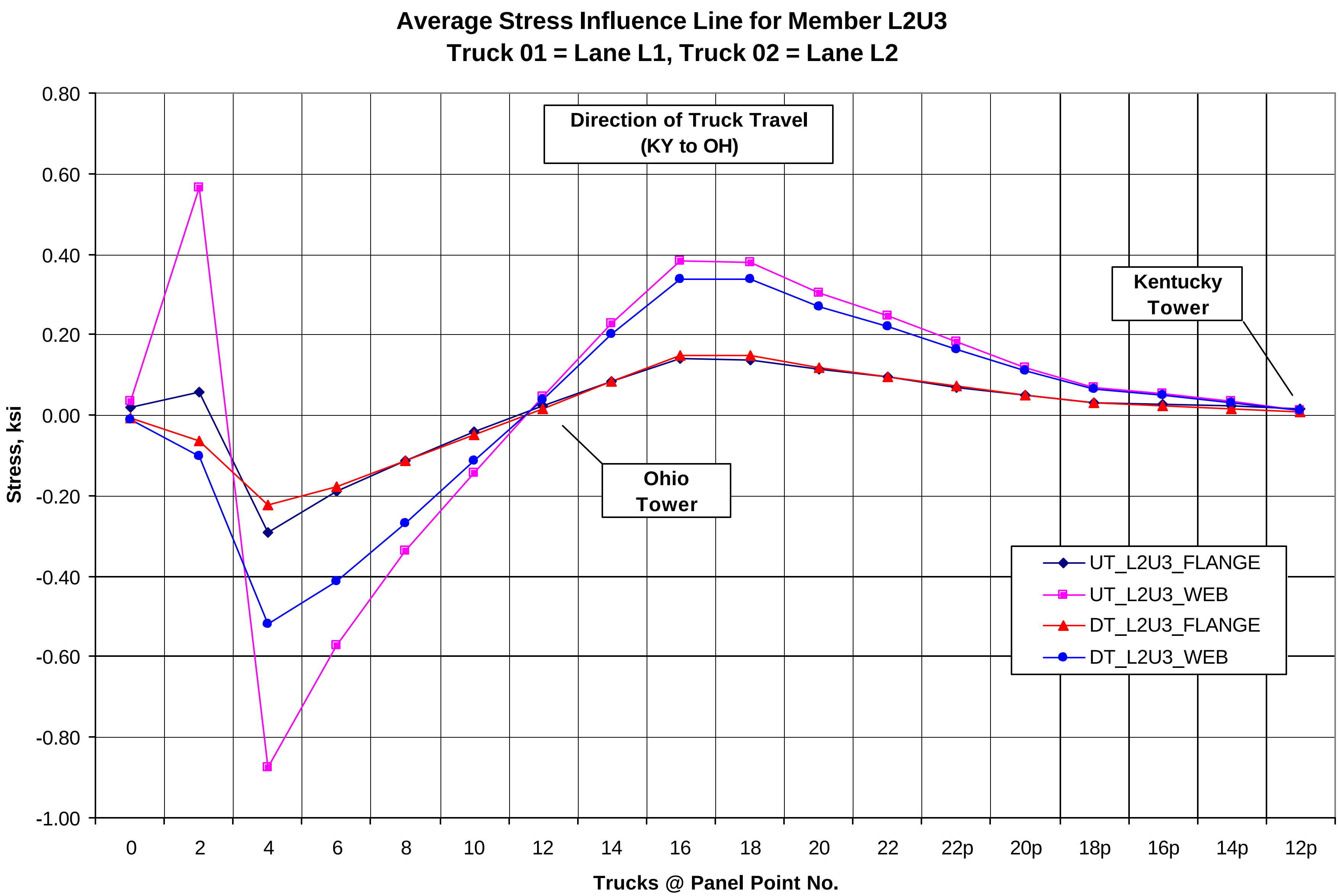


Average Stress Influence Line for Member L2L4
Truck 01 = Lane L1, Truck 02 = Lane L2
Direction of Truck Travel
(KY to OH)
UT_L2L4_FLANGE
UT_L2L4_WEB
DT_L2L4_FLANGE
DT_L2L4_WEB
Ohio
Tower
Kentucky
Tower
Stress, ksi
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.

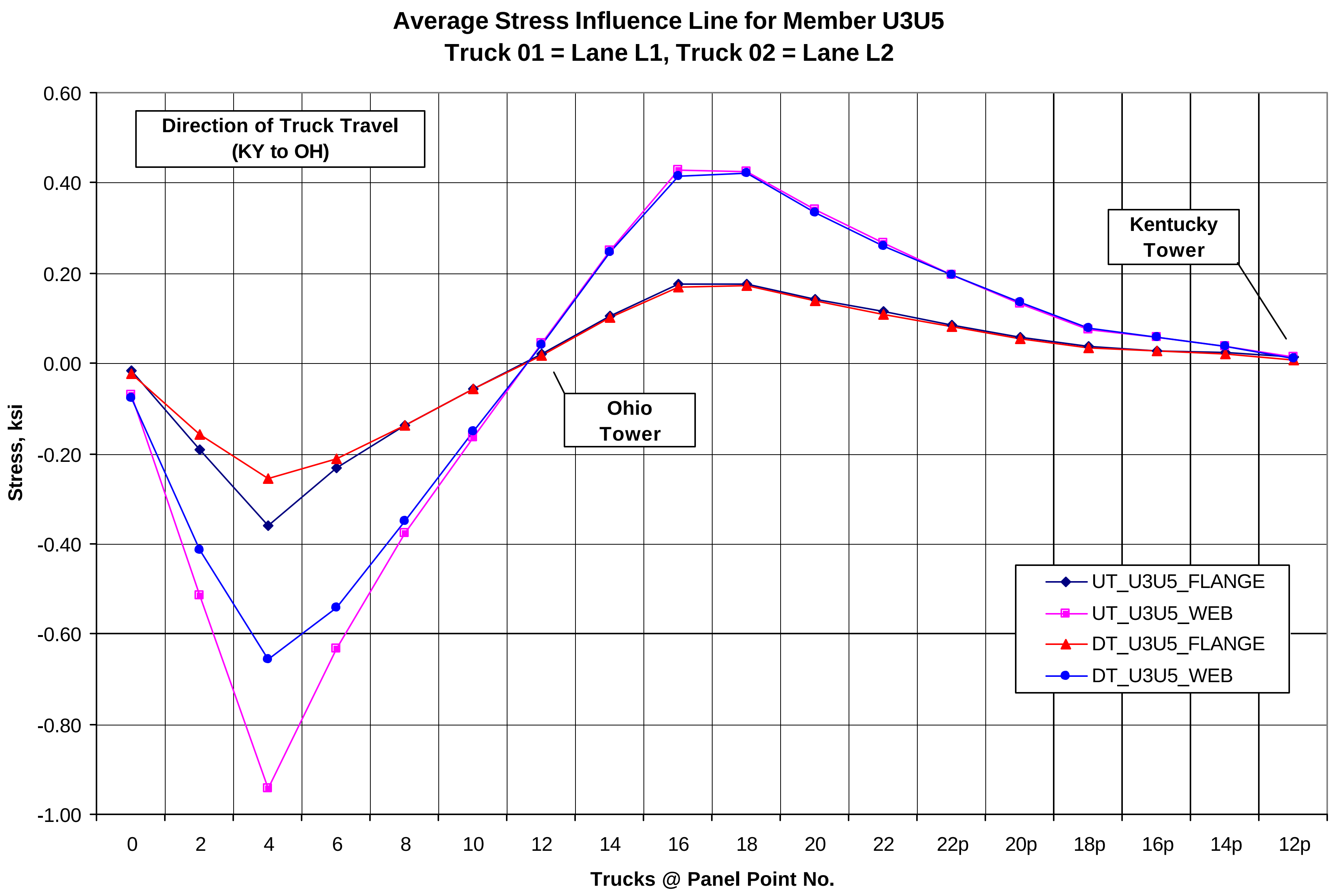

Average Stress Influence Line for Member L4L6
Truck 01 = Lane L1, Truck 02 = Lane L2
Direction of Truck Travel
(KY to OH)
UT_L4L6_FLANGE
UT_L4L6_WEB
DT_L4L6_FLANGE
DT_L4L6_WEB
Ohio Tower
Kentucky Tower
Stress, ksi
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.



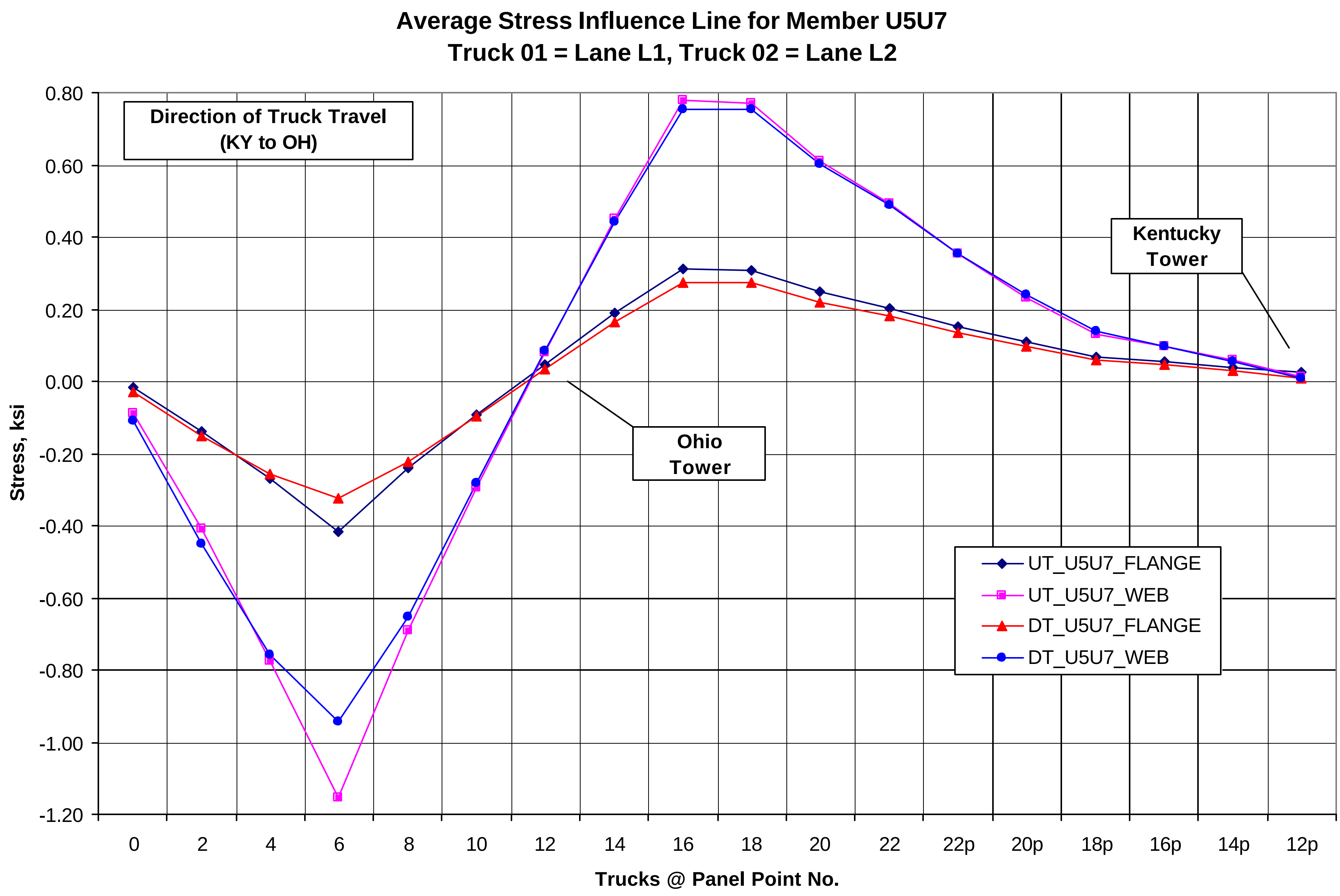
Average Stress Influence Line for Member U1L2
Truck 01 = Lane L1, Truck 02 = Lane L2
Direction of Truck Travel
(KY to OH)
UT_U1L2_FLANGE
UT_U1L2_WEB
DT_U1L2_FLANGE
DT_U1L2_WEB
Ohio Tower
Kentucky Tower
Stress, ksi
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.



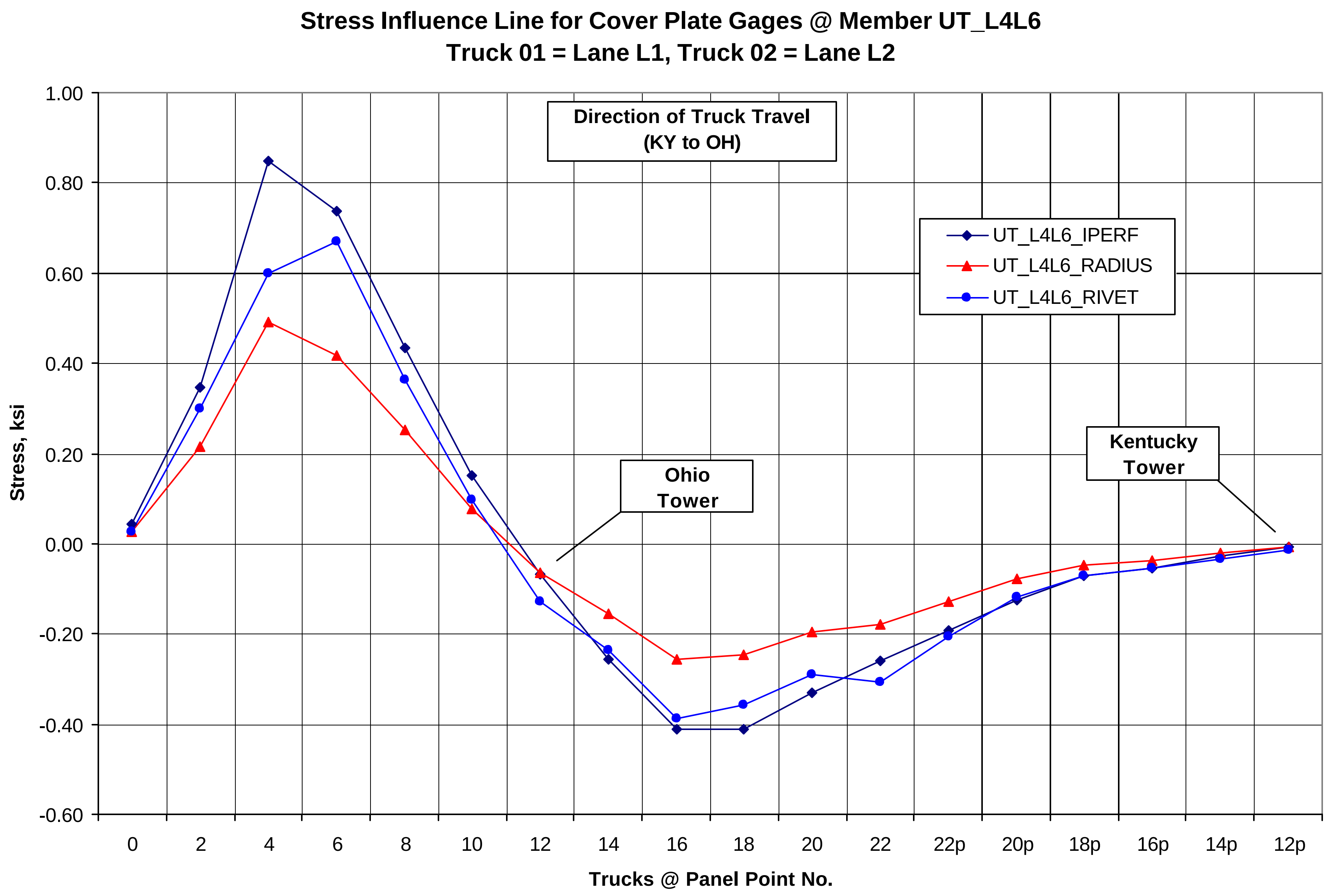
Average Stress Influence Line for Member L2U3
Truck 01 = Lane L1, Truck 02 = Lane L2
Direction of Truck Travel
(KY to OH)
Kentucky
Tower
Ohio
Tower
UT_L2U3_FLANGE
UT_L2U3_WEB
DT_L2U3_FLANGE
DT_L2U3_WEB
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
Stress, ksi
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.



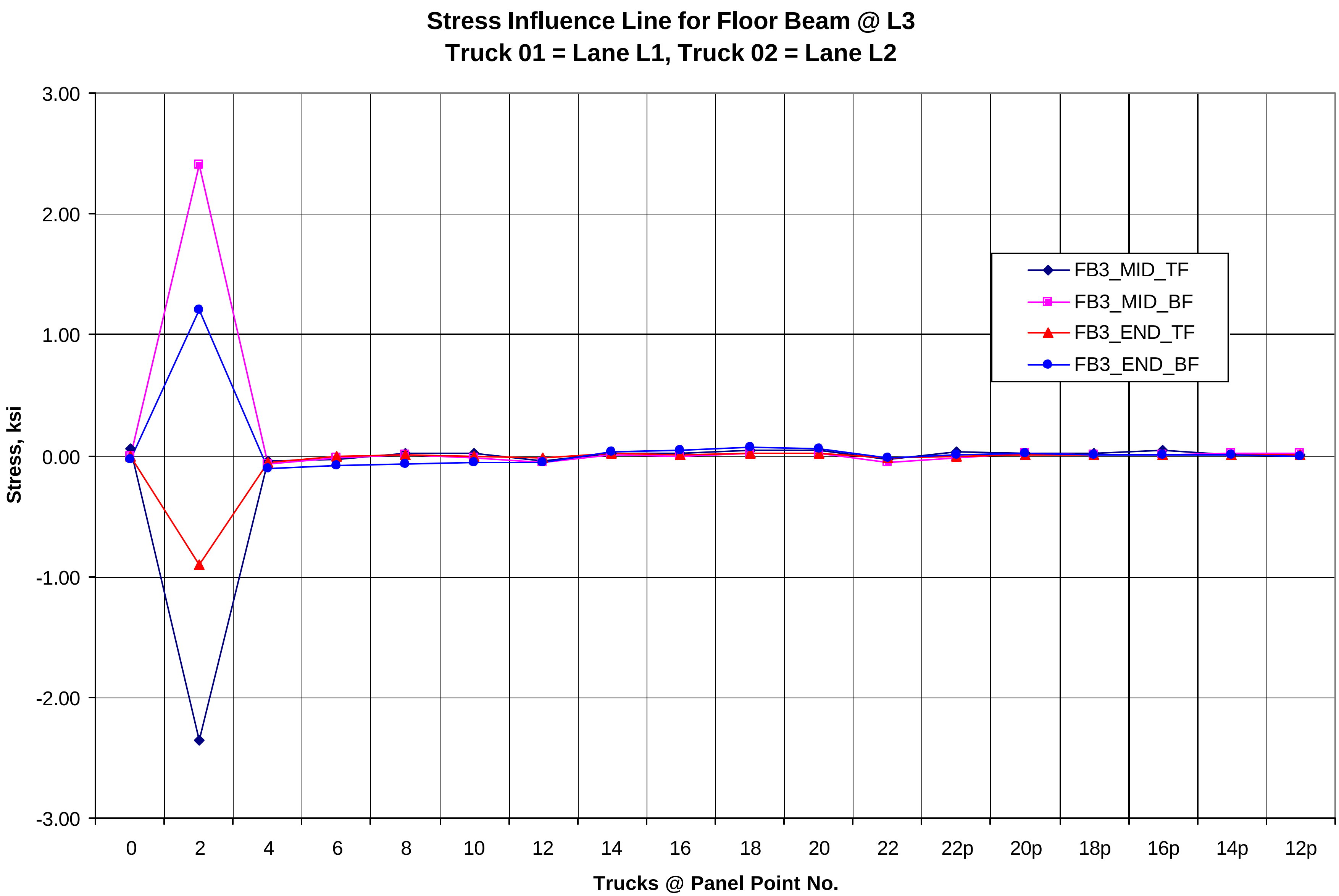
Average Stress Influence Line for Member U3U5
Truck 01 = Lane L1, Truck 02 = Lane L2
Direction of Truck Travel
(KY to OH)
Kentucky
Tower
Ohio
Tower
UT_U3U5_FLANGE
UT_U3U5_WEB
DT_U3U5_FLANGE
DT_U3U5_WEB
Stress, ksi
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.



Average Stress Influence Line for Member U5U7
Truck 01 = Lane L1, Truck 02 = Lane L2
Direction of Truck Travel
(KY to OH)
Kentucky
Tower
Ohio
Tower
UT_U5U7_FLANGE
UT_U5U7_WEB
DT_U5U7_FLANGE
DT_U5U7_WEB
Stress, ksi
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.



Stress Influence Line for Cover Plate Gages @ Member UT_L4L6
Truck 01 = Lane L1, Truck 02 = Lane L2
Direction of Truck Travel
(KY to OH)
UT_L4L6_IPERF
UT_L4L6_RADIUS
UT_L4L6_RIVET
Ohio Tower
Kentucky Tower
Stress, ksi
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.



Stress Influence Line for Floor Beam @ L3
Truck 01 = Lane L1, Truck 02 = Lane L2
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
Stress, ksi
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.
FB3_MID_TF
FB3_MID_BF
FB3_END_TF
FB3_END_BF

Average Stress Results - Test 05

Travel Direction	**KY to OH**
Truck 01 =	**Lane L1**
Truck 02 =	**Lane L2**
Young's Modulus	**0.029**

	Units	ksi	ksi	ksi	ksi
Point No.	**PP**	**UT_L2L4_FLANGE**	**UT_L2L4_WEB**	**DT_L2L4_FLANGE**	**DT_L2L4_WEB**
0	0	0.028	0.055	0.018	0.042
2	2	0.282	0.651	0.149	0.346
4	4	0.268	0.664	0.187	0.430
6	6	0.171	0.410	0.145	0.334
8	8	0.096	0.232	0.088	0.206
10	10	0.036	0.082	0.032	0.082
12	12	-0.013	-0.041	-0.013	-0.024
14	14	-0.056	-0.151	-0.057	-0.128
16	16	-0.092	-0.242	-0.099	-0.225
18	18	-0.093	-0.241	-0.098	-0.221
20	20	-0.073	-0.191	-0.078	-0.177
22	22	-0.057	-0.154	-0.059	-0.136
24	22p	-0.040	-0.113	-0.045	-0.096
26	20p	-0.027	-0.078	-0.027	-0.061
28	18p	-0.015	-0.044	-0.018	-0.035
30	16p	-0.009	-0.030	-0.012	-0.024
32	14p	-0.002	-0.018	-0.006	-0.015
34	12p	0.002	-0.004	-0.003	-0.006

Average Stress Results - Test 05

Travel Direction	**KY to OH**
Truck 01 =	**Lane L1**
Truck 02 =	**Lane L2**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_L4L6_FLANGE**	**UT_L4L6_WEB**	**DT_L4L6_FLANGE**	**DT_L4L6_WEB**
0	0.025	0.042	0.019	0.045
2	0.121	0.272	0.100	0.269
4	0.236	0.569	0.176	0.506
6	0.227	0.535	0.177	0.483
8	0.129	0.303	0.119	0.327
10	0.051	0.109	0.047	0.133
12	-0.010	-0.043	-0.016	-0.037
14	-0.064	-0.181	-0.072	-0.203
16	-0.110	-0.301	-0.124	-0.351
18	-0.113	-0.296	-0.121	-0.350
20	-0.084	-0.236	-0.096	-0.276
22	-0.064	-0.185	-0.074	-0.215
22p	-0.046	-0.132	-0.052	-0.154
20p	-0.028	-0.085	-0.031	-0.099
18p	-0.010	-0.048	-0.017	-0.053
16p	-0.003	-0.031	-0.011	-0.035
14p	0.003	-0.018	-0.005	-0.022
12p	0.009	0.001	-0.002	-0.004

Average Stress Results - Test 05

Travel Direction	**KY to OH**
Truck 01 =	**Lane L1**
Truck 02 =	**Lane L2**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_U1L2_FLANGE**	**UT_U1L2_WEB**	**DT_U1L2_FLANGE**	**DT_U1L2_WEB**
0	-0.002	-0.008	0.013	0.043
2	0.339	1.057	0.179	0.551
4	0.272	0.833	0.185	0.563
6	0.182	0.558	0.140	0.430
8	0.110	0.340	0.088	0.276
10	0.045	0.146	0.032	0.114
12	-0.012	-0.035	-0.016	-0.038
14	-0.066	-0.199	-0.068	-0.201
16	-0.110	-0.343	-0.113	-0.340
18	-0.109	-0.341	-0.111	-0.340
20	-0.088	-0.270	-0.091	-0.272
22	-0.066	-0.212	-0.071	-0.216
22p	-0.047	-0.153	-0.052	-0.157
20p	-0.031	-0.099	-0.034	-0.103
18p	-0.015	-0.054	-0.020	-0.060
16p	-0.009	-0.035	-0.012	-0.042
14p	-0.006	-0.019	-0.007	-0.024
12p	0.001	0.002	0.001	-0.003

Average Stress Results - Test 05
Travel Direction KY to OH
Truck 01 = Lane L1
Truck 02 = Lane L2
Young's Modulus 0.029

Units	ksi	ksi	ksi	ksi
PP	**UT_L2U3_FLANGE**	**UT_L2U3_WEB**	**DT_L2U3_FLANGE**	**DT_L2U3_WEB**
0	0.020	0.033	-0.006	-0.011
2	0.056	0.566	-0.064	-0.103
4	-0.290	-0.876	-0.223	-0.518
6	-0.190	-0.573	-0.177	-0.413
8	-0.112	-0.338	-0.113	-0.268
10	-0.041	-0.144	-0.049	-0.112
12	0.024	0.047	0.017	0.039
14	0.083	0.227	0.085	0.200
16	0.141	0.382	0.148	0.336
18	0.138	0.380	0.148	0.336
20	0.113	0.302	0.118	0.269
22	0.094	0.246	0.096	0.219
22p	0.070	0.181	0.072	0.163
20p	0.049	0.117	0.050	0.110
18p	0.030	0.070	0.030	0.064
16p	0.026	0.053	0.024	0.049
14p	0.022	0.034	0.015	0.031
12p	0.017	0.013	0.007	0.010

Average Stress Results - Test 05
Travel Direction **KY to OH**
Truck 01 = **Lane L1**
Truck 02 = **Lane L2**
Young's Modulus **0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_U3U5_FLANGE**	**UT_U3U5_WEB**	**DT_U3U5_FLANGE**	**DT_U3U5_WEB**
0	-0.017	-0.071	-0.025	-0.077
2	-0.191	-0.516	-0.156	-0.415
4	-0.361	-0.942	-0.257	-0.656
6	-0.232	-0.633	-0.212	-0.541
8	-0.137	-0.377	-0.138	-0.349
10	-0.057	-0.165	-0.058	-0.150
12	0.022	0.046	0.018	0.039
14	0.106	0.248	0.102	0.247
16	0.176	0.428	0.170	0.415
18	0.175	0.426	0.171	0.421
20	0.141	0.340	0.138	0.333
22	0.115	0.266	0.107	0.260
22p	0.085	0.196	0.080	0.195
20p	0.059	0.131	0.056	0.134
18p	0.036	0.075	0.035	0.079
16p	0.028	0.057	0.026	0.056
14p	0.023	0.039	0.022	0.039
12p	0.013	0.013	0.009	0.010

Average Stress Results - Test 05

Travel Direction	**KY to OH**
Truck 01 =	**Lane L1**
Truck 02 =	**Lane L2**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_U5U7_FLANGE**	**UT_U5U7_WEB**	**DT_U5U7_FLANGE**	**DT_U5U7_WEB**
0	-0.015	-0.089	-0.028	-0.109
2	-0.138	-0.409	-0.152	-0.449
4	-0.270	-0.774	-0.257	-0.758
6	-0.416	-1.152	-0.324	-0.944
8	-0.242	-0.691	-0.224	-0.654
10	-0.094	-0.293	-0.096	-0.282
12	0.047	0.079	0.034	0.083
14	0.188	0.450	0.165	0.443
16	0.312	0.777	0.275	0.754
18	0.309	0.772	0.274	0.754
20	0.248	0.610	0.221	0.601
22	0.202	0.491	0.183	0.489
22p	0.150	0.353	0.134	0.355
20p	0.108	0.231	0.097	0.239
18p	0.067	0.132	0.057	0.138
16p	0.055	0.095	0.044	0.098
14p	0.040	0.060	0.028	0.056
12p	0.023	0.014	0.009	0.009

Stress Results - Test 05

Travel Direction	**KY to OH**
Truck 01 =	**Lane L1**
Truck 02 =	**Lane L2**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	UT_L4L6_IPERF	UT_L4L6_OPERF	UT_L4L6_RADIUS	UT_L4L6_RIVET
0	0.043	-63.129	0.028	0.025
2	0.345	-63.129	0.216	0.298
4	0.849	-63.129	0.491	0.599
6	0.738	-63.129	0.418	0.670
8	0.433	-63.129	0.253	0.365
10	0.151	-63.129	0.076	0.097
12	-0.069	-63.129	-0.063	-0.127
14	-0.256	-63.129	-0.156	-0.238
16	-0.412	-63.129	-0.255	-0.388
18	-0.412	-63.129	-0.247	-0.359
20	-0.329	-63.129	-0.197	-0.290
22	-0.260	-63.129	-0.179	-0.308
22p	-0.193	-63.129	-0.127	-0.205
20p	-0.126	-63.129	-0.078	-0.119
18p	-0.072	-63.129	-0.047	-0.071
16p	-0.054	-63.129	-0.039	-0.054
14p	-0.029	-63.129	-0.020	-0.035
12p	-0.006	-63.129	-0.007	-0.014

Stress Results - Test 05

Travel Direction	**KY to OH**
Truck 01 =	**Lane L1**
Truck 02 =	**Lane L2**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	FB3_MID_TF	FB3_MID_BF	FB3_END_TF	FB3_END_BF
0	0.058	-0.006	-0.006	-0.029
2	-2.361	2.409	-0.908	1.211
4	-0.047	-0.068	-0.060	-0.112
6	-0.026	-0.015	-0.011	-0.085
8	0.015	0.001	0.003	-0.065
10	0.020	-0.019	-0.004	-0.053
12	-0.039	-0.057	-0.024	-0.053
14	0.021	0.008	0.014	0.032
16	0.023	-0.006	0.008	0.045
18	0.046	0.022	0.018	0.065
20	0.047	0.022	0.022	0.062
22	-0.033	-0.059	-0.021	-0.021
22p	0.028	-0.015	-0.003	0.004
20p	0.017	0.015	0.010	0.019
18p	0.013	0.010	0.006	0.006
16p	0.041	0.012	0.005	0.004
14p	0.012	0.013	0.005	0.003
12p	0.011	0.014	0.002	-0.001

BRENT SPENCE BRIDGE

STRESS RESULTS FROM QUASI-STATIC LOAD TEST

LOWER DECK LEVEL

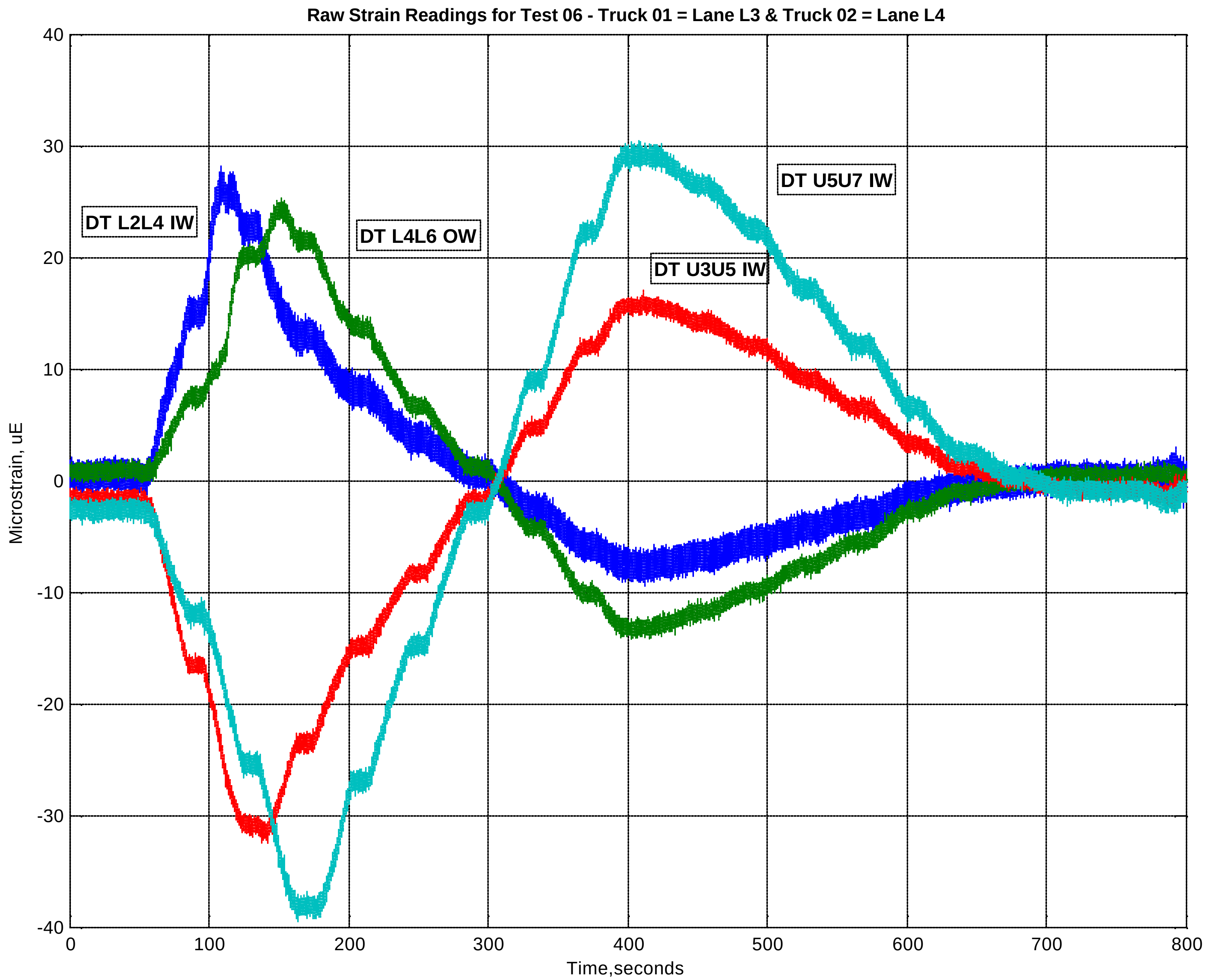
TRUCK 01 IN LANE L3
TRUCK 02 IN LANE L4

TRAVEL DIRECTION OF TRUCKS IS OHIO TO KENTUCKY

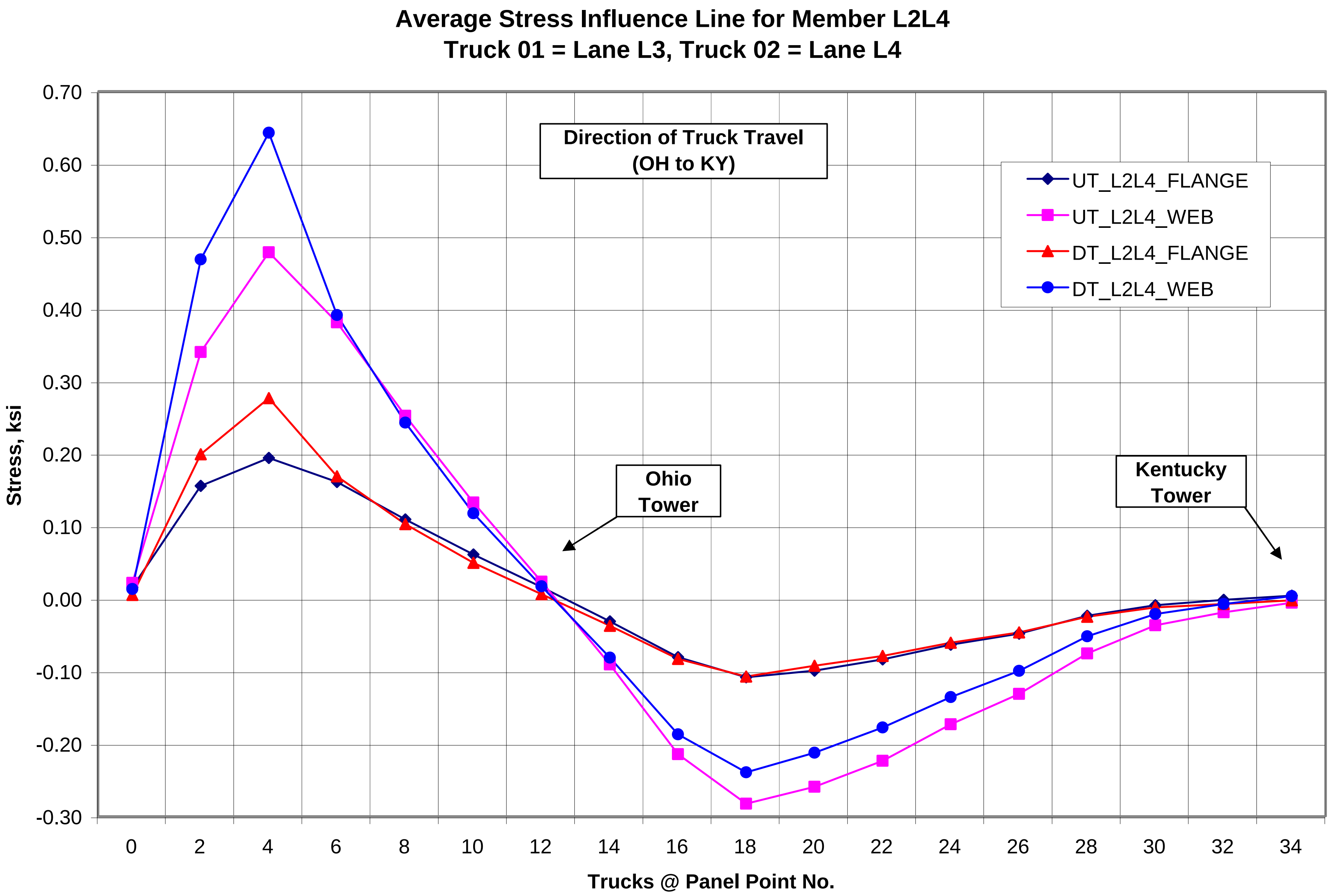
DATA SET TAKEN FROM TEST 06
TWO TRUCKS SIDE BY SIDE
STOP @ EVEN PANEL POINTS FOR 5 SECONDS

Processed By: Kirk A. Grimmelsman

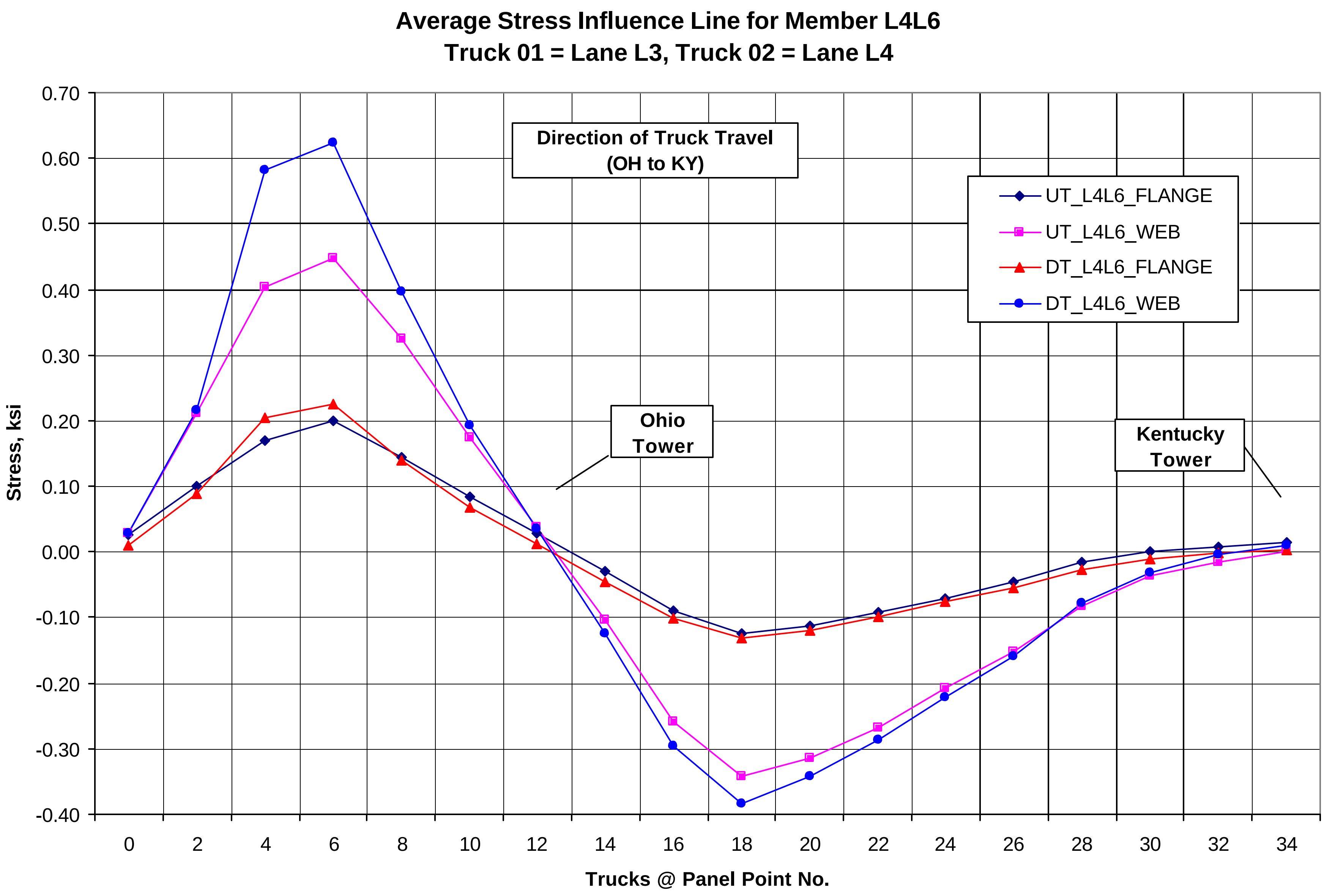
May 17, 2004

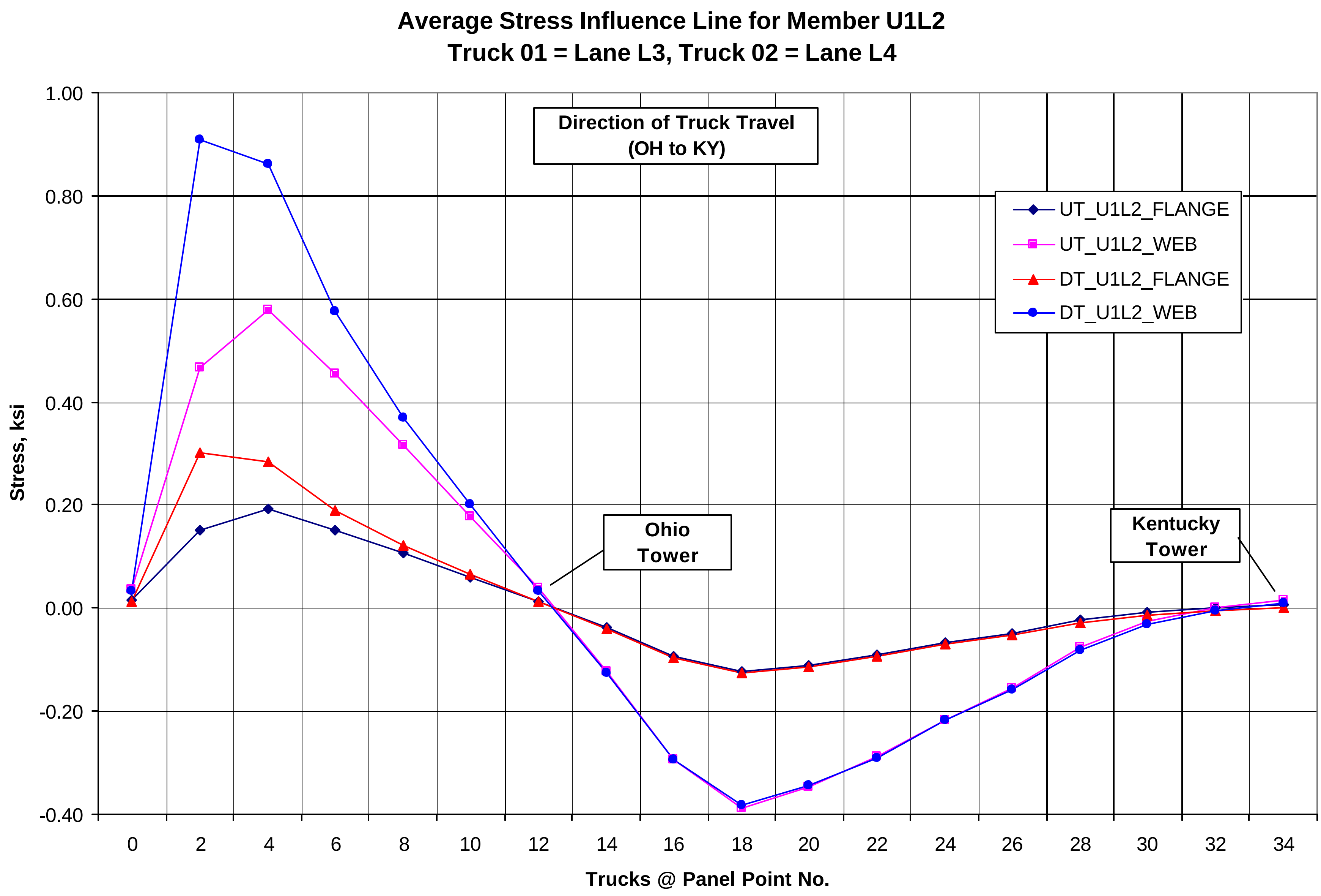


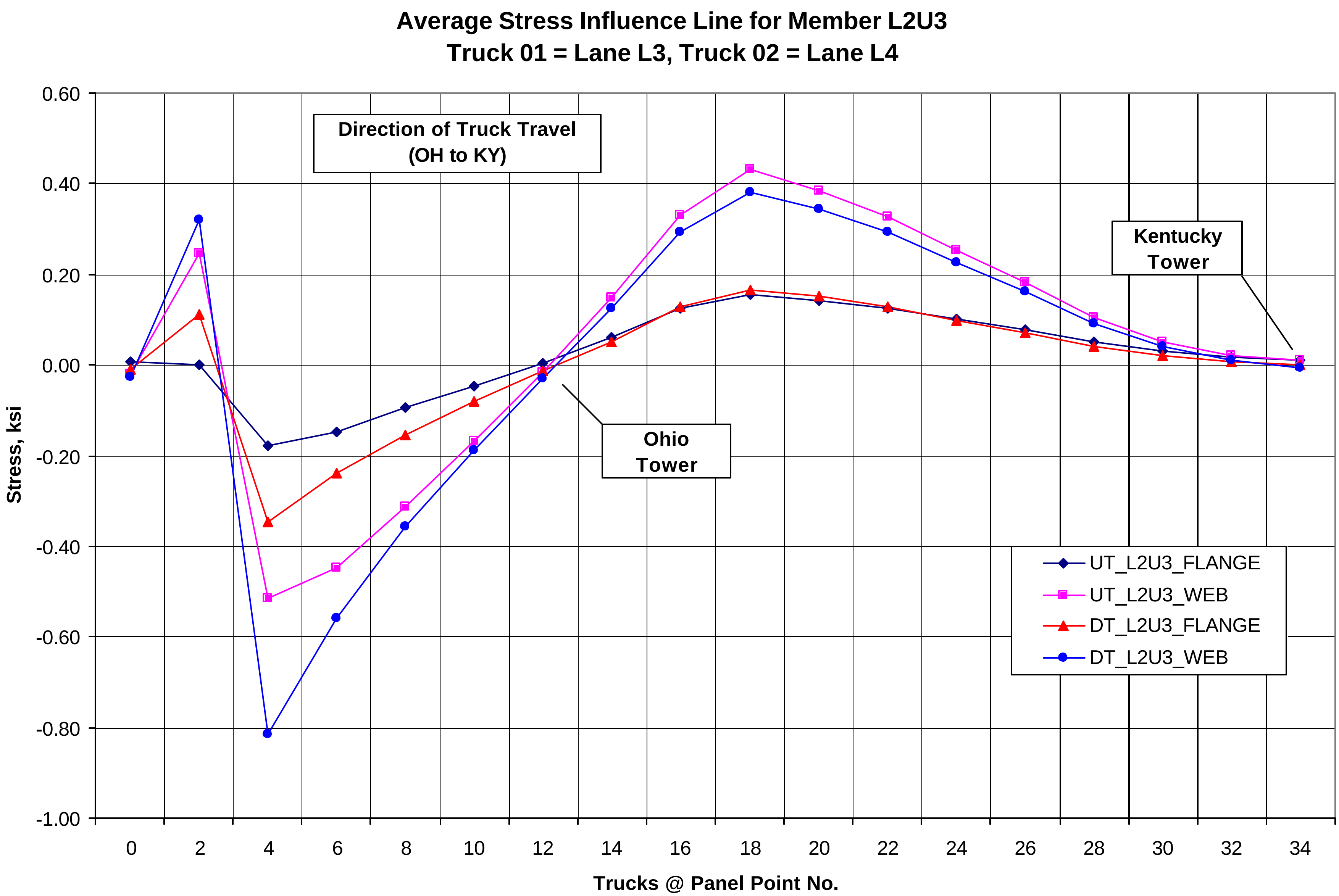
Raw Strain Readings for Test 06 - Truck 01 = Lane L3 & Truck 02 = Lane L4
Microstrain, uE
Time,seconds
DT L2L4 IW
DT L4L6 OW
DT U5U7 IW
DT U3U5 IW
40
30
20
10
0
-10
-20
-30
-40
0
100
200
300
400
500
600
700
800

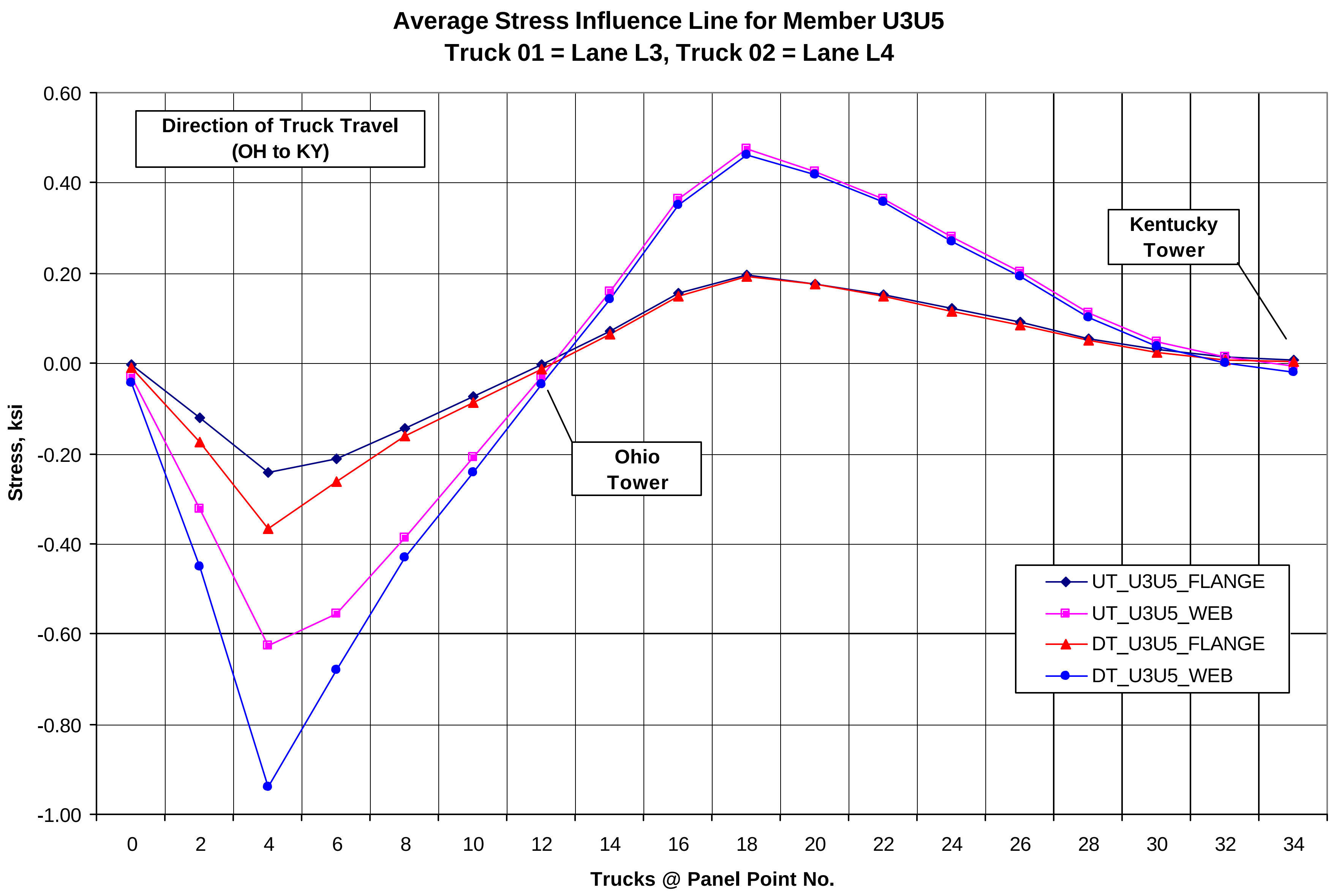


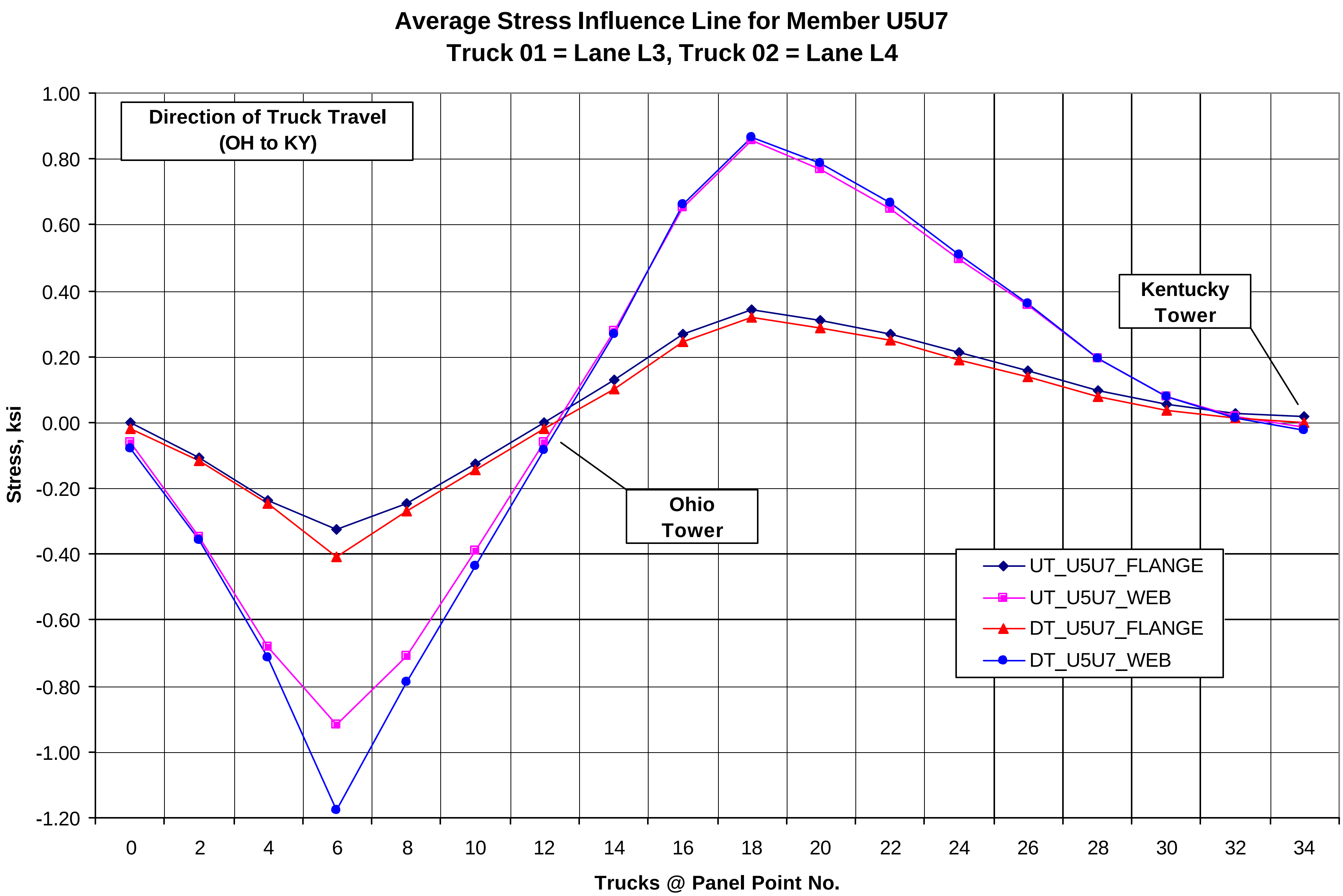
Average Stress Influence Line for Member L2L4
Truck 01 = Lane L3, Truck 02 = Lane L4
Direction of Truck Travel
(OH to KY)
UT_L2L4_FLANGE
UT_L2L4_WEB
DT_L2L4_FLANGE
DT_L2L4_WEB
Ohio
Tower
Kentucky
Tower
Stress, ksi
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
Trucks @ Panel Point No.


Average Stress Influence Line for Member L4L6
Truck 01 = Lane L3, Truck 02 = Lane L4
Direction of Truck Travel
(OH to KY)
Ohio
Tower
Kentucky
Tower
UT_L4L6_FLANGE
UT_L4L6_WEB
DT_L4L6_FLANGE
DT_L4L6_WEB
Stress, ksi
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
Trucks @ Panel Point No.

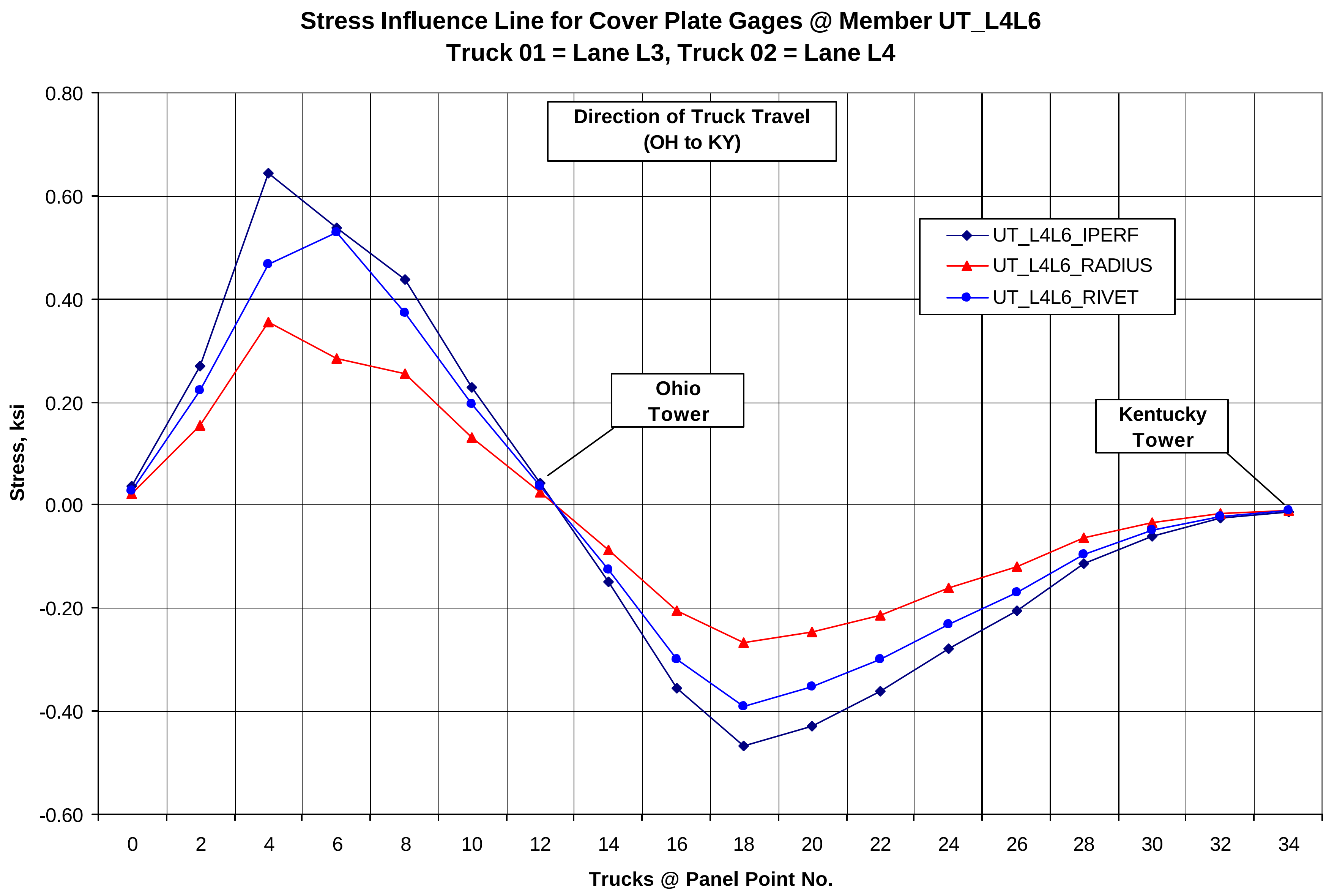

Average Stress Influence Line for Member U1L2
Truck 01 = Lane L3, Truck 02 = Lane L4
Direction of Truck Travel
(OH to KY)
UT_U1L2_FLANGE
UT_U1L2_WEB
DT_U1L2_FLANGE
DT_U1L2_WEB
Ohio
Tower
Kentucky
Tower
Stress, ksi
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
Trucks @ Panel Point No.


Average Stress Influence Line for Member L2U3
Truck 01 = Lane L3, Truck 02 = Lane L4
Direction of Truck Travel
(OH to KY)
Kentucky
Tower
Ohio
Tower
UT_L2U3_FLANGE
UT_L2U3_WEB
DT_L2U3_FLANGE
DT_L2U3_WEB
Stress, ksi
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
Trucks @ Panel Point No.

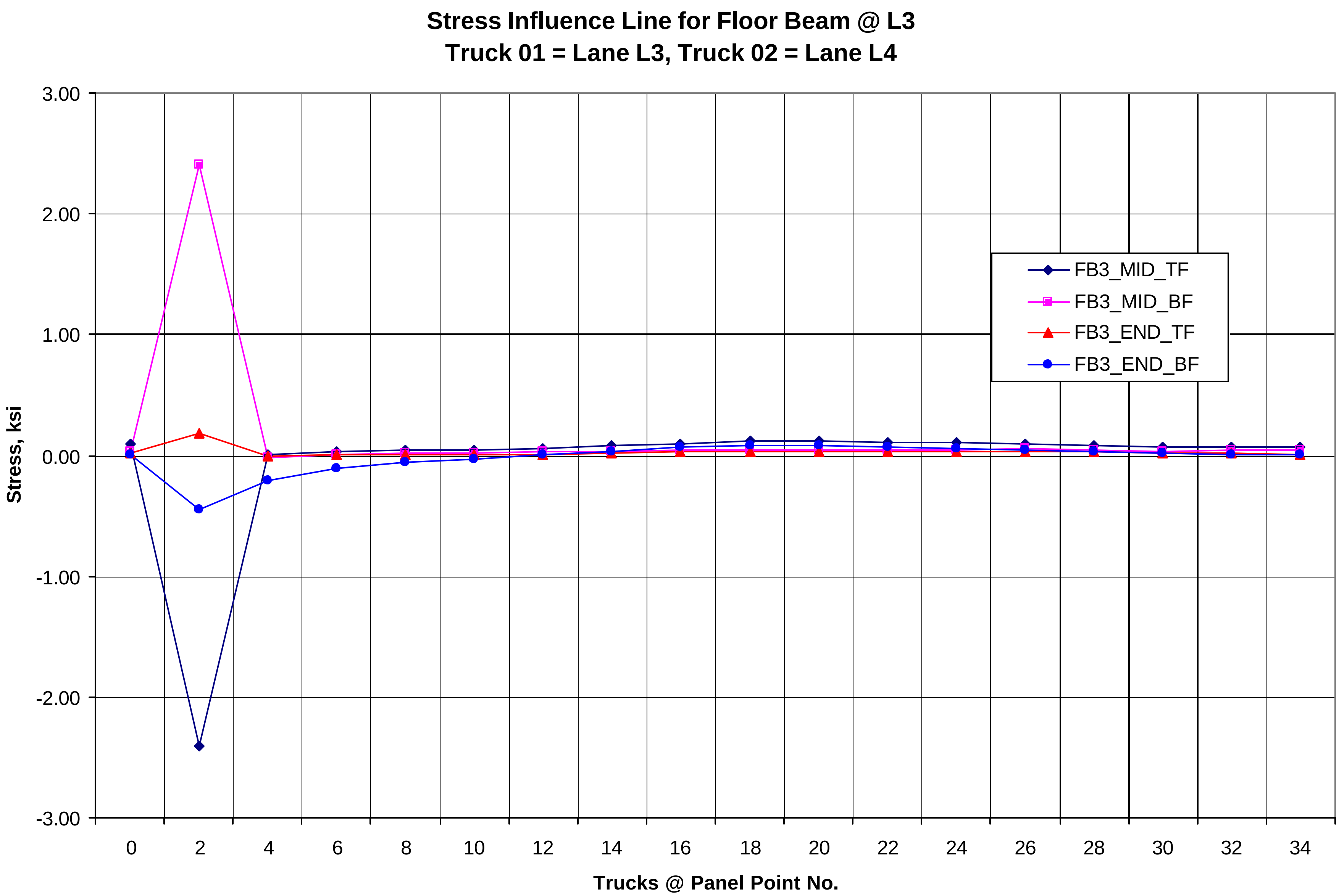

Average Stress Influence Line for Member U3U5
Truck 01 = Lane L3, Truck 02 = Lane L4
Direction of Truck Travel
(OH to KY)
Kentucky
Tower
Ohio
Tower
UT_U3U5_FLANGE
UT_U3U5_WEB
DT_U3U5_FLANGE
DT_U3U5_WEB
Stress, ksi
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
Trucks @ Panel Point No.



Average Stress Influence Line for Member U5U7
Truck 01 = Lane L3, Truck 02 = Lane L4
Direction of Truck Travel
(OH to KY)
Kentucky
Tower
Ohio
Tower
UT_U5U7_FLANGE
UT_U5U7_WEB
DT_U5U7_FLANGE
DT_U5U7_WEB
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
Stress, ksi
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
Trucks @ Panel Point No.



Stress Influence Line for Cover Plate Gages @ Member UT_L4L6
Truck 01 = Lane L3, Truck 02 = Lane L4
Direction of Truck Travel
(OH to KY)
UT_L4L6_IPERF
UT_L4L6_RADIUS
UT_L4L6_RIVET
Ohio
Tower
Kentucky
Tower
Stress, ksi
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
Trucks @ Panel Point No.


Stress Influence Line for Floor Beam @ L3
Truck 01 = Lane L3, Truck 02 = Lane L4
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
Stress, ksi
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
Trucks @ Panel Point No.
FB3_MID_TF
FB3_MID_BF
FB3_END_TF
FB3_END_BF

Average Stress Results - Test 06

Travel Direction	**OH to KY**
Truck 01 =	**Lane L3**
Truck 02 =	**Lane L4**
Young's Modulus	**0.029**

	Units	ksi	ksi	ksi	ksi
Point No.	**PP**	**UT_L2L4_FLANGE**	**UT_L2L4_WEB**	**DT_L2L4_FLANGE**	**DT_L2L4_WEB**
0	0	0.016	0.022	0.005	0.013
2	2	0.156	0.340	0.199	0.468
4	4	0.194	0.478	0.277	0.643
6	6	0.161	0.381	0.169	0.391
8	8	0.109	0.252	0.103	0.243
10	10	0.061	0.133	0.049	0.118
12	12	0.016	0.023	0.006	0.017
14	14	-0.031	-0.091	-0.037	-0.081
16	16	-0.081	-0.215	-0.083	-0.187
18	18	-0.108	-0.283	-0.107	-0.240
20	20	-0.099	-0.260	-0.092	-0.212
22	22	-0.084	-0.224	-0.079	-0.178
24	24	-0.064	-0.173	-0.061	-0.136
26	26	-0.048	-0.131	-0.046	-0.100
28	28	-0.024	-0.076	-0.025	-0.052
30	30	-0.009	-0.037	-0.012	-0.021
32	32	-0.002	-0.019	-0.007	-0.007
34	34	0.004	-0.006	-0.002	0.003

Average Stress Results - Test 06

Travel Direction	**OH to KY**
Truck 01 =	**Lane L3**
Truck 02 =	**Lane L4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_L4L6_FLANGE**	**UT_L4L6_WEB**	**DT_L4L6_FLANGE**	**DT_L4L6_WEB**
0	0.026	0.029	0.009	0.027
2	0.100	0.212	0.090	0.216
4	0.170	0.403	0.204	0.583
6	0.199	0.449	0.226	0.624
8	0.143	0.325	0.140	0.397
10	0.084	0.175	0.067	0.193
12	0.029	0.039	0.012	0.036
14	-0.029	-0.104	-0.045	-0.124
16	-0.091	-0.259	-0.101	-0.296
18	-0.125	-0.342	-0.132	-0.383
20	-0.112	-0.315	-0.120	-0.342
22	-0.092	-0.269	-0.099	-0.288
24	-0.070	-0.207	-0.075	-0.221
26	-0.046	-0.152	-0.054	-0.158
28	-0.015	-0.083	-0.027	-0.078
30	0.001	-0.037	-0.010	-0.031
32	0.009	-0.015	-0.002	-0.004
34	0.014	0.001	0.002	0.010

Average Stress Results - Test 06

Travel Direction	**OH to KY**
Truck 01 =	**Lane L3**
Truck 02 =	**Lane L4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_U1L2_FLANGE**	**UT_U1L2_WEB**	**DT_U1L2_FLANGE**	**DT_U1L2_WEB**
0	0.015	0.038	0.014	0.034
2	0.153	0.466	0.301	0.908
4	0.191	0.580	0.284	0.860
6	0.152	0.456	0.191	0.576
8	0.106	0.316	0.121	0.370
10	0.060	0.178	0.066	0.201
12	0.013	0.039	0.013	0.033
14	-0.038	-0.122	-0.041	-0.126
16	-0.093	-0.295	-0.098	-0.294
18	-0.124	-0.389	-0.127	-0.384
20	-0.112	-0.346	-0.114	-0.345
22	-0.091	-0.288	-0.094	-0.290
24	-0.067	-0.216	-0.070	-0.218
26	-0.048	-0.156	-0.054	-0.158
28	-0.023	-0.075	-0.027	-0.080
30	-0.007	-0.027	-0.013	-0.030
32	0.002	-0.001	-0.006	-0.005
34	0.005	0.015	0.000	0.009

Average Stress Results - Test 06

Travel Direction	**OH to KY**
Truck 01 =	**Lane L3**
Truck 02 =	**Lane L4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_L2U3_FLANGE**	**UT_L2U3_WEB**	**DT_L2U3_FLANGE**	**DT_L2U3_WEB**
0	0.006	-0.020	-0.010	-0.026
2	-0.001	0.246	0.110	0.319
4	-0.180	-0.514	-0.345	-0.815
6	-0.149	-0.448	-0.240	-0.559
8	-0.095	-0.313	-0.153	-0.357
10	-0.047	-0.169	-0.082	-0.190
12	0.004	-0.015	-0.014	-0.029
14	0.061	0.148	0.052	0.124
16	0.125	0.331	0.129	0.294
18	0.157	0.431	0.166	0.382
20	0.141	0.386	0.151	0.345
22	0.125	0.327	0.129	0.292
24	0.101	0.253	0.099	0.226
26	0.079	0.183	0.071	0.162
28	0.051	0.105	0.041	0.090
30	0.029	0.052	0.021	0.041
32	0.016	0.022	0.007	0.011
34	0.011	0.009	0.001	-0.005

Average Stress Results - Test 06

Travel Direction	**OH to KY**
Truck 01 =	**Lane L3**
Truck 02 =	**Lane L4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_U3U5_FLANGE**	**UT_U3U5_WEB**	**DT_U3U5_FLANGE**	**DT_U3U5_WEB**
0	-0.002	-0.030	-0.010	-0.044
2	-0.121	-0.325	-0.174	-0.451
4	-0.241	-0.626	-0.368	-0.939
6	-0.211	-0.556	-0.264	-0.682
8	-0.144	-0.386	-0.163	-0.430
10	-0.074	-0.208	-0.089	-0.242
12	-0.004	-0.030	-0.011	-0.048
14	0.070	0.158	0.063	0.141
16	0.154	0.363	0.149	0.351
18	0.197	0.476	0.194	0.462
20	0.176	0.426	0.176	0.419
22	0.153	0.364	0.150	0.357
24	0.122	0.281	0.116	0.269
26	0.091	0.203	0.086	0.192
28	0.055	0.112	0.049	0.102
30	0.030	0.049	0.025	0.038
32	0.014	0.015	0.008	0.001
34	0.008	-0.007	0.002	-0.019

Average Stress Results - Test 06

Travel Direction	**OH to KY**
Truck 01 =	**Lane L3**
Truck 02 =	**Lane L4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_U5U7_FLANGE**	**UT_U5U7_WEB**	**DT_U5U7_FLANGE**	**DT_U5U7_WEB**
0	0.000	-0.062	-0.020	-0.078
2	-0.108	-0.346	-0.117	-0.356
4	-0.234	-0.681	-0.245	-0.715
6	-0.324	-0.916	-0.408	-1.179
8	-0.246	-0.711	-0.270	-0.789
10	-0.125	-0.389	-0.144	-0.434
12	0.001	-0.061	-0.021	-0.084
14	0.127	0.279	0.102	0.268
16	0.269	0.653	0.246	0.660
18	0.344	0.855	0.319	0.866
20	0.312	0.769	0.289	0.785
22	0.267	0.649	0.248	0.668
24	0.212	0.496	0.190	0.509
26	0.157	0.355	0.139	0.363
28	0.097	0.192	0.080	0.193
30	0.054	0.080	0.038	0.077
32	0.030	0.019	0.014	0.013
34	0.018	-0.015	0.001	-0.025

Average Stress Results - Test 06

Travel Direction	**OH to KY**
Truck 01 =	**Lane L3**
Truck 02 =	**Lane L4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	UT_L4L6_IPERF	UT_L4L6_OPERF	UT_L4L6_RADIUS	UT_L4L6_RIVET
0	0.036	-63.129	0.023	0.028
2	0.269	-63.129	0.154	0.222
4	0.643	-63.129	0.356	0.468
6	0.536	-63.129	0.285	0.530
8	0.437	-63.129	0.255	0.374
10	0.229	-63.129	0.132	0.195
12	0.043	-63.129	0.024	0.037
14	-0.148	-63.129	-0.086	-0.125
16	-0.356	-63.129	-0.205	-0.298
18	-0.466	-63.129	-0.268	-0.390
20	-0.428	-63.129	-0.245	-0.353
22	-0.363	-63.129	-0.213	-0.301
24	-0.279	-63.129	-0.162	-0.232
26	-0.204	-63.129	-0.119	-0.169
28	-0.114	-63.129	-0.064	-0.096
30	-0.060	-63.129	-0.034	-0.050
32	-0.026	-63.129	-0.016	-0.023
34	-0.013	-63.129	-0.010	-0.010

Average Stress Results - Test 06

Travel Direction	**OH to KY**
Truck 01 =	**Lane L3**
Truck 02 =	**Lane L4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	FB3_MID_TF	FB3_MID_BF	FB3_END_TF	FB3_END_BF
0	0.092	0.036	0.017	0.006
2	-2.408	2.408	0.181	-0.453
4	0.005	-0.013	-0.005	-0.210
6	0.029	0.006	0.010	-0.108
8	0.048	0.014	0.002	-0.055
10	0.045	0.022	0.004	-0.028
12	0.062	0.029	0.011	0.005
14	0.082	0.037	0.017	0.035
16	0.099	0.039	0.027	0.069
18	0.114	0.049	0.032	0.087
20	0.116	0.049	0.032	0.080
22	0.111	0.048	0.030	0.069
24	0.102	0.045	0.032	0.055
26	0.100	0.054	0.029	0.047
28	0.087	0.046	0.027	0.028
30	0.068	0.028	0.018	0.014
32	0.074	0.040	0.018	0.009
34	0.068	0.041	0.011	0.008

BRENT SPENCE BRIDGE

STRESS RESULTS FROM QUASI-STATIC LOAD TEST

UPPER DECK LEVEL

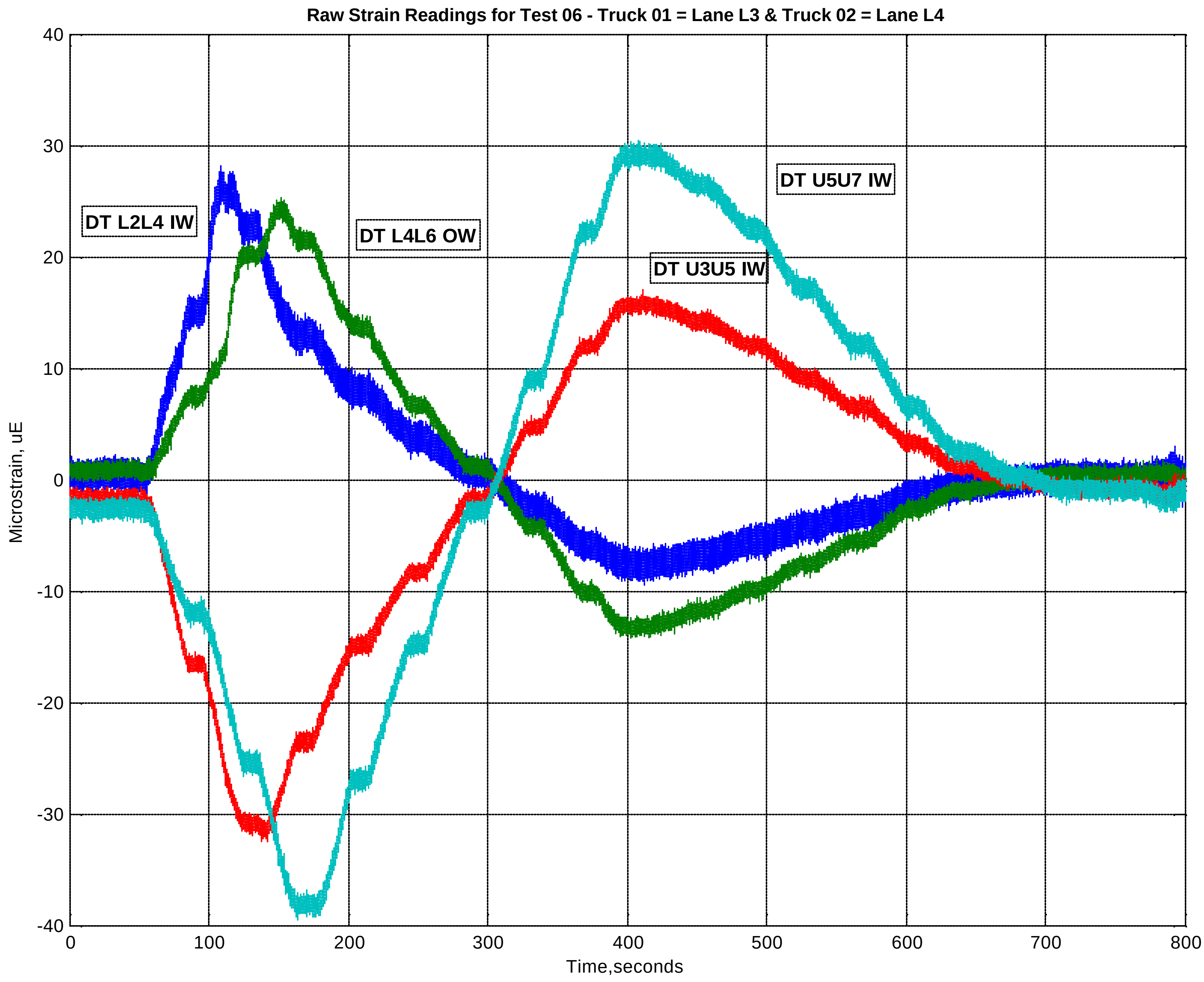
TRUCK 01 IN LANE U1
TRUCK 02 IN LANE U2

TRAVEL DIRECTION OF TRUCKS IS OHIO TO KENTUCKY

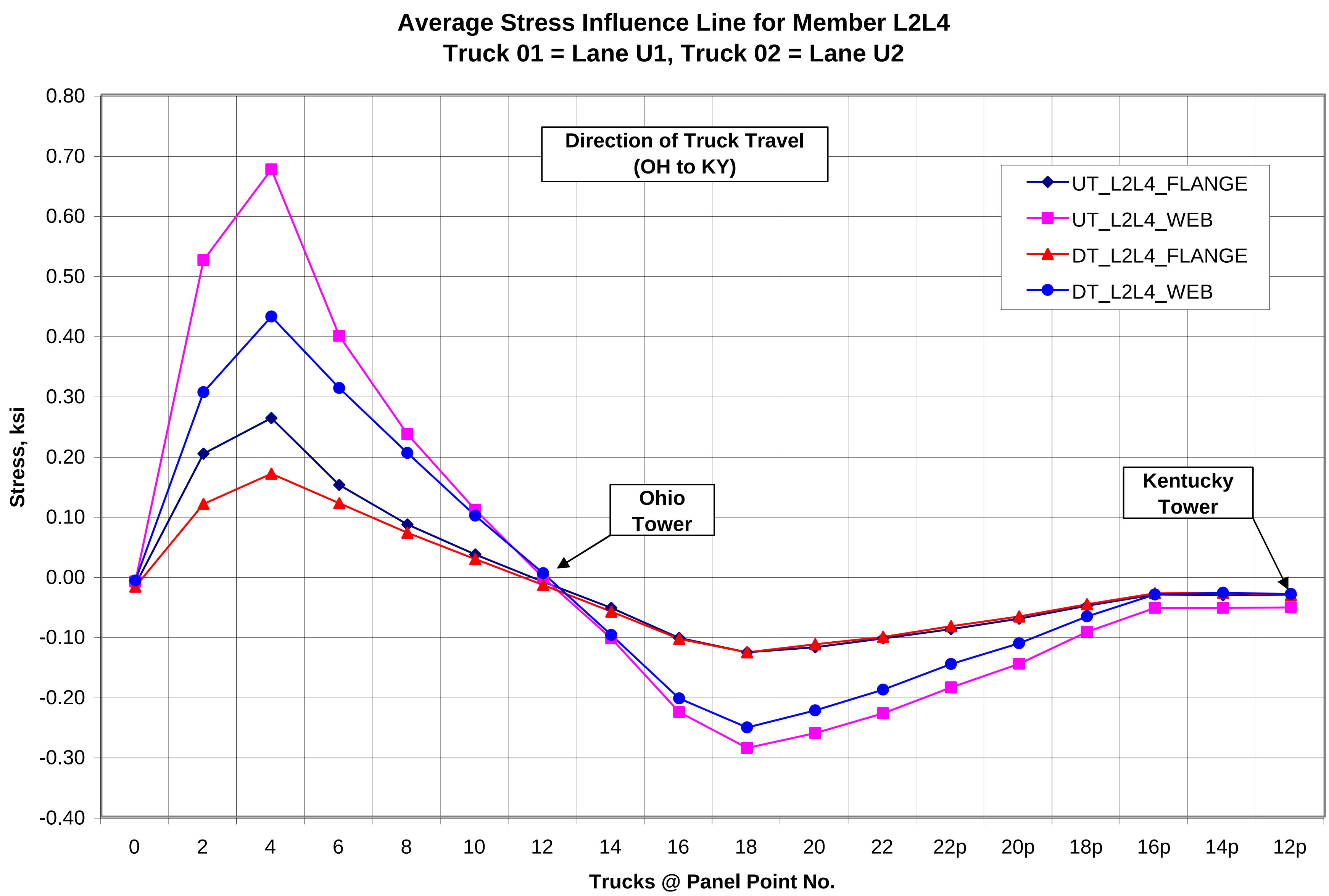
DATA SET TAKEN FROM TEST 02
TWO TRUCKS SIDE BY SIDE
STOP @ EVEN PANEL POINTS FOR 5 SECONDS

Processed By: Kirk A. Grimmelsman

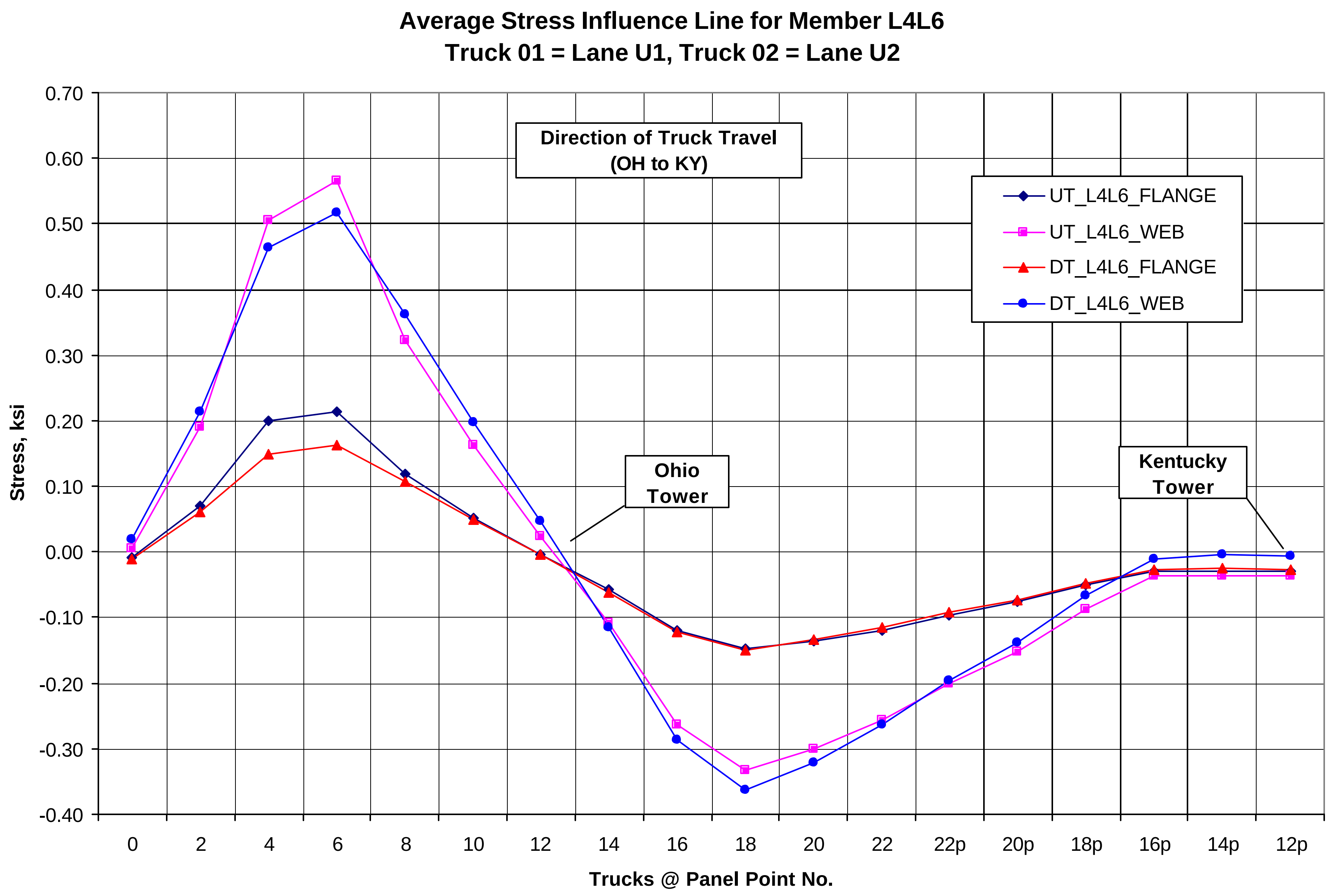
May 17, 2004



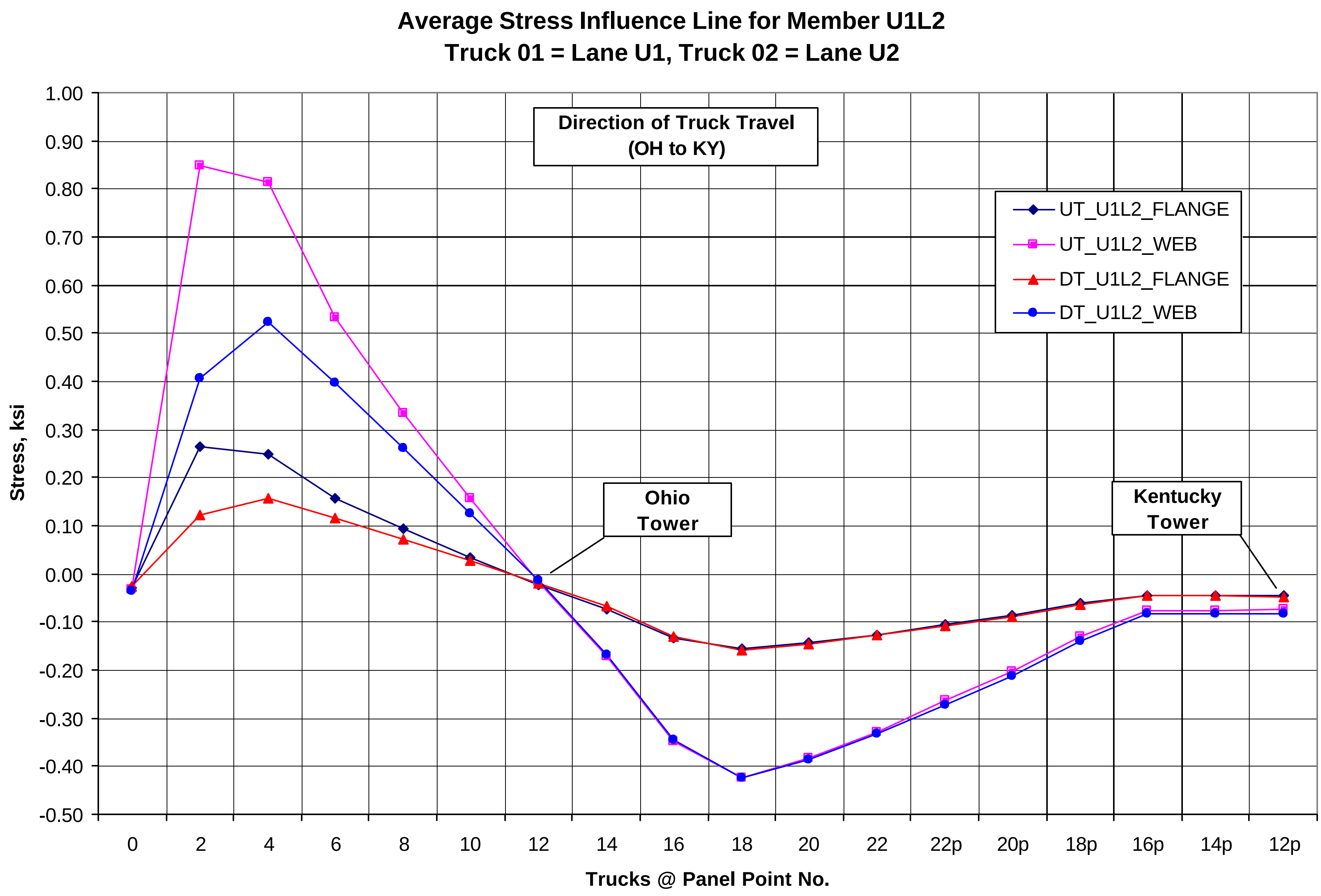
Raw Strain Readings for Test 06 - Truck 01 = Lane L3 & Truck 02 = Lane L4
DT L2L4 IW
DT L4L6 OW
DT U5U7 IW
DT U3U5 IW
Microstrain, uE
Time,seconds
40
30
20
10
0
-10
-20
-30
-40
0
100
200
300
400
500
600
700
800

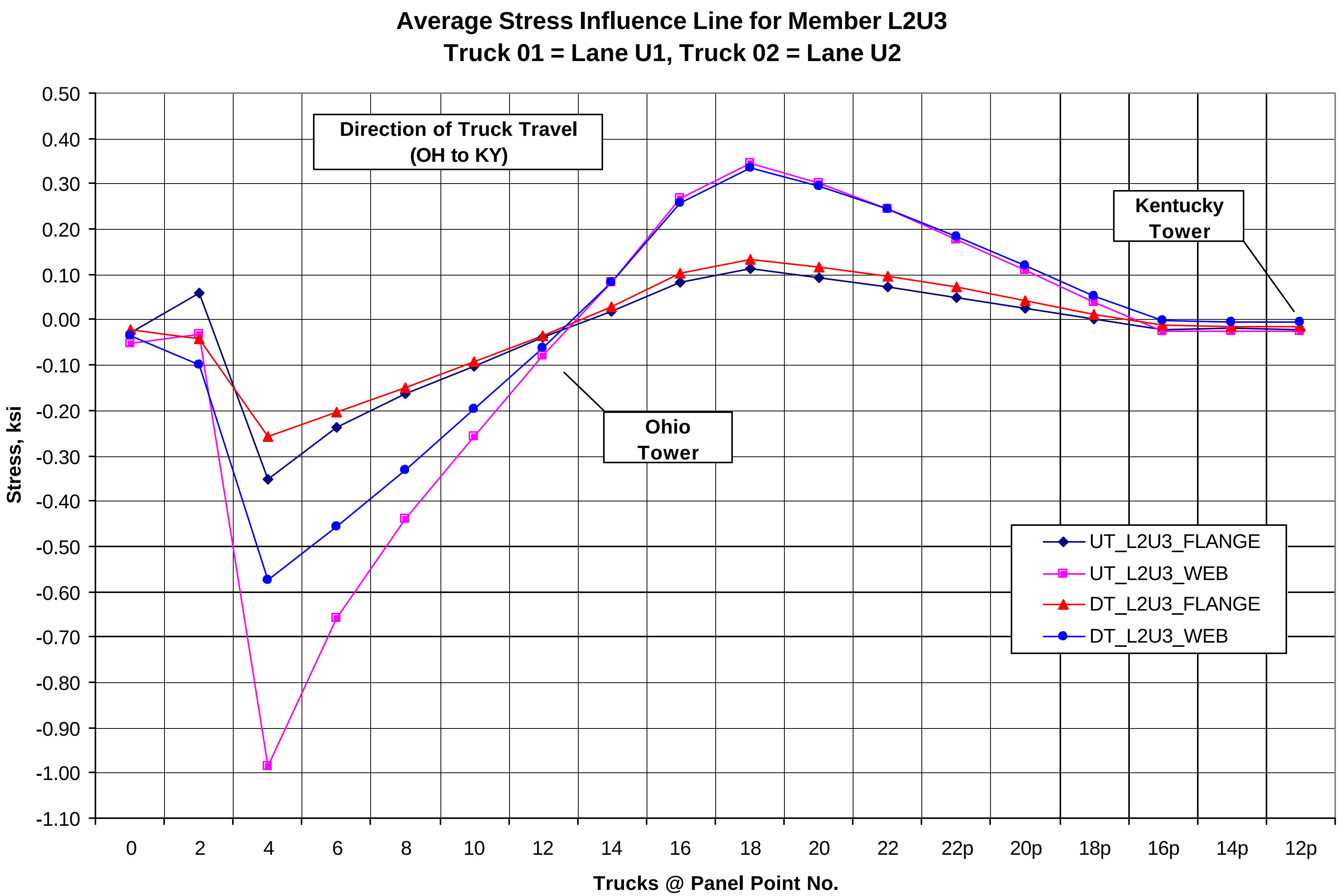


Average Stress Influence Line for Member L2L4
Truck 01 = Lane U1, Truck 02 = Lane U2
Direction of Truck Travel
(OH to KY)
UT_L2L4_FLANGE
UT_L2L4_WEB
DT_L2L4_FLANGE
DT_L2L4_WEB
Ohio
Tower
Kentucky
Tower
Stress, ksi
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.

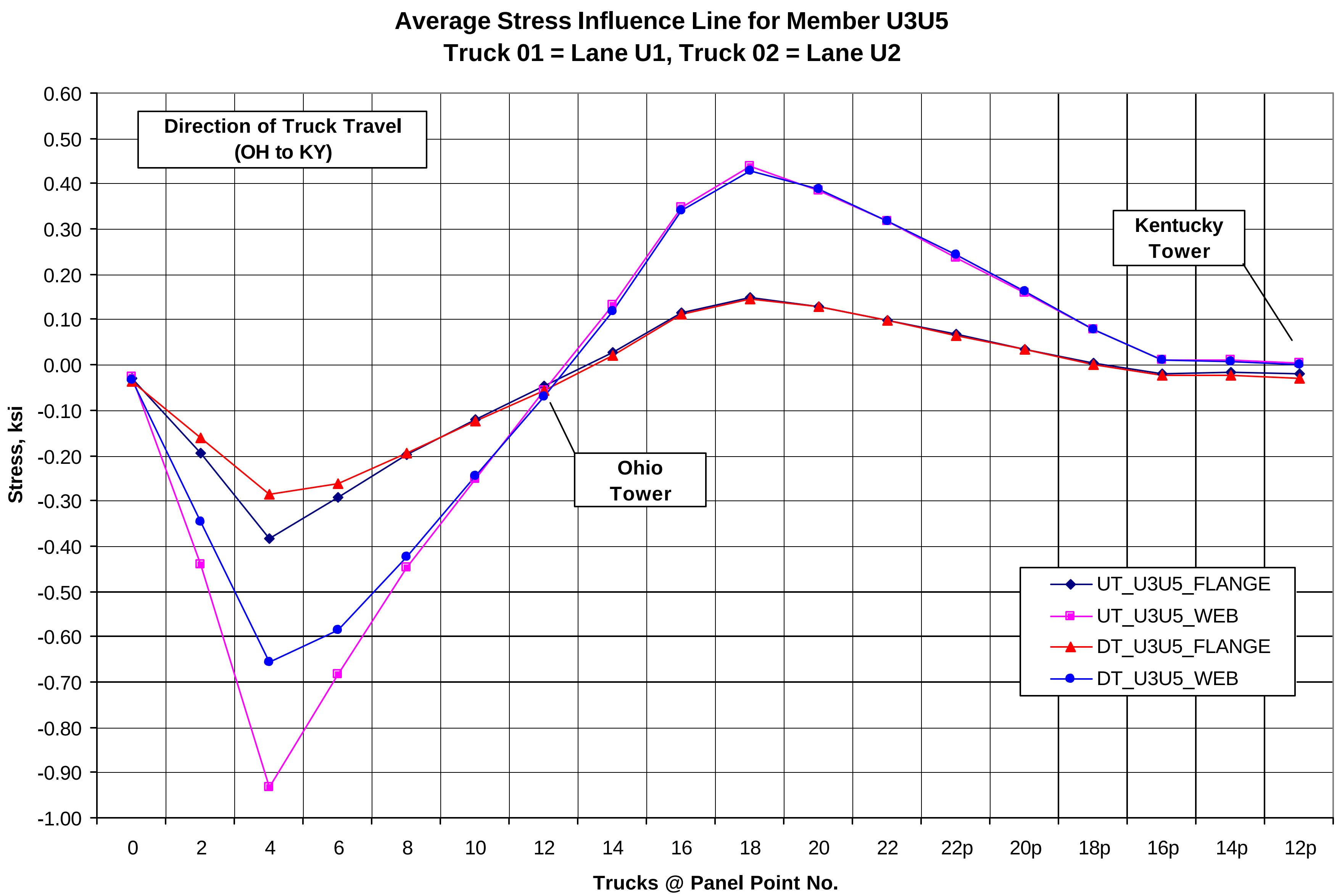


Average Stress Influence Line for Member L4L6
Truck 01 = Lane U1, Truck 02 = Lane U2
Direction of Truck Travel
(OH to KY)
UT_L4L6_FLANGE
UT_L4L6_WEB
DT_L4L6_FLANGE
DT_L4L6_WEB
Ohio
Tower
Kentucky
Tower
Stress, ksi
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.

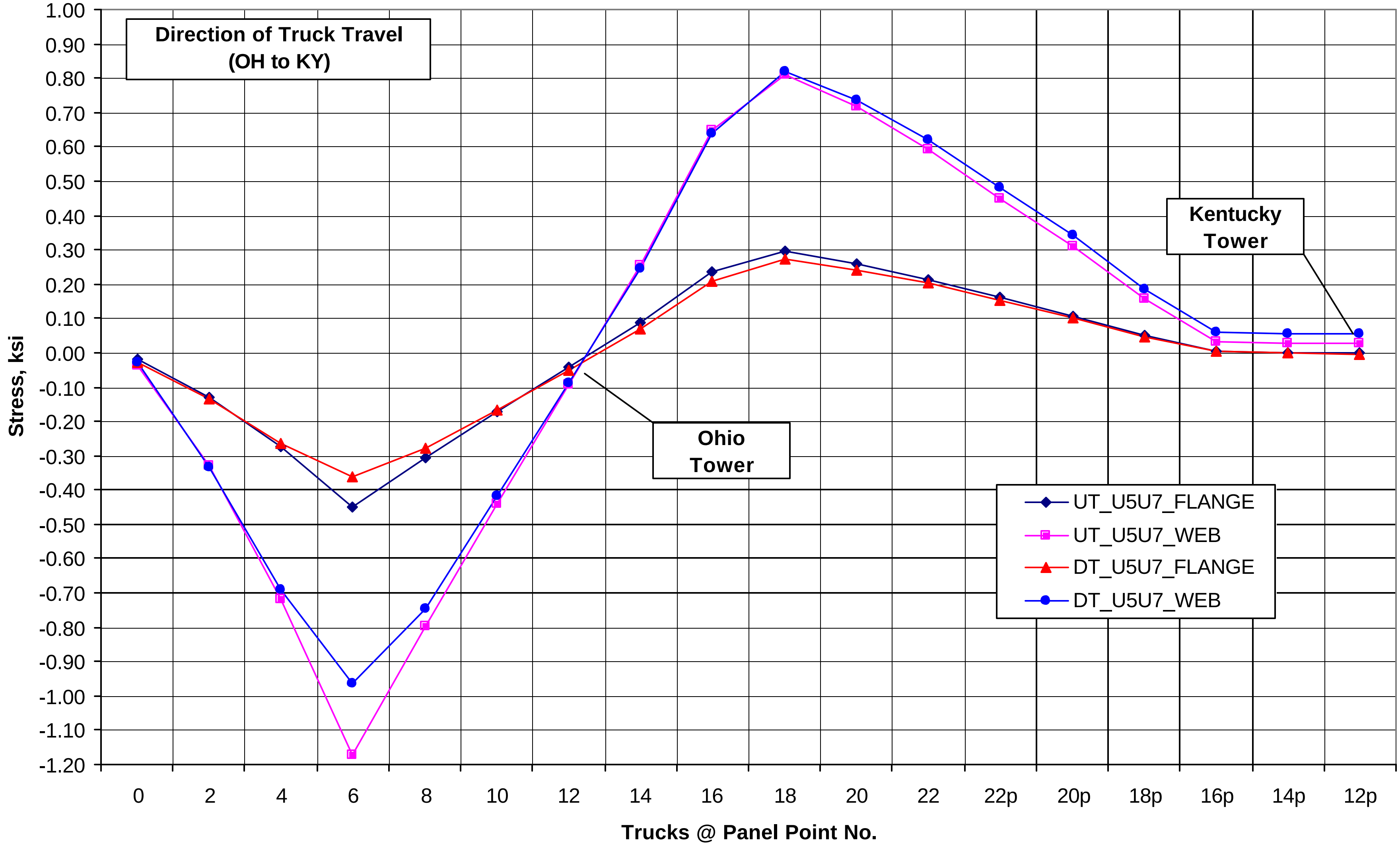

Average Stress Influence Line for Member U1L2
Truck 01 = Lane U1, Truck 02 = Lane U2
Direction of Truck Travel
(OH to KY)
UT_U1L2_FLANGE
UT_U1L2_WEB
DT_U1L2_FLANGE
DT_U1L2_WEB
Ohio
Tower
Kentucky
Tower
Stress, ksi
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.

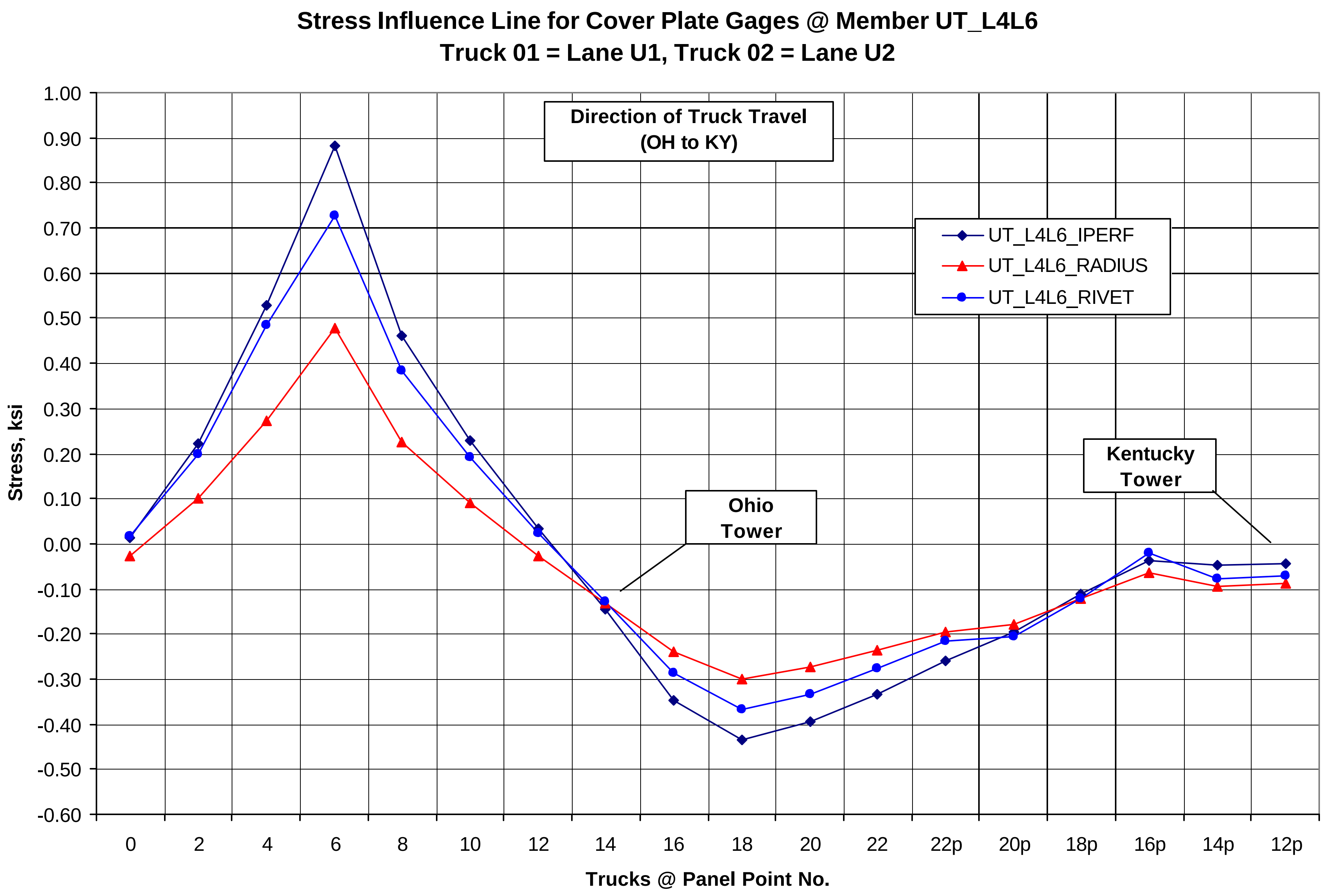


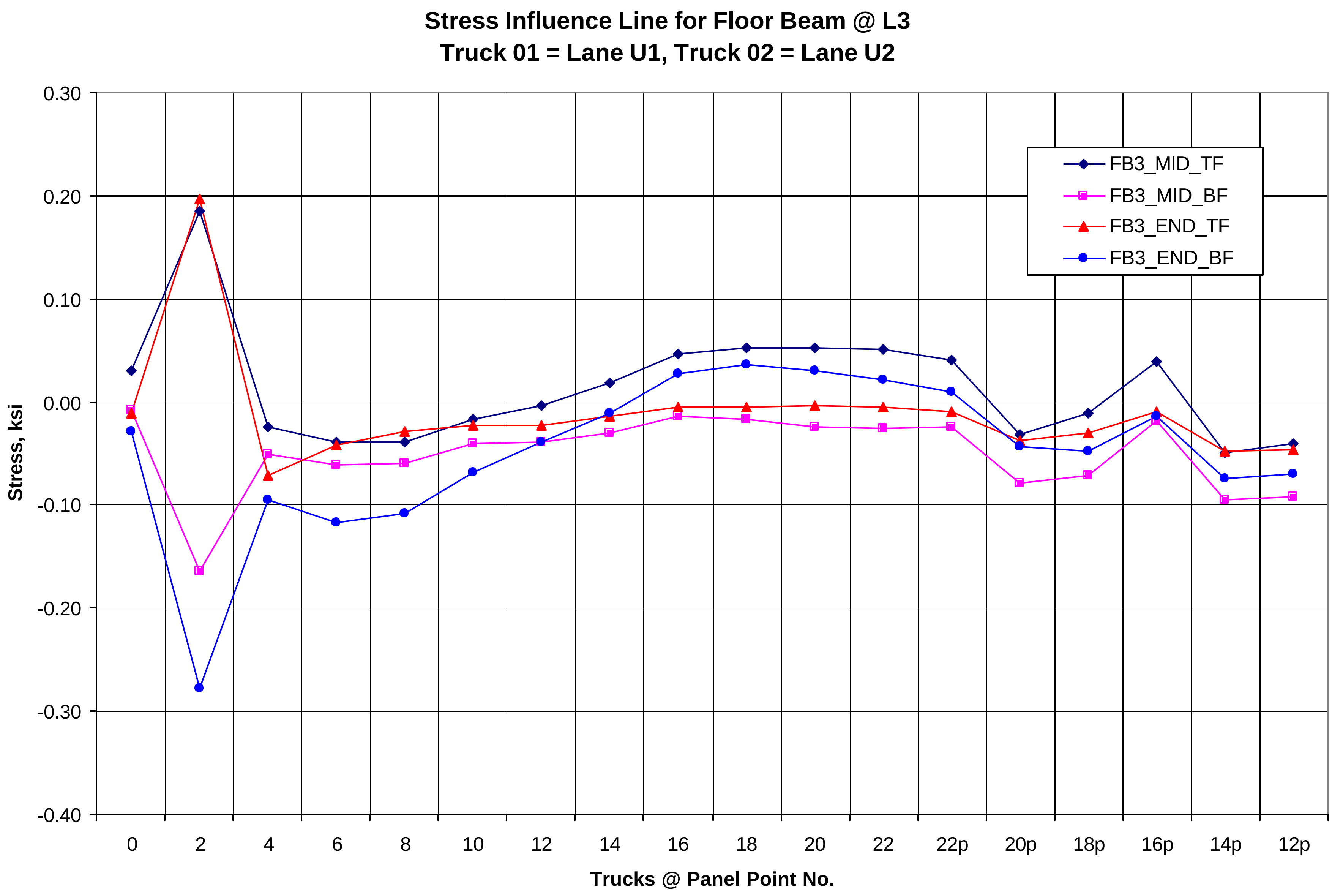
Average Stress Influence Line for Member L2U3
Truck 01 = Lane U1, Truck 02 = Lane U2
Direction of Truck Travel
(OH to KY)
Kentucky
Tower
Ohio
Tower
UT_L2U3_FLANGE
UT_L2U3_WEB
DT_L2U3_FLANGE
DT_L2U3_WEB
Stress, ksi
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
-1.10
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.


Average Stress Influence Line for Member U3U5
Truck 01 = Lane U1, Truck 02 = Lane U2
Direction of Truck Travel
(OH to KY)
Kentucky
Tower
Ohio
Tower
UT_U3U5_FLANGE
UT_U3U5_WEB
DT_U3U5_FLANGE
DT_U3U5_WEB
Stress, ksi
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.

Average Stress Influence Line for Member U5U7
Truck 01 = Lane U1, Truck 02 = Lane U2




Stress Influence Line for Cover Plate Gages @ Member UT_L4L6
Truck 01 = Lane U1, Truck 02 = Lane U2
Direction of Truck Travel
(OH to KY)
UT_L4L6_IPERF
UT_L4L6_RADIUS
UT_L4L6_RIVET
Ohio Tower
Kentucky Tower
Stress, ksi
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.


Stress Influence Line for Floor Beam @ L3
Truck 01 = Lane U1, Truck 02 = Lane U2
FB3_MID_TF
FB3_MID_BF
FB3_END_TF
FB3_END_BF
Stress, ksi
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.

Average Stress Results - Test 02

Travel Direction	**OH to KY**
Truck 01 =	**Lane U1**
Truck 02 =	**Lane U2**
Young's Modulus	**0.029**

	Units	ksi	ksi	ksi	ksi
Point No.	**PP**	**UT_L2L4_FLANGE**	**UT_L2L4_WEB**	**DT_L2L4_FLANGE**	**DT_L2L4_WEB**
0	0	-0.015	-0.010	-0.018	-0.008
2	2	0.203	0.525	0.119	0.305
4	4	0.262	0.675	0.170	0.431
6	6	0.151	0.399	0.121	0.312
8	8	0.085	0.236	0.072	0.204
10	10	0.036	0.110	0.028	0.100
12	12	-0.010	-0.003	-0.015	0.004
14	14	-0.053	-0.104	-0.059	-0.098
16	16	-0.103	-0.226	-0.105	-0.204
18	18	-0.127	-0.286	-0.127	-0.252
20	20	-0.118	-0.261	-0.114	-0.224
22	22	-0.104	-0.229	-0.102	-0.189
24	22p	-0.089	-0.185	-0.084	-0.146
26	20p	-0.071	-0.146	-0.068	-0.112
28	18p	-0.050	-0.093	-0.047	-0.067
30	16p	-0.031	-0.053	-0.029	-0.031
32	14p	-0.032	-0.053	-0.028	-0.028
34	12p	-0.032	-0.052	-0.032	-0.030

Average Stress Results - Test 02

Travel Direction	**OH to KY**
Truck 01 =	**Lane U1**
Truck 02 =	**Lane U2**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_L4L6_FLANGE**	**UT_L4L6_WEB**	**DT_L4L6_FLANGE**	**DT_L4L6_WEB**
0	-0.008	0.005	-0.011	0.019
2	0.069	0.191	0.060	0.213
4	0.200	0.505	0.148	0.464
6	0.214	0.566	0.163	0.516
8	0.118	0.323	0.108	0.361
10	0.052	0.163	0.049	0.198
12	-0.004	0.023	-0.004	0.046
14	-0.058	-0.109	-0.063	-0.115
16	-0.119	-0.264	-0.121	-0.287
18	-0.148	-0.334	-0.150	-0.364
20	-0.136	-0.300	-0.133	-0.322
22	-0.119	-0.257	-0.114	-0.263
22p	-0.096	-0.202	-0.091	-0.195
20p	-0.076	-0.152	-0.074	-0.137
18p	-0.050	-0.087	-0.047	-0.067
16p	-0.030	-0.037	-0.026	-0.010
14p	-0.029	-0.036	-0.026	-0.005
12p	-0.030	-0.036	-0.027	-0.007

Average Stress Results - Test 02

Travel Direction	**OH to KY**
Truck 01 =	**Lane U1**
Truck 02 =	**Lane U2**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_U1L2_FLANGE**	**UT_U1L2_WEB**	**DT_U1L2_FLANGE**	**DT_U1L2_WEB**
0	-0.029	-0.034	-0.026	-0.036
2	0.263	0.848	0.121	0.406
4	0.248	0.813	0.158	0.522
6	0.158	0.534	0.115	0.397
8	0.092	0.333	0.072	0.263
10	0.033	0.156	0.027	0.126
12	-0.023	-0.015	-0.019	-0.015
14	-0.075	-0.173	-0.069	-0.170
16	-0.133	-0.348	-0.131	-0.344
18	-0.156	-0.425	-0.158	-0.425
20	-0.144	-0.384	-0.146	-0.386
22	-0.126	-0.328	-0.127	-0.334
22p	-0.106	-0.265	-0.109	-0.272
20p	-0.086	-0.204	-0.091	-0.212
18p	-0.062	-0.131	-0.065	-0.140
16p	-0.044	-0.076	-0.045	-0.082
14p	-0.044	-0.076	-0.046	-0.082
12p	-0.045	-0.075	-0.047	-0.082

Average Stress Results - Test 02

Travel Direction	**OH to KY**
Truck 01 =	**Lane U1**
Truck 02 =	**Lane U2**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_L2U3_FLANGE**	**UT_L2U3_WEB**	**DT_L2U3_FLANGE**	**DT_L2U3_WEB**
0	-0.027	-0.051	-0.023	-0.035
2	0.057	-0.031	-0.042	-0.099
4	-0.352	-0.986	-0.257	-0.573
6	-0.236	-0.657	-0.205	-0.458
8	-0.164	-0.439	-0.151	-0.332
10	-0.103	-0.258	-0.094	-0.199
12	-0.040	-0.081	-0.036	-0.063
14	0.018	0.083	0.028	0.083
16	0.082	0.269	0.102	0.256
18	0.111	0.345	0.134	0.334
20	0.093	0.301	0.117	0.296
22	0.071	0.243	0.095	0.243
22p	0.048	0.175	0.071	0.184
20p	0.023	0.109	0.043	0.120
18p	0.000	0.039	0.013	0.053
16p	-0.020	-0.025	-0.012	-0.003
14p	-0.020	-0.025	-0.014	-0.006
12p	-0.022	-0.027	-0.015	-0.006

Average Stress Results - Test 02

Travel Direction	**OH to KY**
Truck 01 =	**Lane U1**
Truck 02 =	**Lane U2**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_U3U5_FLANGE**	**UT_U3U5_WEB**	**DT_U3U5_FLANGE**	**DT_U3U5_WEB**
0	-0.030	-0.027	-0.037	-0.034
2	-0.196	-0.442	-0.161	-0.346
4	-0.383	-0.931	-0.285	-0.655
6	-0.293	-0.682	-0.261	-0.587
8	-0.198	-0.446	-0.195	-0.423
10	-0.121	-0.252	-0.123	-0.245
12	-0.046	-0.057	-0.056	-0.070
14	0.028	0.133	0.021	0.118
16	0.116	0.347	0.111	0.339
18	0.149	0.438	0.145	0.429
20	0.129	0.384	0.129	0.387
22	0.097	0.316	0.098	0.318
22p	0.069	0.236	0.066	0.242
20p	0.036	0.160	0.034	0.161
18p	0.005	0.078	-0.001	0.076
16p	-0.019	0.009	-0.025	0.012
14p	-0.017	0.009	-0.024	0.007
12p	-0.021	0.004	-0.030	0.000

Average Stress Results - Test 02

Travel Direction	**OH to KY**
Truck 01 =	**Lane U1**
Truck 02 =	**Lane U2**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_U5U7_FLANGE**	**UT_U5U7_WEB**	**DT_U5U7_FLANGE**	**DT_U5U7_WEB**
0	-0.019	-0.035	-0.027	-0.028
2	-0.129	-0.331	-0.136	-0.335
4	-0.275	-0.717	-0.263	-0.691
6	-0.449	-1.171	-0.360	-0.963
8	-0.308	-0.798	-0.280	-0.745
10	-0.173	-0.441	-0.166	-0.418
12	-0.041	-0.093	-0.051	-0.090
14	0.087	0.256	0.068	0.246
16	0.236	0.646	0.209	0.638
18	0.298	0.810	0.271	0.817
20	0.261	0.716	0.242	0.736
22	0.214	0.591	0.202	0.618
22p	0.161	0.448	0.151	0.481
20p	0.108	0.310	0.099	0.340
18p	0.052	0.158	0.045	0.187
16p	0.003	0.031	0.002	0.059
14p	0.002	0.029	-0.001	0.057
12p	0.000	0.029	-0.003	0.055

Average Stress Results - Test 02

Travel Direction	**OH to KY**
Truck 01 =	**Lane U1**
Truck 02 =	**Lane U2**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	UT_L4L6_IPERF	UT_L4L6_OPERF	UT_L4L6_RADIUS	UT_L4L6_RIVET
0	0.012	-63.129	-0.028	0.015
2	0.221	-63.129	0.101	0.197
4	0.530	-63.129	0.272	0.486
6	0.882	-63.129	0.478	0.728
8	0.461	-63.129	0.225	0.384
10	0.229	-63.129	0.090	0.191
12	0.032	-63.129	-0.026	0.025
14	-0.146	-63.129	-0.131	-0.127
16	-0.349	-63.129	-0.241	-0.286
18	-0.435	-63.129	-0.299	-0.367
20	-0.395	-63.129	-0.273	-0.333
22	-0.334	-63.129	-0.235	-0.278
22p	-0.259	-63.129	-0.194	-0.216
20p	-0.196	-63.129	-0.177	-0.204
18p	-0.112	-63.129	-0.121	-0.121
16p	-0.037	-63.129	-0.065	-0.020
14p	-0.047	-63.129	-0.094	-0.077
12p	-0.043	-63.129	-0.090	-0.072

Average Stress Results - Test 02

Travel Direction	**OH to KY**
Truck 01 =	**Lane U1**
Truck 02 =	**Lane U2**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	FB3_MID_TF	FB3_MID_BF	FB3_END_TF	FB3_END_BF
0	0.031	-0.009	-0.012	-0.029
2	0.185	-0.164	0.197	-0.277
4	-0.024	-0.050	-0.072	-0.095
6	-0.039	-0.060	-0.042	-0.117
8	-0.039	-0.060	-0.029	-0.108
10	-0.017	-0.041	-0.023	-0.069
12	-0.004	-0.039	-0.022	-0.040
14	0.018	-0.031	-0.014	-0.010
16	0.046	-0.014	-0.005	0.028
18	0.053	-0.017	-0.006	0.036
20	0.052	-0.025	-0.003	0.031
22	0.051	-0.025	-0.005	0.021
22p	0.041	-0.025	-0.009	0.009
20p	-0.031	-0.079	-0.037	-0.043
18p	-0.010	-0.072	-0.030	-0.048
16p	0.039	-0.019	-0.009	-0.014
14p	-0.049	-0.095	-0.048	-0.074
12p	-0.041	-0.092	-0.046	-0.070

BRENT SPENCE BRIDGE

STRESS RESULTS FROM QUASI-STATIC LOAD TEST

UPPER DECK LEVEL

TRUCK 01 IN LANE U3
TRUCK 02 IN LANE U4

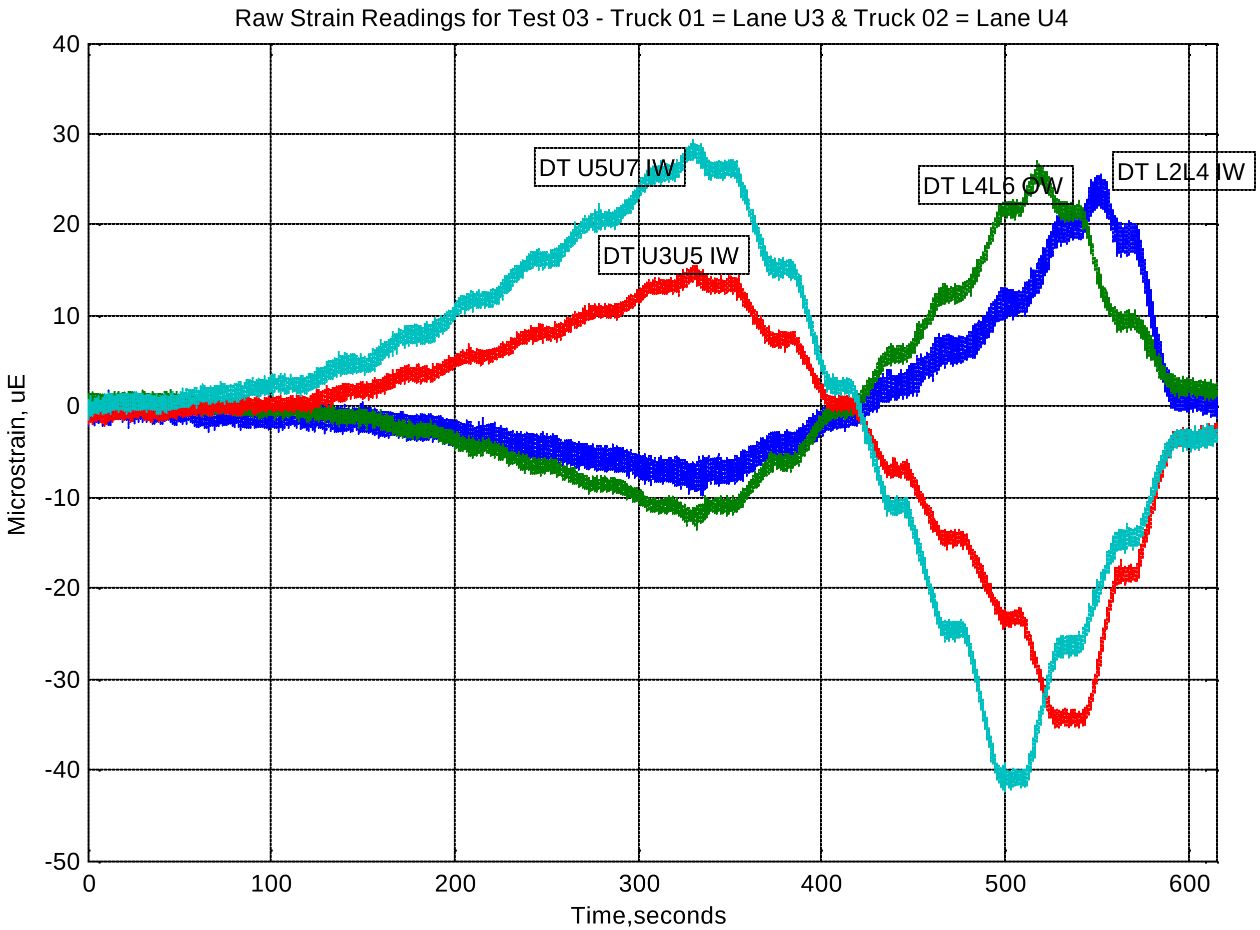
TRAVEL DIRECTION OF TRUCKS IS KENTUCKY TO OHIO

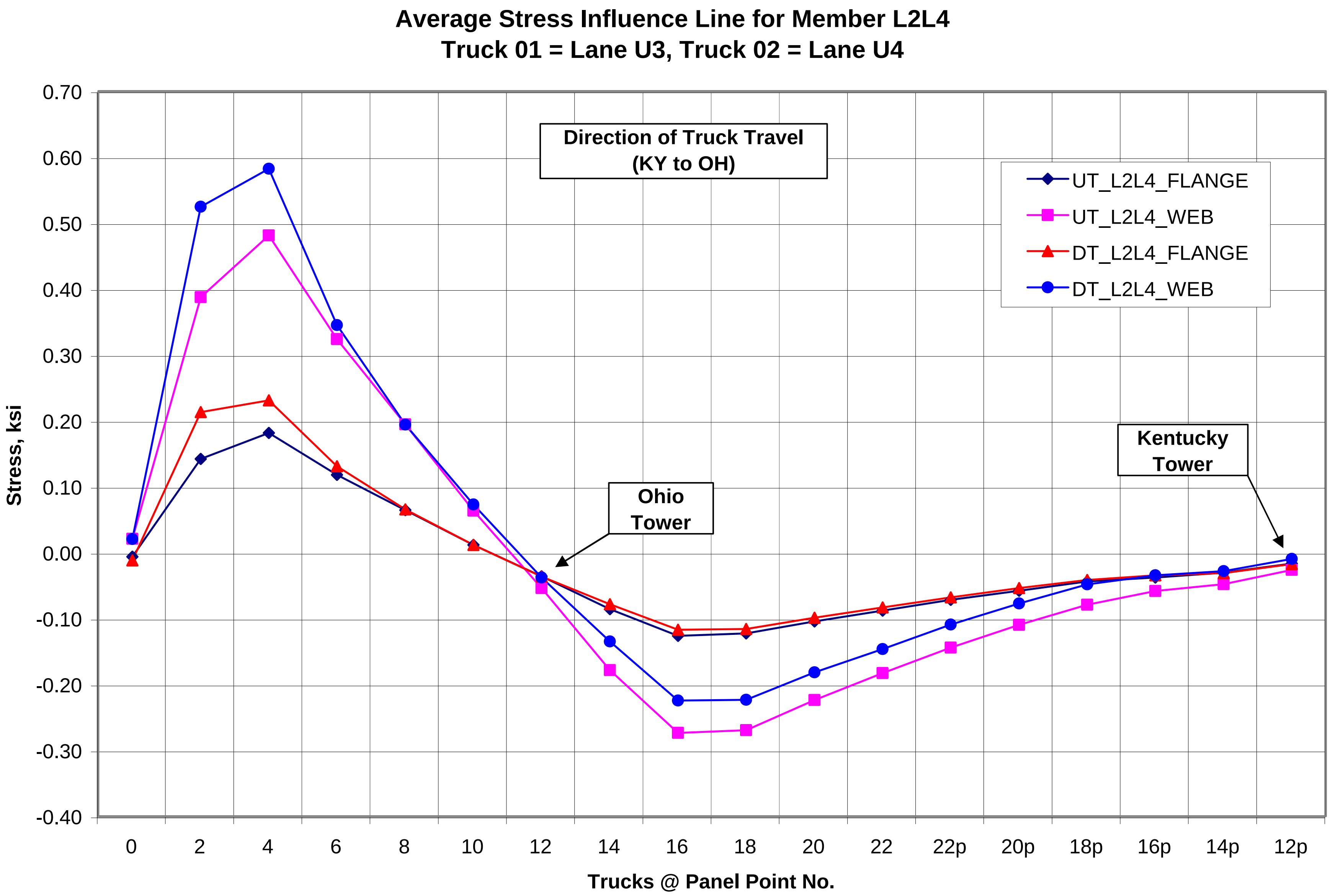
DATA SET TAKEN FROM TEST 03
TWO TRUCKS SIDE BY SIDE
STOP @ EVEN PANEL POINTS FOR 5 SECONDS

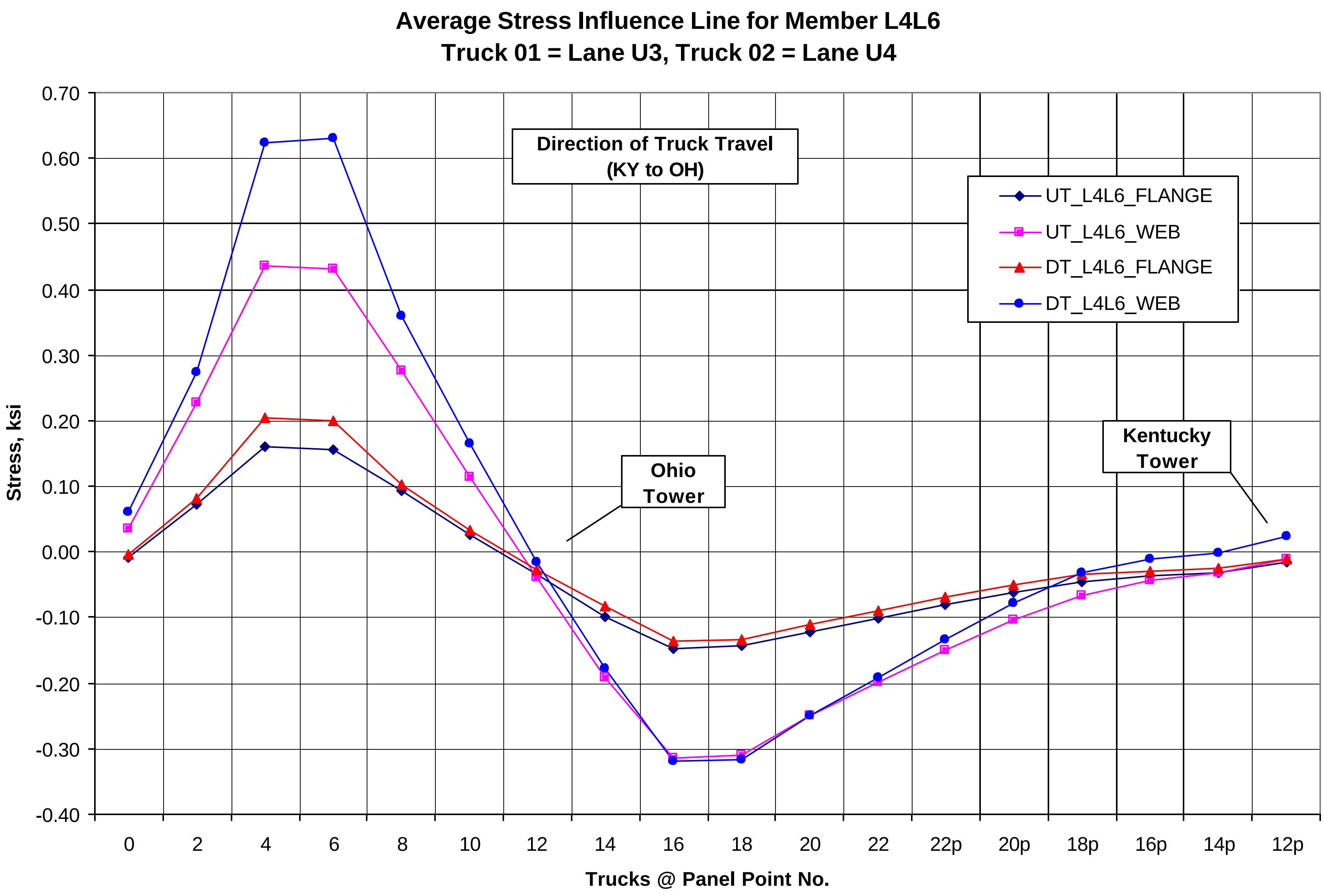
Processed By: Kirk A. Grimmelsman

Drexel UNIVERSITY

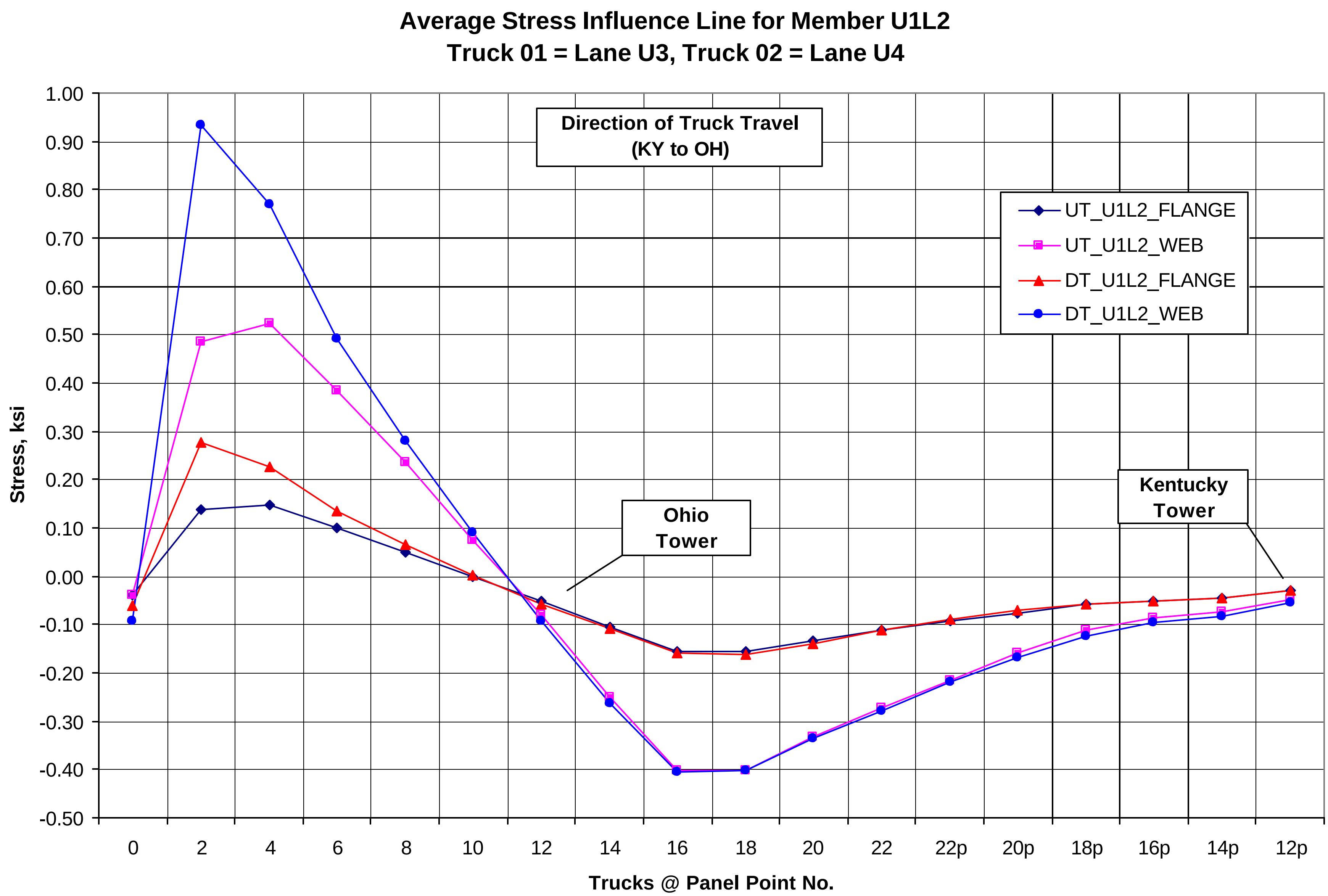
May 17, 2004

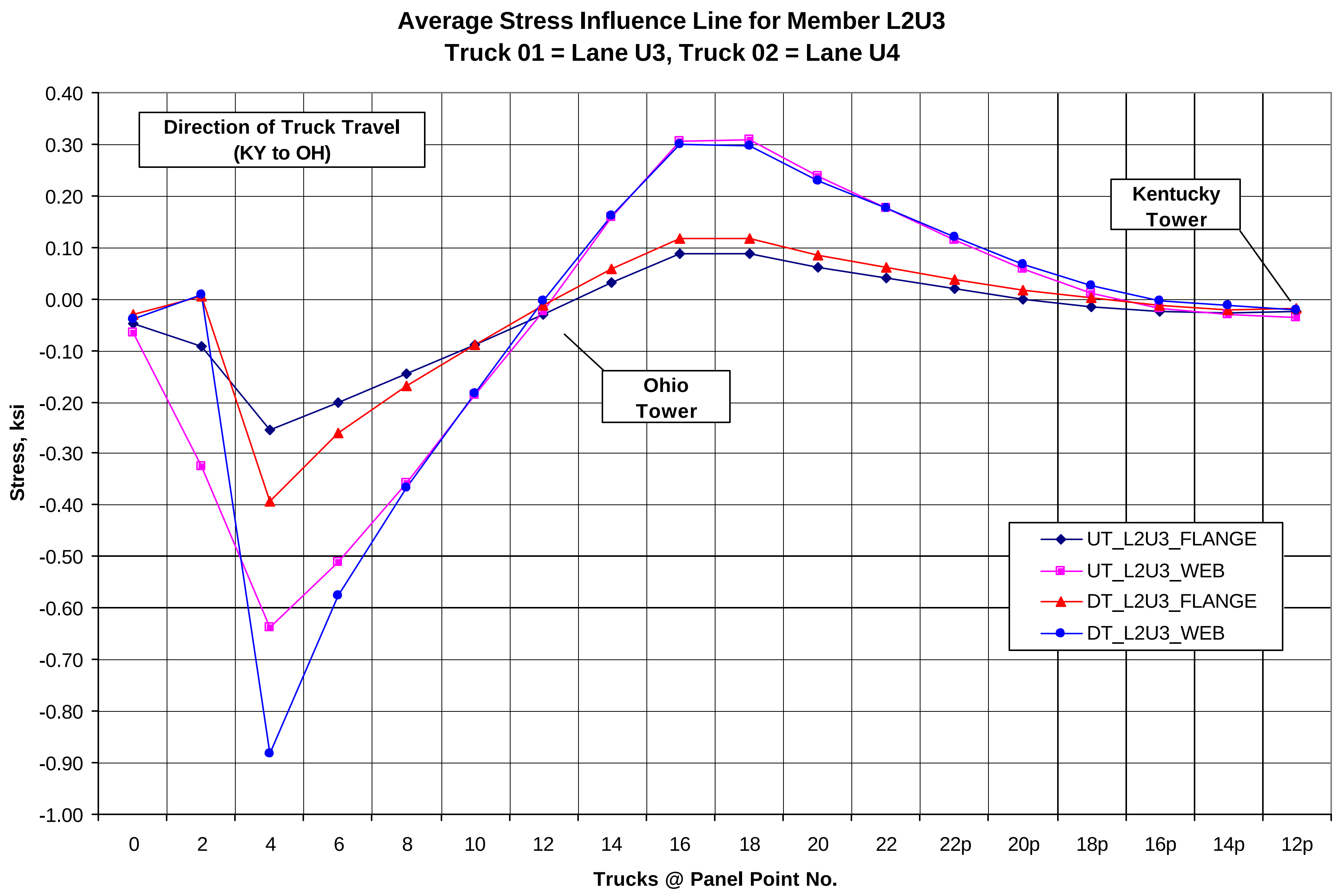

Raw Strain Readings for Test 03 - Truck 01 = Lane U3 & Truck 02 = Lane U4
Microstrain, uE
Time,seconds
DT U5U7 IW
DT U3U5 IW
DT L4L6 OW
DT L2L4 IW
40
30
20
10
0
-10
-20
-30
-40
-50
0
100
200
300
400
500
600

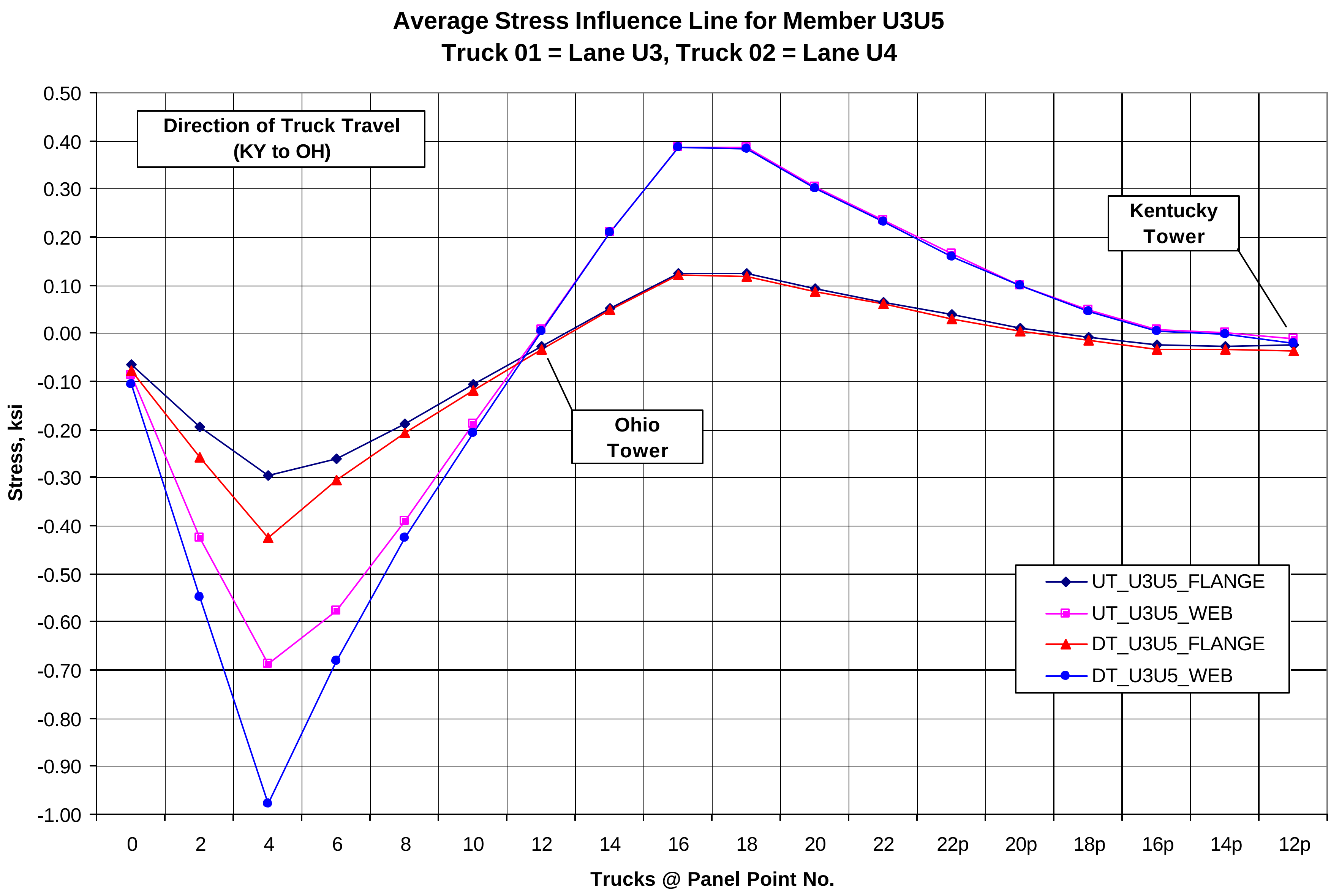

Average Stress Influence Line for Member L2L4
Truck 01 = Lane U3, Truck 02 = Lane U4
Direction of Truck Travel
(KY to OH)
UT_L2L4_FLANGE
UT_L2L4_WEB
DT_L2L4_FLANGE
DT_L2L4_WEB
Ohio
Tower
Kentucky
Tower
Stress, ksi
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.

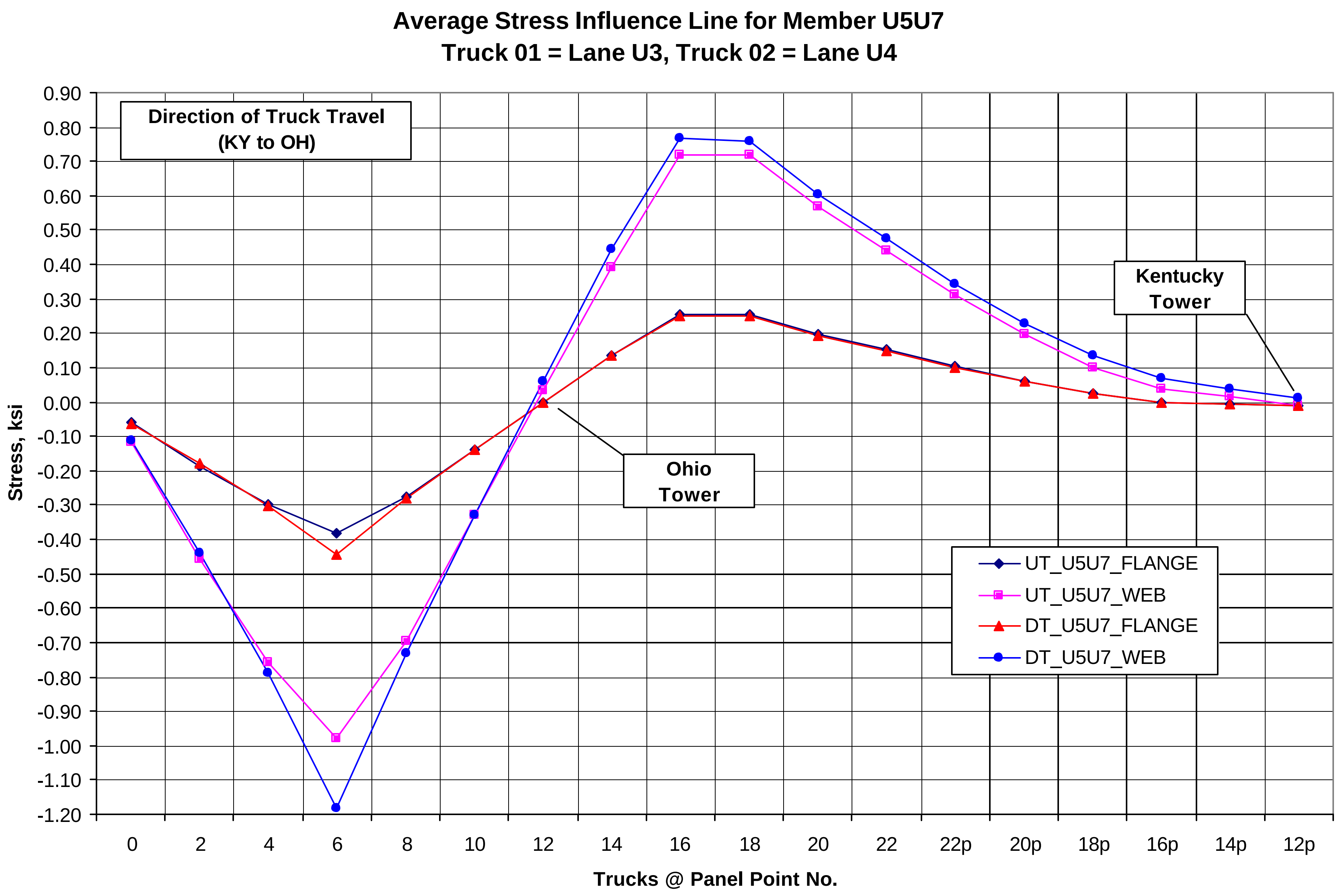


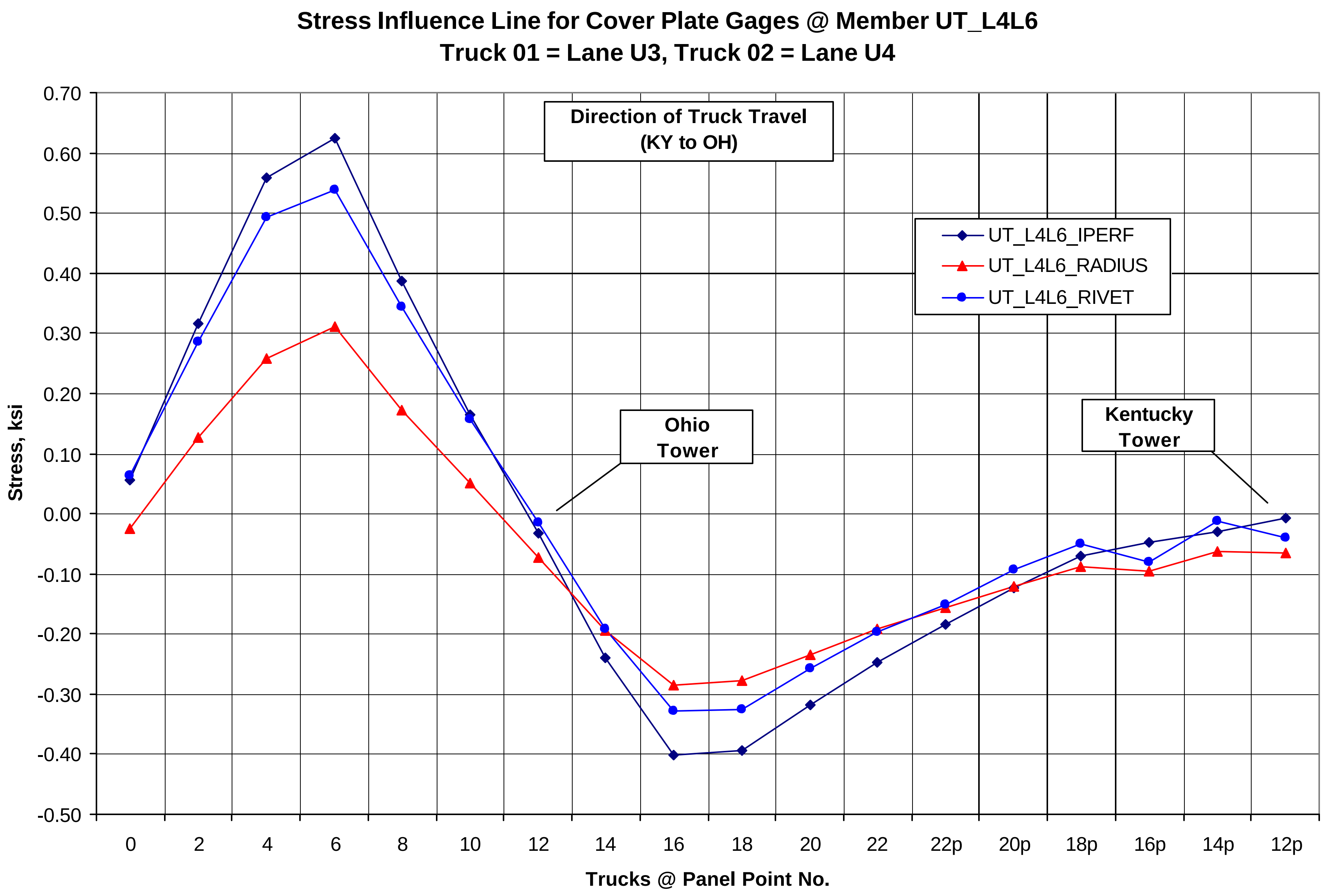
Average Stress Influence Line for Member L4L6
Truck 01 = Lane U3, Truck 02 = Lane U4
Direction of Truck Travel
(KY to OH)
UT_L4L6_FLANGE
UT_L4L6_WEB
DT_L4L6_FLANGE
DT_L4L6_WEB
Ohio Tower
Kentucky Tower
Stress, ksi
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.

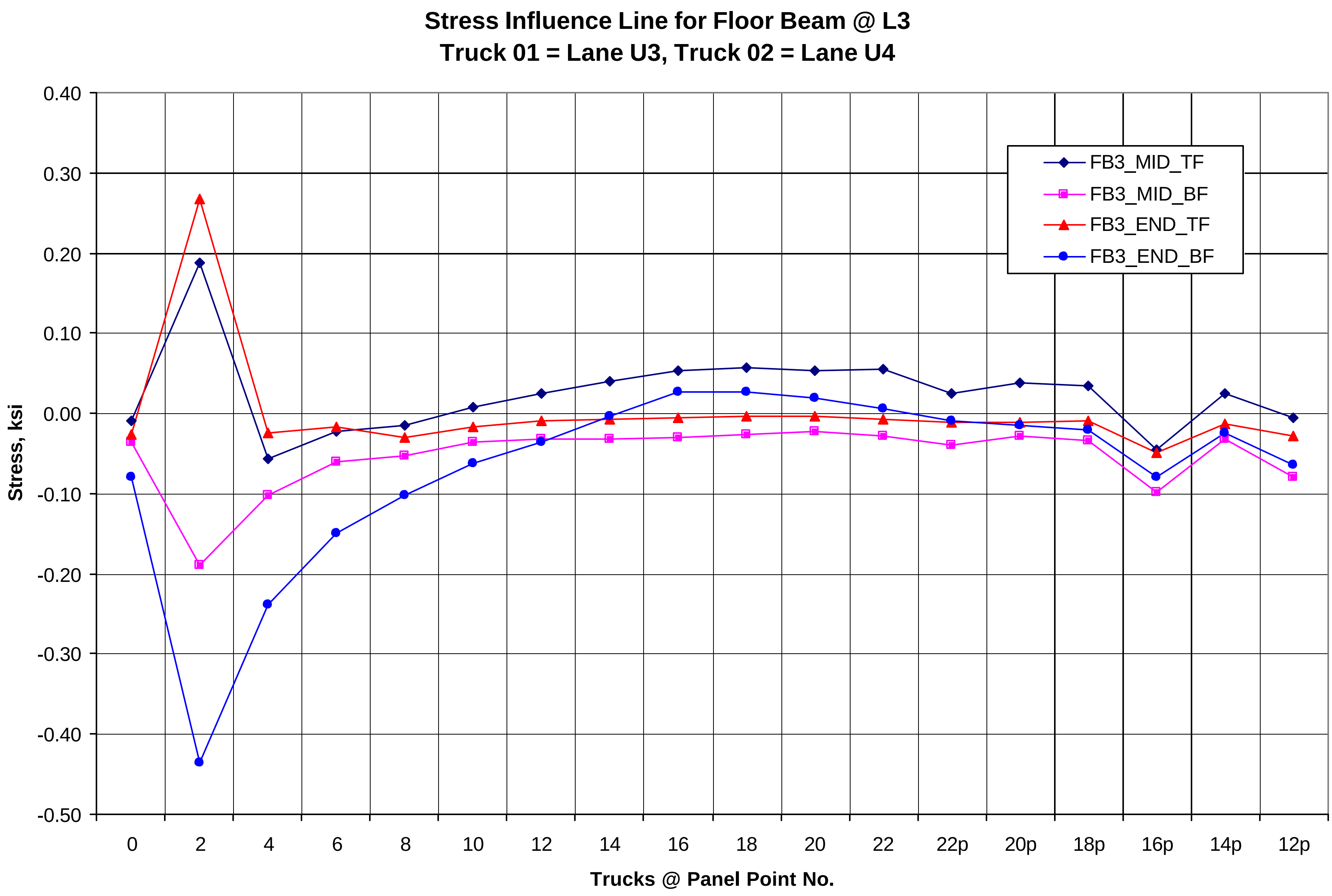

Average Stress Influence Line for Member U1L2
Truck 01 = Lane U3, Truck 02 = Lane U4
Direction of Truck Travel
(KY to OH)
UT_U1L2_FLANGE
UT_U1L2_WEB
DT_U1L2_FLANGE
DT_U1L2_WEB
Ohio Tower
Kentucky Tower
Stress, ksi
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.


Average Stress Influence Line for Member L2U3
Truck 01 = Lane U3, Truck 02 = Lane U4
Direction of Truck Travel
(KY to OH)
Kentucky Tower
Ohio Tower
Stress, ksi
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.
UT_L2U3_FLANGE
UT_L2U3_WEB
DT_L2U3_FLANGE
DT_L2U3_WEB


Average Stress Influence Line for Member U3U5
Truck 01 = Lane U3, Truck 02 = Lane U4
Direction of Truck Travel
(KY to OH)
Kentucky
Tower
Ohio
Tower
UT_U3U5_FLANGE
UT_U3U5_WEB
DT_U3U5_FLANGE
DT_U3U5_WEB
Stress, ksi
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.


Average Stress Influence Line for Member U5U7
Truck 01 = Lane U3, Truck 02 = Lane U4
Direction of Truck Travel
(KY to OH)
Kentucky Tower
Ohio Tower
UT_U5U7_FLANGE
UT_U5U7_WEB
DT_U5U7_FLANGE
DT_U5U7_WEB
Stress, ksi
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
-1.10
-1.20
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.


Stress Influence Line for Cover Plate Gages @ Member UT_L4L6
Truck 01 = Lane U3, Truck 02 = Lane U4
Direction of Truck Travel
(KY to OH)
UT_L4L6_IPERF
UT_L4L6_RADIUS
UT_L4L6_RIVET
Ohio
Tower
Kentucky
Tower
Stress, ksi
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.



Stress Influence Line for Floor Beam @ L3
Truck 01 = Lane U3, Truck 02 = Lane U4
FB3_MID_TF
FB3_MID_BF
FB3_END_TF
FB3_END_BF
Stress, ksi
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
0
2
4
6
8
10
12
14
16
18
20
22
22p
20p
18p
16p
14p
12p
Trucks @ Panel Point No.

Average Stress Results - Test 03

Travel Direction	**KY to OH**
Truck 01 =	**Lane U3**
Truck 02 =	**Lane U4**
Young's Modulus	**0.029**

	Units	ksi	ksi	ksi	ksi
Point No.	**PP**	**UT_L2L4_FLANGE**	**UT_L2L4_WEB**	**DT_L2L4_FLANGE**	**DT_L2L4_WEB**
0	0	-0.006	0.021	-0.012	0.020
2	2	0.142	0.387	0.213	0.525
4	4	0.181	0.481	0.231	0.582
6	6	0.118	0.324	0.131	0.345
8	8	0.064	0.194	0.065	0.194
10	10	0.012	0.064	0.012	0.073
12	12	-0.036	-0.054	-0.037	-0.038
14	14	-0.086	-0.178	-0.079	-0.135
16	16	-0.126	-0.274	-0.117	-0.225
18	18	-0.123	-0.269	-0.116	-0.224
20	20	-0.104	-0.224	-0.099	-0.182
22	22	-0.088	-0.183	-0.083	-0.146
24	22p	-0.072	-0.144	-0.068	-0.109
26	20p	-0.058	-0.110	-0.054	-0.077
28	18p	-0.044	-0.079	-0.042	-0.048
30	16p	-0.038	-0.058	-0.035	-0.035
32	14p	-0.030	-0.048	-0.031	-0.028
34	12p	-0.017	-0.026	-0.017	-0.010

Average Stress Results - Test 03

Travel Direction	**KY to OH**
Truck 01 =	**Lane U3**
Truck 02 =	**Lane U4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_L4L6_FLANGE**	**UT_L4L6_WEB**	**DT_L4L6_FLANGE**	**DT_L4L6_WEB**
0	-0.008	0.035	-0.004	0.061
2	0.073	0.227	0.083	0.273
4	0.161	0.437	0.205	0.623
6	0.155	0.431	0.201	0.630
8	0.093	0.277	0.102	0.360
10	0.025	0.113	0.034	0.165
12	-0.034	-0.039	-0.028	-0.014
14	-0.098	-0.192	-0.084	-0.177
16	-0.148	-0.313	-0.135	-0.319
18	-0.144	-0.309	-0.133	-0.317
20	-0.123	-0.250	-0.109	-0.249
22	-0.101	-0.199	-0.090	-0.192
22p	-0.080	-0.149	-0.069	-0.133
20p	-0.062	-0.104	-0.051	-0.077
18p	-0.046	-0.067	-0.034	-0.033
16p	-0.036	-0.043	-0.029	-0.011
14p	-0.031	-0.033	-0.026	-0.001
12p	-0.015	-0.010	-0.011	0.023

Average Stress Results - Test 03

Travel Direction	**KY to OH**
Truck 01 =	**Lane U3**
Truck 02 =	**Lane U4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_U1L2_FLANGE**	**UT_U1L2_WEB**	**DT_U1L2_FLANGE**	**DT_U1L2_WEB**
0	-0.039	-0.039	-0.061	-0.092
2	0.137	0.485	0.278	0.932
4	0.147	0.524	0.225	0.769
6	0.101	0.385	0.136	0.492
8	0.051	0.235	0.065	0.279
10	-0.001	0.075	0.002	0.091
12	-0.051	-0.080	-0.057	-0.093
14	-0.106	-0.251	-0.109	-0.263
16	-0.155	-0.401	-0.159	-0.407
18	-0.155	-0.401	-0.161	-0.401
20	-0.133	-0.333	-0.140	-0.335
22	-0.113	-0.274	-0.111	-0.278
22p	-0.094	-0.214	-0.091	-0.220
20p	-0.077	-0.161	-0.072	-0.167
18p	-0.059	-0.113	-0.059	-0.123
16p	-0.052	-0.087	-0.052	-0.096
14p	-0.046	-0.074	-0.045	-0.084
12p	-0.030	-0.048	-0.031	-0.055

Average Stress Results - Test 03

Travel Direction	**KY to OH**
Truck 01 =	**Lane U3**
Truck 02 =	**Lane U4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_L2U3_FLANGE**	**UT_L2U3_WEB**	**DT_L2U3_FLANGE**	**DT_L2U3_WEB**
0	-0.048	-0.066	-0.031	-0.040
2	-0.092	-0.324	0.004	0.009
4	-0.254	-0.637	-0.392	-0.882
6	-0.200	-0.510	-0.260	-0.576
8	-0.147	-0.359	-0.168	-0.367
10	-0.088	-0.188	-0.089	-0.183
12	-0.030	-0.025	-0.014	-0.005
14	0.031	0.157	0.057	0.160
16	0.086	0.306	0.117	0.300
18	0.086	0.307	0.116	0.296
20	0.060	0.237	0.084	0.229
22	0.041	0.176	0.061	0.175
22p	0.021	0.113	0.038	0.119
20p	0.000	0.057	0.018	0.067
18p	-0.014	0.010	0.001	0.026
16p	-0.026	-0.019	-0.014	-0.004
14p	-0.028	-0.029	-0.020	-0.013
12p	-0.025	-0.037	-0.019	-0.021

Average Stress Results - Test 03

Travel Direction	**KY to OH**
Truck 01 =	**Lane U3**
Truck 02 =	**Lane U4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_U3U5_FLANGE**	**UT_U3U5_WEB**	**DT_U3U5_FLANGE**	**DT_U3U5_WEB**
0	-0.064	-0.088	-0.079	-0.105
2	-0.194	-0.425	-0.257	-0.550
4	-0.295	-0.686	-0.426	-0.979
6	-0.260	-0.576	-0.307	-0.680
8	-0.187	-0.391	-0.206	-0.426
10	-0.106	-0.188	-0.118	-0.209
12	-0.027	0.008	-0.032	0.004
14	0.052	0.209	0.050	0.211
16	0.123	0.387	0.122	0.388
18	0.124	0.386	0.119	0.383
20	0.091	0.304	0.085	0.301
22	0.065	0.235	0.060	0.231
22p	0.038	0.165	0.029	0.159
20p	0.011	0.098	0.004	0.098
18p	-0.010	0.049	-0.015	0.046
16p	-0.024	0.008	-0.033	0.006
14p	-0.027	0.001	-0.033	-0.003
12p	-0.024	-0.013	-0.036	-0.021

Average Stress Results - Test 03

Travel Direction	**KY to OH**
Truck 01 =	**Lane U3**
Truck 02 =	**Lane U4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	**UT_U5U7_FLANGE**	**UT_U5U7_WEB**	**DT_U5U7_FLANGE**	**DT_U5U7_WEB**
0	-0.058	-0.119	-0.063	-0.113
2	-0.187	-0.458	-0.177	-0.440
4	-0.299	-0.758	-0.302	-0.790
6	-0.384	-0.977	-0.443	-1.181
8	-0.276	-0.696	-0.281	-0.732
10	-0.139	-0.330	-0.137	-0.330
12	-0.004	0.033	-0.001	0.060
14	0.134	0.394	0.137	0.443
16	0.254	0.717	0.252	0.768
18	0.255	0.718	0.248	0.757
20	0.198	0.567	0.192	0.603
22	0.153	0.442	0.147	0.476
22p	0.105	0.313	0.102	0.345
20p	0.060	0.195	0.061	0.230
18p	0.024	0.099	0.026	0.135
16p	-0.002	0.038	0.000	0.067
14p	-0.007	0.017	-0.008	0.038
12p	-0.013	-0.011	-0.013	0.010

Stress Results - Test 03
Travel Direction **KY to OH**
Truck 01 = **Lane U3**
Truck 02 = **Lane U4**
Young's Modulus **0.029**

Units	ksi	ksi	ksi	ksi
PP	UT_L4L6_IPERF	UT_L4L6_OPERF	UT_L4L6_RADIUS	UT_L4L6_RIVET
0	0.056	-63.129	-0.024	0.062
2	0.315	-63.129	0.127	0.285
4	0.558	-63.129	0.257	0.494
6	0.625	-63.129	0.311	0.539
8	0.387	-63.129	0.173	0.343
10	0.166	-63.129	0.050	0.158
12	-0.032	-63.129	-0.072	-0.016
14	-0.240	-63.129	-0.194	-0.191
16	-0.402	-63.129	-0.285	-0.327
18	-0.393	-63.129	-0.279	-0.327
20	-0.318	-63.129	-0.235	-0.258
22	-0.247	-63.129	-0.193	-0.198
22p	-0.184	-63.129	-0.156	-0.152
20p	-0.123	-63.129	-0.122	-0.095
18p	-0.072	-63.129	-0.087	-0.051
16p	-0.047	-63.129	-0.097	-0.081
14p	-0.030	-63.129	-0.062	-0.013
12p	-0.007	-63.129	-0.066	-0.041

Stress Results - Test 03

Travel Direction	**KY to OH**
Truck 01 =	**Lane U3**
Truck 02 =	**Lane U4**
Young's Modulus	**0.029**

Units	ksi	ksi	ksi	ksi
PP	FB3_MID_TF	FB3_MID_BF	FB3_END_TF	FB3_END_BF
0	-0.009	-0.036	-0.026	-0.079
2	0.188	-0.190	0.268	-0.435
4	-0.057	-0.102	-0.025	-0.238
6	-0.022	-0.060	-0.018	-0.150
8	-0.015	-0.054	-0.031	-0.102
10	0.007	-0.036	-0.017	-0.062
12	0.026	-0.032	-0.009	-0.036
14	0.040	-0.032	-0.008	-0.004
16	0.052	-0.030	-0.005	0.026
18	0.056	-0.026	-0.004	0.026
20	0.053	-0.023	-0.004	0.019
22	0.054	-0.028	-0.007	0.006
22p	0.026	-0.039	-0.011	-0.010
20p	0.037	-0.027	-0.011	-0.016
18p	0.034	-0.033	-0.009	-0.020
16p	-0.046	-0.099	-0.050	-0.080
14p	0.024	-0.032	-0.013	-0.024
12p	-0.006	-0.078	-0.029	-0.065

APPENDIX F

Comparison of Predicted and Measured Stresses

Ratios of Predicted Versus Measured Stress

Panel Point	L2L4 LD US	L2L4 LD DS	L2L4 UD US	L2L4 UD DS	L4L6 LD US	L4L6 LD DS	L4L6 UD US	L4L6 UD DS
0	2.600	0.001	-0.001	6.152	1.540	0.000	0.000	1.395
2	1.783	1.575	1.534	1.949	1.745	1.579	1.673	1.888
4	1.782	1.889	1.915	1.834	1.632	1.507	1.534	1.655
6	1.937	2.084	2.263	2.154	1.611	1.707	1.693	1.546
8	2.129	2.224	2.502	2.404	1.685	1.735	1.832	1.666
10	2.587	2.360	2.821	3.097	1.995	1.832	1.868	1.737
12	1.293	2.102	84.076	0.914	1.196	1.276	1.387	1.805
14	2.123	2.467	2.101	1.893	1.756	2.118	2.156	1.827
16	2.357	2.320	2.169	2.206	1.921	1.912	1.926	1.982
18	2.446	2.295	2.231	2.292	1.991	1.884	1.957	2.054
20	2.495	2.094	2.038	2.262	2.041	1.712	1.808	2.094
22	2.436	1.931	1.857	2.147	2.010	1.586	1.699	2.056
24	2.366	1.827	1.706	1.955	1.968	1.501	1.618	1.996
26	2.034	1.527	1.367	1.512	1.749	1.295	1.389	1.778
28	0.897	1.101	0.881	0.558	0.799	0.996	1.042	0.807
Average	2.084	1.853	7.297	2.222	1.709	1.509	1.572	1.752
Std. Dev.	0.472	0.608	20.531	1.201	0.328	0.487	0.496	0.318
Adj. Avg.	2.084	1.853	1.953	1.941	1.709	1.509	1.572	1.752
Lower Chord Average								1.797

Panel Point	U1L2 LD US	U1L2 LD DS	U1L2 UD US	U1L2 UD DS	L2U3 LD US	L2U3 LD DS	L2U3 UD US	L2U3 UD DS
0	-2.147	0.000	0.000	0.574	3.403	0.000	0.000	-0.706
2	1.251	0.958	1.050	1.419	-0.678	0.669	-2.907	0.997
4	1.143	1.203	1.298	1.234	1.140	1.299	1.108	1.047
6	1.194	1.276	1.414	1.345	1.192	1.303	1.177	1.082
8	1.239	1.313	1.511	1.485	1.255	1.340	1.164	1.048
10	1.335	1.279	1.719	2.092	1.352	1.346	1.057	0.933
12	0.942	0.956	-2.293	0.398	0.797	1.558	0.476	-2.285
14	1.212	1.400	1.012	0.943	1.131	1.272	2.084	1.524
16	1.319	1.296	1.103	1.115	1.250	1.217	1.449	1.481
18	1.358	1.270	1.155	1.153	1.287	1.204	1.441	1.528
20	1.386	1.170	1.050	1.125	1.311	1.102	1.350	1.607
22	1.351	1.099	0.960	1.047	1.239	1.023	1.303	1.641
24	1.305	1.065	0.860	0.932	1.172	0.961	1.282	1.738
26	1.145	0.919	0.694	0.705	1.016	0.834	1.256	1.859
28	0.509	0.744	0.426	0.246	0.431	0.589	1.249	1.606
Average	0.969	1.063	0.797	1.054	1.153	1.048	0.899	1.007
Std. Dev.	0.860	0.334	0.922	0.447	0.783	0.381	1.109	1.062
Adj. Avg.	1.192	1.063	1.018	1.054	1.284	1.048	1.171	1.392
Diagonal Average								1.153

Panel Point	U3U5 LD US	U3U5 LD DS	U3U5 UD US	U3U5 UD DS	U5U7 LD US	U5U7 LD DS	U5U7 UD US	U5U7 UD DS
0	1.114	0.000	0.000	0.854	0.760	0.000	0.000	0.649
2	1.248	1.072	1.056	1.191	1.236	1.082	1.140	1.181
4	1.196	1.169	1.153	1.148	1.286	1.196	1.186	1.273
6	1.203	1.274	1.243	1.125	1.231	1.231	1.209	1.195
8	1.260	1.323	1.242	1.119	1.241	1.314	1.277	1.169
10	1.321	1.291	1.169	1.048	1.321	1.289	1.235	1.151
12	0.970	1.057	0.649	6.868	0.929	1.038	0.822	1.618
14	1.173	1.391	1.657	1.383	1.188	1.388	1.513	1.267
16	1.280	1.281	1.333	1.393	1.287	1.271	1.300	1.327
18	1.308	1.254	1.357	1.441	1.325	1.248	1.320	1.371
20	1.338	1.147	1.257	1.488	1.357	1.138	1.218	1.405
22	1.317	1.056	1.201	1.486	1.290	1.055	1.150	1.377
24	1.240	1.006	1.158	1.496	1.250	1.006	1.088	1.345
26	1.046	0.876	1.077	1.414	1.077	0.879	0.971	1.191
28	0.451	0.646	0.897	0.732	0.470	0.655	0.731	0.542
Average	1.164	1.056	1.097	1.612	1.150	1.053	1.077	1.204
Std. Dev.	0.216	0.338	0.363	1.423	0.240	0.335	0.344	0.266
Adj. Avg.	1.164	1.056	1.097	1.237	1.150	1.053	1.077	1.204
Upper Chord Average								1.130

Notes:
1. Ratios represent sum of predicted stresses from STAAD model for both trusses divided by sum of measured stresses for the corresponding truss member
2. Measured stresses based on web guages.

APPENDIX F
CONCEPTUAL ALTERNATIVES
DEVELOPMENT ENGINEERING

I. Development Workshop

Brent Spence Bridge Team Meeting
Wednesday, December 10, 2003
Montgomery Inn Boathouse
Cincinnati, Ohio

Agenda

- **Welcome & Introductions**
- **Process to be followed**
- **Mission of Workshop**
    - **Determine 6 “Best” Alternatives to carry forward**
- **Information Phase**
- **Development of Parameters**
    - **Criteria used to filter alternatives to 6 “Best”**
- **Alternatives Considered in 1998 Scoping Study**
- **Brainstorming for New/Additional Alternatives**
- **Judgment Phase**
    - **Advantages/Disadvantages**
- **Results/Closing**
    - **Guidance/Concerns/Items of Interest**

Brent Spence Bridge Team Meeting
Wednesday, December 10, 2003

Name	Organization	Office Phone Number	Cell Phone	E-mail
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Brent Spence Bridge Team Meeting
Wednesday, December 10, 2003

Meeting Notes

- Railroad under Brent Spence – 40 trains a day, Cincinnati side. Main route for CSX between the north (Chicago/Toledo) and south (Atlanta) and the coalfields; tri-weekly Amtrak to Washington, D.C.
- Cinergy – Substation
  - Feeds all Downtown and a large portion of Northern Kentucky
  - As much underground as on surface
  - 3 main transmission lines underground to Downtown
  - Relocation rumored to cost $200 million
  - Future; 345 KV addition possible
  - FHWA indicated that they may not be as concerned with going over power substation, however, gas lines could be a concern
- Cost Guard
  - Only have initial window, holding until possible locations developed
- Environmental
  - "No Fatal Flaws" from desktop survey
    - Several federal endangered mussels in the region. Study area width was 3000' total (1500' either side of I-75)
  - 37 HazMat sites documented within study area, one within the ROW limits
  - Some Superfund sites (KY definition)
  - 60 underground sites, near interchanges and industrial area
    - UST, un-documented sites expected to be found in future work
    - Substation could likely contain PCB's
  - Some parks in area
- Cultural/Historical Resources
  - Ohio
    - National Historic Register – Buildings listed on register
      - A. Union Terminal – significant building both inside and out
      - B. B&O Freight Terminal – "Longworth Hall" Inside is recently renovated. Floors and ceiling integrity remain. Only freight terminal of its nature remaining in country. When I-75 originally built, 135' of building was taken. However, it was not on the Historical Register at that time.
    - Feeling is that Cincinnati Preservation Association will fight to preserve Longworth Hall (unmodified). Is in a preservation easement.
    - Going over Longworth may be better than taking or modifying it.
    - Longworth:
      - If purpose and need are strong and there is no other feasible alternative then it could be taken.
      - Other existing buildings (other than terminal) not as significant
      - Any historic building or historic district impacted will add to timeline
    - 4 archaeological sites in Ohio

        - Expecting some archaeological sites in Ohio
    - Remnants of Cincinnati & White Water Canal – “not a show stopper,” mostly covered by railroad bed
- Kentucky
    - A number of historic districts in Covington; added after I-75 built
    - 900 buildings within area, individually listed
    - Big part of identity of Covington
    - 1 archaeological site in Kentucky
    - Unknown resources
    - Many potential archaeological sites in Kentucky (many disturbed)
    - All theoretically can be dealt with
    - Recommend not break boundaries of the districts
    - Issue of impacts to timeline – KYTC noted that 12th Street in Covington taking over 10 years and still not built

Discussion of parameters

A. Environmental Fatal Flaws
    - ? years to resolve disposition of Longworth
    - UST/HazMat will likely be issues

B. Maintenance of Traffic

C. Relative costs (Hi-Mod-Low)

D. Operations

E. Access to Cincinnati and Covington

F. Impacts on existing buildings

G. Utility impacts

I-71/75 MIS Concepts Discussed

- The three “best” as determined from the Scoping Study were displayed and discussed.

Range of Alternatives

Initially, the team identified 12 alternatives and/or combinations. The following characterizes the major elements of the various alternatives:

- Single deck structures
- Double deck structures

- Near existing bridge (west and/or east)
- Further downstream

- Separate bridges for I-75 and I-71
- I-75/I-71 on same bridge(s)

- Separate I-75 through traffic
- Maintain all present connections

- New bridge plus existing BSB (rehabilitate)
- New bridge plus replace on existing

After considerable discussion, the list of preliminary alternatives was reduced to the following groupings:

- Parallel structure to the east (two possible)
- Parallel structure to the west (two possible)
- Rehabilitate existing BSB (no-build)
- New bridge on existing alignment
- New I-75 downstream (with no local connections) with I-71 left on existing bridge
- New I-75/I-71 downstream with all connections retained

The exhibits at the end of this document represent only a visualization of these groupings, or concepts and are intended to encourage further discussion and to get a representative sample of feasible alternatives to carry forward into design development.

Further discussion ensued on the addition of more parameters

- Minimize design exceptions
- Eliminate left-hand exits
- Minimize weaves
- 5 through lanes with full shoulders

Outstanding Issues

- Confirm typical section once traffic is developed

Brent Spence Bridge Constructability Study
Preliminary Alternative Alignment
Advantage/Disadvantage
Assessment

Rehab + I-75 West

Advantages:

- Minimizes the number of new lanes required for a new bridge crossing and its approach structure 2X3 lanes*
- Fully utilizes the existing infrastructure, existing Brent Spence Bridge, approaches, and ramps to local access with minimal construction/rehab
- Allows for un-congested “thru traffic” directly to and through I-75
- Accommodates thru/truck traffic well on the more heavily traveled I-75 roadway*
- Dramatically reduces heavy traffic loading on the existing Brent Spence Bridge structure, allowing its continued use*
- It avoids major delay and cost generators such as Longworth Hall, maintenance of traffic problems and the Cinergy power plant
- This plan allows for redundancy of the I-75 crossing of the Ohio River

Disadvantages:

- It’s skewed alignment requires a somewhat longer bridge across the Ohio River
- Approach roadways may have to be elevated along the entire alignment*
- Existing overpass structures on the Ohio end cause the alignment to terminate 1600+/- feet beyond the study limits at Ezzard Charles Drive
- The alignment will pass over several existing buildings
- The alignment “chases” the existing I-75 corridor, shadowing the existing roadway below
- The rehabilitation of the existing Bent Spence Bridge may not be cost effective nor aesthetically desirable*
- This alternative does not allow for full redundancy of the I-71 crossing of the Ohio River

New East + I-75 West

Advantages:

- Allows for un-congested “thru traffic” directly to and through I-75
- Accommodates thru/truck traffic well on the more heavily traveled I-75 roadway*
- Dramatically reduces heavy traffic loading on a new bridge dedicated to I-71 and local I-75 and downtown commuter traffic*
- It avoids major delay and cost generators such as Longworth Hall, some maintenance of traffic problems and the Cinergy power plant
- This plan allows for redundancy of the I-75 crossing of the Ohio River

All lane configurations and numbers of lanes are assumed and include appropriate 12 foot wide shoulders and barriers where warranted.
* indicates assumed advantages or disadvantages that will require verification by further study (traffic analysis or detailed geometric study).

- It provides for two new major river crossing structures, allowing for greater flexibility in accommodating future traffic volumes.
- This alternative allows for flexibility of the aesthetic treatment of the bridge crossing

Disadvantages:

- This alternative requires two new bridges, in stead of one
- The I-75 "by-Pass component of this plan is a skewed alignment requiring a somewhat longer bridge across the Ohio River
- Approach roadways from the bypass alignment may have to be elevated along the entire I-75 by-pass alignment*
- Existing overpass structures on the Ohio end cause the by-pass alignment to terminate 1600+/- feet beyond the study limits at Ezzard Charles Drive
- The bypass alignment will pass over several existing buildings, possibly causing their removal
- The by-pass alignment "chases" the existing I-75 corridor, shadowing the existing I-75 roadway below
- This alternative does not allow for full redundancy of the I-71 crossing of the Ohio River
- Maintenance of traffic associated with the Kentucky side construction of the new I-75/71 bridge will be difficult*

New West W/ New Interchange

Advantages:

- Allows for un-congested "thru traffic" directly to and through I-75 and to I-71 via Fort Washington Way
- Accommodates thru/truck traffic well on the more heavily traveled I-75 roadway*
- It avoids major delay and cost generators such as Longworth Hall, maintenance of traffic problems and the Cinergy power plant
- This alternative allows for flexibility of the aesthetic treatment of the bridge crossing

Disadvantages:

- This plan does not allow for redundancy of the I-75, nor the I-71 crossing of the Ohio River
- Causes the abandonment of existing infrastructure, existing Brent Spence Bridge, approaches, and ramps to local access
- It requires an extremely wide (approximately 150'), single elevation bridge*
- It requires the construction of a new major interchange to provide local access to downtown Cincinnati
- Maintenance of traffic during construction will be very difficult and problematic*
- It may require the re-construction/ widening of 6th Street and attendant local access roads
- It's skewed alignment requires a somewhat longer bridge across the Ohio River
- Approach roadways may have to be elevated along the entire alignment*

All lane configurations and numbers of lanes are assumed and include appropriate 12 foot wide shoulders and barriers where warranted.
* indicates assumed advantages or disadvantages that will require verification by further study (traffic analysis or detailed geometric study).

- Existing overpass structures on the Ohio end cause the alignment to terminate 1600+/- feet beyond the study limits at Ezzard Charles Drive
- The alignment will pass over several existing buildings

Single Bridge Replacement

Advantages:

- It's zero skew alignment requires a minimal bridge length across the Ohio River
- The alignment partially utilizes the existing bridge approaches, and ramps to local access with moderate levels of construction/rehab
- This alternative allows for flexibility of the aesthetic treatment of the bridge crossing

Disadvantages:

- It does not completely avoid major delay and cost generators such as Longworth Hall, maintenance of traffic problems and the Cinergy power plant
- This alternative does not allow for redundancy of the I-75 nor the I-71 crossing of the Ohio River
- It requires an extremely wide (approximately 150'), single elevation bridge*
- Maintenance of interstate traffic during construction may be difficult*
- The "at grade" widening of existing I-75 on the Ohio side may be problematic or not feasible*

Double Bridge Replacement

Advantages:

- It's zero skew alignment requires minimal bridge lengths across the Ohio River
- The alignment partially utilizes the existing bridge approaches, and ramps to local access with moderate levels of construction/rehab
- Allows for un-congested "thru traffic" directly to and through I-75*
- This alternative allows for flexibility of the aesthetic treatment of the bridge crossing

Disadvantages:

- Approach roadways on the Ohio side will have to be elevated along the entire alignment*
- Two new bridges are required
- Existing overpass structures on the Ohio end cause the alignment to terminate 1600+/- feet beyond the study limits at Ezzard Charles Drive
- The alignment "chases" the existing I-75 corridor, shadowing the existing roadway below
- This alternative does not allow for redundancy of the I-71 crossing of the Ohio River
- Removal of the Brent Spence Bridge may be more difficult
- Does not provide for local access from I-75 to Covington. Addition of this access may be possible but will be problematic at best*

All lane configurations and numbers of lanes are assumed and include appropriate 12 foot wide shoulders and barriers where warranted.

* indicates assumed advantages or disadvantages that will require verification by further study (traffic analysis or detailed geometric study).

Rehab + I-75/I-71 West

Advantages:

- Fully utilizes the existing infrastructure, existing Brent Spence Bridge, approaches, and ramps to local access with minimal construction/rehab
- Allows for un-congested "thru traffic" directly to I-71 via Fort Washington Way and I-75
- Accommodates thru/truck traffic well on the more heavily traveled I-75 roadway*
- Dramatically reduces heavy traffic loading on the existing Brent Spence Bridge structure, allowing its continued use*
- It avoids major delay and cost generators such as Longworth Hall, maintenance of traffic problems and the Cinergy power plant
- This plan allows for nearly complete redundancy of the both I-71 and I-75 crossing of the Ohio River

Disadvantages:

- It's skewed alignment requires a somewhat longer bridge across the Ohio River
- Approach roadways attendant to the new bridge will have to be elevated along their entire alignments*
- It requires an extremely wide (approximately 150'), single elevation bridge*
- Existing overpass structures on the Ohio end cause the new I-75 alignment to terminate 1600+/- feet beyond the study limits at Ezzard Charles Drive
- The alignment will pass over several existing buildings
- The rehabilitation of the existing Bent Spence Bridge may not be cost effective nor astatically desirable*

All lane configurations and numbers of lanes are assumed and include appropriate 12 foot wide shoulders and barriers where warranted.
* indicates assumed advantages or disadvantages that will require verification by further study (traffic analysis or detailed geometric study).

II. Schematics

APPENDIX G
MISCELLANEOUS INFORMATION

I. Meeting Minutes

BURGESS & NIPLE

To:	Kevin Rust, PE Project Manager, KYTC District 6	**Date:**	May 13, 2003
From:	Herb Mack, PE Project Manager, Burgess & Niple, Ltd.	**Subject:**	Feasibility and Constructability Study for the Replacement/Rehabilitation of Brent Spence Bridge BSMT Meeting No.1 Minutes

Project Memorandum

Burgess & Niple, Limited
220 Lexington Green Circle
Suite 110
Lexington, KY 40503
859 273.0557
Fax 859 273.3332

The Bi-State Management Team (BSMT) kickoff meeting for the Feasibility and Constructability Study for the Replacement/Rehabilitation of Brent Spence Bridge was held at the B&N Cincinnati offices on May 12, 2003. Attendees included:

Name	Organization	Phone/Email
Kevin Rust	KYTC	859-341-2700 kevin.rust@mail.state.ky.us
Mike Bezold	KYTC	859-341-2700 mike.bezold@mail.state.ky.us
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Bryan Moser	Global Project Design	859-392-2653 Bryan@gpdesign.com

Highlights of the Bi-State Management Team kickoff meeting, by agenda item, were as follows:

I. Welcome/Introductions
- Sign in (as shown above)

II. Review Study Status
- Study area map distributed (attached)
- Draft problem statement passed out with key questions to be answered
- Initial Comments on Draft Problem Statement
  - Original shoulder widths were not wide enough to accommodate disabled vehicles
  - Solutions and corridor usages should be compatible (e.g. NAFTA vs. truck diversion)
- Comments to be provided back in a week to Kevin Rust

III. Vision and Goals
- Vision: Reviewed the Vision from the Pre-Design Conference held July 16, 2002
  - Success to Kentucky – Approach/implementation strategy with cost for feasible alternative on how to replace and/or fix Brent Spence Bridge
  - Success to Ohio – Good preliminary engineering document with action items regarding when to plan work
- Goal:
  - Complete by Christmas 2005
  - Answer the following questions:
    - Is it feasible to replace the Brent Spence Bridge at or near its existing location?
    - Can the existing Brent Spence Bridge be rehabilitated to provide additional service life and/or capacity?
    - How could traffic be maintained while the I-71/I-75 Brent Spence Bridge is being replaced or rehabilitated?
    - What are the limits of the approach work under various replacement/rehabilitation scenarios?
    - What are the costs of the various rehabilitation or replacement scenarios and the associated approach work?

        - Are there any environmental “fatal flaws” that would preclude certain options from advancing?
        - Type, size, location and costs of recommended alternative?
        - When does the bridge need to be replaced?
        - What controls action timeline: fatigue or capacity?
        - How are fatal flaws defined?
    - Seek options with an avoidance mind-set
    - Minimize approach work

IV. Study Process, Schedule, and Scope

- Scope of Services Exhibit passed out (attached)
- ODOT: Contact with Resource Agencies in Ohio will be made through OES
- Consultant Team discussed deliverable (e.g. applying limited dollars primarily to engineering efforts; concepts will be shown on aerial exhibits; roll plan format; final document - plan views with narratives, with backup and qualifiers; main span bridge limited primarily to geometry/clearance studies, aesthetics not included)
- Document discussion of why (and why not) certain alternatives taken forward for further study is important for next steps in NEPA

V. Advisory Committee

- AC members will have “technical role” and be resources for input
- Meetings will be informational, giving them an opportunity to comment on materials
- All communication with AC will go through Kevin Rust
- First meeting with AC is tentatively targeted for the end of June. BSMT representatives will contact initial list of committee members to confirm their willingness to participate

VI. Other Business

- All media communication will go through Sam Beverage
- A press release will be developed to advise the public what the current study would accomplish and what it would not include
- For future AC meetings: BSMT meeting in a.m. and AC in p.m. on the same day
- Fatigue Study: Appears money will be forthcoming

<u>Miscellaneous Notes:</u>

- Congressional delegation in Washington very interested in project; Washington FHWA is engaged in project
- NSTI completion date extended, due in September
    - ODOT asked for more information regarding what it will take to get to specific level of service
    - Information on truck-ban option could be used in this study

- “Prudent” and “feasible” will be important parameters/definitions in the evaluation of concepts
- Environmental: avoidance first, minimize next
- We should explore with the City of Cincinnati their interest in addressing access to US 50
- Previously, Covington wanted to maintain all existing access; confirm early
- ODOT will be studying I-75/I-74 and Hoppel St. interchange area soon. Projects will need to be coordinated.

Immediate Action Items:

- B&N to send electronic copy of problem statement out to attendees
- All: Send edits/suggestions on Draft Problem Statement to Kevin Rust
- KYTC District 6: Check in with John Carr regarding fatigue study
- B&N: To draft a press release

Action Items:

- B&N or KYTC District 6: Send ODOT copy of fatigue scope
- B&N to send to ODOT: Initial list of resource agencies to contact with draft letter
- B&N: Draft Performance Measures/Parameters for review and comment
- B&N: Obtain copy of ODOT’s Reebie truck data from Central Office
- ODOT District 8: To call potential AC members to confirm their interest in participating

BURGESS & NIPLE

To: Sam Beverage
KYTC D-6
Chief District Engineer

From: Herb Mack, PE
Project Manager, Burgess & Niple

Date: Wednesday, July 9, 2003

Subject: Brent Spence Bridge
Feasibility and Constructability
BSMT and Advisory
Committee Meeting

Project Memorandum

Burgess & Niple, Limited
220 Lexington Green Circle
Suite 110
Lexington, KY 40503
859 273.0557
Fax 859 273.3332

See Attendance List attached.

Notes from the meeting is as follows:

I. Welcome/Team Introductions - Sam Beverage, Chief District Engineer, KYTC District 6
- Opened the meeting and addressed the following items:
  - Introductions (attendance sheet attached)
  - Explained items that led to this initial meeting
  - Reviewed study budget limitations
  - Discussed purpose of assembling the committee
  - Reported on status of the transportation authorization bill

II. Study Process and Schedule – Herb Mack, B&N Team Project Manager
- Presented process (handout provided)
  - Study process
  - Project limits
  - Limited Anderson Ferry and Truck Diversion Elements

III. Draft Problem Statement – Herb Mack
- Reviewed initial list of factors to be contained in Problem Statement
- Provided a draft at the end of the meeting for review and comment

IV. General Discussion of Bridge Alternatives – Herb Mack
- Presented the preliminary range of alternatives (handout provided)

Notes of Advisory Committee (AC) Input/Questions to BSMT
- Procedural
  - Products will be public.
  - At least two-week advance notice will be given for meetings.
  - AC will not be requested to vote but rather a sense of consensus will be sought.

  - AC would like to be informed how their input will be given consideration.
    - General Group Comments
  - A number of people in the room have been involved in previous studies (e.g., Anderson Ferry, Brent Spence Bridge, Truck Diversion) and have information/knowledge that could be helpful to BSMT. Consideration should be given to assembling this group.
  - Consideration of routing I-71 traffic to I-471 is not part of this study. OKI will be looking at moving I-71 to I-471 sometime in the future.
  - Truck Diversion Study
    - A number of the Committee members had significant concerns about the controversy created by the two previous truck diversion initiatives. The most recent during OKI's NSTI. OKI staff made a presentation to the Board of Trustees identifying the size and complexity of the issue.
    - The slide show regarding what a complete truck diversion would entail can be obtained through Diana Martin, at ODOT D8 office.
    - It was offered by a number of members that the truck diversion study not be performed. Also, possibly change name to Truck Impact Analysis to show that its only function is related to the fatigue analysis.
- Developing a recommended bridge type (e.g. truss, cable-stay) is not part of this study.

- Specific Interests:
  - City of Covington: Maintenance of traffic (MOT); relocation of private concerns; new access from Interstate; coordination with the Corps of Engineers study along riverfront; aesthetics; community sensitivity to each side of the river
  - Southbank: Kenton County and other development initiatives; regional contexts; safety; commerce
  - Kenton County: same as Southbank's; corridor level impacts need consideration
  - City of Cincinnati: asked for consideration of being included as part of BSMT; the adjacent communities; secondary road system; improving driver's way-finding; funding; simplify ramps; reducing foot print size of Interstate; aesthetics
  - Hamilton County: connectivity of corridor; public acceptance
  - Greater Cincinnati Chamber of Commerce: region's competitive position as it relates to the transportation infrastructure
  - Cinergy Corporation: impact on other infrastructure; reliability and maintenance of electrical service to area
  - ODOT CO: controlling foot print of approach roadways
  - Cincinnati/Northern KY International Airport: balancing aesthetics and cost; utilize past studies as much as possible

- DHL Worldwide Express: visual safety at night; delays both existing and during construction; capacity/traffic flow

- Closing Comments
  - Handed out Draft Problem Statement and a comment sheet for AC members.

BSB Advisory Committee/BSMT Initial Meeting Attendees
July 9, 2003

NAME	PHONE	REPRESENTING	EMAIL
		Bi-State Management Team	
Barry House	502-695-4070	KYTC Central Office Multimodal Programs	barry.house@mail.state.ky.us
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		Guests	
Bryan Moser	869-392-2653	Global Project Design	Bryan@gpdesign.com
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Brent Spence Bridge Team Meeting
Wednesday, December 10, 2003
Montgomery Inn Boathouse
Cincinnati, Ohio

Agenda

- **Welcome & Introductions**
- **Process to be followed**
- **Mission of Workshop**
  - **Determine 6 "Best" Alternatives to carry forward**
- **Information Phase**
- **Development of Parameters**
  - **Criteria used to filter alternatives to 6 "Best"**
- **Alternatives Considered in 1998 Scoping Study**
- **Brainstorming for New/Additional Alternatives**
- **Judgment Phase**
  - **Advantages/Disadvantages**
- **Results/Closing**
  - **Guidance/Concerns/Items of Interest**

Brent Spence Bridge Team Meeting
Wednesday, December 10, 2003

Name	Organization	Office Phone Number	Cell Phone	E-mail
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Carol Weed	Gray & Pape	513-287-7700	513-300-1520	cweed@graypape.com

Brent Spence Bridge Team Meeting
Wednesday, December 10, 2003

Meeting Notes

- Railroad under Brent Spence – 40 trains a day, Cincinnati side. Main route for CSX between the north (Chicago/Toledo) and south (Atlanta) and the coalfields; tri-weekly Amtrak to Washington, D.C.
- Cinergy – Substation
  - Feeds all Downtown and a large portion of Northern Kentucky
  - As much underground as on surface
  - 3 main transmission lines underground to Downtown
  - Relocation rumored to cost $200 million
  - Future; 345 KV addition possible
  - FHWA indicated that they may not be as concerned with going over power substation, however, gas lines could be a concern
- Cost Guard
  - Only have initial window, holding until possible locations developed
- Environmental
  - "No Fatal Flaws" from desktop survey
    - Several federal endangered mussels in the region. Study area width was 3000' total (1500' either side of I-75)
  - 37 HazMat sites documented within study area, one within the ROW limits
  - Some Superfund sites (KY definition)
  - 60 underground sites, near interchanges and industrial area
    - UST, un-documented sites expected to be found in future work
    - Substation could likely contain PCB's
  - Some parks in area
- Cultural/Historical Resources
  - Ohio
    - National Historic Register – Buildings listed on register
      - A. Union Terminal – significant building both inside and out
      - B. B&O Freight Terminal – "Longworth Hall" Inside is recently renovated. Floors and ceiling integrity remain. Only freight terminal of its nature remaining in country. When I-75 originally built, 135' of building was taken. However, it was not on the Historical Register at that time.
    - Feeling is that Cincinnati Preservation Association will fight to preserve Longworth Hall (unmodified). Is in a preservation easement.
    - Going over Longworth may be better than taking or modifying it.
    - Longworth:
      - If purpose and need are strong and there is no other feasible alternative then it could be taken.
      - Other existing buildings (other than terminal) not as significant
      - Any historic building or historic district impacted will add to timeline
    - 4 archaeological sites in Ohio

        - Expecting some archaeological sites in Ohio
    - Remnants of Cincinnati & White Water Canal – “not a show stopper,” mostly covered by railroad bed
- Kentucky
    - A number of historic districts in Covington; added after I-75 built
    - 900 buildings within area, individually listed
    - Big part of identity of Covington
    - 1 archaeological site in Kentucky
    - Unknown resources
    - Many potential archaeological sites in Kentucky (many disturbed)
    - All theoretically can be dealt with
    - Recommend not break boundaries of the districts
    - Issue of impacts to timeline – KYTC noted that 12th Street in Covington taking over 10 years and still not built

<u>Discussion of parameters</u>

A. Environmental Fatal Flaws
    - ? years to resolve disposition of Longworth
    - UST/HazMat will likely be issues

B. Maintenance of Traffic

C. Relative costs (Hi-Mod-Low)

D. Operations

E. Access to Cincinnati and Covington

F. Impacts on existing buildings

G. Utility impacts

<u>I-71/75 MIS Concepts Discussed</u>

- The three “best” as determined from the Scoping Study were displayed and discussed.

Range of Alternatives

Initially, the team identified 12 alternatives and/or combinations. The following characterizes the major elements of the various alternatives:

- Single deck structures
- Double deck structures

- Near existing bridge (west and/or east)
- Further downstream

- Separate bridges for I-75 and I-71
- I-75/I-71 on same bridge(s)

- Separate I-75 through traffic
- Maintain all present connections

- New bridge plus existing BSB (rehabilitate)
- New bridge plus replace on existing

After considerable discussion, the list of preliminary alternatives was reduced to the following groupings:

- Parallel structure to the east (two possible)
- Parallel structure to the west (two possible)
- Rehabilitate existing BSB (no-build)
- New bridge on existing alignment
- New I-75 downstream (with no local connections) with I-71 left on existing bridge
- New I-75/I-71 downstream with all connections retained

The exhibits at the end of this document represent only a visualization of these groupings, or concepts and are intended to encourage further discussion and to get a representative sample of feasible alternatives to carry forward into design development.

Further discussion ensued on the addition of more parameters

- Minimize design exceptions
- Eliminate left-hand exits
- Minimize weaves
- 5 through lanes with full shoulders

Outstanding Issues

- Confirm typical section once traffic is developed

Brent Spence Bridge Constructability Study
Preliminary Alternative Alignment
Advantage/Disadvantage
Assessment

Rehab + I-75 West

Advantages:

- Minimizes the number of new lanes required for a new bridge crossing and its approach structure 2X3 lanes*
- Fully utilizes the existing infrastructure, existing Brent Spence Bridge, approaches, and ramps to local access with minimal construction/rehab
- Allows for un-congested "thru traffic" directly to and through I-75
- Accommodates thru/truck traffic well on the more heavily traveled I-75 roadway*
- Dramatically reduces heavy traffic loading on the existing Brent Spence Bridge structure, allowing its continued use*
- It avoids major delay and cost generators such as Longworth Hall, maintenance of traffic problems and the Cinergy power plant
- This plan allows for redundancy of the I-75 crossing of the Ohio River

Disadvantages:

- It's skewed alignment requires a somewhat longer bridge across the Ohio River
- Approach roadways may have to be elevated along the entire alignment*
- Existing overpass structures on the Ohio end cause the alignment to terminate 1600+/- feet beyond the study limits at Ezzard Charles Drive
- The alignment will pass over several existing buildings
- The alignment "chases" the existing I-75 corridor, shadowing the existing roadway below
- The rehabilitation of the existing Bent Spence Bridge may not be cost effective nor aesthetically desirable*
- This alternative does not allow for full redundancy of the I-71 crossing of the Ohio River

New East + I-75 West

Advantages:

- Allows for un-congested "thru traffic" directly to and through I-75
- Accommodates thru/truck traffic well on the more heavily traveled I-75 roadway*
- Dramatically reduces heavy traffic loading on a new bridge dedicated to I-71 and local I-75 and downtown commuter traffic*
- It avoids major delay and cost generators such as Longworth Hall, some maintenance of traffic problems and the Cinergy power plant
- This plan allows for redundancy of the I-75 crossing of the Ohio River

All lane configurations and numbers of lanes are assumed and include appropriate 12 foot wide shoulders and barriers where warranted.
* indicates assumed advantages or disadvantages that will require verification by further study (traffic analysis or detailed geometric study).

- It provides for two new major river crossing structures, allowing for greater flexibility in accommodating future traffic volumes.
- This alternative allows for flexibility of the aesthetic treatment of the bridge crossing

Disadvantages:

- This alternative requires two new bridges, in stead of one
- The I-75 “by-Pass component of this plan is a skewed alignment requiring a somewhat longer bridge across the Ohio River
- Approach roadways from the bypass alignment may have to be elevated along the entire I-75 by-pass alignment*
- Existing overpass structures on the Ohio end cause the by-pass alignment to terminate 1600+/- feet beyond the study limits at Ezzard Charles Drive
- The bypass alignment will pass over several existing buildings, possibly causing their removal
- The by-pass alignment “chases” the existing I-75 corridor, shadowing the existing I-75 roadway below
- This alternative does not allow for full redundancy of the I-71 crossing of the Ohio River
- Maintenance of traffic associated with the Kentucky side construction of the new I-75/71 bridge will be difficult*

New West W/ New Interchange

Advantages:

- Allows for un-congested “thru traffic” directly to and through I-75 and to I-71 via Fort Washington Way
- Accommodates thru/truck traffic well on the more heavily traveled I-75 roadway*
- It avoids major delay and cost generators such as Longworth Hall, maintenance of traffic problems and the Cinergy power plant
- This alternative allows for flexibility of the aesthetic treatment of the bridge crossing

Disadvantages:

- This plan does not allow for redundancy of the I-75, nor the I-71 crossing of the Ohio River
- Causes the abandonment of existing infrastructure, existing Brent Spence Bridge, approaches, and ramps to local access
- It requires an extremely wide (approximately 150’), single elevation bridge*
- It requires the construction of a new major interchange to provide local access to downtown Cincinnati
- Maintenance of traffic during construction will be very difficult and problematic*
- It may require the re-construction/ widening of 6th Street and attendant local access roads
- It’s skewed alignment requires a somewhat longer bridge across the Ohio River
- Approach roadways may have to be elevated along the entire alignment*

All lane configurations and numbers of lanes are assumed and include appropriate 12 foot wide shoulders and barriers where warranted.

* indicates assumed advantages or disadvantages that will require verification by further study (traffic analysis or detailed geometric study).

- Existing overpass structures on the Ohio end cause the alignment to terminate 1600+/- feet beyond the study limits at Ezzard Charles Drive
- The alignment will pass over several existing buildings

Single Bridge Replacement

Advantages:

- It's zero skew alignment requires a minimal bridge length across the Ohio River
- The alignment partially utilizes the existing bridge approaches, and ramps to local access with moderate levels of construction/rehab
- This alternative allows for flexibility of the aesthetic treatment of the bridge crossing

Disadvantages:

- It does not completely avoid major delay and cost generators such as Longworth Hall, maintenance of traffic problems and the Cinergy power plant
- This alternative does not allow for redundancy of the I-75 nor the I-71 crossing of the Ohio River
- It requires an extremely wide (approximately 150'), single elevation bridge*
- Maintenance of interstate traffic during construction may be difficult*
- The "at grade" widening of existing I-75 on the Ohio side may be problematic or not feasible*

Double Bridge Replacement

Advantages:

- It's zero skew alignment requires minimal bridge lengths across the Ohio River
- The alignment partially utilizes the existing bridge approaches, and ramps to local access with moderate levels of construction/rehab
- Allows for un-congested "thru traffic" directly to and through I-75*
- This alternative allows for flexibility of the aesthetic treatment of the bridge crossing

Disadvantages:

- Approach roadways on the Ohio side will have to be elevated along the entire alignment*
- Two new bridges are required
- Existing overpass structures on the Ohio end cause the alignment to terminate 1600+/- feet beyond the study limits at Ezzard Charles Drive
- The alignment "chases" the existing I-75 corridor, shadowing the existing roadway below
- This alternative does not allow for redundancy of the I-71 crossing of the Ohio River
- Removal of the Brent Spence Bridge may be more difficult
- Does not provide for local access from I-75 to Covington. Addition of this access may be possible but will be problematic at best*

All lane configurations and numbers of lanes are assumed and include appropriate 12 foot wide shoulders and barriers where warranted.
* indicates assumed advantages or disadvantages that will require verification by further study (traffic analysis or detailed geometric study).

Rehab + I-75/I-71 West

Advantages:

- Fully utilizes the existing infrastructure, existing Brent Spence Bridge, approaches, and ramps to local access with minimal construction/rehab
- Allows for un-congested “thru traffic” directly to I-71 via Fort Washington Way and I-75
- Accommodates thru/truck traffic well on the more heavily traveled I-75 roadway*
- Dramatically reduces heavy traffic loading on the existing Brent Spence Bridge structure, allowing its continued use*
- It avoids major delay and cost generators such as Longworth Hall, maintenance of traffic problems and the Cinergy power plant
- This plan allows for nearly complete redundancy of the both I-71 and I-75 crossing of the Ohio River

Disadvantages:

- It’s skewed alignment requires a somewhat longer bridge across the Ohio River
- Approach roadways attendant to the new bridge will have to be elevated along their entire alignments*
- It requires an extremely wide (approximately 150’), single elevation bridge*
- Existing overpass structures on the Ohio end cause the new I-75 alignment to terminate 1600+/- feet beyond the study limits at Ezzard Charles Drive
- The alignment will pass over several existing buildings
- The rehabilitation of the existing Bent Spence Bridge may not be cost effective nor astatically desirable*

All lane configurations and numbers of lanes are assumed and include appropriate 12 foot wide shoulders and barriers where warranted.

* indicates assumed advantages or disadvantages that will require verification by further study (traffic analysis or detailed geometric study).

BRENT SPENCE BRIDGE STUDY
BSMT & ADVISORY COMMITTEE MEETING AGENDA
Wednesday, January 28, 2004
1:30 p.m.
Ohio-Kentucky-Indiana Regional Council of Governments
720 East Pete Rose Way, Suite 420
Cincinnati, OH 45202
Board Room

I. Welcome/Introductions

II. Study Status

III. Review Alternative Concepts

IV. Comments/Concerns

V. Adjourn

BRENT SPENCE BRIDGE STUDY
BSMT & ADVISORY COMMITTEE MEETING AGENDA
Wednesday, January 28, 2004
Attendance List

Name	Organization	Email
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Sharon Laycock	KYTC Environmental	Sharon.Laycock@ky.gov
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Diana Martin	ODOT, District 8	diana.martin@dot.state.oh.us
Larry Sutherland	ODOT Central Office	LSutherl@dot.state.oh.us
Dory Montazemi	OKI	dorym@oki.org
Bob Koehler	OKI	RKoehler@oki.org
Mark Policinski	OKI	mpolicinski@oki.org
Richard Crane	FHWA, Kentucky	richard.crane@fhwa.dot.gov
Michael Loyselle	FHWA, Kentucky	michael.loyselle@fhwa.dot.gov
Evan Wisniewski	FHWA Kentucky	evan.wisniewski@fhwa.dot.gov
Charles Meyers 420 Independence Station Rd. Independence, KY 41051	Kenton County Engineer's Office	CharlieMeyers@KentonCo.org
Herb Mack	Burgess & Niple	hmack@burnip.com
Henry Osman	Burgess & Niple	hosman@burnip.com
Mark Willis	Burgess & Niple	mwillis@burnip.com

Jim Garrison	Burgess & Niple	jgarrison@burnip.com
Jon Brunot	Burgess & Niple	jbrunot@burnip.com
Donald Horn	Burgess & Niple	dhorn@burnip.com
Richard Sutherland	American	RSutherland@ace-plc.com
Glenn Hardin	American	hardin@ace-plc.com
Steve Cecil	Parsons	Steven.Cecil@parsons.com
Jill Hoffman	Parsons	jill.hoffman@parsons.com
Bryan Moser	Global Project Design	Bryan@gpdesign.com
Wally Pagan	Southbank Partners	
Russ Campbell	Cinergy	rcampbell@cinergy.com
Terry Hughes	City of Covington	BOBISS@city-of-covington.com
Lee Flischel	Northern Kentucky Chamber of Commerce	
Eileen Enabnit	City of Cincinnati	Eileen.enabnit@cincinnati-oh.gov
Steve Niemeier	City of Cincinnati	Steve.niemeier@cincinnati-oh.gov
Joe Vogel	City of Cincinnati	Joe.vogel@cincinnati-oh.gov
James Pilcher	Cincinnati Enquirer	jpilcher@enquirer.com

BURGESS & NIPLE

To: Mike Bezold, PE
Project Manager KYTC District 6

From: Herb Mack
Project Manager, Burgess & Niple

Date: March 10, 2004

Subject: Meeting Notes for: Brent Spence Bridge Feasibility and Constructability Study
BSMT Meeting

Project Memorandum

Burgess & Niple, Limited
220 Lexington Green Circle
Suite 110
Lexington, KY 40503
859 273.0557
Fax 859 273.3332

See attached Attendance List;

I. General Notes:
- Meetings from here on will change from BSMT meetings to be open to all Advisory Committee members in addition to the BSMT agencies.

II. Proposed Schedule
- B&N reported that it has reviewed and revised the project schedule and sees no problem completing the project by November 15, 2004.
- NTP on schedule for fatigue study March 15th, with June 1 draft Fatigue Report due.

III. Discussion of Anderson Ferry Study
- An exhibit and a brief overview of Technical Memo was presented
- Copies of the Tech Memo were distributed
- Summary: concept didn't help divert enough trucks off BSB nor help meet the Problem Statement for the Study.

IV. Discussion of Truck Diversion Study
- Tech Memo handed out and brief discussion of its contents occurred.
- Summary: If trucks are removed from BSB, based on the model, the trucks just move to the next quickest route (e.g., Clay Wade Bailey); this will turn into an enforcement issue regarding where the community wants the trucks to divert to which specific routes.

V. Status Update:
- Status of the alternatives development was discussed.
  - Presentation of concepts
    - Some minor alignment adjustments have occurred to date.

        - Details of 5 alternative alignments are being developed.
    - Identification of property likely to be impacted has begun.
    - Rehab + I-75 West Concept (Alternate 1) development was discussed.
        - Notable elements:
        - Works well on Ohio side
        - Allows for some phase construction, regarding when BSB would need to be replaced
            - Will push work up the KY hill
            - When highway was constructed it was noted that hillside was sliding. Cost estimates will need to address this
            - Working on maintaining existing access
            - MOT looks relatively promising
            - Cross section and rehab decisions will come later in schedule
            - Need to explore life expectancy or rehab need of bridges on Ohio side to see if something should be considered in the strategy
    - New BSB East + I –75 West (Alternate 2)
        - Works well on Ohio side
        - Allows for some phase construction, regarding when BSB would need to be replaced
            - Will push work up the KY hill
            - When highway was constructed it was noted that hillside was sliding. Cost estimates will need to address this
            - Working on maintaining existing access
            - Cross section and rehab decisions are down the road
            - Need to explore life expectancy or rehab need of bridges on Ohio side to see if something should be considered in the strategy
    - Single Bridge (Alternate 4)
        - Concept has been moved east to miss Longworth Hall
        - Will require considerable retaining walls on KY side up the hill and OH side to meet 5 lane requirements
    - Double Bridge Replacement (Alternate 5)
        - All of the approach on the Ohio side is elevated
    - Rehab + I-75 /I-71 West (Alternate 6)
        - Adjusted in attempt to miss key structures
    - New West w/ New Interchange (Alternate 3)
        - High cost, takes a lot of property
        - Appears to be outside the scope of the problem statement
        - Have enough alternates that could meet the problem statement
        - States should agree and document the elimination of any alternative
    - Copies of the Conceptual Typical were distributed
- States okay to moving forward with CORSIM traffic model development on Alternates 1, 2, 4, 5 & 6.
- KYTC to send out notice to Advisory Committee regarding format and future meeting
- Target next meeting for May 12th at ODOT District 8 @ 10 am
    - B&N to provide agenda and handout mock-ups one week before the meeting
    - Meeting will focus on CORSIM traffic numbers, numbers of lanes required and level of service for each Alternative
    - Plan on walking all attendees through concepts again
    - KYTC will develop mechanism to share comments given to date

BRENT SPENCE BRIDGE STUDY
BSMT MEETING AGENDA
Wednesday, March 10, 2004
KYTC District 6 Conference Room
421 Buttermilk Pike
Fort Mitchell, Kentucky

I. Proposed Schedule

- **The consultant team proposes that the initial 6 alternative concepts will be completed in time for the June 10, 2004 meeting and the final 3 alternatives and project documentation completed by November, 2004.**

II. Discussion of Anderson Ferry Study

III. Discussion of Truck Diversion Study

IV. Status Update/Discussion of Issues of the Alternatives Development

V. Other Business

BRENT SPENCE BRIDGE
REHAB/REPLACEMENT
CONSTRUCTABILITY/FEASABILITY STUDY
MARCH 10, 2004

Name	Agency	Email Address	Meeting Docs
Mike Bezold	KYTC	Mike.Bezold@ky.gov	
Sam Beverage	KYTC	Sam.Beverage@ky.gov	Yes
Mike Yeager	KYTC	Mike.Yeager@ky.gov	Yes
David Kratt	KYTC	David.Kratt@ky.gov	Yes
Nancy Wood	KYTC	Nancy.Wood@ky.gov	No
Diana Martin	ODOT	diana.martin@dot.state.oh.us	Yes
Richard Crane	FHWA	richard.crane@fhwa.dot.gov	Yes
Eileen Enabnit	City of Cincinnati	eileen.enabnit@cincinnati-oh.gov	Yes
Herb Mack	Burgess & Niple	hmack@burnip.com	
Mark Willis	Burgess & Niple	mwillis@burnip.com	No
Jim Garrison	Burgess & Niple	jgarrison@burnip.com	Yes
Henry Osman	Burgess & Niple	hosman@burnip.com	
Jamie Snow	Burgess & Niple	jsnow@burnip.com	
Donald Horn	Burgess & Niple	dhorn@burnip.com	No
Richard Sutherland	American Consulting Engneers	Sutherland@ace-plc.com	
Glen Hardin	American Consulting Engineers	Hardin@ace-plc.com	
Greg Sharp	American Consulting Engineers	GSharp@ace-plc.com	No
J. Paul Silvestri	National Constructors Group	jpaul.silvestri@lycos.com	No
Bob Driehaus	Kentucky Post	bdriehaus@cincypost.com	Yes
James Pilcher	Cincinnati Enquirer	jpilcher@enquirer.com	Yes

BURGESS & NIPLE

To:	Mike Bezold, PE Project Manager, KYTC District 6	**Date:**	May 7, 2004
From:	Herb Mack, PE Project Manager, Burgess & Niple, Ltd.	**Subject:**	Meeting Notes for: Brent Spence Bridge Feasibility and Constructability Study Meeting, April 29, 2004

Project Memorandum

Burgess & Niple, Limited
220 Lexington Green Circle
Suite 110
Lexington, KY 40503
859 273.0557
Fax 859 273.3332

A team meeting was held on April 29, 2004 for the Feasibility and Constructability Study for the Replacement/Rehabilitation of Brent Spence Bridge.

Attendees at the meeting included:

Mike Bezold	KYTC
Jim Brannon	KYTC
Mike Yeager	KYTC
Laura Mitchell	KYTC
Diana Martin	ODOT
Stefan Spinosa	ODOT
Jay Hamilton	ODOT
Herb Mack	Burgess & Niple
Mark Willis	Burgess & Niple
Randy Kill	Burgess & Niple
Henry Osman	Burgess & Niple
Glen Hardin	American Consulting Engineers
Bob Yeager	American/Balke

Final notes from the meeting are as follows:

- The design team reviewed the most recent versions of the five alternative alignments superimposed on aerial photos. The team discussed the visual quality of the exhibits and their presentation at the anticipated May 12 meeting. It was thought by some that the glossy paper gave the impression that plans are more complete than they really are. The consensus of the design team was that, for the May 12th meeting and subsequent meetings involving the public, that non-glossy medium be used to display the alternative alignments, so as to not give the impression of a "finished product."

- Mike Bezold led the discussion regarding the people/groups to be invited to the May 12 meeting. This will include the groups formerly known as the Advisory Committee and the BSMT. The names are to be dropped in an attempt to lessen the feeling of some that they are excluded from decision making. We will postpone meeting with this "Large Group" until the CORSIM models for all alternative alignments are scrutinized by the team, calibrated, and completed.

- Randy Kill presented the preliminary CORSIM model geometry of the existing infrastructure developed to date. The traffic functionality had not been perfected beyond the CORSIM default setting stage of development. Models presented were:

    - A.M. and P.M. peak hour traffic on existing (2003) infrastructure,
    - Design Year (2030) A.M. and P.M. peak hour traffic on existing infrastructure.

- Design team comments reflected that the model geometry looked excellent but modeled traffic flow was not truly representing the congestion on I-75/I-71 and certain key ramps.

- The consultant team will continue to revise/refine the current and future existing infrastructure CORSIM models and present them in a more functionally correct form at the May 12th meeting. CORSIM geometry modeling of the alternative alignments will commence immediately. Any useful preliminary results will also be shown at the May 12 meeting for comment.

- The team will meet May 12 at 10:00 A.M. at ODOT District 8 to discuss results to date. The next meeting of the Large Group will be discussed at that time.

- The consultant team offered to increase efforts to raise the level of communication among all of the members of the design team and stakeholders by taking on more of those responsibilities. These efforts will be coordinated with Mike Bezold.

BURGESS & NIPLE

To: Sam Beverage, PE
Chief District Engineer, District 6

Attn: Mike Bezold, PE
Project Manager, KYTC District 6

From: Herb Mack, PE
Project Manager, Burgess & Niple, Inc.

By: Henry Osman, PE
Project Engineer, Burgess & Niple, Inc.

Date: May 20, 2004

Subject: Meeting Minutes for: Brent Spence Bridge Constructability and Feasibility Study Meeting, May 12, 2004

Project Memorandum

Burgess & Niple, Inc.
220 Lexington Green Circle
Suite 110
Lexington, KY 40503
859 273.0557
Fax 859 273.3332

A team meeting was held at the ODOT District 8 offices at 10:00 am on May 12, 2004 for the Constructability and Feasibility Study of the Replacement/Rehabilitation of Brent Spence Bridge.

Attendees at the meeting were:

Mike Bezold	KYTC	Mike.bezold@ky.gov
Mike Yeager	KYTC	Mike.yeager@ky.gov
David Kratt	KYTC	David.kratt@ky.gov
Brad Eldridge	KYTC	Brad.eldridge@ky.gov
Michael M. Loyselle	FHWA/KY	Michael.loyselle@fhwa.dot.gov
Evan J. Wisniewski	FHWA/KY	Evan.wisniewski@fhwa.dot.gov
Anthony Goodman	FHWA/KY	Anthony.Goodman@fhwa.dot.gov
Jay Hamilton	ODOT- District 8	Jay.Hamilton@dot.state.oh.us
Stefan Spinosa	ODOT	Stefan.spinosa@dot.state.oh.us
Larry Sutherland	ODOT-Central Office	lsutherl@dot.state.oh.us
Mark Vonderembse	FHWA/Ohio	Mark.vonderembse@fhwa.dot.gov
Victoria Peters	FHWA/Ohio	Victoria.peters@fhwa.dot.gov
Herb Mack	Burgess & Niple	hmack@burnip.com
Jim Garrison	Burgess & Niple	jgarrison@burnip.com
Mark Willis	Burgess & Niple	mwillis@burnip.com
Henry Osman	Burgess & Niple	hosman@burnip.com
Randy Kill	Burgess & Niple	rkill@burnip.com
Jon Brunot	Burgess & Niple	jbrunot@burnip.com
Richard Sutherland	American Consulting Engineers	rsutherland@ace-plc.com
Glenn Hardin	American Consulting Engineers	harding@ace-plc.com
Bob Yeager	Balke American	ryeager@balke.com

The following Draft notes from the meeting are for review and comment by all attendees. Comments received by May 31, 2004 will be incorporated into the final meeting minutes and made a part of the project record.

- Mark Willis began the meeting with a brief recap of traffic model work accomplished to date and a report of possible problems arising with the OKI TRANPLAN travel demand model that was provided for the project. The meaning of the “travel demand” model was explained. Problems identified were:

  Travel demand modeling produces theoretical traffic volumes that do not necessarily reflect current travel trouble spots in the project area. They do, tend to more accurately predict travel shortcomings that might occur in the future.

  Micro modeling (using CORSIM) of these theoretical “demand model” volumes will show traffic trouble spots that are not consistent with those currently being experienced. These apparent inconsistencies, while accurate, may cause credibility problems during the public input process later in a NEPA process.

- The design team was asked to discus the problem and suggest possible method/s to resolve the problem

Various viewpoints / concerns were debated

- The design team recommended that traffic forecasting experts from KYTC, ODOT and OKI meet with the consultant team to arrive at current and future year (2030) traffic volume estimates that would appropriately meet the needs of this project, as well as the NEPA process to follow. These figures would be “certified” as correct by these experts by letter from KYTC Division of Multi-modal Services to the project manager. The project team would adopt these volumes and resume with normal planning functions using these “certified traffic volumes” as a basis for micro (CORSIM) modeling of the alternative alignments.

- Mike Bezold is to bring these experts together, facilitate their work and expedite the results. These experts (or their designees), consisting of:

Rob Bostrom, KYTC Specialist, Division of Multi-modal Services (502) 564 7686

Bob Burgett, ODOT Project Analyses Administrator, Office of Technical Services (614) 644 8195

Cheng I. Tsai, OKI Manager, Division of Data Services (513) 621 6300 Ext.115
Randy Kill, Burgess & Niple, Inc., Traffic Engineer, (614) 459 2050 Ext. 436

Time allotted for this traffic volume certification process was estimated at no longer that 60 days form May 12th. Deliverables shall consist of current year and design (2030) year traffic volumes for average daily traffic, AM Peak hour traffic and PM peak hour traffic for the existing infrastructure and each of the five alternatives identified in the Constructability/Feasibility study to date. Traffic volumes shall be estimated in terms of numbers of passenger cars with % trucks for each link or by separate car and truck volumes for each link of the models.

The consultant team estimated that such a two-month delay would not require a revision to the anticipated project completion date of November 1, 2004.

- The consultant team will continue with the refinement of project exhibits and calibration of the behavioral characteristics of the CORSIM models in preparation of the receipt of the certified traffic volumes.
- The next team meeting will be scheduled for a time after receipt of the certified traffic volumes and their inclusion into the CORSIM models.

The meeting concluded at 12:15 pm

Copy: All in Attendance, Sam Beverage, Rob Bostrom, Bob Burgett, Cheng I. Tsai

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BURGESS & NIPLE

To: David Jones, P.E.
Chief District Engineer, District 6

Date: September 8, 2004

Attn: Kevin Rust, PE
TEBM for Pre-construction,
KYTC D-6

Subject: **FINAL** Meeting Minutes for:
Brent Spence Bridge
Constructability and Feasibility
Study Meeting, September 3, 2004

From: Herb Mack, PE
Project Manager, Burgess &
Niple, Inc.

By: Henry Osman, PE
Project Engineer, Burgess &
Niple, Inc.

Project Memorandum

Burgess & Niple, Inc.
220 Lexington Green Circle
Suite 110
Lexington, KY 40503
859 273.0557
Fax 859 273.3332

The principal consultant team members met with Kevin Rust, KYTC project Manager for the project, to get clarification on project completion date revisions recently proposed. The meeting was held in the Lexington offices of Burgess & Niple at 11:00am on Friday September 3, 2004.

Attendees at the meeting were:

Kevin Rust	KYTC	kevin.rust@ky.gov
Richard Sutherland	American Consulting Engineers	rsutherland@ace-plc.com
Glenn Hardin	American Consulting Engineers	ghardin@ace-plc.com
Greg Sharp	American Consulting Engineers	gsharp@ace-plc.com
Mark Willis	Burgess & Niple	mwillis@burnip.com
Herb Mack	Burgess & Niple	hmack@burnip.com
Henry Osman	Burgess & Niple	hosman@burnip.com
Donald Horn	Burgess & Niple	dhorn@burnip.com

Draft Minutes, recorded from the meeting were sent to all attendees for comment. The following Final Minutes contain comments on the Draft Minutes received by September 8, 2004.

The consultant team has been asked to accelerate the completion date of the project in order to facilitate consultant selection for the next phase of the project. A new completion date for the PRELIMINARY DRAFT version of the report has been proposed as November 1, 2004. KYTC acknowledges that changes in the extent and or numbers of the previously agreed upon deliverables may have to be made. In the mean time, KYTC and ODOT has administratively determined that the numbers of lanes required for the mainline portions of the project have increased considerably from initial assumptions of five (5) lanes across the river, to seven lanes. This new parameter will cause a near-complete re-evaluation and design of the five alternatives identified to date. The purpose of the meeting was to clarify new design assumptions to be used to produce a PRELIMINARY DRAFT REPORT, determine a completion date for a PRELIMINARY DRAFT version of the final REPORT, and set a list of PRELIMINARY DRAFT REPORT deliverables that all parties could live with.

To begin the meeting Kevin was asked to clarify the findings and the wishes of the KYTC and ODOT representatives of the Bi-State Management Team (BSMT) which is requiring the accelerated completion date.

The BMST has administratively recommended that the Brent Spence Bridge Constructability and Feasibility Study be revised to consider a seven (7) lane river crossing scenario rather than the 5 lane assumption used to date. This means that the river crossing structures considered in this study, whether accommodated by existing and/or proposed structures, must total 7 lanes in both directions. Five lanes would be used to carry I-75 traffic and 2 lanes would carry I-71 traffic. The accommodation of local traffic was unspecified. The local traffic could be handled on either, or both of the interstate routes or a completely separate structure. The crossing structure(s) may be either a single or double structure. For the purposes of this study, the Bi-state Management Team has adopted these lane recommendations without specific traffic modeling to act as guidance for the exit/entrance ramp connections, and local access details. These details will be developed in later phases of the project.
It was decided to set identical project limits for each of the five alternative alignments and design improvements as if the assumed lane numbers existed at those points of termination. In other words:

- Five (5) lanes of traffic in each direction would exist on I-75 at Findlay street
- Two (2) lanes of traffic would (and does) exist at the entrance and exit of Fort Washington Way
- Seven lanes of traffic would exist along the I-75/71 roadway at a point 2000 feet south of the intersection of Pike Street

The additional lanes assumed to exist under this new design parameter would be located immediately out board of the existing lanes. A 12 foot wide shoulder will accompany the lanes.

By setting the same start/ stop limits for all five alternative alignments, construction cost estimates, to be provided at the FINAL REPORT stage of the study, would be most comparable.

The accelerated completion date arose as a result of a need to advertise for the second phase of the project sooner than anticipated. ODOT will lead the next phase of this project. The selection process to be used is still under discussion by the BSMT.

In an attempt to provide a "level playing field" for all prospective respondents to the next phase of the project, the selection process must include disclosure of all current study materials available. The project team realizes that the FINAL REPORT will not be ready by November 1, 2004, but a PRELIMINARY DRAFT version could be. The following is a list of deliverables that the consultant team thinks may reasonably be expected to be available by November 1, 2004. The timely production of these deliverables assumes the acceptance of the conditions stated above:

Brent Spence Bridge
Feasibility and constructability
PRELIMINARY DRAFT REPORT
Deliverables

Documentation:

- Problem Statement
- Performance Measures
- Minutes of Meetings
- Resource Agency Documentation
- Summary documents of existing reports
- Bridge Inventory Schematic and Tech Summary
- Rail Road System Technical Summary

Reports:

- Environmental Overview
  - Appendices
    - Geotechnical
    - Cultural
    - HazMat/UST
    - Socio-economics
    - Air
    - Noise
    - Ecological

Truck Diversion Study

Anderson Ferry Study

Traffic
- Summary
- Technical Memos

Fatigue Study

Alternatives Development Engineering
- Documents and Exhibits (showing the “5 and 7 lane” configurations)
- Development Workshop(s)
- Schematics
  - Alignments (showing the “5 and 7 lane” configurations)
  - Profiles (for the “ 5 and 7 lane” configurations)

Executive Summary
- Schematics of Alternatives and CD Copy
  - Plan & Profile (showing the “7 lane” configurations)
  - MOT
  - Construction Sequencing

Excluded from the PRELIMINARY DRAFT REPORT Deliverables but included in the DRAFT REPORT and the FINAL REPORT deliverables will be:

Right of way area and cost estimates
Construction cost estimates (base costs and risk costs)

The submission of the PRELIMINARY DRAFT REPORT, outlined above, shall not diminish the content of the FINAL REPORT as outlined in the contract document for the project with KYTC. The final submittal should include the final report containing all information in the draft meeting minutes, information requested above, and all other documentation compiled by the team during the feasibility study. Failure to identify items either in these meeting minutes or comments should not be construed as an elimination of a task or requirement of the FINAL REPORT. The final document will address, summarize, and/or comment on all activities completed by the consultant team.

Electronic deliverables of the CADD drawings, base maps, aerial photography, Survey and Mapping should also be submitted with the FINAL REPORT.

The meeting concluded at approximately 1:35pm.

Copy, Diana Martin, Stefan Spinosa

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BURGESS & NIPLE

To: David Jones, P.E.
Chief District Engineer, District 6

Date: October 18, 2004

Attn: Kevin Rust, PE
TEBM for Pre-construction,
KYTC D-6

Subject: **FINAL** Meeting Minutes for:
Brent Spence Bridge
Constructability and Feasibility
Study Meeting, October 7, 2004

From: Herb Mack, PE
Project Manager, Burgess &
Niple, Inc.

By: Henry Osman, PE, PLS
Project Engineer, Burgess &
Niple, Inc.

Project Memorandum

Burgess & Niple, Inc.
220 Lexington Green Circle
Suite 110
Lexington, KY 40503
859 273.0557
Fax 859 273.3332

The principal consultant team members meet with KYTC and ODOT project leaders to preview the new "seven lane designs", currently in progress, and to get a status report regarding the November 1st delivery of the Preliminary Draft Report for the project. The meeting was held in the Covington offices of the Kentucky Highway Department District 6 at 1:30pm on Thursday October 7, 2004.

Attendees at the meeting were:

Kevin Rust	KYTC	kevin.rust@ky.gov
Mike Bezold	KYTC	mike.bezold@ky.gov
Jim Brannon	KYTC	jim.brannon@ky.gov
Diana Martin	ODOT	diana.martin@dot.state.oh.us
Stefan Spinosa	ODOT	stefan.spinosa@dot.state.oh.us
Richard Sutherland	American Consulting Engineers	rsutherland@ace-plc.com
Glenn Hardin	American Consulting Engineers	ghardin@ace-plc.com
Greg Sharp	American Consulting Engineers	gsharp@ace-plc.com
Jim Garrison	Burgess & Niple	jgarrison@burnip.com
Herb Mack	Burgess & Niple	hmack@burnip.com
Jody Barker	Burgess & Niple	jbarker@burnip.com
Henry Osman	Burgess & Niple	hosman@burnip.com

The following Final minutes from the meeting have been reviewed by the attendees. Comments received by October 15, 2004 have been incorporated into the final meeting minutes and made a part of the project record.

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On September 3, 2004 the consultant team was asked to publish a Preliminary Draft Report of the project by November 1, 2004 in order to facilitate an expedited consultant selection process for the next phase of the project. In addition, this Preliminary Draft Report is to include alignment alternatives using numbers of lanes increased from initial assumptions of five (5) lanes across the river, to seven (7) lanes.

The purpose of this October 7th meeting is to show the KYTC/ODOT leadership team a preview of the seven (7) lane alternative alignments in progress, discuss some of the ramifications of the increased footprint of the project, to reiterate the list of deliverables to be included in the Preliminary Draft Report, and verify that the consultant team is on track to deliver this report by the November 1 delivery date specified.

The Consultant team provided 1" = 200 foot scale plans of the five alternative alignments exhibiting the "seven lane" design. Each alternative was described by the consultant designer and the functional aspects discussed and compared to those of the previous "5 lane" design plans. Generally the consultant team believes that all five alternatives can continue to be viable alternatives using the seven lane design criteria. The alignment locations and most of the local accessibility is similar to the 5 lane scenarios. The increased width of the seven lane designs does increase the amount of disturbance to the existing improvements in the area. Most notably, the (round) Radisson Hotel building must be taken to accommodate the seven lane designs for alternates 4 and 5B. All affected buildings were clearly identified on the plans. After the meeting, copies of these preliminary seven lane design plans were given to KYTC and ODOT team members.

The following list of deliverables will be included in the Preliminary Draft Report.

Brent Spence Bridge
Feasibility and constructability
PRELIMINARY DRAFT REPORT
Deliverables

Documentation:
- Problem Statement
- Performance Measures
- Minutes of Meetings
- Resource Agency Documentation
- Summary documents of existing reports
- Bridge Inventory Schematic and Tech Summary
- Rail Road System Technical Summary

Reports:

- Environmental Overview
  - Appendices
    - Geotechnical
    - Cultural
    - HazMat/UST

Truck Diversion Study

Anderson Ferry Study

Traffic
- Summary
- Technical Memos

Fatigue Study

Alternatives Development Engineering
- Documents and Exhibits
- Development Workshop(s)
- Schematics
  - Alignments
  - Profiles

Executive Summary
- Schematics of Alternatives and CD Copy
  - Plan & Profile (showing the “final” configurations)
  - MOT
  - Construction Sequencing

Excluded from the PRELIMINARY DRAFT REPORT Deliverables but included in the DRAFT FINAL REPORT deliverables will be:

Right of way area and cost estimates of the “final” (seven lane) designs.
Construction cost estimates of the “final” designs.
Maintenance of traffic cost estimates of the “final” designs
The plan and profile exhibits of the “initial” (five lane) designs produced in conformance with the original contract would be included in an appendix to the Draft Final Report. Showing these early (five lane) designs would help demonstrate the path taken by the

design team in arriving at the “final” designs. The final (seven lane) designs demonstrate improvement scenarios for the I-75/I-71 corridor which are thought to be fully developed to the maximum number of lanes possible.

The Draft Final Report shall be delivered in .PDF format

The Draft Final Report is due to be completed In January of 2005

The meeting concluded at approximately 2:30pm.

Copy, Mark Willis

II. Summary of Existing Reports

I-71 Corridor Transportation Study

Technical Memorandum

I-71/I-75 Brent Spence Bridge Traffic Management Plan

Executive Summary

October 1997

Ohio • Kentucky • Indiana Regional Council of Governments

EXECUTIVE SUMMARY

Introduction

This report is the culmination of a study to develop a traffic management plan for the I-71/I-75 Brent Spence Bridge. The Brent Spence Bridge, an 8-lane double-deck truss bridge spanning the Ohio River between Covington, Kentucky and Cincinnati, Ohio, carries combined I-75 and I-71 traffic in Northern Kentucky. Immediately north of the bridge in Cincinnati, the interstate routes diverge. Under current conditions, the Brent Spence Bridge carries an average daily traffic of 133,000 vehicles. This represents 35 percent of all of the average daily river crossings in the Cincinnati - Northern Kentucky metropolitan area. The OKI traffic model predicts a 13 percent increase in traffic volumes to 150,000 vehicles per day by the year 2020. The Brent Spence Bridge is a critical link in the regional and national transportation system.

During the development of the I-71/I-75 Brent Spence Bridge Traffic Management Plan, the following points were considered:

- The impact on traffic of a partial closure.
- Potential for diversion to other bridges, mainly the Clay Wade Bailey Bridge.
- Diversion of I-71/I-75 traffic to alternative routes.
- Recommended modifications to the local street and traffic control systems.
- Examination of potential new linkages to the Clay Wade Bailey Bridge or a potential new bridge.

This report documents the study process and results.

Purpose of a Traffic Management Plan

The purpose of a traffic management plan is to provide local transportation officials and safety service personnel with a plan to deal with a variety of uncertainties that might befall a major bridge serving two major interstate routes. These uncertainties can range from minor accidents that cause short-term lane closures to major incidents that can precipitate long-term closure. Obviously, closure of all or a portion of the Brent Spence Bridge for whatever reason would cause inconvenience to the traveling public at best, and severe mobility problems and economic hardship for the Cincinnati-Northern Kentucky metropolitan area at worst. For such a vital structure, a traffic management plan or incident management plan can be a useful tool in mitigating those situations that arise during the normal life of the structure.

Routine maintenance activities fall under the category of "planned" incidents that usually require lane closures. Such maintenance activities have customized maintenance of traffic plans prepared in advance. Unplanned incidents can include severe weather events, earthquakes, traffic accidents, terrorist activities, and impact from vessels operating on the Ohio River. The duration of full or partial closure depends upon the severity of the incident. The traffic management plan is intended to address these unplanned incidents.

Study Methodology

Predictions of traffic conditions during full and partial closure of the Brent Spence Bridge were accomplished through the use of a traffic assignment model developed for use by the Ohio-Kentucky-Indiana Regional Council of Governments (OKI). The model was edited by the project team to examine alternative scenarios for the base year (1995) traffic and for future traffic projections in the year 2020. Transportation System Management (TSM) measures were included in the future year baseline model. In addition, select link analyses were used to determine trip origins and destinations across the bridge. This assisted in the evaluation of alternative diversion strategies and detour routes. Other local bridges -- the I-275 West Bridge, the Clay Wade Bailey Bridge, the John A. Roebling Bridge, the Taylor-Southgate Bridge, the L&N Bridge, the I-471 Daniel Carter Beard Bridge, and the I-275 East Bridge were considered as potential reliever routes for the Brent Spence Bridge.

Brent Spence Bridge at Reduced Capacity and During Closure

The traffic model predicts a reduction of 23 percent on Brent Spence Bridge during a partial closure. Even at half capacity, Brent Spence Bridge carries over 100,000 vehicles per day in the current year and an estimated 116,000 in 2020. Peak traffic conditions under a partial closure would extend several hours longer than under normal operating conditions. Under a partial closure scenario for Brent Spence Bridge in the current year, modeled traffic on the Clay Wade Bailey Bridge (the preferred alternate bridge) increases 149 percent.

In the event of a full closure of Brent Spence Bridge, traffic volumes on some of the other downtown bridges soar even though total river crossings decrease 14 percent due to the heightened level of congestion. Some travellers simply stay home or alter their path to avoid a river crossing. For a Brent Spence Bridge total closure in the current year, traffic on the Clay Wade Bailey Bridge is projected to increase 365 percent.

The ARTIMIS System

Travel in the Cincinnati-Northern Kentucky area will be enhanced by the implementation of the OKI Regional Traffic Management System (dubbed "ARTIMIS") in late 1997 or early

1998. ARTIMIS will be applied initially to I-71 and I-75 from a point south of I-275 in Kentucky to a point just north of I-275 in Ohio. The portions of I-275 connecting I-75 and I-71 in both Kentucky and Ohio, the two major non-interstate routes in Cincinnati -- the Cross County Highway and the Norwood Lateral, and I-471 will also be included in the system. The main objectives of this system are incident management (reducing the impact of incidents) and congestion management (for combating recurring congestion).

ARTIMIS will identify and monitor traffic incidents and congestion by using surveillance devices (such as closed-circuit television) and sensors (such as loop detectors and wide-beam radar detectors) placed at strategic locations throughout the highway system. Other sources such as cellular telephone calls, police dispatch, freeway service patrols, maintenance crew reports, and aircraft will also be used to identify incidents. The collected data will be routed to a Control Center in the I-75/Fort Washington Way interchange in Cincinnati. At the Control Center, operators will monitor the information and verify incidents as they are reported using remotely controlled cameras.

Once an incident is detected and verified, an operator will contact the appropriate police, fire, ambulance, rescue, HAZMAT, and towing service response teams as needed. The operator will then activate an advisory system consisting of Highway Advisory Radio (HAR) and changeable message signs (CMSs) to notify the traveling public of congestion or an incident and to recommend appropriate action.

Once fully operational, ARTIMIS will be a powerful tool for traffic management. Fifty-three percent of the traffic originally destined for the Brent Spence Bridge on northbound I-71/I-75 can be warned of an incident by ARTIMIS and detoured using I-275 and I-471. A majority of the traffic approaching Brent Spence Bridge from the north on I-71 or I-75 can be warned of an incident by ARTIMIS and given a suggested detour route to follow.

Detour Criteria and Evaluation

The ARTIMIS system is designed to divert I-71/I-75 traffic to the I-47I Daniel Carter Beard Bridge during incidents on the Brent Spence Bridge. However, not all of the traffic wishing to cross the river via the Brent Spence Bridge can be alerted by the ARTIMIS system. This includes some of the traffic that is generated south of the Norwood Lateral in Ohio and traffic that enters the system north of the I-275 interchange on I-71/I-75 in Kentucky. The Clay Wade Bailey Bridge was selected as the main alternate route for diverting this traffic from the Brent Spence Bridge. Detour paths between the I-71/I-75 system and the Bailey Bridge were identified and evaluated to meet the goals of:

- minimizing the length of the detour
- avoiding congested portions of the cities
- selecting routes to minimize disruption to the local street system and adjacent

businesses

- controlling access to the maximum extent possible to maintain detour traffic flow
- providing city street detours when closures are needed to favor through travel for I-71/I-75
- minimizing permanent construction by using signing, temporary striping, barricades, and flaggers
- identifying detours with sufficient existing capacity

Separate alternative detours were developed for northbound and southbound traffic, which were further divided into detours for traffic coming from and going to I-71 and I-75 in Ohio. Four alternate detour routes for I-75 northbound, two for I-71 northbound, five for I-75 southbound, and two for I-71 southbound were developed for evaluation.

Recommendations

The recommended detour routes for each of the travel directions for I-75 and I-71 are illustrated in the attached figures.

I-75 Northbound	Figure ES-1
I-71 Northbound	Figure ES-2
I-75 Southbound (Option "A")	Figure ES-3
I-75 Southbound (Option "B") *	Figure ES-4
I-71 Southbound	Figure ES-5

* (Option B included at recommendation of City of Cincinnati Traffic Engineering)

For each of the recommended detour routes, existing and proposed intersection diagrams were developed at each intersection along the route. The proposed layout for each intersection presents one way to reconfigure the intersection to allow for preferential and nearly continuous movements for rerouted I-71/I-75 traffic. This allows motorists to reconnect to the interstate, I-71 or I-75, as quickly as possible and lessen the congestion in downtown Covington and Cincinnati.

The Recommendations chapter of this report was structured to be a stand-alone document for use by local safety service personnel and transportation officials in the event of an incident that closes or severely reduces the traffic capacity of the Brent Spence Bridge. The effect of the proposed Fort Washington Way Reconstruction on detour routing was discussed for each of the recommended alternatives. Potential new linkages to the Clay Wade Bailey bridge were also examined and discussed.

Long Term Action Plan

Transportation systems are dynamic. What works well today may not be feasible in ten or even five years from now. Periodic adjustments to this plan are expected to be needed as urban land use changes and traffic patterns change due to construction or rehabilitation. The proposed reconstruction of Fort Washington Way is one example of a project that can change the feasibility of a proposed detour route. The potential detour routes identified in this report should be reviewed at least annually by a panel of transportation and safety service officials from both Kentucky and Ohio. The purpose of the periodic reviews is to determine the continued feasibility of the emergency response plan and to discuss the details of setting up, maintaining, and dismantling the detour routes. The emergency response team may also wish to recommend capital improvements to city streets, such as permanent signing, along the recommended detour routes.

The logical repository for the Brent Spence Bridge detour plans is the ARTIMIS system. Although the ARTIMIS system primarily utilizes the Interstate system to reroute traffic during incidents, and approval from local officials would be needed before detouring interstate traffic to the local street system, the recommended detour routes identified in this report should be included in the operations plan for the ARTIMIS system. Implementation of any detour routes identified in this report would be an integral part of the regional traffic management response.

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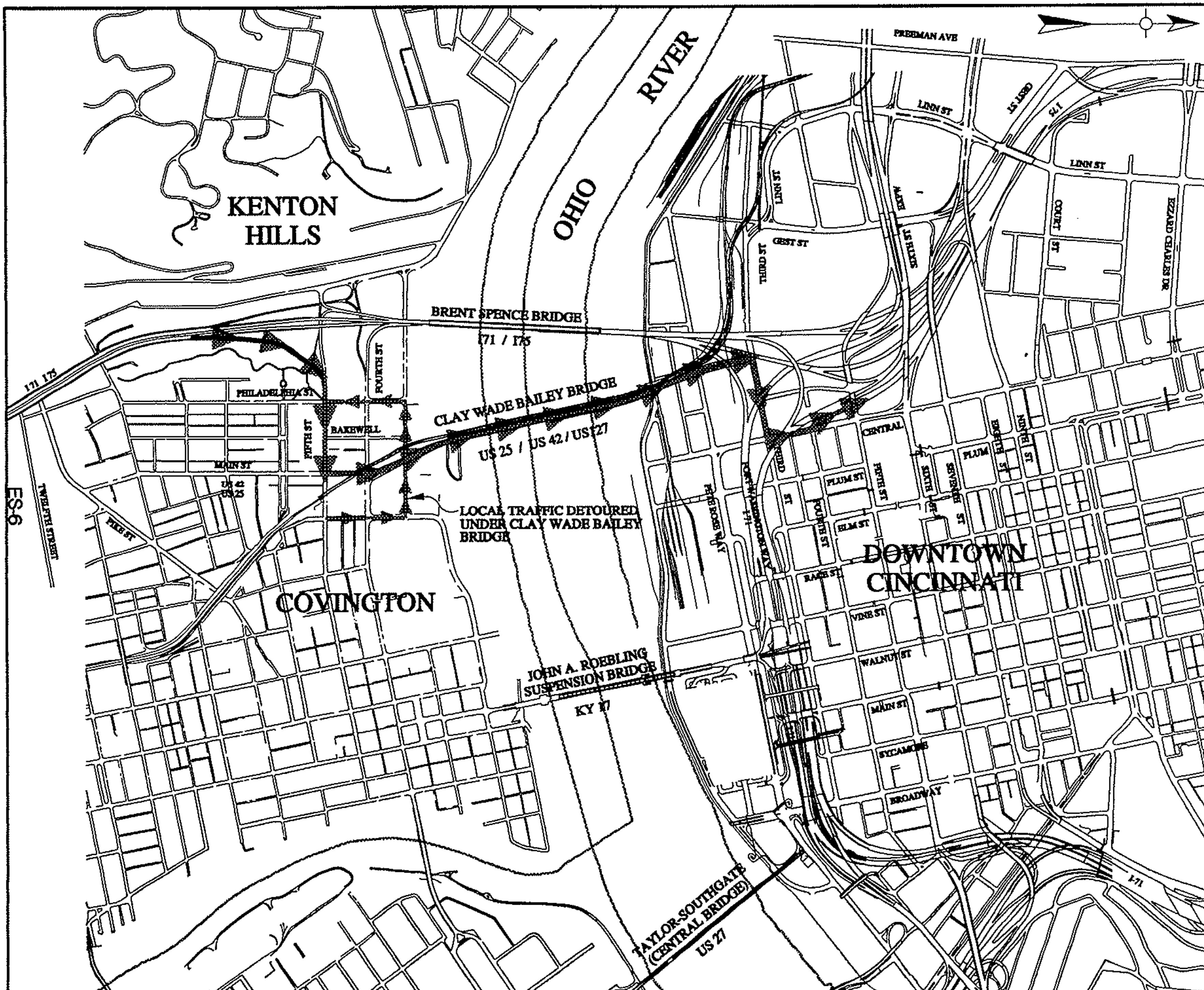

Figure ES-1

I-71/I-75 BRENT SPENCE BRIDGE TRAFFIC MANAGEMENT PLAN

I-75 Northbound Recommended Detour Route N-2

Scale: None

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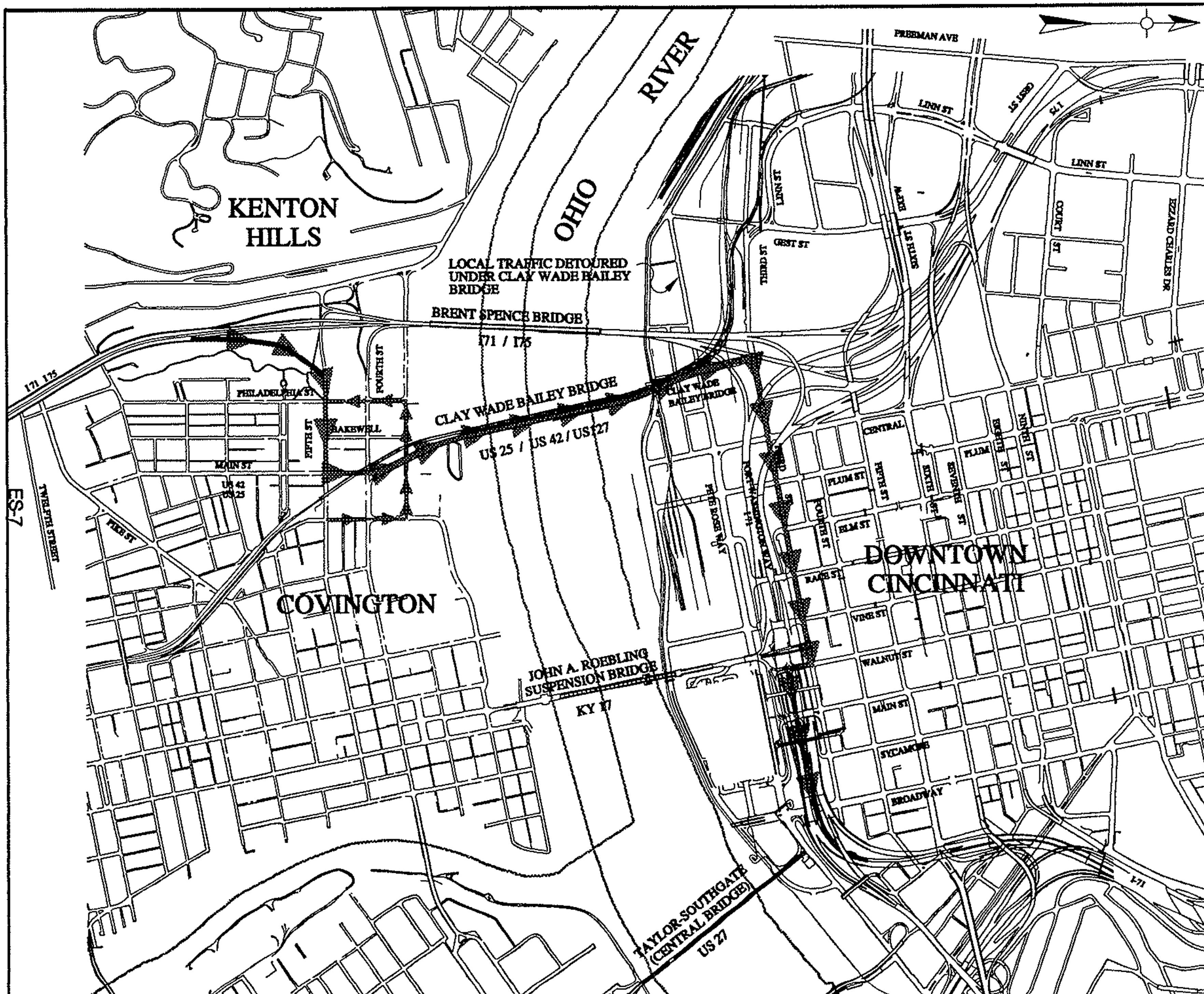

Figure ES-2

I-71/I-75 BRENT SPENCE BRIDGE TRAFFIC MANAGEMENT PLAN

I-71 Northbound
Recommended
Detour Route E-2

Scale: None

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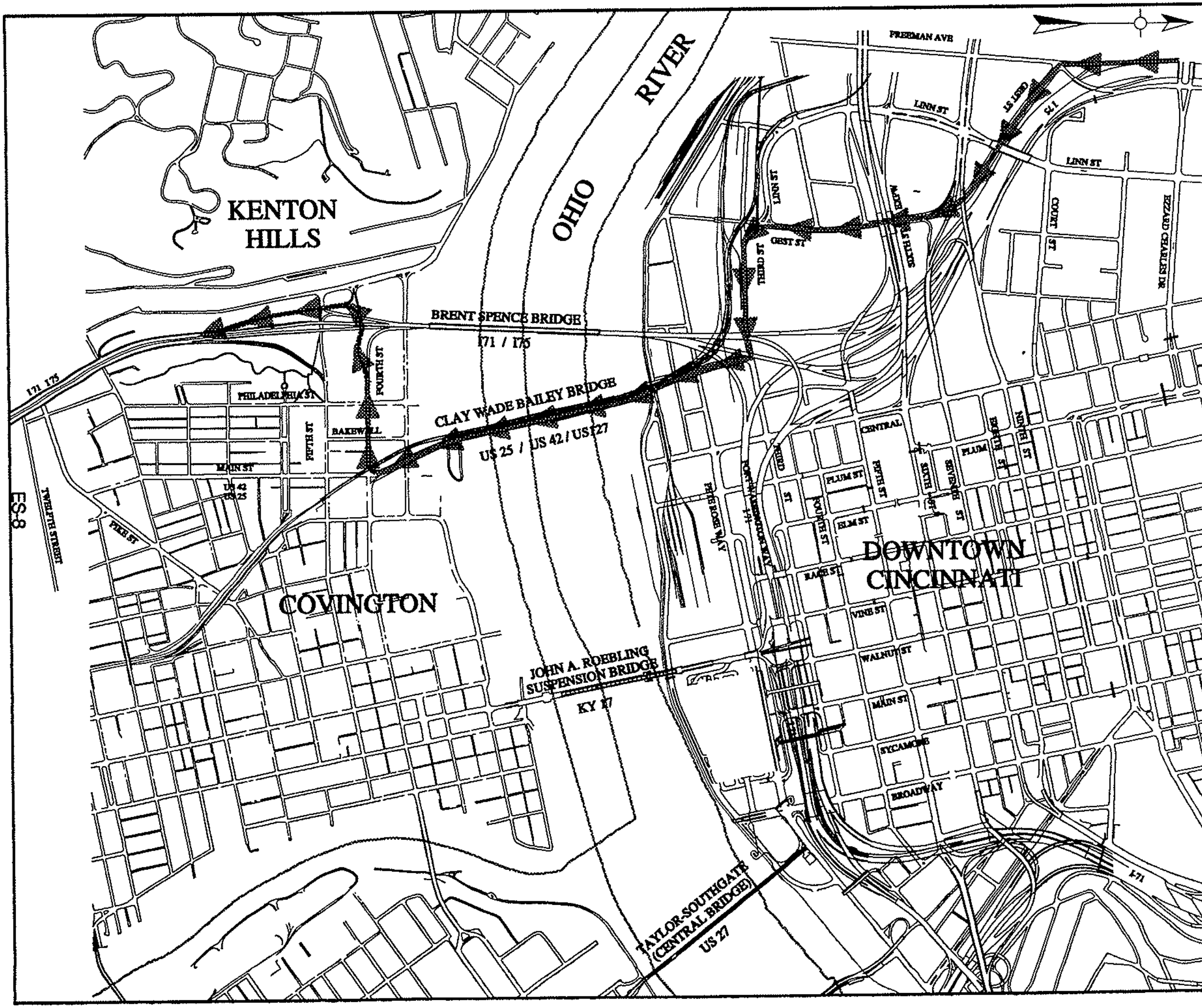

Figure ES-3

I-71/I-75 BRENT SPENCE BRIDGE TRAFFIC MANAGEMENT PLAN

I-75 Southbound Recommended Detour Route S-2 (Option "A")

Scale: None

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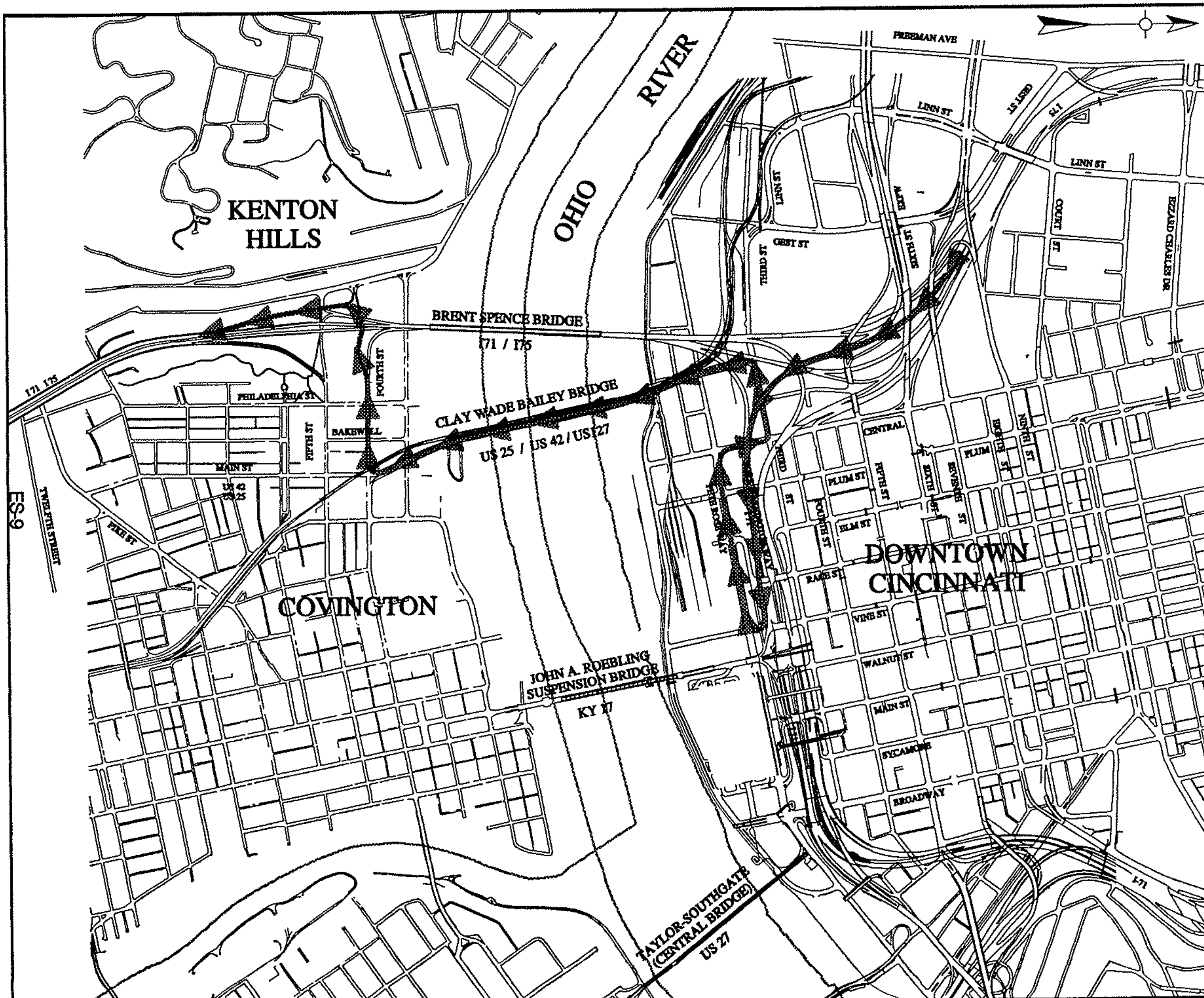

Figure ES-4

I-71/I-75 BRENT SPENCE BRIDGE TRAFFIC MANAGEMENT PLAN

I-75 Southbound Recommended Detour Route S-5 (Option "B")

Scale: None

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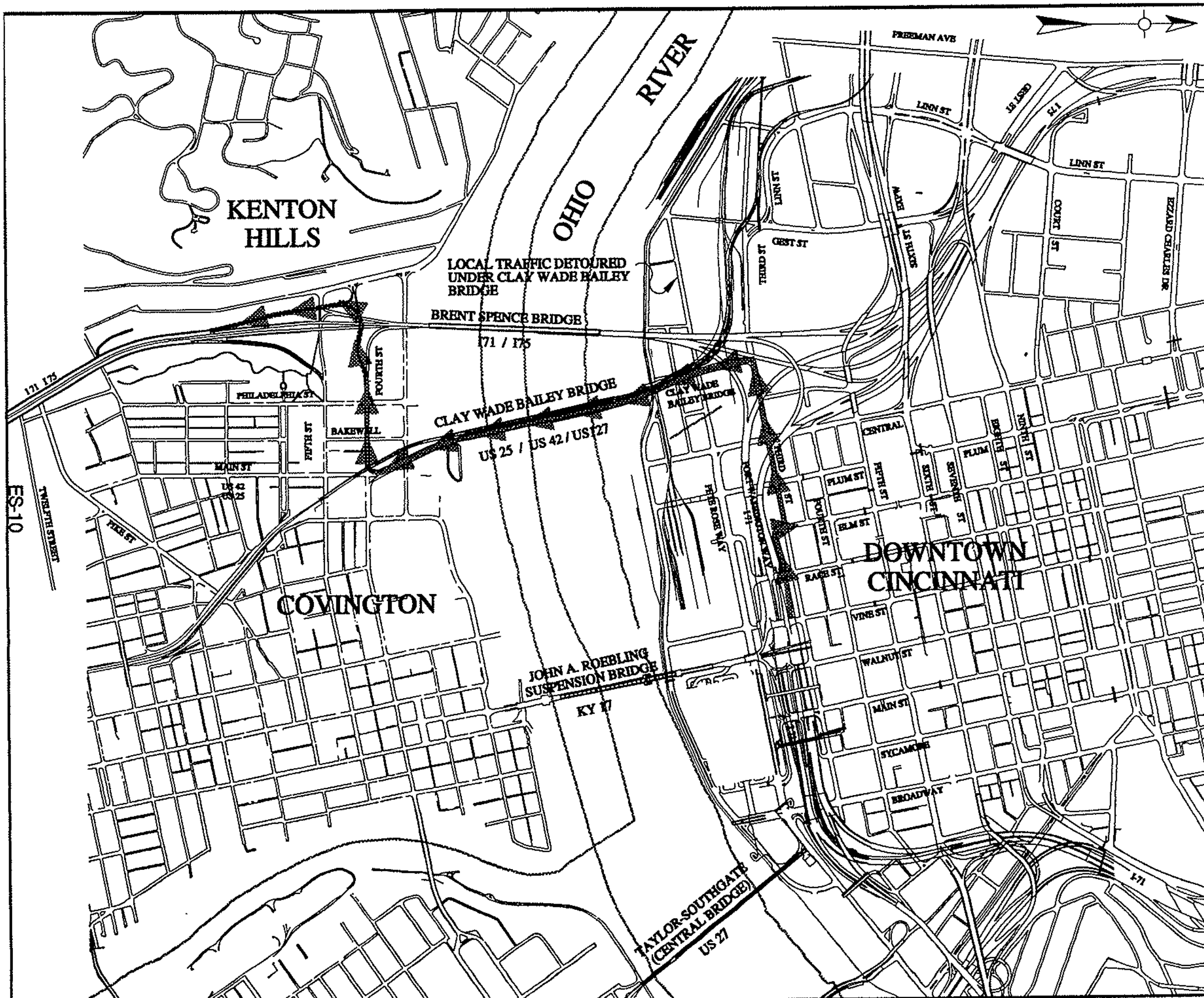

Figure ES-5

I-71/I-75 BRENT SPENCE BRIDGE TRAFFIC MANAGEMENT PLAN

I-71 Southbound Recommended Detour Route W-1

Scale: None

Technical Memorandum:

I-71/I-75 BRENT SPENCE BRIDGE SCOPING STUDY

Ohio-Kentucky-Indiana Regional Council of Governments

Prepared for

Ohio-Kentucky-Indiana Regional Council of Governments

Prepared by

Burgess & Niple, Limited
BRW, Inc.
KPMG Peat Marwick LLP

The preparation of this document was financed cooperatively by the United States Department of Transportation, Federal Transit Administration, the Ohio Department of Transportation, the Kentucky Transportation Cabinet, and county and local governments in the I-71 Corridor. The opinions, findings, and conclusions expressed are those of the OKI Regional Council of governments and are not necessarily those of the U.S. Department of Transportation.

September 1998

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APPENDICES

EXECUTIVE SUMMARY

The Brent Spence Bridge is a vital element of the interstate system serving national, regional, and local travel. The bridge carries both Interstate (I)-71 and I-75 over the Ohio River, facilitating passenger and freight movement through and within the region, and providing access to downtown Cincinnati and Covington.

Built in 1963, total length of the bridge is 1,737 feet and its longest span is 831 feet. Although this double-deck bridge was designed to carry three 12-foot travel lanes in each direction, it is currently operating with four 11-foot travel lanes in both directions in order to better accommodate increasing traffic levels. Shoulders were removed in order to provide the fourth lane.

The 1995 estimated average daily traffic was 132,757 vehicles. The year 2020 traffic forecast is approximately 175,000 vehicles per day. A new bridge with an additional travel lane in each direction is anticipated to attract almost 182,000 vehicles per day. The bridge currently operates at Level of Service (LOS) F during peak travel periods. Anticipated traffic growth will only worsen this condition.

The high traffic volumes and substandard design have resulted in a very high accident rate on the bridge and its approaches. The total accident rate on the bridge exceeds the Kentucky interstate rate by 750 percent.

The 1998 National Bridge Inventory gives the bridge a sufficiency rating of 73 on a 100-point scale. The Inventory also evaluates the bridge status as "functionally obsolete." The Bridge Condition Report completed in 1996 concludes that "the current projected remaining fatigue life is liberally estimated at less than 12 years." Using an alternate analysis technique, the same report indicated that the safe life could extend to 16 years.

Because of the poor level of service, safety considerations, and excess demands being placed upon the bridge, it is appropriate that a replacement strategy be developed for the bridge.

A series of alternatives were developed and evaluated as part of the replacement strategy. These alternatives included No-Build, Rehabilitation, and various Build Alternatives. A screening process was applied to an initial range of nine alternatives. The I-71 Corridor Transportation Study

Oversight Committee reviewed the screening analysis and agreed to drop several preliminary options because of constructibility and traffic operations issues. In addition, the Committee recommended the combination of the No-Build and Rehabilitation options, as a major rehabilitation would be required in order to ensure any reasonable service life for the bridge.

Alternatives that were analyzed in detail are summarized below. The characteristics of the alternatives are summarized in Table 1.

No-Build Alternative

Alternative 2 represents the combination "no action" No-Build (formerly Alternative 1) and Rehabilitation of the Brent Spence Bridge (Alternative 2). This combined alternative would include a substantial rehabilitation of the existing bridge in order to prolong its effective life. Some disruption of service would occur as the bridge deck is replaced in sections. The current four-lane configuration would be continued with no shoulders. Approaches to the bridge from each side of the river would remain unchanged. The cost for this rehabilitation would be approximately $7 million. This alternative was rejected by the Oversight Committee because it would not operate at an acceptable level of service.

Build Alternatives

The geometric design used for development of the alternatives follows standard interstate freeway design practices. Alternatives include several configurations totaling five travel lanes in each direction. Travel lanes and shoulders are 3.6 meters (12 feet) for the bridge and approaches. As described below, none of the alternatives carry opposing traffic on the same bridge deck, so there are no medians. Lane configurations refer to the number of lanes on each deck.

Alternative 3 would replace the existing four-lane double-deck facility with a five-lane double deck bridge on the same location with approaches modified to accommodate the additional lane. This alternative was not acceptable because of the extended time period in which there would be no I-71/I-75 service at that location as the old bridge is removed and a new bridge constructed.

Table 1

Brent Spence Bridge Alternative Evaluation Matrix

Alternative	Traffic Impacts (Year 2020)						Capital Costs (millions $ 1998)		Annual Delay Savings[2] (millions $ 1998)	Net[3] Benefit/ Cost	Ease Of Maintenance (1-10 Scale)	Displacements	Visual (1-10 Scale)
	V/C Ratio PM Peak		Backup (Miles)		Construct Impacts	Detour Flexibility	Total	Annual[1]					
	NB	SB	NB	SB									
2.) No-Build/Rehabilitate Bridge (4 Lanes)	1.10	1.15	0.72	1.10	major	none	7	.84	N/A	N/A	5	0	5
3.) Replace Bridge on Same Site, Double Deck (5 Lanes)					major	none	34	--	4.12	--	--	--	--
4.) Replace Bridge on New Site, Double Deck (5 Lanes)	0.94	0.96	0.00	0.00	minor	none	119	9.60	4.12	.47	7+	6	6+
5.) Replace Bridge on New Site, Single Level (5 Lanes)					minor	major	143	11.59	4.12	.38	8+	8	7+
6.) Additional Bridge, Rehabilitate Existing Bridge (3/2 Lanes) I-75, I-71	1.00 0.94	0.90 1.16	0.00 0.00	0.00 1.08	minor	Major	107	9.05	2.51	.31	4-	6	3
6a.) Additional Bridge, Rehabilitate Existing Bridge (3/2 Lanes) No 4th/5th Street Ramps I-75, I-71	1.00 0.76	0.90 1.04	0.00 0.00	0.00 0.28	minor	Major	N/A	--	--	--	--	--	--
7) Additional Bridge, Replace Existing Bridge (3/2 Lanes) I-75, I-71	1.00 0.94	0.90 1.16	0.00 0.00	0.00 1.08	minor	Major	116	--	--	--	--	6	--

[1] Includes maintenance cost for rehabilitated bridge
[2] Preliminary, under review
[3] Net of No-Build costs

Alternative 4 would replace the existing bridge with a new five-lane double deck bridge immediately downstream from the existing bridge. Approaches would be widened and realigned to service the new bridge location. This facility would operate at Level of Service E during the afternoon peak hour in both the northbound and southbound directions. Five commercial properties would be impacted with this option. The capital cost for the bridge and approach modifications is $119 million.

Alternative 5 would replace the existing double-deck bridge with single-level five-lane decks flanking the existing bridge. The upstream deck would operate northbound and the downstream deck would operate southbound. The approaches would be widened and realigned to service the new bridge locations. The bridges would operate at Level of Service E during the afternoon peak hour in both the northbound and southbound directions. Eight commercial properties would be displaced with this option. The capital cost for the bridge and approach modifications is $143 million.

Alternative 6 would make use of a rehabilitated Brent Spence Bridge, operating as an I-71 bridge with two lanes on each deck. A parallel double-deck bridge would be constructed immediately downstream which would provide three travel lanes in each direction for I-75. The approaches would be modified to service the two independent bridges. During the initial development of alternatives, it was determined that there was not sufficient space to provide connections from each of two, two-directional bridges to both I-71 and I-75 in Ohio.

This configuration results in separate northbound and southbound travel movements for I-71 and I-75. Traffic is projected to operate at LOS E for three of the four travel movements during the afternoon rush hour. Southbound traffic on the I-71 bridge operates at LOS F, largely due to the limited freeway ramps from downtown Cincinnati to the Brent Spence Bridge. The Fort Washington Way project adds a northbound ramp from I-75 to downtown; however, the reverse movement is not possible. All southbound returning traffic must use I-71 to access the Brent Spence Bridge.

This alternative would impact six commercial properties. The capital cost for the bridges and approach modifications is $107 million.

Alternative 6a was developed in order to mitigate the southbound traffic problem inherent in Alternative 6. This was achieved by closing the fourth and fifth Street ramps in Covington, forcing local downtown-to-downtown traffic off the Brent Spence and on to local bridges. This resulted in an improvement in-traffic flow, but did not reduce congestion to LOS E.

This alternative was developed primarily for informational purposes. It was rejected because it eliminated existing freeway access opportunities in Covington. In addition to diverting downtown-to-downtown traffic, it also created circuitous travel for longer trips wishing to enter or exit the freeway in downtown Covington.

Alternative 7 is also a variation of Alternative 6. Rather than rehabilitating the Brent Spence as an I-71 bridge, the Brent Spence would be replaced on site with a new two-lane double-deck bridge. The option was found to be less attractive than simply rehabilitating the existing bridge. It was rejected by the Oversight Committee because Alternative 6 was less costly and had significantly less traffic impact during construction.

Preferred Alternatives

The recommended alternatives are Alternatives 4 and 5. These options both provide a satisfactory Level of Service (E) in each of the travel directions during the afternoon peak hour, which is the most congested travel period. Alternative 5 is preferred because its single-deck configuration may offer some advantage compared to double-deck with respect to maintenance and aesthetics. Alternative 4 has the advantage of a lower capital cost ($143 million vs $119 million). These alternatives are depicted in Figures 1 and 2, respectively.

Project Strategy

There is no single index that can be used to determine when to replace an existing bridge that has not reached the end of its useful life. Several characteristics of the Brent Spence Bridge suggest, however, that development of a replacement strategy should begin in the near future.

First, the bridge design has been compromised in order to add traffic lanes. Even with the additional lanes, traffic volumes significantly exceed capacity. Peak hour congestion will only worsen as traffic levels continue to increase. In addition to reducing the quality of service on the bridge, the increased traffic volumes have placed unanticipated stress on the bridge, resulting in premature deterioration. Over the next several years, the existing bridge will require increasing levels of maintenance.

It is important to recognize that the environmental, design, and construction aspects of a major bridge replacement can require 7 to 10 years to accomplish. The funding program may further extend the implementation process. Based upon the long lead time required for this type of project, it is appropriate that an implementation strategy be developed quickly if there is an interest in replacing the bridge within the next decade.

Implementation of a Brent Spence funding program will have a significant impact on local and state transportation budgeting. In an era of limited funds, decisions must be made at various levels regarding the relative importance of any bridge replacement with respect to other local or statewide transportation projects with which it may compete for funds. This process can and should begin in the near future so that a proposed schedule can be developed to advance the project.

The federal funding situation is complex and may have a significant impact on a Brent Spence schedule. Although discretionary bridge funds are available through Federal Highway Administration (FHWA), it is likely the project cost will require an earmark in the existing transportation bill or its successor. The earliest the existing bill could be modified would be the midterm correction, which may occur in fiscal 2001. If a correction does not occur, no earmark would be possible until the next transportation authorization bill that will not occur until the end of fiscal 2003.

If significant federal funding is desired, it would be prudent to continue project development activities so that preliminary engineering and an environmental impact statement can be completed prior to congressional action on an earmark. Such activity would (1) provide more detailed project information, (2) advance the project technically so that it is closer to completion, and (3) demonstrate local commitment to the project. The major risk with this approach is the 3-year "shelf life" of an environmental impact statement, which may expire if funding issues delay the project.

Additional efforts could focus upon building political support for the project at the local, state, and national levels. This project is unique in that it directly involves two states, and potentially impacts a number of others. Each state which benefits from commerce using I-75 may have a stake in the replacement of the Brent Spence Bridge. If these forces could be martialled, a substantial support group could be established to pursue federal funding.

FIGURE 1

PREFERRED ALTERNATIVE A:
REPLACE BRIDGE ON NEW SITE
(SINGLE DECKS)

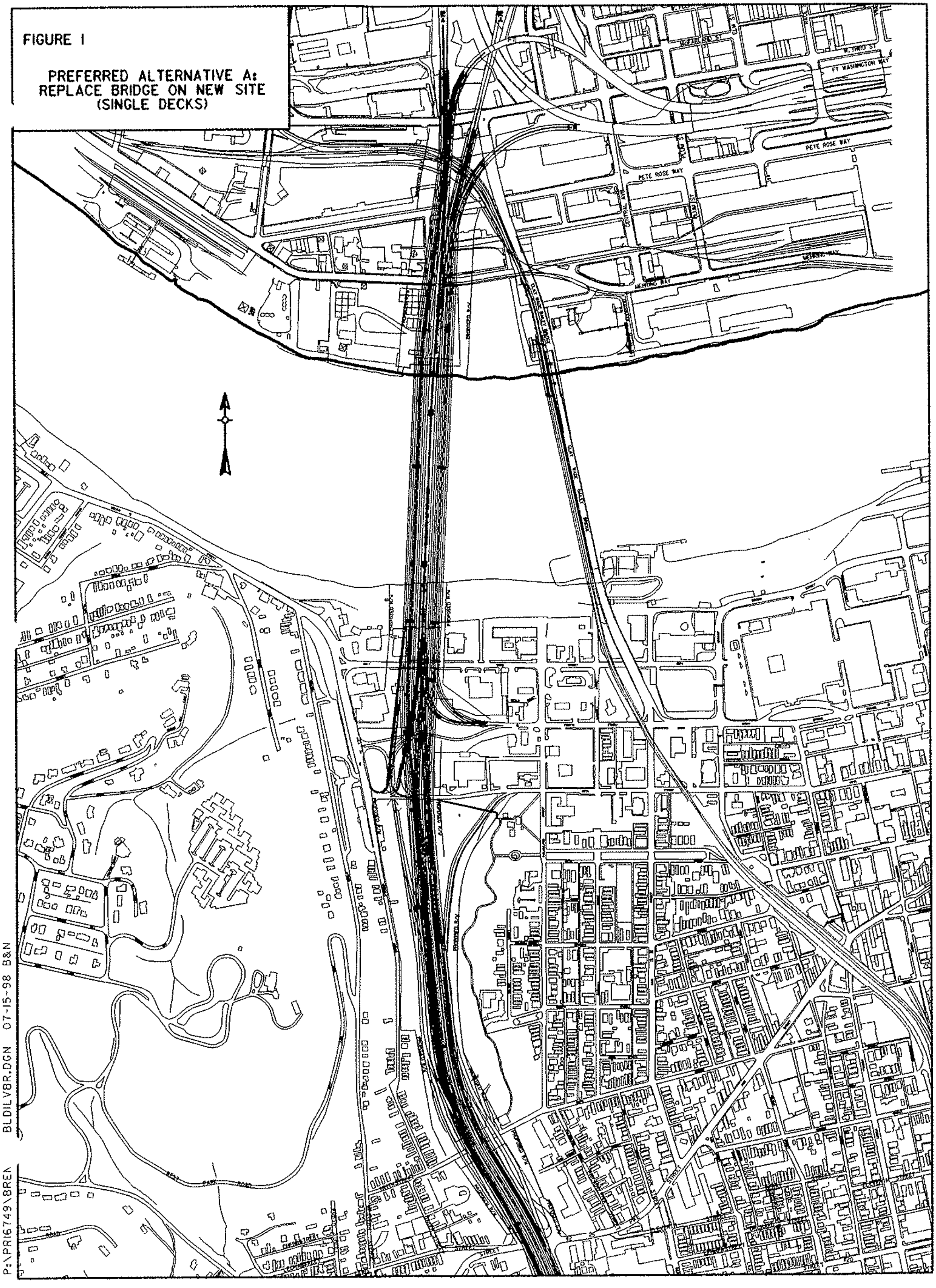

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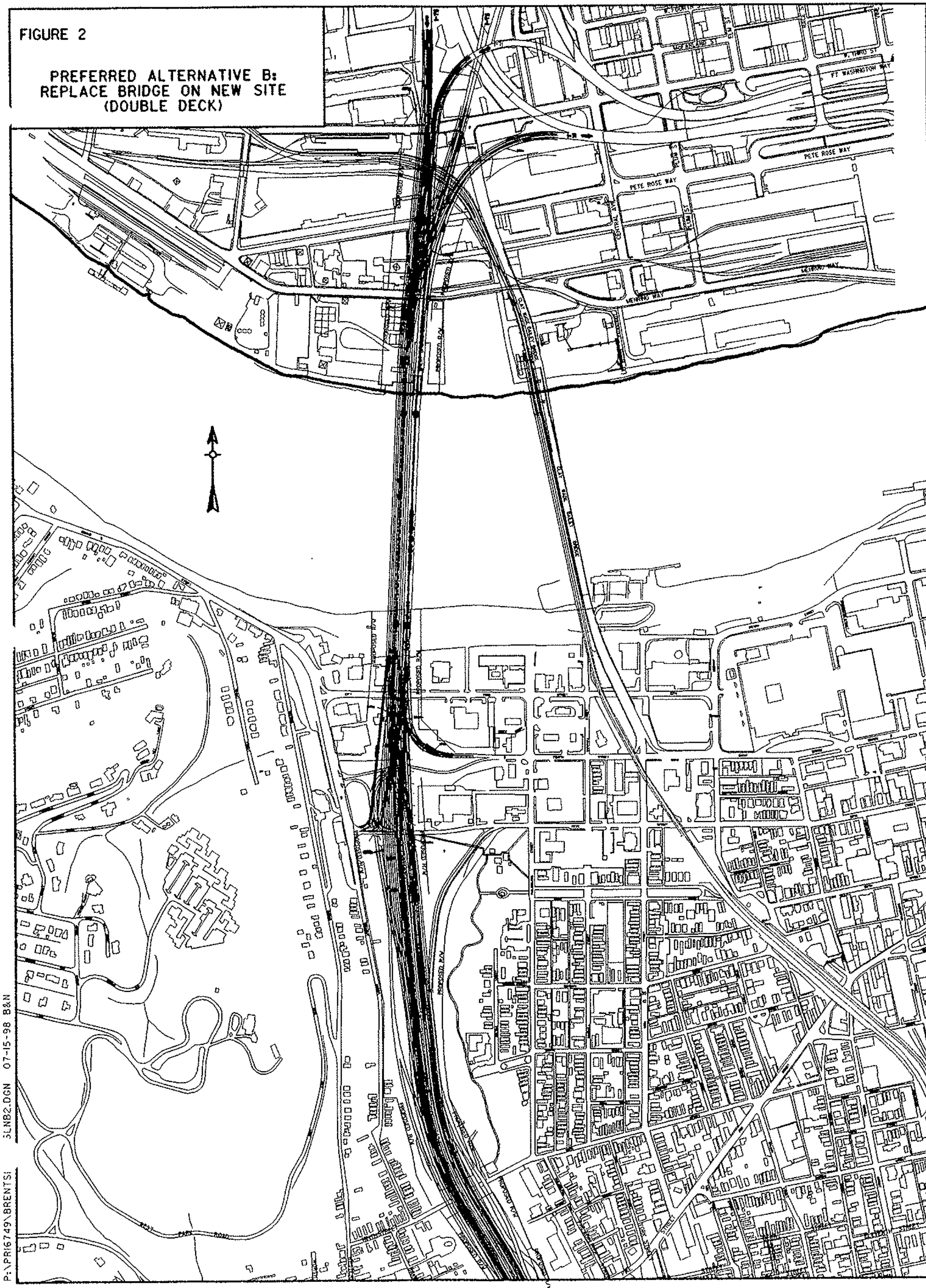
FIGURE 2

PREFERRED ALTERNATIVE B:
REPLACE BRIDGE ON NEW SITE
(DOUBLE DECK)



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In summary, state and local decisions must be made regarding the relative importance of this project and the willingness to provide financial and political support. These efforts should recognize the technical steps and procedural efforts necessary to advance the project as funding is available. The sooner these activities begin, the greater the flexibility in shaping and implementing a bridge-replacement program.

III. Bridge Inventory

BURGESS & NIPLE

Mr. Darrell Dudgeon, PE
Division of Operations
Kentucky Transportation Cabinet
State Office Building
Frankfort, KY 40622

Re: Statewide Fracture Critical Structure Inspection – Brent Spence Bridge

September 4, 2001

Dear ~~Mr. Dudgeon~~ Darrell,

Burgess & Niple, Limited
220 Lexington Green Circle
Suite 110
Lexington, KY 40503
859 273.0557
Fax 859 273.3332

On April 2, 2001, Burgess & Niple, Ltd. completed the Fracture Critical Inspection of the Brent Spence Bridge (I75) over the Ohio River in Kenton County, Kentucky, Bridge No. MP-059-0075-B46. The inspection included the main (through-truss) spans, and the steel pier caps, piers and bearing of the Kentucky approach up to the abutments, including ramps H and B. The total bridge length inspected is 2951 feet (main truss spans are 1,736.5 feet).

Most of the components in the truss spans were accessed using bridge climbing techniques developed by B&N to minimize traffic disruption. The floorbeams and floorbeam connections supporting the upper deck through the truss spans were inspected using a manlift at night, with traffic control set up in conformance with the MUTCD. The exterior of the steel pier caps in the Kentucky approach spans were also accessed in this manner. The interiors of the pier caps were accessed from the ground with a manlift. A manned safety boat was provided while inspectors worked over the river.

The inspection included arm's length inspection of:

- All fracture critical members of the trusses,
- All bearings and tops of piers and abutments within the scoped limits of inspection,
- Areas where significant problems were found during previous inspections,
- All floorbeam connections to the trusses,
- Floorbeams located under expansion joints, and
- The interiors and exteriors of all steel pier caps in the Kentucky approach structure.

The remainder of the bridge components were inspected in sufficient detail to complete the KTC Form TC71-118.

SUMMARY OF FINDINGS

I. Alignment-Related Deficiencies in the South Approach Spans

In the Kentucky approach spans, several unusual deficiencies were noted. These are related to structural alignment and the manner in which components of the south approach spans fit together. They include the following:

1.) Several of the pin bearings of the lower deck stringers are gapped. Some sole plates are lifted up off of the pins and only contact the pins when a heavy load passes over. This is most noticeable at the south lower deck abutment, among other locations (Photo 1). At the piers for the H ramp, some of the rockers are lifted up off of the masonry plates by as much as ¾ inch of pack rust (Photo 2).

    Included with this report is a framing plan of the lower deck approach spans locating the gapped bearings. Typically, the gapped bearings have heavy fretting corrosion and rust staining from the pin to the top of the pier. Those identified as not bearing were moved by hand, or it was visually evident they had lifted from the masonry plate. In some cases the gap between the rocker and masonry plate was filled with pack rust. Several other bearings had fretting corrosion staining indicating movement although they could not be moved by hand. These bearings are identified on the framing plan as "possibly not bearing 100%."

    This condition was not observed in any of the upper deck bearings.

2.) The bearings for the upper deck girders at pier UD12 are rocked inconsistently as follows, from 1 to 9 (left to right facing north): 1° S., 0, 0, 10° N., 6° N., 7° N., 5° N., 5° N., and 7° N. The bearings for lower deck girders at pier LD16 are also rocked inconsistently, with the bearings for girders 1 through 6 rocked 3° N. and the bearings for girders 7 through 9 rocked 1° S. These measurements were taken at a temperature of approximately 45° F. Similarly, the bearings for the lower deck girders at pier 4 and pier LD15, were rocked inconsistently.

3.) Related to the lifting of the bearings, there are cracks in some stringer diaphragms of the lower deck approach spans. The most severe is a 13-inch crack in the diaphragm between stringers 4 and 5 at the south lower deck abutment – nearly the full depth of the diaphragm (Photo 3).

4.) On the south side of the pier cap at Pier 7, the stringer positions on their sliding seats are inconsistent, and the compression seal has fallen (Photos 4 and 5). Girders 1 through 8 are slid south ¾", ¼", ½", ¾", ½", ¾", 1-½", and 1-¾", respectively. Closure of these gaps is blocked by debris and the fallen seal. The seal has fallen because the deck joint (between girders 4 and 8) has spread farther than the compression seal was intended to span.

5.) On the south side of the pier cap at Pier 4, there is also some inconsistency in the positions of the girders on the sliding seat connections. Girder 1 has slid south 3/16 inch, girder 2 is centered on the seat, girder 3 has slid north ½ inch. The remaining girders have slid to the north. These measurements were taken at a temperature of approximately 50°F. It should be noted that cable seismic retrofit connections are present at this pier and at pier 7 (can be seen in photos 4 and 5), so there is no danger of the girders sliding off of the seats. These observations are included to document the extent of the misalignment of the steel framing in the south approach spans.

6.) There is a noticeable sag in the girders between Abutment H3 and Pier H2.

It should be noted that no evidence of shifting or settlement was visible in the piers or abutments. The origins of these misalignments seem to be due to the deck replacement and widening that took place in 1985. Based on accounts from personnel of the Kentucky Transportation Cabinet and Intech Contracting who were present at the time the deck was widened, a sudden realignment of the floor system took place when the dead weight of the old deck was removed. Apparently, either due to improper sequence of work or the stringers not being properly re-seated before the new deck was cast, some permanent misalignment of the lower deck was introduced at that time.

II. Deficiencies in Pier Caps of South Approach Spans, Upper Deck

The pier caps exteriors were in generally good condition. However, several deficiencies were found inside the pier caps. Several new cracks were found inside the pier caps. Remedial measures taken for previously noted cracks were observed. Our significant observations include:

- The typical condition inside the pier caps is as follows: The intermediate stiffeners are welded to the top flange plate. This is the location where most of the cracks are occurring. The diaphragms are only welded to the web plates of the cap and are not rigidly attached to the top flange plate. The top coat of paint is peeling throughout the interior of the cap. There are bird nesting materials in end compartments. Except for the cap at Pier IV, the interiors are dry inside with no sign of water entering cap. There is some surface corrosion on all plates in the end compartments. In most of the caps, regular 3-inch diameter burn circles are visible in the paint on the top flange where shear studs were welded onto the caps. There are thick splice welds in web plates near midspan. Generally, there were no tack welds or stitch welds or backing bars on the web or flange plates. The caps have pronounced vibration and deflection under live load.
- In the pier cap at Pier IV, there are mislocated holes in the north web plate between diaphragms 2 & 3, with corrosion on web plate from water entering the holes (Photo 6). Nuts and washers are tack-welded to the top flange between diaphragms 2 & 3. A bolt has fallen through the hole in top flange between diaphragms 5 & 6. Much debris from corrosion on the bottom flange is typical throughout. There is a 2 1/8 inch crack in top of the north web weld, west face of diaphragm 7. Between diaphragms 6 & 8 several washers are separating from the top flange, cracking tack welds. There is water entering the cap at unused and mislocated holes just on either side of diaphragm 9. There are tack welds between the south web plate and the top flange in the east end compartment.

- In many of the caps, such as Pier Cap 1, there are bars placed between some stiffeners during fabrication. Typically these bars were attached to the stiffeners with tack welds which have since broken.
- In Pier Cap 2, the welds on the stiffener between diaphragms 4 & 5 are very irregular. One section of weld completely misses the north web plate. In general, the welds to the flange stiffeners of the diaphragms are very irregular and sloppy in this cap, with undercutting of the web plates in several locations. At diaphragm 4, on the face, the flange stiffeners are fillet welded to the north web plate on one side only. At diaphragm 1, on the north web plate, there is an unused hole, but it does not appear to be leaking.
- In Pier Cap 3, the tops of stiffeners 7N and 7S have been rewelded to the top plate to repair the previously noted cracks, and coated in new paint. In most steel pier caps, the paint is not well adhered to the welds. Exposure of the weld metal has not yet resulted in significant corrosion, except in Pier IV.
- In Pier Cap 4, diaphragm 2 has marks at the top from previous inspection, but no apparent crack. Diaphragm 5 has a 1-5/8 inch crack at top of weld to the south web plate, west face. The crack shows 1 inch long on the east face (Photo 7). A weld intended to connect the south stiffener between diaphragms 4 & 5 to the web plate only engages the web plate, missing the stiffener (poor welding). The north stiffener between diaphragms 5 & 6 has a small ½ inch crack across the very tip of the weld. Diaphragms 7 & 8 and the stiffeners between them are marked and scraped from a previous inspection, but there is no apparent crack.
- In Pier Cap 7, the welds at the 2N and 2S stiffeners have been welded over. There was a suspicious paint crack on the seal weld of stringer 4 to south web plate. Magnetic particle testing did not indicate a steel crack.
- In Pier Cap 1, there is a poor weld from the outside lateral plate. The welding undercut the base metal in the top flange plate at diaphragm 5, on the west side.
- Pier Caps 5, 6, 8 had no atypical deficiencies.

III. Other Deficiencies in Truss Spans and South Approach Spans

The following is a summary of the other significant findings resulting from the fracture critical inspection:

- The previously noted cracks in the angle tees which connect the top flanges of the lower deck floorbeams to the truss were confirmed on floorbeams 0', 1', 16', 23, 17, and the upstream connection of floorbeam 0. None of these cracks have grown since the last inspection. The cracks in the angle tees on the downstream connections of floorbeams 0 and 16 have possibly grown 1/8 inch since 1992; more likely this observed difference is a result of the manner in which the end of the crack was marked. The previously noted cracks in the downstream connection of floorbeam 15 were not seen.
- A new 1-inch crack was found in the typical location of the angle tee on floorbeam 2 on the upstream side.
- The interiors of the lower chord typically have pack rust forming at the corners.
- The drainage trough at Pier IV is filled to the top and not draining (Photo 8).

- The drainage conduit next to floorbeam 0 in the upper deck, downstream truss, is completely corroded through (Photo 9)
- Several of the piers in the south approach have been patched on the undersides of the concrete pier caps. The patch is delaminating and spalling off at pier 4. The other patches appear to be holding.
- The deck is leaking onto pier UD17 between the older part of the pier and the part added when the deck was widened.
- There is typically 1/16 to 1/8 inch pitting on the verticals of the truss at the connections to the lower deck floorbeams, and some pack rust at framing angles for the floorbeams and the floorbeam diaphragms inside the verticals. In vertical L10-U10 of the upstream truss, there is 1 inch of pack rust between the diaphragm framing angles and upstream plate, which has broken 2 rivets (Photo 10).
- At floorbeam 9' of the upper deck at the connection to the downstream truss, there are 3 bolts missing between the floorbeam bottom flange and the gusset plate, which has allowed up to ¾ inch of pack rust to develop and bend the gusset plate (Photo 11).
- The dummy members in the upper chord of the suspended span (U17-U18 and U18'-U17') are attached by pins through slotted holes. The guide bars for these sliding pins are cracked at the ends because the pins have slid so far. Several bolts have sheared off near these pins (Photo 12).
- As noted in the previous inspection ('97) and in the 1992 in-depth inspection report, the supports for the catwalk on the south side of floorbeam 16 of the lower deck are sheared on both sides.
- Next to pier LD17, the embankment is eroding around the pier column base.

RECOMMENDATIONS

The following recommendations are intended for maintaining the current quality of the bridge and prolonging its useful service life:

- Jack up non-bearing stringers in Kentucky approach spans and shim bearings.
- Replace cracked diaphragms at lower deck south abutment *after* bearings are re-set.
- Weld over cracks inside pier caps as was done with previous cracks.
- Seal holes in pier cap IV to prevent drainage entering the cap.
- Install thicker backer bars to restore compression seal over pier 7. This may need to be performed during cold weather to take advantage of the wider joint opening.
- Clean out drainage troughs and scuppers.
- Replace corroded drainage conduit in downstream truss near floorbeam 0.
- Cut off sliding joint for catwalk at floorbeam 16, leaving a 4 inch gap so catwalk can move with the deck without the interference of the catwalk supports and the lower lateral bracing. Replace sheared bent plates connecting catwalk.

Sincerely,

Gordon C. Glass, PE
Project Engineer

JMC
Enclosures
copy: Mr. Mark E. Bernhardt, PE, Associate, Director of Facility Inspection
File

Photo 1: Looking south at bearings for stringers 5 and 6, south lower deck abutment. Note heavy staining from fretting corrosion indicative of lifted bearings.

Photo 2: Looking north at bearing for girder 3 at pier H2. Note pack rust under rocker has lifted bearing by ½ inch from masonry plate.

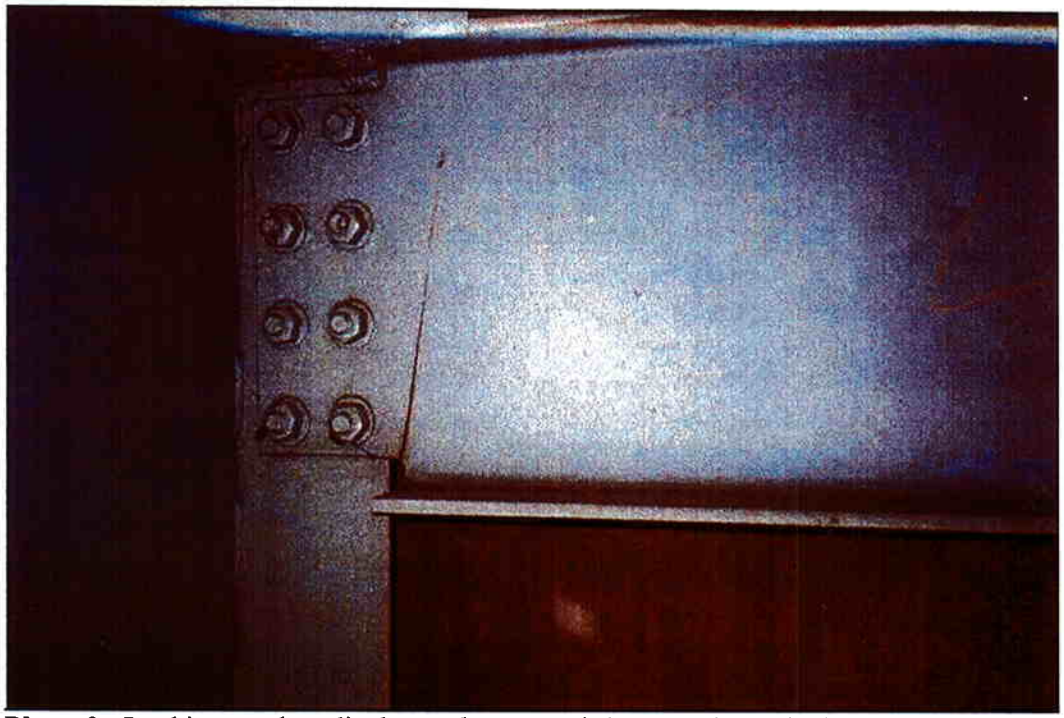


Photo 3: Looking south at diaphragm between girders 4 and 5 at the lower deck south abutment. Note 13 inch crack in diaphragm web.

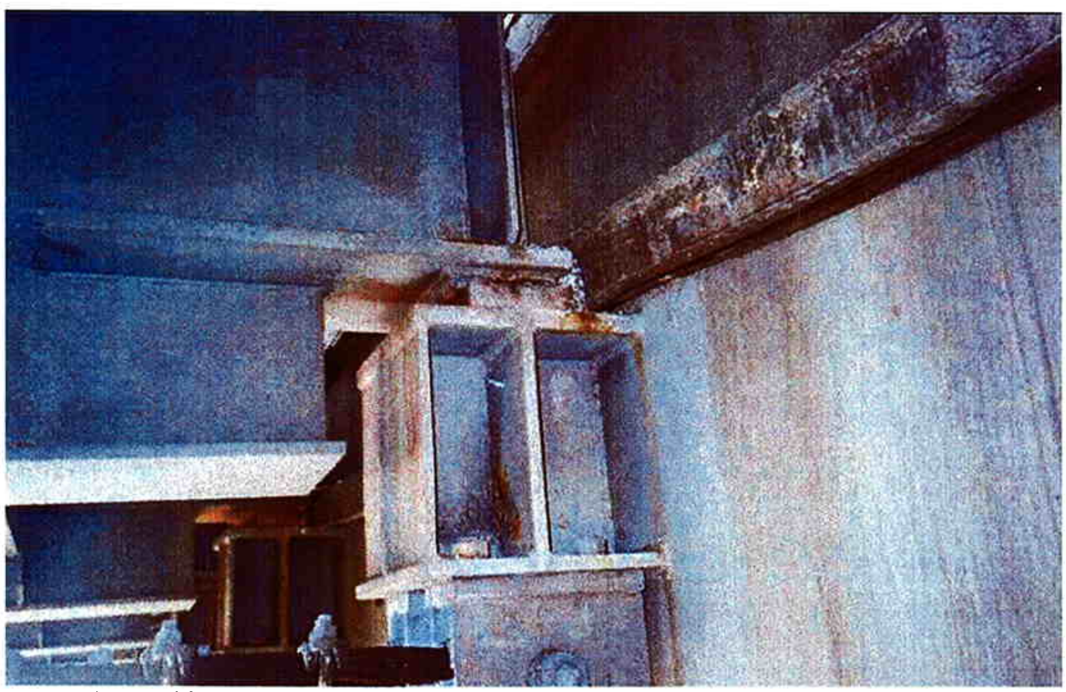


Photo 4: Looking west at stringer 6, south side of Pier Cap 7. Note fallen compression seal and debris behind sliding seat stringer bearing obstructing stringer movement.

Photo 5: Looking up at Pier 7 in south approach. Note fallen compression seal.

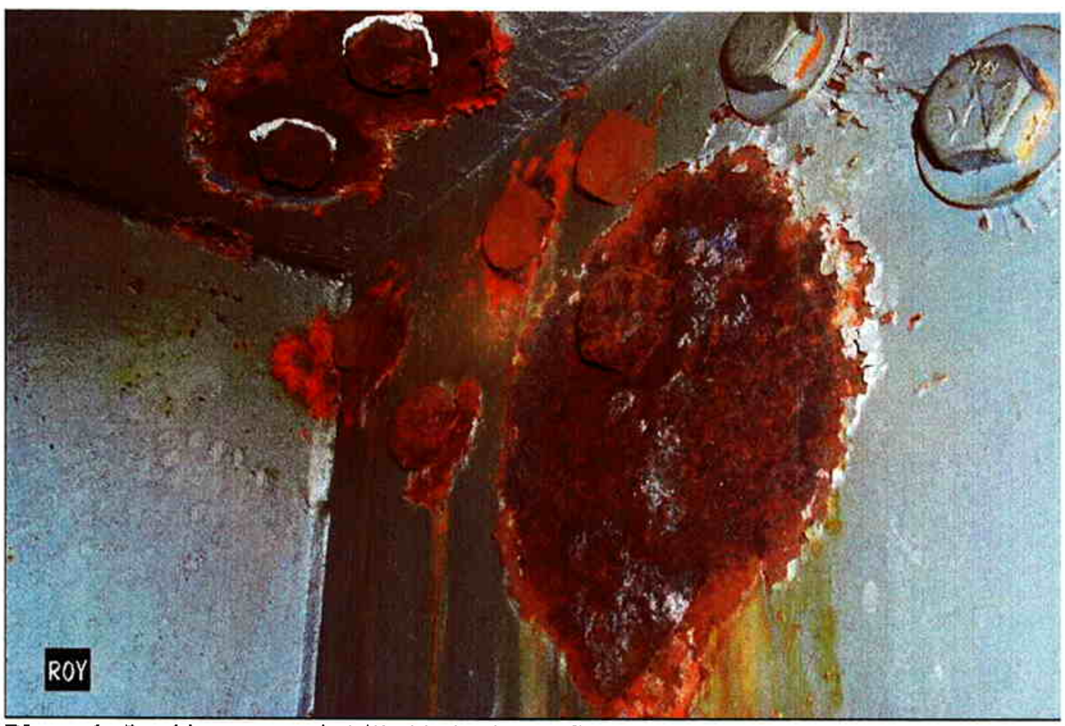


Photo 6: Looking up at misdrilled holes in top flange plate, pier cap at Pier IV. Note corrosion inside cap due to roadway drainage leaking through holes.

Photo 7: Looking south at the west face of diaphragm 5 and the south web plate in Pier Cap 4. Note 1-5/8 inch crack at top of weld from diaphragm to web plate.

Photo 8: Looking east at drainage trough at Pier IV. Note trough is completely filled and cannot drain into drainpipes.

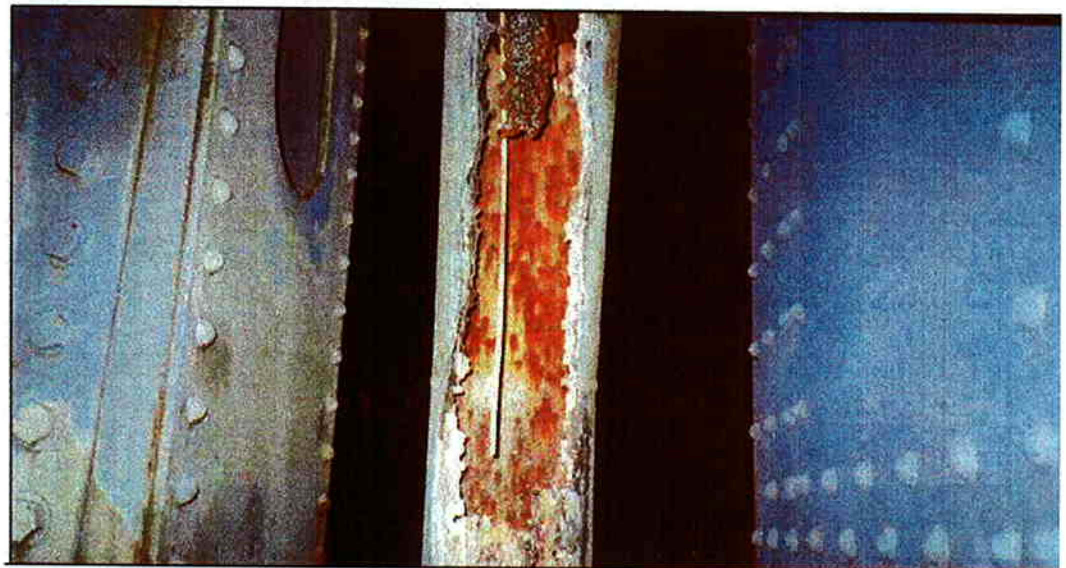


Photo 9: Looking west at drainage conduit next to upper deck floorbeam 0, downstream truss. Note complete section loss through conduit.

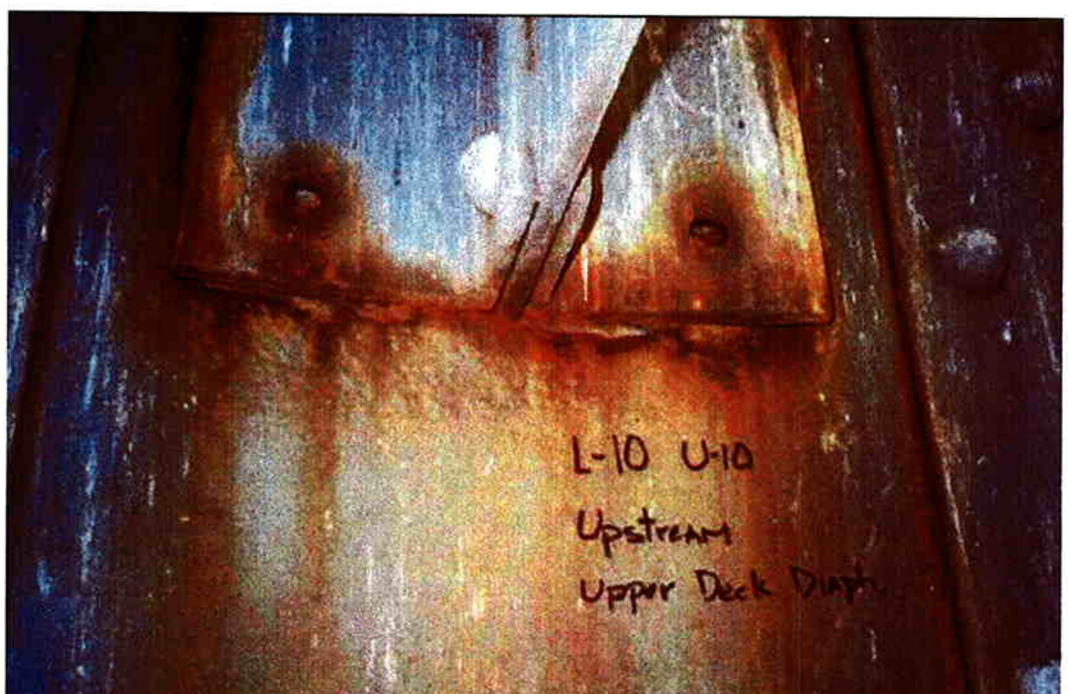


Photo 10: Looking inside L10-U10, upstream truss. Note pack rust has broken two rivets.

Photo 11: Looking up at gusset plate connecting bottom flange of upper deck floorbeam 9' to the downstream truss. Note ¾ inch pack rust has developed in location where 3 bolts are missing.

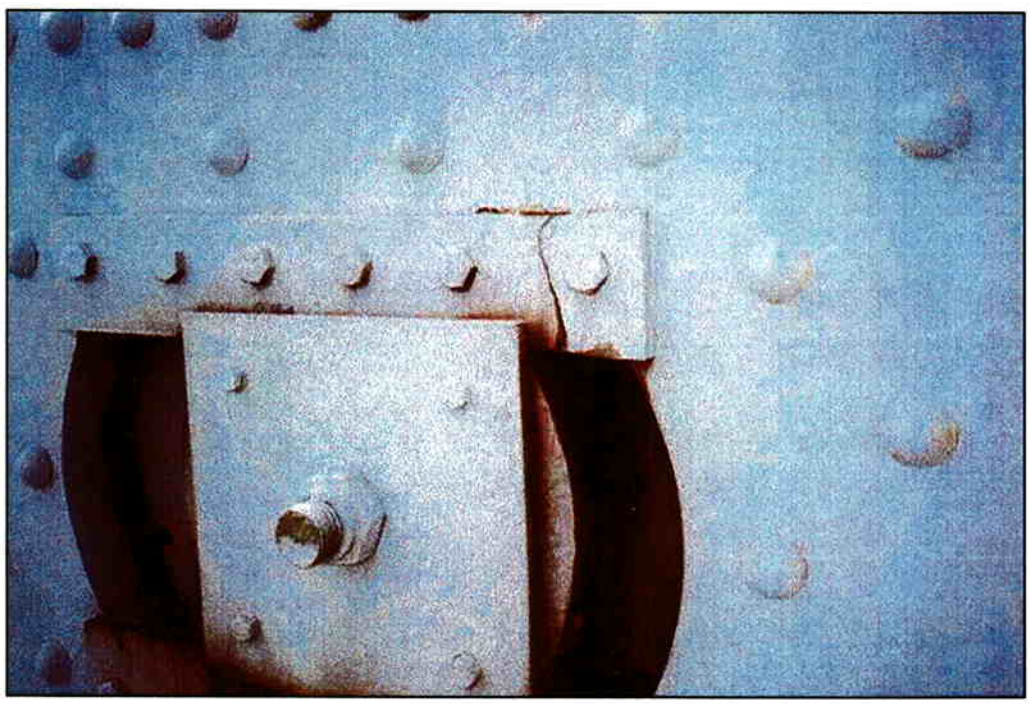
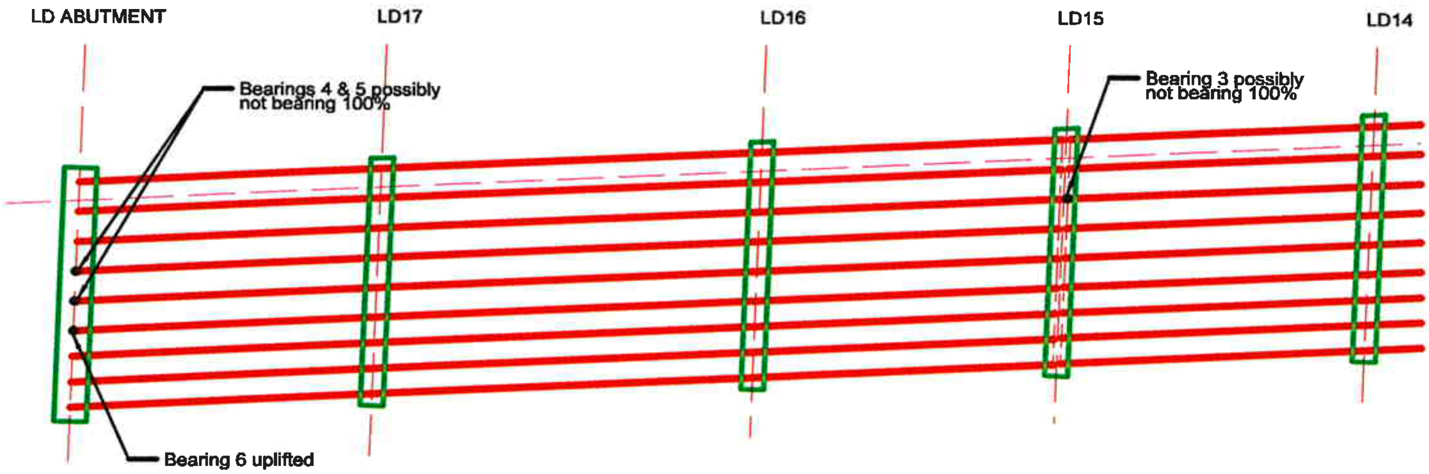
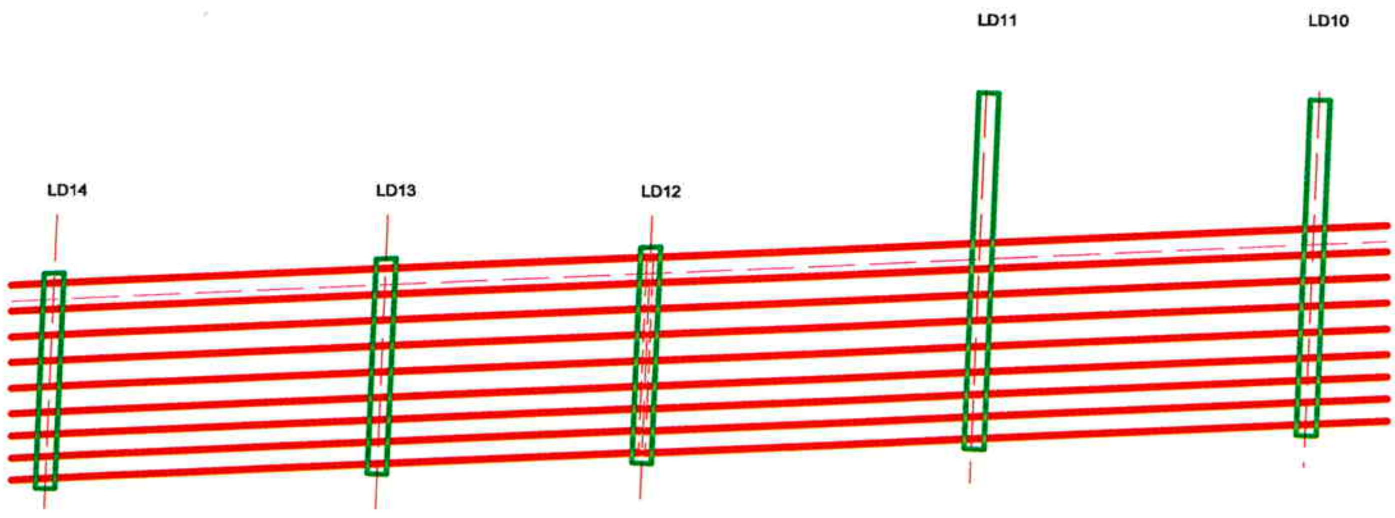


Photo 12: Looking at downstream face of downstream truss at U18. Note that guide bar for sliding pin connection is cracked.

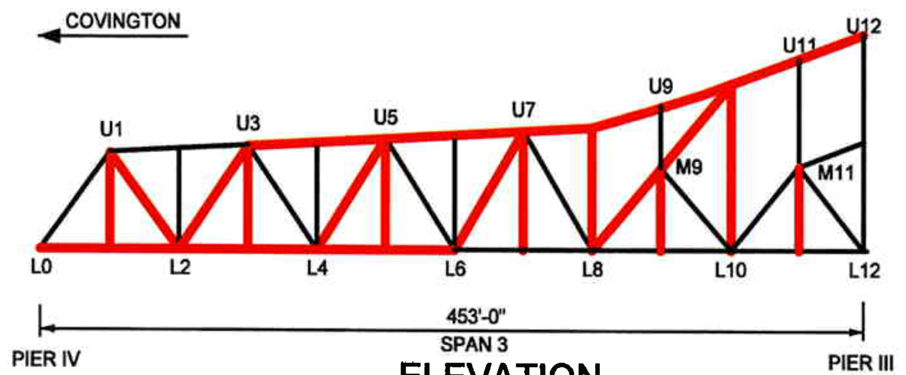




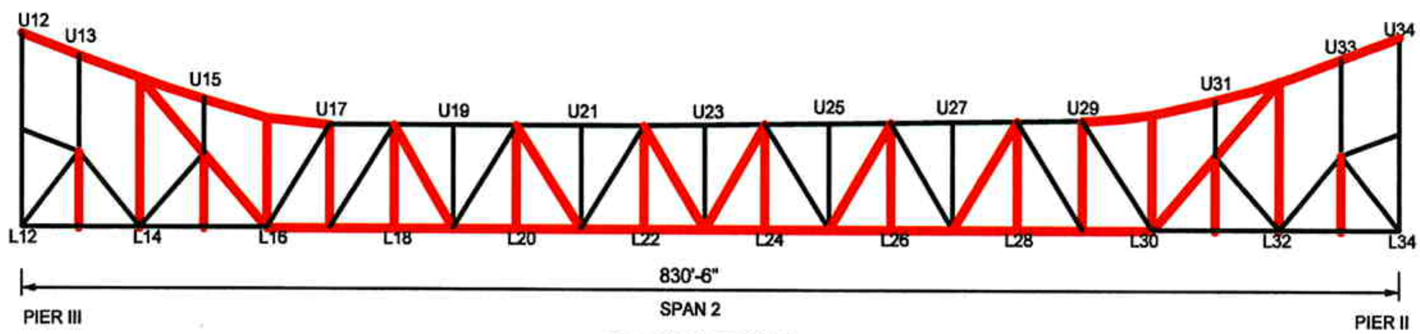
XX / XX	XX	BRENT SPENCE BRIDGE LOWER DECK FRAMING PLAN	XXX	XXX	XXX XXX
			XXX		XXXXXXX

LEGEND

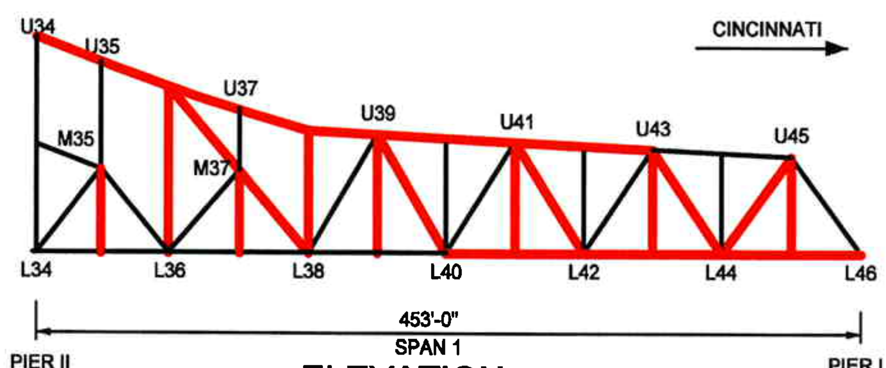
- FRACTURE CRITICAL
- NON-FRACTURE CRITICAL



ELEVATION



ELEVATION



ELEVATION

BURGESS & NIPLE

BRENT SPENCE BRIDGE OVER THE OHIO RIVER
AT COVINGTON, KENTUCKY

Transportation Cabinet
Division of Operations

TC 71-118
Rev. 1/96

BRIDGE INSPECTION REPORT

Reviewed By:
Review Date:

Two Yr		Substd		UnderWater		In-Depth		Fracture Critical	X

Project No: MP-059-0075-B46 NBI-Location: Brent Spence over Ohio River

Local-ID: I-75 at Covington, Kentucky

Structure Description: Cantilver Steel Through Truss, Double Deck Bridge

Milepoint: 191.411 Inspectors Initials: GCG Inspection Date: 04 02 01

Inspector's Signature [signature]
Burgess & Niple, Limited

58	Deck	5
1	Structural Condition	5
2	Wearing Surface	3
3	Joints	6
4	Drains	5
5	Expansion Devices	6
6	Curbs, Sidewalks, Medians	N
7	Railings	7
8	Lighting or Utilities	6

59	Superstructure	6
1	Stringers, Girders, Beams	7
2	Floor Beams	6
3	Trusses – Main Members	7
3a	Trusses – Bracing, Portals	7
3b	Trusses – Inspection Walk	6
4	Bearing Devices	6
5	Alignment/ Structural Members	6
6	Deflection/ Vibration under Load	7
7	Debris on Members	6

59a Paint Condition				6
Color	GREEN	Date Painted	19	91

60	Substructure	7
1	Abutments, Wingwalls	N
2	Piers/ or Bents	7
3	Alignment/ or Settling	8
4	Scour, Erosions	8
5	Debris on Seats, Caps	7
6	Protection Systems	N
7	Abutments, Wingwalls (S.Z.D.)	N
8	Piers/ or Bents (S.Z.D.)	8
9	Alignment or Settling Due to Scour	8

61	Channel/Channel Protection	7
1	Channel Scour	8
2	Embankment Erosion	7
3	Drift	8
4	Channel Alignment	8
5	Vegetation	8
6	Erosion Control System	N
7	Rip-Rap	7

62	Culvert-Retaining Walls	N
1	Barrel	
2	Wingwalls, Headwall	
3	Debris	
4	Scour Under Footings (Underwater)	
5	Erosion at Wingwalls (Underwater)	
6	Drainage Adequacy (Underwater)	

10 Inventory Route Vertical Clearances

Over: 14 FT 11 IN
Under: 00 FT 00 IN

36 Traffic Safety

1	1	1	1

71	Waterway Adequacy	9
72	Approach Roadway Alignment	7

113	Scour Critical Bridge Rating	5

108 Wearing Surface/Protective System

Type:	4	Membrane:	0	Protection:	1

OVERLAY No: Yes: X Date: 1/85
TYPE Latex: PCC: X Ashphalt:
Depth: N/A

RECOMMENDED LOAD CAPACITIES (tons) I: ____ II: ____ III: ____ IV: ____ Gross:______.
FIELD POSTINGS N/E No S/W No I: ____ II: ____ III: ____ IV: ____ Gross:______.
Underwater Data:

ITEM NO.	ADDITIONAL COMMENTS
58.1	**Structural Condition** – The deck has numerous transverse cracks with efflorescence.
58.2	**Wearing Surface** – There are numerous asphalt and concrete patches and spalls throughout the deck.
58.5	**Joints** – Joint armor and backer bars have fallen down at the Upper Deck south abutment, the upper deck seal of pier 7, and pier H2. At the upper deck abutment, the joint is leaking. At pier 7, the seal has fallen down in the center portion and is blocking movement of the stringers, along with debris that has fallen on the sliding seats of the stringers because of the sagged seal.
58.4	**Drains** – All scuppers are clogged. The drainage trough at Pier IV is filled to the top and not draining. The downspout next to upper deck floorbeam 0 is completely corroded through.
58.5	**Expansion Devices** – The center part of the compression seal at pier 7 has fallen due to a gap between the deck sections there (no compression). The finger joint at lower deck floorbeam 17' is not centered.
58.8	**Lighting** – Several lights were inoperative. Maintenance crews repaired lights simultaneously with lane closure for inspection on upstream side.
59.2	**Floor Beams** – Cracks are present in some of the angle tees that frame the top flanges of the floorbeams into the trusses.
59.3b	**Trusses – Inspection Walk** – The connection on the south side of floorbeam LD 16 is sheared on both sides of the inspection walk (noted in 1992 and 1997 inspection reports).
59.4	**Bearing Devices** – Many of the girder bearings in the south approach are lifted up and not bearing.
59.5	**Alignment/Structural Members** – The girders in the H ramp are in a sagged position with the deck cast straight on top of them. There is vehicular impact damage to the longitudinal force bracing above the upper deck. The girders in the south approaches are not carrying the loads equally due to the problem with the bearings, which is causing the cracks in the diaphragms between the girders due to their movement relative to each other.
59.7	**Debris on Members** – There is debris on the top flanges of floorbeams at joint locations.
59 A	**Paint Condition** – The paint is deteriorating with rust spotting through at various locations.
60.2	**Piers &/or Bents** – The patching that was performed on the underside of the concrete cap of pier 4 is delaminating and spalling. Patches appear to be holding at the other piers.
60.6	**Protection Systems** – The concrete slope protection at the lower deck south abutment is being undermined.

BURGESS & NIPLE

Mr. Darrell Dudgeon, PE
Division of Operations
Kentucky Transportation Cabinet
State Office Building
Frankfort, KY 40622

Re: Statewide Fracture Critical Structure Inspection – Item 99-233, Package 2
Brent Spence Bridge

June 27, 2003

Burgess & Niple, Inc.
220 Lexington Green Circle
Suite 110
Lexington, KY 40503
859 273.0557
Fax 859 273.3332

Dear Mr. Dudgeon,

Between November 11 and November 19, 2002, Burgess & Niple completed the Fracture Critical Inspection of the Brent Spence Bridge (I71/I75) over the Ohio River in Kenton County, Kentucky, Bridge No. MP-059-0075-B46. The inspection included the main (through-truss) spans, and the steel pier caps, piers, and bearing of the Kentucky approach up to the abutments, including ramps H and B. The total bridge length inspected is 2951 feet (main truss spans are 1,736.5 feet).

Most of the components in the truss spans were accessed using bridge climbing techniques developed by B&N to minimize traffic disruption. The exterior of the pier caps and bearings in the lower deck of the Kentucky approach spans were accessed with a manlift. The interiors of these pier caps were accessed in the same manner. A manned safety boat was provided while inspectors worked over the river.

The inspection included arm's length inspection of:

- All fracture critical members of the trusses,
- All lower deck and main truss bearings, concrete pier caps and abutments within the scoped limits of inspection,
- Areas where significant problems were found during previous inspections,
- All floorbeam connections to the trusses (upper and lower deck),
- Floorbeams located under expansion joints in the lower deck, and
- The interiors of all steel pier caps in the Kentucky approach structure.

Upper deck floorbeams under expansion joints were sighted from the truss and the exterior of the steel pier caps in the Kentucky approach span were sighted from the ends in order to eliminate the need for lane closures. The remaining bridge components were observed during arm's length inspection of the fracture critical components in sufficient detail to complete the KYTC Form TC71-118.

SUMMARY OF FINDINGS

The following is a summary of typical deficiencies found during the fracture critical inspection and deficiencies that have occurred or progressed since the previous fracture critical inspection:

Kentucky Approach Spans, Lower Deck

As has been documented in prior reports, misalignments were introduced into the lower deck floor system during the 1985 deck replacement and widening. These misalignments are likely a result of sequencing of deck removal and replacement or reseating the girders when the new deck was placed, as there is no apparent settlement or shifting of the substructure.

As a result, numerous girders visibly move under heavy loading and several of the pin bearings can be moved by hand. The presence of fretting corrosion on the bearing pins is the most common indication of this condition. (Photograph 1) Pack rust has formed below the rockers in several locations, lifting the bearings on average approximately 1/2 inch off of the masonry plate. (Photograph 2)

The differential movement between girders has caused cracks in a number of diaphragms. The most severe of these cracks occurs between girders 4 and 5 at the lower deck abutment where the diaphragm is cracked nearly full height. (Photograph 3) This crack has grown 2 1/8 inches since the previous fracture critical inspection in April 2001. Several new cracks and growth of some previously noted cracks were observed on the stiffener welds at diaphragm attachments between girders 3 and 4 and girders 4 and 5 on the northern line of diaphragms between piers LD11 and LD12. (Photograph 4) The previously noted crack on the diaphragm between girders 6 and 7, northern line of diaphragms between piers LD2 and LD3 has grown approximately 1/8 inch since the previous inspection. A potential crack was observed on the upper west diaphragm cope between girders 2 and 3 of the same line of diaphragms. Magnetic particle testing was inconclusive. No other previously noted cracks displayed any apparent growth since the previous inspection.

Kentucky Approach Spans, Upper Deck

The majority of upper deck inspection effort focused on steel pier cap interiors. Cap exteriors and upper deck bearings were inspected at arm's length where traffic control was not required. All other components within the inspection scope were sighted from the best position feasible without traffic control.

The pier caps exteriors were in fair condition. The interiors, however, exhibited several deficiencies and several new cracks. Many welds on the cap interiors exhibited rough workmanship but appeared to be sound. Most of the cracks occur where intermediate stiffeners are welded to the top flange plate. Unlike the stiffeners, the diaphragms are welded to the web plates of the cap, but not to the top flange plate. The top coat of paint is peeling throughout the interior of the cap. Paint adhesion to welds is particularly poor.

There are bird nesting materials in end compartments. Except for the cap at Pier IV, the interiors are dry inside with no sign of water entering cap. There is some surface corrosion on all plates in the end compartments. In most of the caps, regular 3-inch diameter burn circles are visible in the paint on the top flange where shear studs were welded onto the caps. There are thick splice welds in web plates near midspan. Generally, there were no tack welds, stitch welds, or backing bars on the web or flange plates. The caps exhibit pronounced vibration and deflection under live load.

A new 5/8 inch crack was observed in Pier Cap UD3 at the north side stiffener to top flange plate weld between the bearing diaphragm and diaphragm 1. (Photograph 5) In Pier Cap UD4, at the top of diaphragm 2, the east face has a 7/8 inch crack in weld to the north web plate. In the same cap, the previously noted crack at the top of the weld from diaphragm 5 to the south web plate has grown 1/2 inch since the previous inspection. The top welds of stiffeners between diaphragms 8 and 9 in the same pier cap appear to have cracked and were subsequently welded over. These repairs appear to be functioning well. In Pier Cap IV, upper deck, the previously noted crack in the top of the north web weld, west face of diaphragm 8, has grown 1 1/2 inches since the previous inspection.

Truss Spans

The built up box members typically have developed 1/8 to 3/8 inch pack rust between plates and angles, and localized pack rust is up to 1 inch thick. Floorbeam connections typically had pack rust to 1/4 inch between top flange cover plates and flange angles, between top flange angles and web plates, and under stringer bearings at joints. (Photograph 6) Similar pack rust was observed between framing connection components and between the web and bottom flange angles of floorbeams. Pitting was common on the lower flange angles and the lower portion of the web near floorbeam connections. Pitting of 1/16 to 1/8 inch was typically observed on verticals, most commonly in the splash zone just above the barrier walls. Minor pitting was also typically found on the built up portion of the upper chord. The upper chord eyebars exhibited light surface corrosion and pitting, and minor pack rust was forming between eyebar heads. Light surface corrosion and peeling paint is common throughout the truss members.

Several new cracks were observed in the angle tees which connect the top flanges of the lower deck floorbeams to the verticals. These were located at the following floorbeam connections: LD4 (1/2 inch, Photograph 7) and LD17 (3/8 inch) of the downstream truss and LD7 (1 inch) and LD16 (1/2 inch) of the upstream truss. No growth was observed in any of the previously noted cracks including at LD0 of the upstream truss where a 2 inch diameter hole was drilled to arrest a crack. A possible crack was noted in the top flange at this location, but magnetic particle testing results were negative. A crack was noted in the fill plate of the floorbeam connection at UD15' of the upstream truss at a rivet. This is not a serious concern as the plate is non-structural.

The sliding pin connections at the ends of the suspended span exhibit deficiencies, apparently due to excessive movement. On the upper chord, the bronze guide angles typically are fractured (Photograph 8), and bolts have sheared off at U17 and U17' of the downstream truss. Surface and bleeding corrosion is typical at the twelve pin locations in the upper and lower chords and on the verticals.

Stringer 7 (south) at LD13' had deteriorated anchor bolts and moved noticeably under heavy loads. The compression seal is also falling through at this location. Three anchor bolts are loose at stringer 3 (north) at LD21', and the stringer moves under heavy loads. Diagonal M15'-U14' is missing 9 rivets at the outside web plate at M15'

RECOMMENDATIONS

The following recommendations are intended for maintaining the current quality of the bridge and prolonging its useful service life:

- Jack up and shim bearings in Kentucky approach spans where girders are exhibtting movement.
- Replace cracked diaphragms at lower deck south abutment *after* bearings are re-set. Monitor existing cracks until such time as repairs can be performed.
- Monitor the potential crack location at the upper west diaphragm cope between girders 2 and 3, northern line of diaphragms between piers LD2 and LD3.
- Continue to inspect the fracture critical steel pier caps at a two year interval for the following reasons: There are recurring cracks at the interior welds; the girders that bear on the pier caps are not carrying loads as intended in the design as is evidenced by the lifted bearings and incorrectly seated girders; the pier caps are carrying more load than originally intended due to the widening which is causing rather large live load deflections in the longer pier caps; and the consequences of a pier cap failure is the loss of spans. Until such time as some of these factors are mitigated, we do not suggest increasing the interval between inspections for these members.
- Monitor cracks inside pier caps.
- Monitor existing cracks in angle tee connections and repair or replace if any of the cracks grow significantly.
- Replace missing rivets with high strength bolts.
- Tighten loose bolts.
- Clean out drainage troughs and scuppers.
- Repair or replace joint compression seals as needed.

Sincerely,

Gordon C. Glass, PE
Project Manager

Scott T. Ribble, PE
Project Engineer

Enclosures
copy: Mr. Mark E. Bernhardt, PE, Associate, Director of Facility Inspection
File

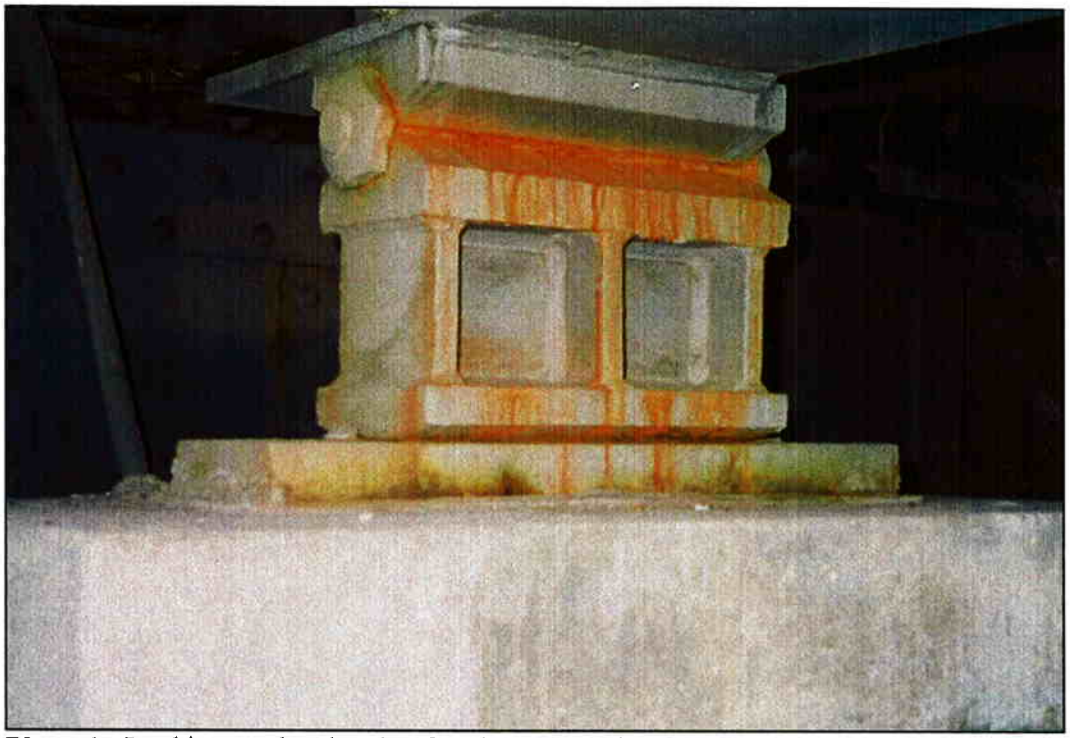


Photo 1: Looking north at bearing for girder 9 on Pier IV, lower deck. Note fretting corrosion on pin indicative of relative movement between girder and bearing.

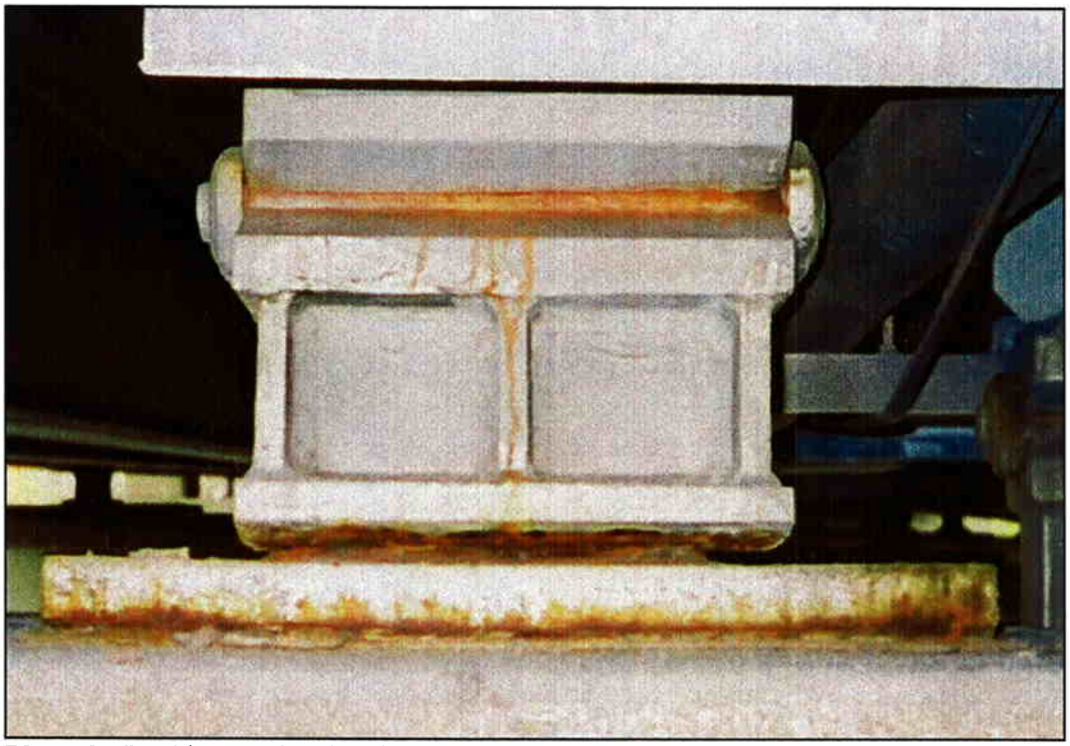


Photo 2: Looking north at bearing for girder 4, Pier 4, lower deck. Note pack rust has lifted rocker by 1/2 inch from masonry plate and fretting corrosion on pin.

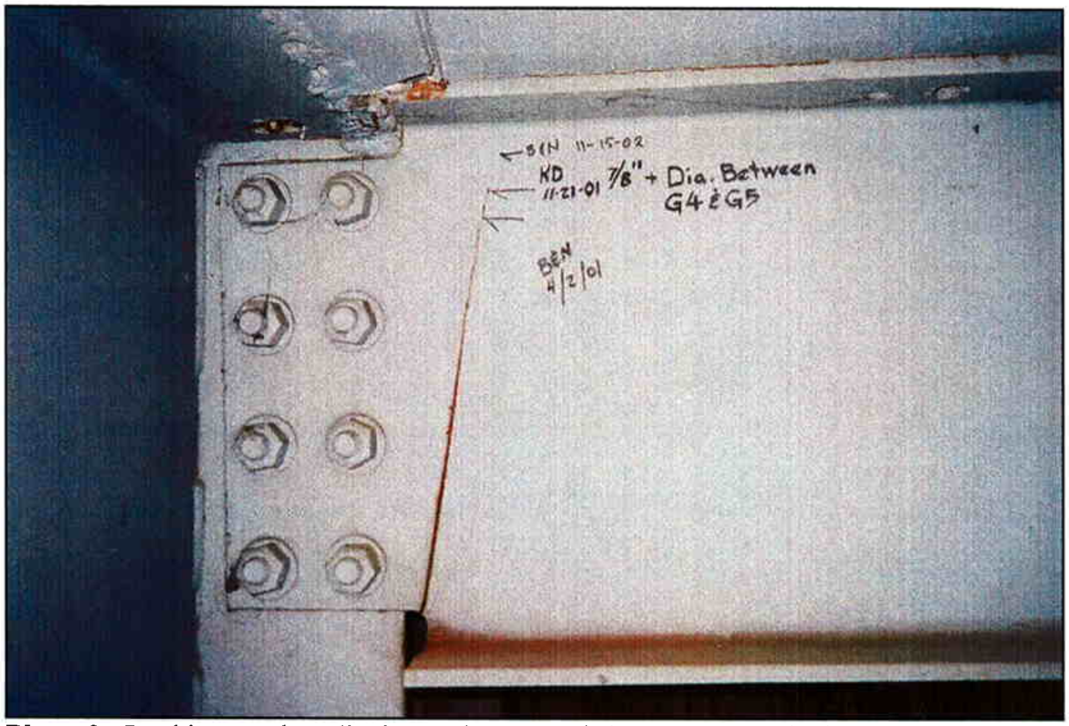


Photo 3: Looking south at diaphragm between girders 4 and 5 at the lower deck south abutment. Note crack in diaphragm web has grown from 13 inches in April 2001 to 15 1/8 inches over 19 months.

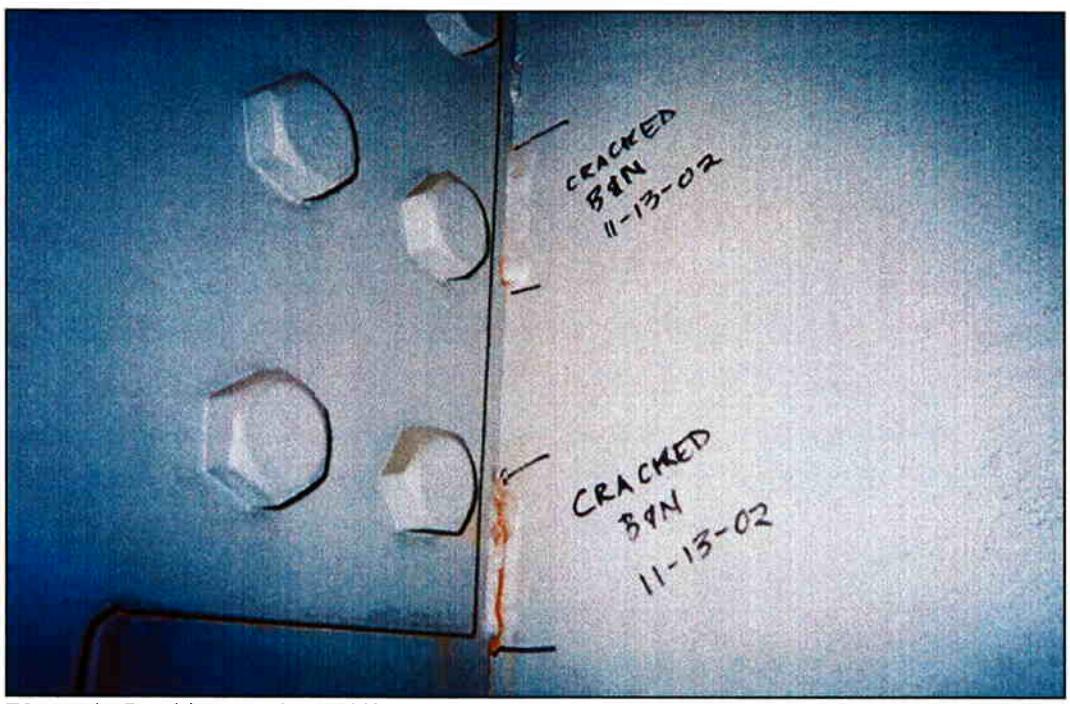


Photo 4: Looking north at stiffener on west face of girder 5, northern line of diaphragms between Piers LD11 and LD12. Note full length cracks in welds with fretting corrosion.

Photo 5: Looking east at west face of stiffener between bearing diaphragm and diaphragm 1 in UD3 pier cap. Note 5/8" crack in top weld.

Photo 6: Looking east at downstream north face of upper deck floorbeam 6. Note pack rust under stringer bearings, between top flange cover plate and angles, and between top flange angle and web.

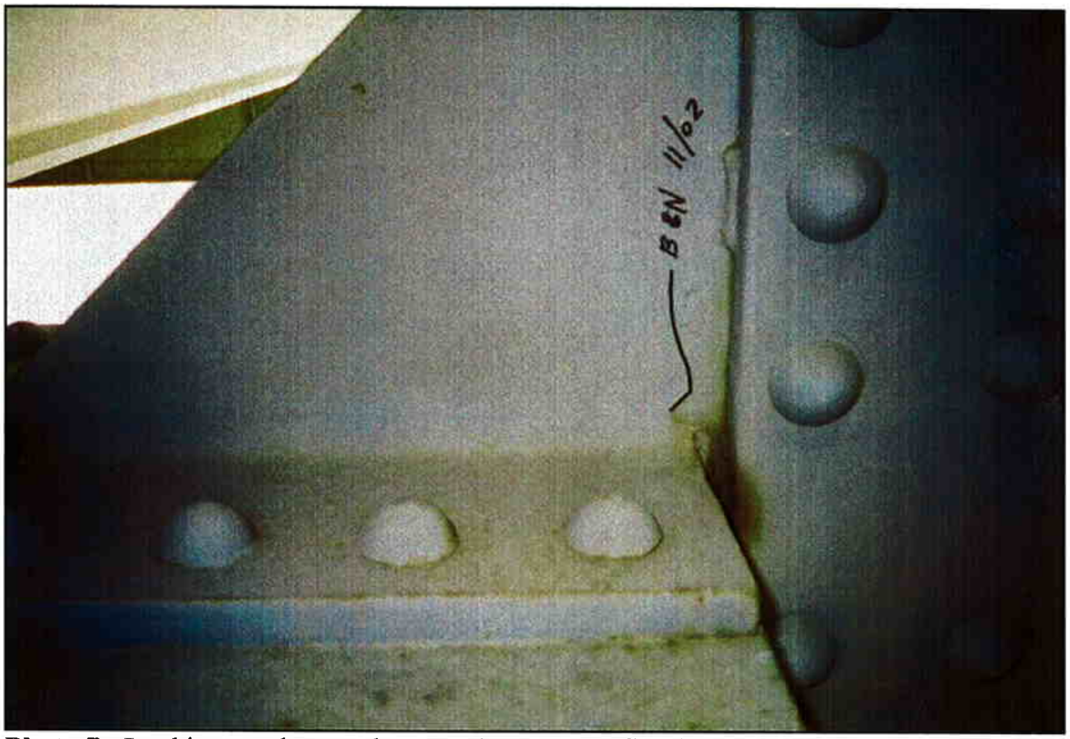


Photo 7: Looking south at angle tee at downstream floorbeam connection 4, lower deck. Note new 1/2 inch long crack in angle tee.

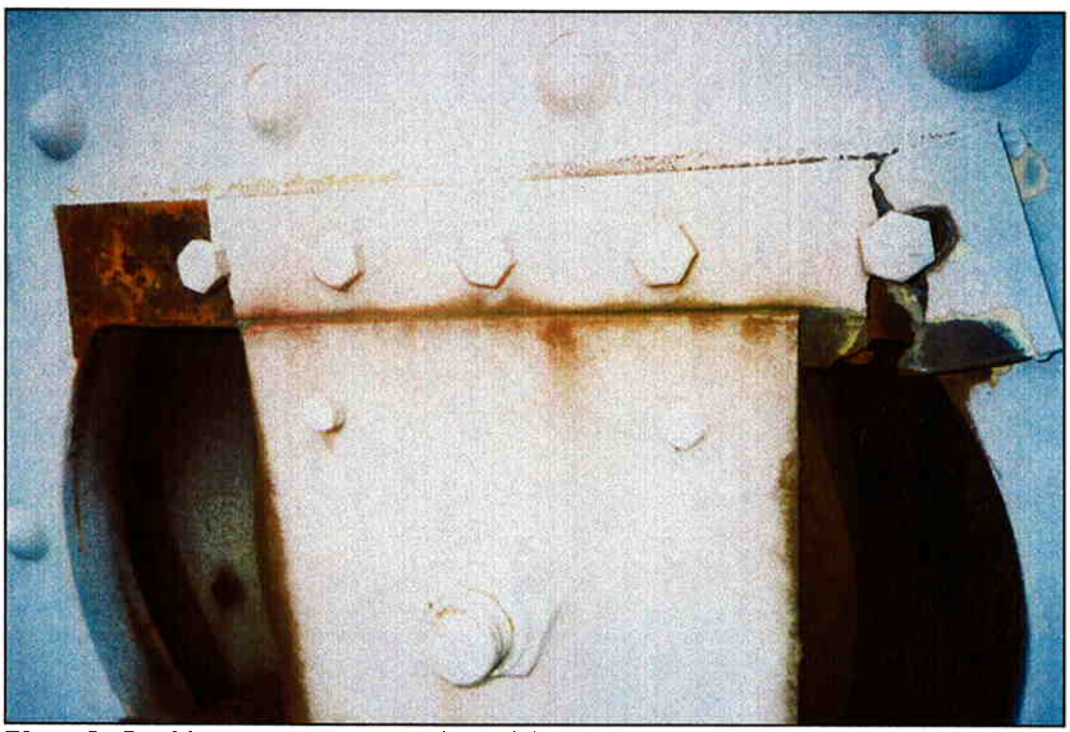
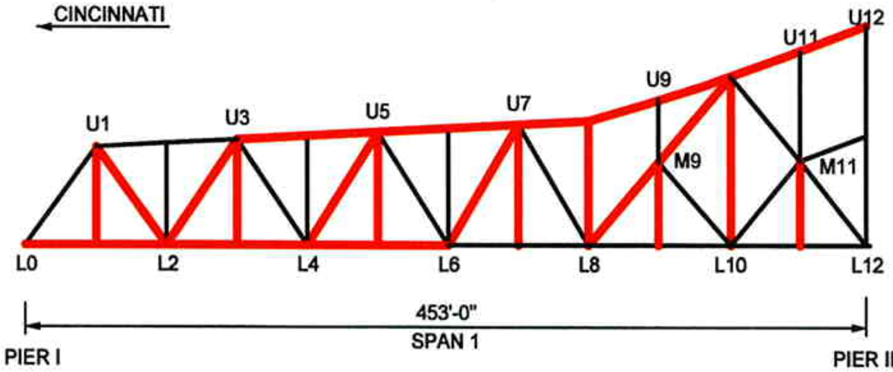


Photo 8: Looking west at upstream face of the upper chord sliding pin connection at U17. Note bronze guide angle cracked at both ends.

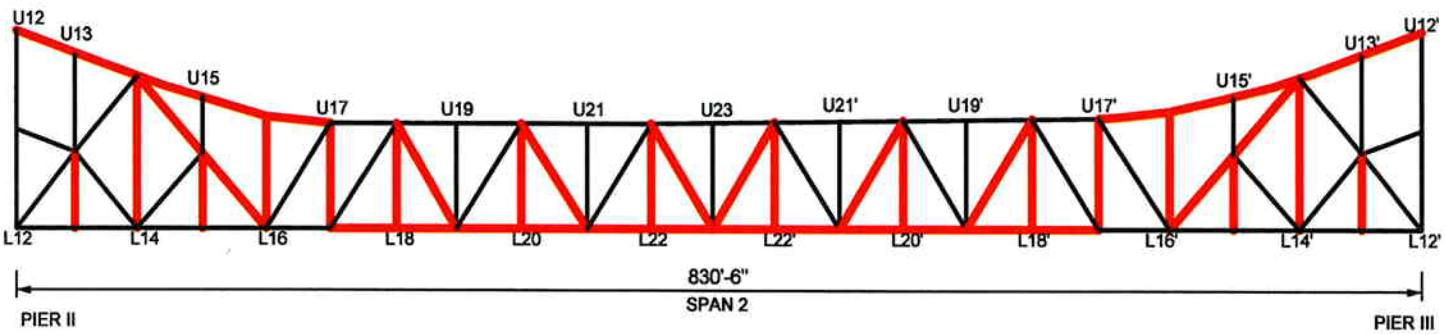
LEGEND

FRACTURE CRITICAL

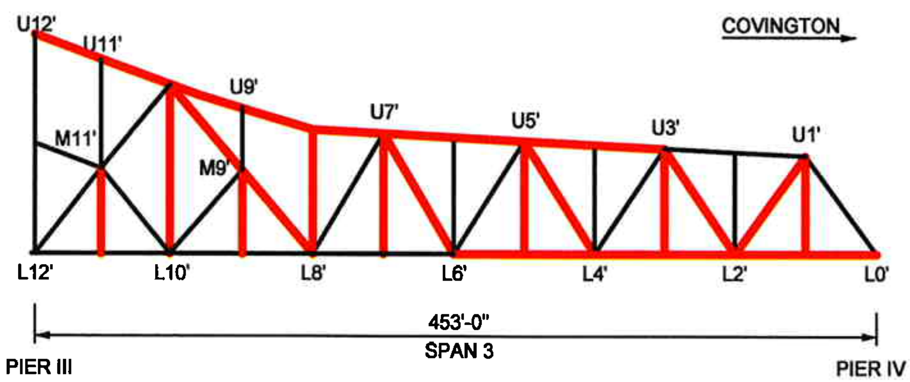
NON-FRACTURE CRITICAL



ELEVATION



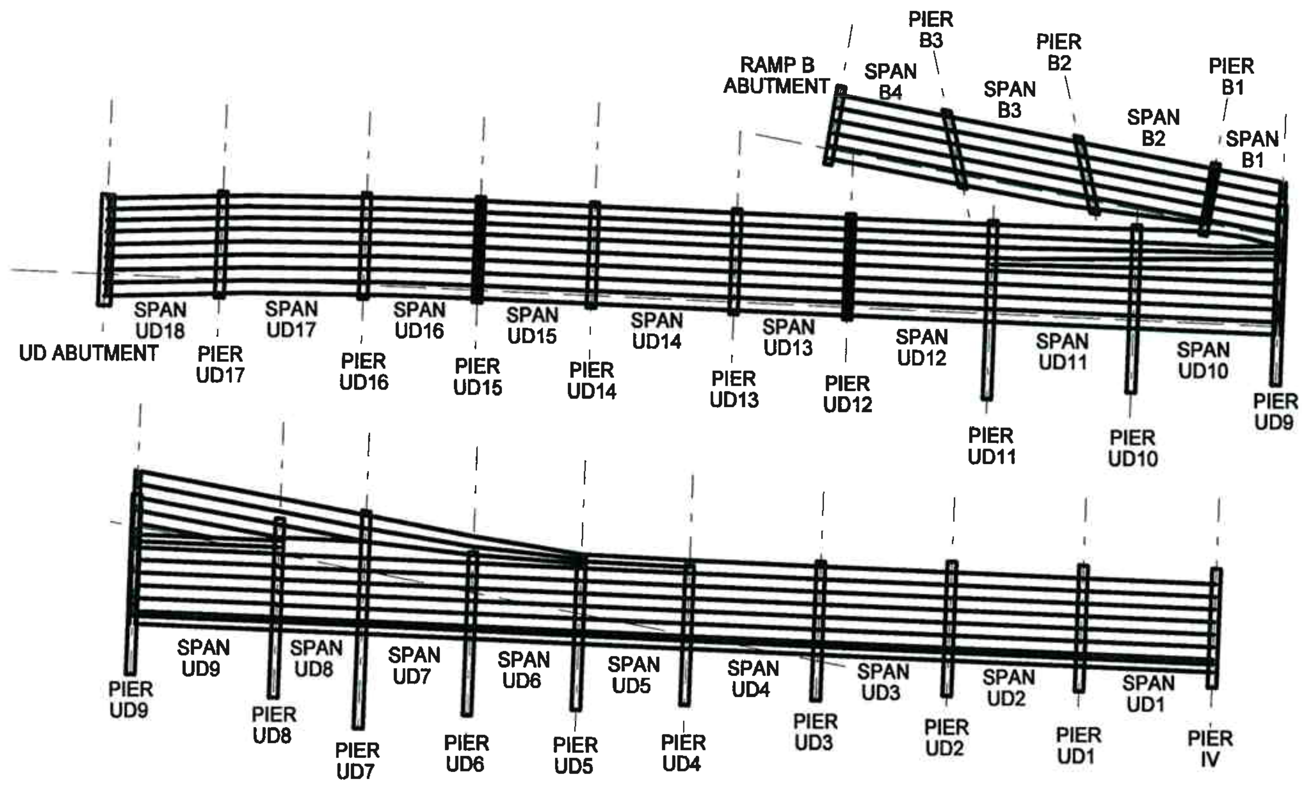
ELEVATION



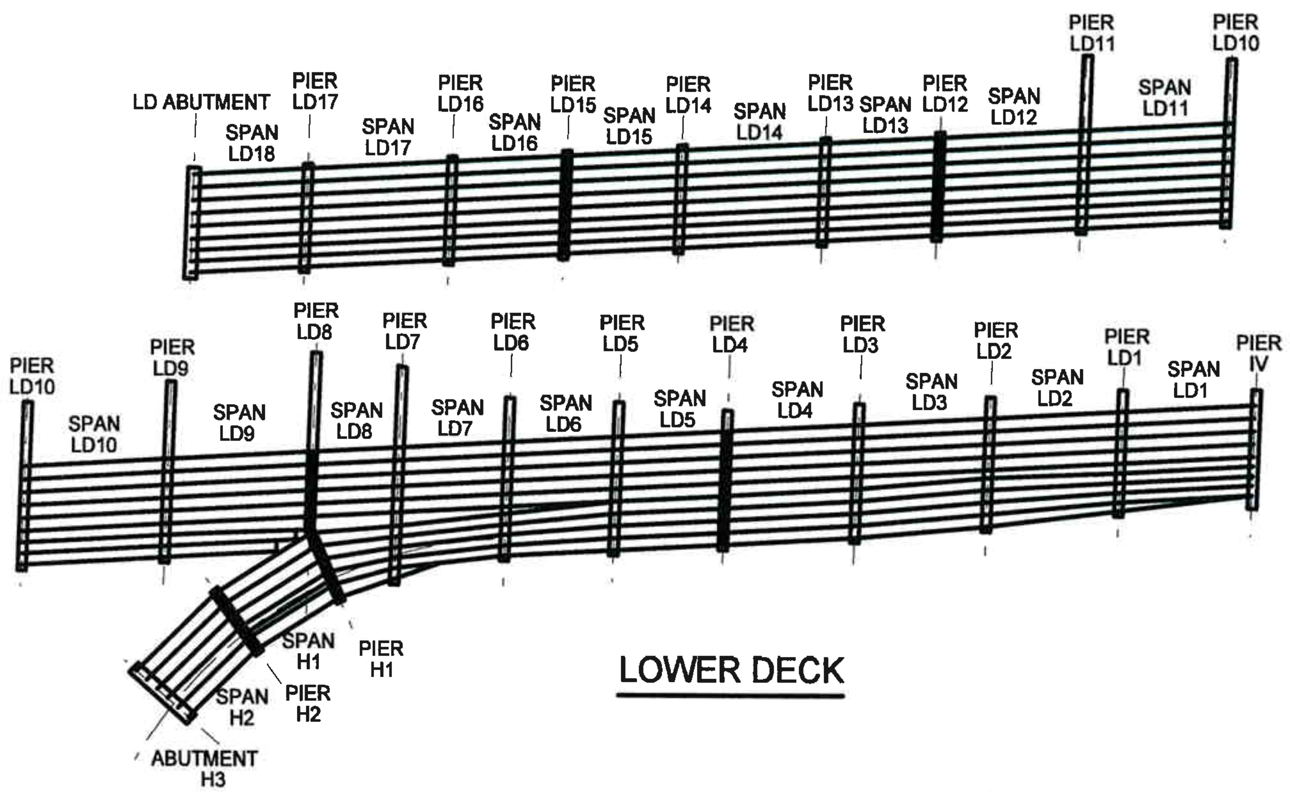
ELEVATION

BURGESS & NIPLE

BRENT SPENCE BRIDGE OVER THE OHIO RIVER
AT COVINGTON, KENTUCKY



UPPER DECK



LOWER DECK

BURGESS & NIPLE

BRENT SPENCE BRIDGE OVER THE OHIO RIVER
AT COVINGTON, KENTUCKY

Transportation Cabinet
Division of Operations

TC 71-118
Rev. 1/96

BRIDGE INSPECTION REPORT

Reviewed By:
Review Date:

Two Yr		Substd		UnderWater		In-Depth		Fracture Critical	X

Project No: MP-059-0075-B46 **NBI-Location:** Brent Spence over Ohio River

Local-ID: I-75 at Covington, Kentucky

Structure Description: Cantilver Steel Through Truss, Double Deck Bridge

Milepoint: 191.411 **Inspectors Initials:** GCG **Inspection Date:** 11 19 02

Inspector's Signature Gordon Glenn
Burgess & Niple

58	Deck	5
1	Structural Condition	5
2	Wearing Surface	7
3	Joints	5
4	Drains	5
5	Expansion Devices	5
6	Curbs, Sidewalks, Medians	N
7	Railings	7
8	Lighting or Utilities	6

59	Superstructure	6
1	Stringers, Girders, Beams	6
2	Floor Beams	6
3	Trusses – Main Members	7
3a	Trusses – Bracing, Portals	7
3b	Trusses – Inspection Walk	5
4	Bearing Devices	5
5	Alignment/ Structural Members	6
6	Deflection/ Vibration under Load	6
7	Debris on Members	6

59a Paint Condition				5
Color	GREEN	Date Painted	19	91

60	Substructure	7
1	Abutments, Wingwalls	N
2	Piers/ or Bents	7
3	Alignment/ or Settling	8
4	Scour, Erosions	8
5	Debris on Seats, Caps	7
6	Protection Systems	N
7	Abutments, Wingwalls (S.Z.D.)	N
8	Piers/ or Bents (S.Z.D.)	8
9	Alignment or Settling Due to Scour	8

61	Channel/Channel Protection	7
1	Channel Scour	8
2	Embankment Erosion	7
3	Drift	8
4	Channel Alignment	8
5	Vegetation	6
6	Erosion Control System	N
7	Rip-Rap	7

62	Culvert-Retaining Walls	N
1	Barrel	
2	Wingwalls, Headwall	
3	Debris	
4	Scour Under Footings (Underwater)	
5	Erosion at Wingwalls (Underwater)	
6	Drainage Adequacy (Underwater)	

10 Inventory Route Vertical Clearances

Over: 14 FT 11 IN
Under: 00 FT 00 IN

36 Traffic Safety 1 1 1 1

71	Waterway Adequacy	9
72	Approach Roadway Alignment	7

113	Scour Critical Bridge Rating	5

108 Wearing Surface/Protective System

Type: 4 Membrane: 0 Protection: 1

OVERLAY No: [ ] Yes: X Date: 1/85
TYPE Latex: [ ] PCC: X Ashphalt: [ ] Depth: N/A

RECOMMENDED LOAD CAPACITIES (tons) I: ____ II: ____ III: ____ IV: ____ Gross:______.
FIELD POSTINGS N/E No S/W No I: ____ II: ____ III: ____ IV: ____ Gross:______.
Underwater Data:

ITEM NO.	ADDITIONAL COMMENTS
58.1	**Structural Condition** – The deck has numerous transverse cracks with efflorescence.
58.3	**Joints** – Joint armor and backer bars have fallen down at the Upper Deck south abutment, the upper deck seal of pier 7, and pier H2. At the upper deck abutment, the joint is leaking. At pier 7, the seal has fallen down in the center portion and is blocking movement of the stringers, along with debris that has fallen on the sliding seats of the stringers because of the sagged seal.
58.4	**Drains** – All scuppers are clogged. The drainage trough at Pier IV is filled to the top and not draining. The downspout next to upper deck floorbeam 0 is completely corroded through.
58.5	**Expansion Devices** – The center part of the compression seal at pier 7 has fallen due to a gap between the deck sections there (no compression). The finger joint at lower deck floorbeam 17' is not centered. Upper chord sliding assembly is exhibiting distress. Suspended span is apparently off center as evidenced by unequal displacement at expansion joints (see inspection walk note, 59.3b).
59.1	**Stringers** – Significant plate wear and laminating corrosion at stringer bearings on floorbeams under deck joints.
59.2	**Floor Beams** – Cracks are present in some of the angle tees that frame the top flanges of the floorbeams into the trusses.
59.3b	**Trusses – Inspection Walk** – The connection on the south side of floorbeam LD 16 is sheared on both sides of the inspection walk (noted in 1992, 1997, and 2001 inspection reports).
59.4	**Bearing Devices** – Many of the girder bearings in the south approach are lifted up and not bearing.
59.5	**Alignment/Structural Members** – The girders in the H ramp are in a sagged position with the deck cast straight on top of them. The girders in the south approaches are not carrying the loads equally due to the problem with the bearings, which is causing the cracks in the diaphragms between the girders due to their movement relative to each other.
59.6	**Deflection/Vibration** – Steel pier caps in Kentucky approach spans have excessive deflection under heavy live loads. Some of the lower deck girders exhibit excessive deflection due to poorly set bearings.
59.7	**Debris on Members** – There is debris on the top flanges of floorbeams at joint locations.
59a	**Paint Condition** – The paint is deteriorating with surface corrosion, pack rust, pitting, and laminating corrosion throughout the structure.
61.5	**Vegetation** – Considerable brush and tree growth within flood levy limits.

IV. Railroad System Summary

BURGESS & NIPLE

To:	File	**Date:**	November 24, 2003
From:	Herb Mack	**Job Number:**	33035
Subject:	Railroad System Summary	**Sect. No./Act.:**	132

Memorandum

Burgess & Niple, Inc.
5085 Reed Road
Columbus, OH 43220
614 459.2050
Fax 614 451.1385

Information obtained in phone conversations with CSXT representatives in November, 2003. The railroad which passes under the Brent Spence Bridge is a main route from the north (Chicago/Toledo), to the south (Atlanta). It also is a major route to the coalfields in Kentucky and West Virginia and carries Amtrak trains three times a week between Chicago and Washington D.C. Approximately 45 – 50 daily trains move on this line.

Close coordination with CSX will be required as the project moves forward. Items known at this time include:

- Clearances required are 23’ vertical and horizontal clearances are a minimum of 10’ from the centerline of the track to the face of the obstruction.
- Criteria for crash walls and impact loading will need to be followed where applicable.
- All plans that affect CSX must receive their review and approval.
- Right-of-Way issues include requirements for aerial easements, encroachment, and potential utilities located within their property.
- Any inspections or tasks requiring access to CSX area must receive their approval prior to entering it.
- Access during construction will require prior approval and a CSX flag person. Present day costs are portal to portal expenses and $500 per day.

APPENDIX H

Cost Estimates

I. Constructability Assessment

CONSTRUCTABILITY ASSESSMENT

Replacement/Rehabilitation of the Brent Spence Bridge and Adjacent Corridor

Prepared for the
Kentucky Transportation Cabinet
And
Ohio Department of Transportation

Prepared By:
The National Constructor's Group
In Association with:
Burgess & Niple, Inc.
American Consulting Engineers
Parsons

April 2005

Table of Contents

Introduction

The National Constructors Group has assessed the conceptual Alternatives Numbers One, Two, Four, Five and Six for the replacement and/or rehabilitation of the Brent Spence Bridge and adjacent I-75 Corridor from a constructability (contractors) perspective.

The assessment includes the following activities:

- Feasibility of ultimately developing a reasonable time span of construction and an economical approach to construction staging and traffic phasing
- Development of conceptual quantities of work and/or allowances for the conceptual cost estimate
- An independent analysis projecting the total project costs based upon construction commencing 2014 and completing 2019.
- An evaluation of potential issues, risks and opportunities
- A comparison of the alternatives

After an initial review of the Alternatives, NCG chose to use Alternative Four "Single Bridge Replacement" as the baseline for its assessment. The detailed discussion will revolve about Alternative Four. The other Alternatives will be discussed as issues which are exceptions to Alternative Four.

Construction Sequence and Schedule

The Construction duration for Alternative Four, assuming full funding is available when actual construction commences is in the range of fifty four to sixty two months depending upon the Notice to Proceed Date for various contracts (e.g., effects of weather on start of construction.)

The initial critical path of construction is the River Crossing Main Span. Once the northbound lanes are complete, the critical path switches to the Ohio roadway work.

Close coordination between the Kentucky Transportation Cabinet and Ohio Department of Transportation will be required for maintenance of traffic relative to placing the new bridge in operation. Both approaches require a lineal sequence once the northbound bridge is completed. The Ohio sequence requires a longer duration than the Kentucky sequence thus requiring detailed special provisions to accommodate the interface between Kentucky Roadway, the River Crossing and the Ohio Roadway.

The Kentucky interface with the River Crossing conceptually requires four significant traffic phases once the northbound River Crossing is initially complete.

The Ohio interface with the River Crossing conceptually requires six significant traffic phases once the northbound River Crossing is initially complete.

The construction durations for the remaining Alternatives are (using the most recent ODOT schedule):

Alternative One commencing construction 2014 and completing construction 2019

Alternative Two commencing construction 2014 and completing construction 2020

Alternative Five commencing construction 2014 and completing construction 2019

Alternative Six commencing construction 2014 and completing construction 2019

Construction Staging and Traffic Phasing

The Construction Staging/Traffic Phasing for the Ohio Approaches for Alternative Four is extremely complex. The first order of business is to reach a Memorandum of Understanding with the City relative to closure of existing cross street bridges that are to be reconstructed and duration and periods such structures can be closed.

To reduce the impact of bridge closures, innovative approaches to sub-structure geometry, foundation and superstructure type selection should occur as the first step of preliminary design.

From the information currently provided, profile conforms and conflicts must also be sorted out as a first step of design.

The initial review of traffic phasing indicates temporary bridges will be required. Furthermore, profile geometry and required structural depths will be an issue for the cross streets and where the ramps to Fort Washington Way tie-in.

The initial review of traffic phasing indicates significant detours will be required for I-75 mainline traffic.

The Construction Staging and Traffic Phasing for the River Crossing for Alternative Four is driven by the approaches to the main span. The main span can be constructed without involvement with the approaches.

The Construction Staging/Traffic Phasing for the Kentucky approaches for Alternative Four are basic to Interstate Highway Reconstruction, that being outside widenings, new alignments which conform to existing roadway coupled with ramp alignment modifications which may require closures or night work.

Conceptual Construction Cost Estimate

The conceptual quantity take-offs are included as Attachment D. These quantities are used as the basis of the conceptual cost estimate. As the program progresses, these quantities can be utilized to contain cost growth during design or as documentation if the scope of work is changed during design thus affecting the cost.

Where quantities of work have been developed, unit prices were used to price individual items of work.

Where quantities of work had not been developed either percentages of the total cost of the unit price work (a major portion of the estimate) or allowances as lump sum were used. The allowances are based upon broad experience in highway and major over water bridge experience. The most important issue is to recognize the items of work that are required at the conceptual stages.

Chart Number 2 summarizes the conceptual construction cost estimate by Group. Chart Number 3 provides the detail included with each Group.

The Conceptual Construction Cost Estimate Total is then carried forward to the Conceptual Total Capital Expenditure.

Analysis of Conceptual Total Capital Expenditures

NCG has identified primary categories of cost to be included in the Total Capital Expenditure. Chart One defines these costs.

Certain items such as right of way, mitigation (i.e., relocation, damages), and utility (owner's construction) costs were developed by other members of the consultant team.

For other cost categories, NCG has expressed an opinion based upon percentages of conceptual construction cost estimate.

Chart One details the Total Capital Expenditure.

Basis of Conceptual Program Total Capital Expenditure

This project, at this phase, appears that it will be classified as a "Mega" project requiring a Financial and Management Plan which must be related to the total Capital Expenditure.

For this reason, the following Categories of Costs have been identified:

- Environmental Study/Preliminary Design - 3% of current construction cost
- Final Design - 9.5% of current construction cost (based upon recent analysis of similar projects)
- Construction Management
    - Department - 6% of current construction cost
    - Third Party (including Quality Control) - 8% of current construction cost
- Environmental / Planning / Right of Way Contingency - 15% of current construction cost
- Design Contingency – 15% of current construction cost
- Construction Reserve (Contract Change Orders) – 5% of current construction cost

Issues

In assessing constructability at the conceptual stage, it is imperative to establish and examine issues that require immediate attention during the development stage. These include the following:

- Program organizational structure and procedures – functional and personnel
- Development of a detailed development, planning and design schedule
- Development of a program delivery strategy
- Design responsibility and approval
- Financial plan approval
- Approach to right of way acquisition
- Approach to Memorandum of Understanding with communities, regulatory agencies, public and private utilities
- Commence in-depth soils investigation program

Risks and Opportunities

In assessing constructability at the conceptual stage of program development, it is imperative to establish and examine the risks and opportunities to improve quality, shorten the program delivery schedule and reduce cost. Potential management strategies should be developed early in the development process. NCG has developed three categories of Risks and Opportunities as follows:

- Category One – Items that require immediate attention during the development stage.
- Category Two – Pre-construction items that impact construction costs and sequence.
- Category Three – Items during construction that impact construction costs and schedule.

Risk evaluation is based on a ten-to-one scale with 10 being extremely high risk

Opportunity evaluation is based on a ten to one scale with 10 being high chance for success.

Category One	Alternatives				
Risks	**1**	**2**	**4**	**5**	**6**
Right of Way	**10**	**10**	**5**	**7**	**10**
Community opposition and legal challenges	**7**	**6**	**8**	**6**	**5**
Utilities	**8**	**8**	**8**	**8**	**8**
Delay in sequence of preferred alternative	**5**	**5**	**4**	**7**	**5**
Potential influence on design criteria	**8**	**7**	**7**	**8**	**7**
Delay in receipt of Record of Decision	**7**	**8**	**7**	**8**	**8**
Environmental mitigation	**5**	**7**	**5**	**7**	**7**

Category Two	Alternatives				
River Crossing Bridge Structures	**1**	**2**	**4**	**5**	**6**
High water – design foundation and substructure to accommodate	**8**	**8**	**8**	**8**	**8**
Access and Logistics – define access approach to river piers – avoid river elevation criteria	**6**	**6**	**5**	**6**	**6**
Containment and treatment of storm water runoff	**9**	**7**	**4**	**7**	**7**
Super-structure type selection	**10**	**10**	**10**	**10**	**10**
Alternative super-structure design – competitive bidding	**8**	**8**	**8**	**8**	**8**
Context – Sensitive design requirement	**10**	**10**	**10**	**10**	**10**
Structure Geometry	**7**	**7**	**6**	**6**	**5**
Coast Guard Requirements – Heavy lifts, etc.	**6**	**6**	**6**	**6**	**6**

Category Two	Alternatives				
Existing BSB Retrofit	1	2	4	5	6
Experience based contract documents, e.g., special provisions	8	6	2	6	8
Structural Integrity of Members	4	4	4	4	4
Lead paint removal issues	10	1	1	1	10
Night work	10	10	10	10	10
Traffic disruption	6	6	5	10	6
Disruption of work due to required sequence	8	5	8	8	5

Category Two	Alternatives				
Existing BSB Removal	1	2	4	5	6
Lead paint removal issues	1	10	10	10	1
Disposal structural steel	4	8	8	8	4
Safety conditions – Coast Guard	5	7	7	7	5
Foundation Removal Requirements	5	7	7	7	5

Category Two	Alternatives				
Roadway Work	1	2	4	5	6
Temporary and permanent storm water pollution control	5	10	5	10	10
Railroad requirements/agreements	10	10	10	10	10
Historical building retrofit, mitigation and relocation	2	2	2	2	2
Pre-construction schedule slippage	6	6	6	6	6

Category Two	Alternatives				
Opportunities	**1**	**2**	**4**	**5**	**6**
Recognize that during design function all parties "Get Smarter." Provide funding for alternatives, separate analysis, implementation of value engineering recommendations.	**7**	**7**	**10**	**7**	**5**
Require Design Team to be co-mingled with department personnel.	**8**	**8**	**8**	**8**	**8**
Deliver very detailed construction and traffic phasing plans.	**8**	**8**	**8**	**8**	**8**
If "High Tech" River Crossing Bridge is chosen, develop completely engineered construction details, calculations and drawings.	**8**	**8**	**8**	**8**	**8**
If "High Tech" River Crossing Bridge is chosen, have independent peer review team for design and constructability.	**9**	**9**	**9**	**9**	**9**
Implement independent third party and department advisory/change committee.	**9**	**9**	**9**	**9**	**9**
Establish bid item allowance funds for certain items of risk.	**8**	**8**	**8**	**8**	**8**

Category Three	Alternatives				
Risks	**1**	**2**	**4**	**5**	**6**
Abnormal escalation of craft labor and permanent materials	**4**	**4**	**4**	**4**	**4**
Competitive bidding atmosphere	**5**	**5**	**5**	**5**	**5**
Adverse impact of unfavorable media	**7**	**7**	**7**	**7**	**7**
Disruptions to local traffic and businesses	**6**	**8**	**8**	**8**	**6**
Noise, vibrations and dust pollution	**5**	**5**	**5**	**5**	**5**

Category Three	Alternatives				
Resource Availability	**1**	**2**	**4**	**5**	**6**
Contractors staff and craft labor	**5**	**5**	**5**	**5**	**5**
Experienced management staff, both agency and third parties	**7**	**7**	**7**	**7**	**7**

Category Three	Alternatives				
Differing Site Conditions	1	2	4	5	6
Roadway	**5**	**5**	**5**	**5**	**5**
Slope Stability	**6**	**5**	**5**	**8**	**6**
Unsuitable foundation conditions for large embankment	**6**	**6**	**6**	**6**	**7**
Ground Water	**5**	**5**	**5**	**5**	**5**
Bridge/Retaining Wall Foundations	**8**	**5**	**5**	**8**	**5**
Unknown Utilities	**6**	**6**	**5**	**7**	**8**
Hazardous Materials	**6**	**7**	**5**	**6**	**6**
Contaminated Water	**6**	**7**	**5**	**6**	**6**
Man-Made buried objects	**6**	**7**	**5**	**6**	**6**
Archeological Sites	**6**	**6**	**6**	**6**	**6**
Aerially Deposited Lead	**8**	**5**	**5**	**5**	**8**
Temporary storm water pollution control	**6**	**7**	**5**	**6**	**6**
Third Party Utility Delays	**7**	**7**	**7**	**7**	**7**
Quantity Growth	**5**	**5**	**5**	**5**	**5**
Extreme Weather Condition	**6**	**6**	**6**	**6**	**6**
Extended review of Contractor Submittals	**5**	**6**	**5**	**6**	**5**
Local Ordinances being changed during construction	**6**	**6**	**6**	**6**	**6**
Construction contract coordination and interface issues, especially between Departments relative to River Bridge M.O.T. sequence	**7**	**7**	**7**	**7**	**7**

Category Three	Alternatives				
Opportunities	**1**	**2**	**4**	**5**	**6**
Develop pro-active management philosophy for construction	**8**	**8**	**8**	**8**	**8**
Contract Special Provisions can be developed to avoid risks of quantity overage and weather conditions	**9**	**9**	**9**	**9**	**9**
Utilize incentives/disincentives for individual project interface	**6**	**6**	**6**	**6**	**6**
Utilize Joint Department/FHWA Management Committee – with specific responsibilities	**8**	**8**	**8**	**8**	**8**

Chart I

CONCEPTUAL PROGRAM TOTAL CAPITAL EXPENDITURE

	Alternative #4 "Base Line" Single Bridge	Alternative #1 - Rehab + I-75 West	Alternate #2 - New East +I-75 West	Alernative #5 - Double Bridge Replacement	Alternative #6 - Rehab + I-75/I-71 West
	Alternative Description				
Conceptual Construction Cost Estimate	553,408,255	667,505,630	745,965,740	747,888,922	707,037,518
Right of Way					
Mitigation					
Utilities (Owner Construction)					
Zone or Limited Air Space					
Sub Total Facilities	**553,408,255**	**667,505,630**	**745,965,740**	**747,888,922**	**707,037,518**
Preliminary Final Design	52,573,784	63,413,035	70,866,745	71,049,448	67,168,564
Construction Management - Department	33,204,495	40,050,338	44,757,944	44,873,335	42,422,251
Construction Management - Third Party	44,272,660	53,400,451	59,677,259	59,831,114	56,563,001
Sub Total Design/Management	**130,050,939**	**156,863,824**	**175,301,948**	**175,753,897**	**166,153,816**
Planning Contingency	83,011,238	100,125,845	111,894,861	112,183,338	106,055,628
Design Contingency	83,011,238	100,125,845	111,894,861	112,183,338	106,055,628
Construction Reserve	27,670,413	33,375,282	37,298,287	37,394,446	35,351,876
Sub Total Contingency & Reserve	**193,692,889**	**233,626,972**	**261,088,009**	**261,761,122**	**247,463,132**
PROGRAM CAPITAL EXPENDITURE(2005 DOLLARS)	**877,152,083**	**1,057,996,426**	**1,182,355,697**	**1,185,403,941**	**1,120,654,466**
Escalation Based Upon 2019 Completion	182,624,726	220,276,851	246,168,692	246,803,346	233,322,410

*Escalation midpoint of construction being year 2017 or 11 years of escalation at 3% (not compounded)=33% of construction cost

Attachment A

Chart 2
CONCEPTUAL PROGRAM CONSTRUCTION COST

	Alternative Description				
	Alternative #4 "Base Line" Single Bridge	Alternative #1 - Rehab + I-75 West	Alternate #2 - New East +I-75 West	Alernative #5 - Double Bridge Replacement	Alternative #6 - Rehab + I-75/I-71 West
Conceptual Construction Cost Estimate					
Controls/Preparation	66,261,626	115,134,027	134,250,437	115,135,223	117,857,248
Roadway Earthwork	46,618,796	46,637,396	46,637,396	60,559,096	60,559,096
Roadway Structural Section	19,165,003	19,165,003	19,165,003	24,914,406	24,914,406
Structures	25,151,160	87,320,960	25,220,960	25,590,900	87,690,900
Bridge - River Crossing	192,000,000	136,000,000	245,520,000	216,000,000	136,000,000
Bridge - Roadway	125,120,000	154,902,400	154,910,400	190,659,040	190,659,040
Retaining Walls	19,792,800	47,296,800	57,852,000	47,296,800	19,792,800
Drainage	5,684,960	5,684,960	5,684,960	5,684,960	5,684,960
Traffic Delination/Safety	20,489,680	20,489,680	20,489,680	24,347,216	24,347,216
Maintenance of Traffic	12,901,340	12,901,340	12,901,340	13,981,608	13,981,608
Utilities (Contractor Required)	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Other	18,222,890	19,973,070	21,333,564	21,719,673	23,550,244
TOTAL PROGRAM COST	553,408,255	667,505,636	745,965,740	747,888,922	707,037,518

Chart 3

Attachment C

Conceptual Construction Cost Estimate - Detail
Alternative #1 - Rehab + I-75 West

Item No.	Item Description	Unit	Quantity	Unit Cost	Total
Group A	**CONTROLS & PREPARATIONS**				
1	Mobilization	LS	5%		$34,690,192
2	Schedule	LS	1	$7,525,000.00	$7,525,000
3	Survey	LS	1	$8,292,000.00	$8,292,000
4	Clearing & Grubbing	AC	88	$5,000.00	$440,000
5	Removal Existing Structures	SY	220,665	$225.00	$49,649,625
6	Removal Pavement & Misc. Concrete	SY	397,442	$5.00	$1,987,210
7	Hazardous Material	Location	15	$250,000.00	$3,750,000
8	Contanimated Water	AC	88	$100,000.00	$8,800,000
	Subtotal Group A				$115,134,027
Group B	**ROADWAY EARTHWORK**				
9	Roadway Excavation Incl. Haul	CY	15,000	$15.00	$225,000
10	Select Borrow Incl. Haul	TN	451,770	$7.25	$3,275,333
11	Common Borrow Incl. Haul	CY	3,885,615	$11.00	$42,741,765
12	Embankment Compaction	CY	225,885	$1.75	$395,299
	Subtotal Group B				$46,637,396
Group C	**ROADWAY STRUCTURAL SECTIONS**				
13	Approach Sub-Base	TN	245,243	$11.00	$2,697,673
14	Approach Base	TN	230,765	$15.00	$3,461,475
15	Asphalt Pavement	TN	75,163	$45.00	$3,382,335
16	Concrete Pavement 12"	CY	80,196	$120.00	$9,623,520
	Subtotal Group C				$19,165,003
Group D	**STRUCTURES**				
17	Structure Excavation	CY	36,296	$10.00	$362,960
18	Bridge - River Crossing	SF	320,000	$425.00	$136,000,000
19	Bridge - Roadway	SF	968,140	$160.00	$154,902,400
20	Bridge - Retrofit Existing	SF	276,000	$300.00	$82,800,000
21	Bridge - Remove Existing	SF	0	$0.00	$0
22	Retaining Walls - M.S.E.	SF	352,800	$45.00	$15,876,000
23	Retaining Walls - Cut Walls	SF	160,050	$96.00	$15,364,800
24	Retaining Walls - Cast in Place	SF	167,250	$96.00	$16,056,000
25	Drainage - Box Culverts	LF	0	$0.00	$0
26	Noise Walls	SF	277,200	$15.00	$4,158,000
	Subtotal Group D				$425,520,160
Group E	**DRAINAGE**				
27	Inlet Structure	EA	250	$14,000.00	$3,500,000
28	Culvert Pipe PPC 24"	LF	29,568	$45.00	$1,330,560
29	Miscellaneous Drainage	ALLOW	1	$300,000.00	$300,000
30	Edge Drains	LF	18,480	$30.00	$554,400
	Subtotal Group E				$5,684,960

	Alternative 1				
Group F	**TRAFFIC DELINATION & SAFETY**				
31	Metal Beam Guard Rail	LF	76,580	$13.00	$995,540
32	Metal Beam Guard Rail Anchors	EA	174	$500.00	$87,000
33	Precast Concrete Barrier Rail	LF	10,560	$25.00	$264,000
34	Cast In Place Concrete Barrier Rail	LF	31,810	$50.00	$1,590,500
35	Impact Atenuators	EA	120	$20,000.00	$2,400,000
36	Traffic Stripping	LF	376,080	$1.75	$658,140
37	Permanent Overhead Signs	EA	10	$150,000.00	$1,500,000
38	Permanent Signs	LS	1	$4,440,000.00	$4,440,000
39	Traffic Signals	LS	1	$2,850,000.00	$2,850,000
40	Highway Lighting	LS	1	$4,500,000.00	$4,500,000
41	IT Systems	LS	1	$1,200,000.00	$1,200,000
42	Pavement Markings	EA	30	$150.00	$4,500
	Subtotal Group F				$20,489,680
Group G	**MAINTENANCE OF TRAFFIC**				
43	Temporary Concrete Barrier Rail	LF	20,000	$11.00	$220,000
44	Temporary Impact Atenuators	EA	20	$50,000.00	$1,000,000
45	Temporary Traffic Stripping	LF	73,920	$1.00	$73,920
46	Temporary Pavement Marking	EA	10	$200.00	$2,000
47	Temporary Sign Boards	EA	15	$12,000.00	$180,000
48	Temporary Signs	LS	1	$300,000.00	$300,000
49	Aggregate Base - Detours	TN	45,000	$15.00	$675,000
50	Asphalt - Detours	TN	30,000	$45.00	$1,350,000
51	Removal Detours	SY	15,000	$5.00	$75,000
52	Removal Traffic Stripping	LF	23,920	$1.00	$23,920
53	Removal Traffic Markings	EA	10	$150.00	$1,500
54	Temporary Bridges	SF	1	$0.00	$0
55	Night Traffic Operation	ALLOW	1	$7,000,000.00	$7,000,000
56	Temporary Roadway Lighting	ALLOW	1	$500,000.00	$500,000
57	Maintain Existing Roadway Lighting	ALLOW	1	$1,500,000.00	$1,500,000
	Subtotal Group G				$12,901,340
Group H	**UTILITIES (CONTRACTOR REQUIRED)**				
58	Sewer Lines	ALLOW	1	$1,000,000.00	$1,000,000
59	Water Lines	ALLOW	1	$1,000,000.00	$1,000,000
	Subtotal Group H				$2,000,000
Group I	**OTHER ITEMS**				
60	Misc. Concrete, Curb, Gutter, Sidewalks	LF	42,240	$50.00	$2,112,000
61	Misc. Concrete, Drainage Ditches	LF	36,960	$25.00	$924,000
62	Temporary Water Pollution Control	AC	88	$50,000.00	$4,400,000
63	Permanent Water Pollution Control	ALLOW	1	$2,000,000.00	$2,000,000
64	Landscaping	AC	22	$5,000.00	$110,000
65	Chain Link Fence	LF	63,620	$12.00	$763,440
66	Non-Identified Items	LS	1	1.5%	$9,663,630
	Subtotal Group I				$19,973,070

Sub Total Facilities		$667,505,636
Preliminary/Final Design	9.5%	$63,413,035
Construction Management- Department	6%	$40,050,338
Third Party	8%	$53,400,451
Sub Total Design/Management		$156,863,825
Planning Contingency	15%	$100,125,845
Design Contingency	15%	$100,125,845
Construction Reserve	5%	$33,375,282
Sub Total Contingency/Reserve		$233,626,972.69
Program Capital Expenditure (2005 dollars)		$1,057,996,433

Chart 3

Attachment C

Conceptual Construction Cost Estimate - Detail
Alternative #2 - New East + I-75 West

Item No.	Item Description	Unit	Quantity	Unit Cost	Total
Group A	**CONTROLS & PREPARATIONS**				
1	Mobilization	LS	5%		$36,006,727
2	Schedule	LS	1	$7,525,000.00	$7,525,000
3	Survey	LS	1	$8,292,000.00	$8,292,000
4	Clearing & Grubbing	AC	88	$5,000.00	$440,000
5	Removal Existing Structures	SY	294,220	$225.00	$66,199,500
6	Removal Pavement & Misc. Concrete	SY	397,442	$5.00	$1,987,210
7	Hazardous Material	Location	20	$250,000.00	$5,000,000
8	Contanimated Water	AC	88	$100,000.00	$8,800,000
	Subtotal Group A				$134,250,437
Group B	**ROADWAY EARTHWORK**				
9	Roadway Excavation Incl. Haul	CY	15,000	$15.00	$225,000
10	Select Borrow Incl. Haul	TN	451,770	$7.25	$3,275,333
11	Common Borrow Incl. Haul	CY	3,885,615	$11.00	$42,741,765
12	Embankment Compaction	CY	225,885	$1.75	$395,299
	Subtotal Group B				$46,637,396
Group C	**ROADWAY STRUCTURAL SECTIONS**				
13	Approach Sub-Base	TN	245,243	$11.00	$2,697,673
14	Approach Base	TN	230,765	$15.00	$3,461,475
15	Asphalt Pavement	TN	75,163	$45.00	$3,382,335
16	Concrete Pavement 12"	CY	80,196	$120.00	$9,623,520
	Subtotal Group C				$19,165,003
Group D	**STRUCTURES**				
17	Structure Excavation	CY	36,296	$10.00	$362,960
18	Bridge - River Crossing	SF	528,000	$465.00	$245,520,000
19	Bridge - Roadway	SF	968,190	$160.00	$154,910,400
20	Bridge - Retrofit Existing	SF	0	$0.00	$0
21	Bridge - Remove Existing	SF	276,000	$75.00	$20,700,000
22	Retaining Walls - M.S.E.	SF	352,800	$45.00	$15,876,000
23	Retaining Walls - Cut Walls	SF	160,050	$96.00	$15,364,800
24	Retaining Walls - Cast in Place	SF	277,200	$96.00	$26,611,200
25	Drainage - Box Culverts	LF	0	$0.00	$0
26	Noise Walls	SF	277,200	$15.00	$4,158,000
	Subtotal Group D				$483,503,360
Group E	**DRAINAGE**				
27	Inlet Structure	EA	250	$14,000.00	$3,500,000
28	Culvert Pipe PPC 24"	LF	29,568	$45.00	$1,330,560
29	Miscellaneous Drainage	ALLOW	1	$300,000.00	$300,000
30	Edge Drains	LF	18,480	$30.00	$554,400
	Subtotal Group E				$5,684,960

	ALTERNATE 2				
Group F	**TRAFFIC DELINATION & SAFETY**				
31	Metal Beam Guard Rail	LF	76,580	$13.00	$995,540
32	Metal Beam Guard Rail Anchors	EA	174	$500.00	$87,000
33	Precast Concrete Barrier Rail	LF	10,560	$25.00	$264,000
34	Cast In Place Concrete Barrier Rail	LF	31,810	$50.00	$1,590,500
35	Impact Atenuators	EA	120	$20,000.00	$2,400,000
36	Traffic Stripping	LF	376,080	$1.75	$658,140
37	Permanent Overhead Signs	EA	10	$150,000.00	$1,500,000
38	Permanent Signs	LS	1	$4,440,000.00	$4,440,000
39	Traffic Signals	LS	1	$2,850,000.00	$2,850,000
40	Highway Lighting	LS	1	$4,500,000.00	$4,500,000
41	IT Systems	LS	1	$1,200,000.00	$1,200,000
42	Pavement Markings	EA	30	$150.00	$4,500
	Subtotal Group F				$20,489,680
Group G	**MAINTENANCE OF TRAFFIC**				
43	Temporary Concrete Barrier Rail	LF	20,000	$11.00	$220,000
44	Temporary Impact Atenuators	EA	20	$50,000.00	$1,000,000
45	Temporary Traffic Stripping	LF	73,920	$1.00	$73,920
46	Temporary Pavement Marking	EA	10	$200.00	$2,000
47	Temporary Sign Boards	EA	15	$12,000.00	$180,000
48	Temporary Signs	LS	1	$300,000.00	$300,000
49	Aggregate Base - Detours	TN	45,000	$15.00	$675,000
50	Asphalt - Detours	TN	30,000	$45.00	$1,350,000
51	Removal Detours	SY	15,000	$5.00	$75,000
52	Removal Traffic Stripping	LF	23,920	$1.00	$23,920
53	Removal Traffic Markings	EA	10	$150.00	$1,500
54	Temporary Bridges	SF	1	$0.00	$0
55	Night Traffic Operation	ALLOW	1	$7,000,000.00	$7,000,000
56	Temporary Roadway Lighting	ALLOW	1	$500,000.00	$500,000
57	Maintain Existing Roadway Lighting	ALLOW	1	$1,500,000.00	$1,500,000
	Subtotal Group G				$12,901,340
Group H	**UTILITIES (CONTRACTOR REQUIRED)**				
58	Sewer Lines	ALLOW	1	$1,000,000.00	$1,000,000
59	Water Lines	ALLOW	1	$1,000,000.00	$1,000,000
	Subtotal Group H				$2,000,000
Group I	**OTHER ITEMS**				
60	Misc. Concrete, Curb, Gutter, Sidewalks	LF	42,240	$50.00	$2,112,000
61	Misc. Concrete, Drainage Ditches	LF	36,960	$25.00	$924,000
62	Temporary Water Pollution Control	AC	88	$50,000.00	$4,400,000
63	Permanent Water Pollution Control	ALLOW	1	$2,000,000.00	$2,000,000
64	Landscaping	AC	22	$5,000.00	$110,000
65	Chain Link Fence	LF	63,620	$12.00	$763,440
66	Non-Identified Items	LS	1	1.5%	$11,024,124
	Subtotal Group I				$21,333,564

Sub Total Facilities		$745,965,740
Preliminary/Final Design	9.5%	$70,866,745
Construction Management - Department	6%	$44,757,944
Third Party	8%	$59,677,259
Sub Total Design/Management		$175,301,949
Planning Contingency	15%	$111,894,861
Design Contingency	15%	$111,894,861
Construction Reserve	5%	$37,298,287
Sub Total Contingency/Reserve		$261,088,009
Program Capital Expenditure (2005 dollars)		$1,182,355,698

Chart 3

Attachment C

Conceptual Construction Cost Estimate - Detail
Alternative #4 - Baseline Estimate - Single Bridge Replacement

Item No.	Item Description	Unit	Quantity	Unit Cost	Total
Group A	**CONTROLS & PREPARATIONS**				
1	Mobilization	LS	5%		$26,140,001
2	Schedule	LS	1	$7,000,000.00	$7,000,000
3	Survey	LS	1	$8,292,000.00	$8,292,000
4	Clearing & Grubbing	AC	83	$5,000.00	$415,000
5	Removal Existing Structures	SY	58,844	$225.00	$13,239,900
6	Removal Pavement & Misc. Concrete	SY	374,945	$5.00	$1,874,725
7	Hazardous Material	Location	4	$250,000.00	$1,000,000
8	Contanimated Water	AC	83	$100,000.00	$8,300,000
	Subtotal Group A				$66,261,626
Group B	**ROADWAY EARTHWORK**				
9	Roadway Excavation Incl. Haul	CY	13,760	$15.00	$206,400
10	Select Borrow Incl. Haul	TN	451,770	$7.25	$3,275,333
11	Common Borrow Incl. Haul	CY	3,885,615	$11.00	$42,741,765
12	Embankment Compaction	CY	225,885	$1.75	$395,299
	Subtotal Group B				$46,618,796
Group C	**ROADWAY STRUCTURAL SECTIONS**				
13	Approach Sub-Base	TN	245,243	$11.00	$2,697,673
14	Approach Base	TN	230,765	$15.00	$3,461,475
15	Asphalt Pavement	TN	75,163	$45.00	$3,382,335
16	Concrete Pavement 12"	CY	80,196	$120.00	$9,623,520
	Subtotal Group C				$19,165,003
Group D	**STRUCTURES**				
17	Structure Excavation	CY	29,316	$10.00	$293,160
18	Bridge - River Crossing	SF	384,000	$500.00	$192,000,000
19	Bridge - Roadway	SF	782,000	$160.00	$125,120,000
20	Bridge - Retrofit Existing	SF	0	$0.00	$0
21	Bridge - Remove Existing	SF	276,000	$75.00	$20,700,000
22	Retaining Walls - M.S.E.	SF	352,800	$45.00	$15,876,000
23	Retaining Walls - Cut Walls	SF	16,800	$96.00	$1,612,800
24	Retaining Walls - Cast in Place	SF	24,000	$96.00	$2,304,000
25	Drainage - Box Culverts	LF	0		$0
26	Noise Walls	SF	277,200	$15.00	$4,158,000
	Subtotal Group D				$362,063,960
Group E	**DRAINAGE**				
27	Inlet Structure	EA	250	$14,000.00	$3,500,000
28	Culvert Pipe PPC 24"	LF	29,568	$45.00	$1,330,560
29	Miscellaneous Drainage	ALLOW	1	$300,000.00	$300,000
30	Edge Drains	LF	18,480	$30.00	$554,400
	Subtotal Group E				$5,684,960

	Alternative 4				
Group F	**TRAFFIC DELINATION & SAFETY**				
31	Metal Beam Guard Rail	LF	76,580	$13.00	$995,540
32	Metal Beam Guard Rail Anchors	EA	174	$500.00	$87,000
33	Precast Concrete Barrier Rail	LF	10,560	$25.00	$264,000
34	Cast In Place Concrete Barrier Rail	LF	31,810	$50.00	$1,590,500
35	Impact Atenuators	EA	120	$20,000.00	$2,400,000
36	Traffic Stripping	LF	376,080	$1.75	$658,140
37	Permanent Overhead Signs	EA	10	$150,000.00	$1,500,000
38	Permanent Signs	LS	1	$4,440,000.00	$4,440,000
39	Traffic Signals	LS	1	$2,850,000.00	$2,850,000
40	Highway Lighting	LS	1	$4,500,000.00	$4,500,000
41	IT Systems	LS	1	$1,200,000.00	$1,200,000
42	Pavement Markings	EA	30	$150.00	$4,500
	Subtotal Group F				$20,489,680
Group G	**MAINTENANCE OF TRAFFIC**				
43	Temporary Concrete Barrier Rail	LF	20,000	$11.00	$220,000
44	Temporary Impact Atenuators	EA	20	$50,000.00	$1,000,000
45	Temporary Traffic Stripping	LF	73,920	$1.00	$73,920
46	Temporary Pavement Marking	EA	10	$200.00	$2,000
47	Temporary Sign Boards	EA	15	$12,000.00	$180,000
48	Temporary Signs	LS	1	$300,000.00	$300,000
49	Aggregate Base - Detours	TN	45,000	$15.00	$675,000
50	Asphalt - Detours	TN	30,000	$45.00	$1,350,000
51	Removal Detours	SY	15,000	$5.00	$75,000
52	Removal Traffic Stripping	LF	23,920	$1.00	$23,920
53	Removal Traffic Markings	EA	10	$150.00	$1,500
54	Temporary Bridges	SF	1	$0.00	$0
55	Night Traffic Operation	ALLOW	1	$7,000,000.00	$7,000,000
56	Temporary Roadway Lighting	ALLOW	1	$500,000.00	$500,000
57	Maintain Existing Roadway Lighting	ALLOW	1	$1,500,000.00	$1,500,000
	Subtotal Group G				$12,901,340
Group H	**UTILITIES (CONTRACTOR REQUIRED)**				
58	Sewer Lines	ALLOW	1	$1,000,000.00	$1,000,000
59	Water Lines	ALLOW	1	$1,000,000.00	$1,000,000
	Subtotal Group H				$2,000,000
Group I	**OTHER ITEMS**				
60	Misc. Concrete, Curb, Gutter, Sidewalks	LF	42,240	$50.00	$2,112,000
61	Misc. Concrete, Drainage Ditches	LF	36,960	$25.00	$924,000
62	Temporary Water Pollution Control	AC	83	$50,000.00	$4,150,000
63	Permanent Water Pollution Control	ALLOW	1	$2,000,000.00	$2,000,000
64	Landscaping	AC	19	$5,000.00	$95,000
65	Chain Link Fence	LF	63,620	$12.00	$763,440
66	Non-Identified Items	LS	1	1.5%	$8,178,450
	Subtotal Group I				$18,222,890

Sub Total Facilities		$553,408,255
Preliminary/Final Design	9.5%	$52,573,784
Construction Management - Department	6%	$33,204,495
- Third Party	8%	$44,272,660
Sub Total Design/Management		$130,050,940
Planning Contingency	15%	$83,011,238
Design Contingency	15%	$83,011,238
Construction Reserve	5%	$27,670,413
Sub Total Contingency/Reserve		$193,692,889
Program Capital Expenditure (2005 dollars)		$877,152,085

Chart 3

Attachment C

Conceptual Construction Cost Estimate - Detail
Alternative #5 - Double Bridge Replacement

Item No.	Item Description	Unit	Quantity	Unit Cost	Total
Group A	**CONTROLS & PREPARATIONS**				
1	Mobilization	LS	5%		$34,281,388
2	Schedule	LS	1	$7,525,000.00	$7,525,000
3	Survey	LS	1	$8,282,000.00	$8,282,000
4	Clearing & Grubbing	AC	92	$5,000.00	$460,000
5	Removal Existing Structures	SY	220,665	$225.00	$49,649,625
6	Removal Pavement & Misc. Concrete	SY	397,442	$5.00	$1,987,210
7	Hazardous Material	Location	15	$250,000.00	$3,750,000
8	Contanimated Water	AC	92	$100,000.00	$9,200,000
	Subtotal Group A				$115,135,223
Group B	**ROADWAY EARTHWORK**				
9	Roadway Excavation Incl. Haul	CY	15,000	$15.00	$225,000
10	Select Borrow Incl. Haul	TN	587,301	$7.25	$4,257,932
11	Common Borrow Incl. Haul	CY	5,051,299	$11.00	$55,564,289
12	Embankment Compaction	CY	292,500	$1.75	$511,875
	Subtotal Group B				$60,559,096
Group C	**ROADWAY STRUCTURAL SECTIONS**				
13	Approach Sub-Base	TN	318,816	$11.00	$3,506,976
14	Approach Base	TN	299,994	$15.00	$4,499,910
15	Asphalt Pavement	TN	97,712	$45.00	$4,397,040
16	Concrete Pavement 12"	CY	104,254	$120.00	$12,510,480
	Subtotal Group C				$24,914,406
Group D	**STRUCTURES**				
17	Structure Excavation	CY	73,290	$10.00	$732,900
18	Bridge - River Crossing	SF	432,000	$500.00	$216,000,000
19	Bridge - Roadway	SF	1,191,619	$160.00	$190,659,040
20	Bridge - Retrofit Existing	SF	0	$0.00	$0
21	Bridge - Remove Existing	SF	276,000	$75.00	$20,700,000
22	Retaining Walls - M.S.E.	SF	352,800	$45.00	$15,876,000
23	Retaining Walls - Cut Walls	SF	160,050	$96.00	$15,364,800
24	Retaining Walls - Cast in Place	SF	167,250	$96.00	$16,056,000
25	Drainage - Box Culverts	LF	0		$0
26	Noise Walls	SF	277,200	$15.00	$4,158,000
	Subtotal Group D				$479,546,740
Group E	**DRAINAGE**				
27	Inlet Structure	EA	250	$14,000.00	$3,500,000
28	Culvert Pipe PPC 24"	LF	29,568	$45.00	$1,330,560
29	Miscellaneous Drainage	ALLOW	1	$300,000.00	$300,000
30	Edge Drains	LF	18,480	$30.00	$554,400
	Subtotal Group E				$5,684,960

	Alternative 5				
Group F	**TRAFFIC DELINATION & SAFETY**				
31	Metal Beam Guard Rail	LF	91,896	$13.00	$1,194,648
32	Metal Beam Guard Rail Anchors	EA	208	$500.00	$104,000
33	Precast Concrete Barrier Rail	LF	12,672	$25.00	$316,800
34	Cast In Place Concrete Barrier Rail	LF	38,172	$50.00	$1,908,600
35	Impact Atenuators	EA	144	$20,000.00	$2,880,000
36	Traffic Stripping	LF	451,296	$1.75	$789,768
37	Permanent Overhead Signs	EA	12	$150,000.00	$1,800,000
38	Permanent Signs	LS	1	$5,328,000.00	$5,328,000
39	Traffic Signals	LS	1	$3,420,000.00	$3,420,000
40	Highway Lighting	LS	1	$5,400,000.00	$5,400,000
41	IT Systems	LS	1	$1,200,000.00	$1,200,000
42	Pavement Markings	EA	36	$150.00	$5,400
	Subtotal Group F				$24,347,216
Group G	**MAINTENANCE OF TRAFFIC**				
42	Temporary Concrete Barrier Rail	LF	24,000	$11.00	$264,000
44	Temporary Impact Atenuators	EA	24	$50,000.00	$1,200,000
45	Temporary Traffic Stripping	LF	88,704	$1.00	$88,704
46	Temporary Pavement Marking	EA	12	$200.00	$2,400
47	Temporary Sign Boards	EA	18	$12,000.00	$216,000
48	Temporary Signs	LS	1	$360,000.00	$360,000
49	Aggregate Base - Detours	TN	54,000	$15.00	$810,000
50	Asphalt - Detours	TN	36,000	$45.00	$1,620,000
51	Removal Detours	SY	18,000	$5.00	$90,000
52	Removal Traffic Stripping	LF	28,704	$1.00	$28,704
53	Removal Traffic Markings	EA	12	$150.00	$1,800
54	Temporary Bridges	SF	1	$0.00	$0
55	Night Traffic Operation	ALLOW	1	$7,000,000.00	$7,000,000
56	Temporary Roadway Lighting	ALLOW	1	$500,000.00	$500,000
57	Maintain Existing Roadway Lighting	ALLOW	1	$1,800,000.00	$1,800,000
	Subtotal Group G				$13,981,608
Group H	**UTILITIES (CONTRACTOR REQUIRED)**				
58	Sewer Lines	ALLOW	1	$1,000,000.00	$1,000,000
59	Water Lines	ALLOW	1	$1,000,000.00	$1,000,000
	Subtotal Group H				$2,000,000
Group I	**OTHER ITEMS**				
60	Misc. Concrete, Curb, Gutter, Sidewalks	LF	42,240	$50.00	$2,112,000
61	Misc. Concrete, Drainage Ditches	LF	36,960	$25.00	$924,000
62	Temporary Water Pollution Control	AC	92	$50,000.00	$4,600,000
63	Permanent Water Pollution Control	ALLOW	1	$2,000,000.00	$2,000,000
64	Landscaping	AC	23	$5,000.00	$115,000
65	Chain Link Fence	LF	76,344	$12.00	$916,128
66	Non-Identified Items	LS	1	1.5%	$11,052,545
	Subtotal Group I				$21,719,673

Sub Total Facilities		$747,888,922
Preliminary/Final Design	9.5%	$71,049,448
Construction Management - Department	6%	$44,873,335
- Third Party	8%	$59,831,114
Sub Total Design/Management		$175,753,897
Planning Contingency	15%	$112,183,338
Design Contingency	15%	$112,183,338
Construction Reserve	5%	$37,394,446
Sub Total Contingency/Reserve		$261,761,123
Program Capital Expenditure (2005 dollars)		$1,185,403,942

Chart 3

Attachment C

Conceptual Construction Cost Estimate - Detail

Alternative #6 - Rehab + I-75/I-71

Item No.	Item Description	Unit	Quantity	Unit Cost	Total
Group A	**CONTROLS & PREPARATIONS**				
1	Mobilization	LS	5%		$36,993,413
2	Schedule	LS	1	$7,525,000.00	$7,525,000
3	Survey	LS	1	$8,292,000.00	$8,292,000
4	Clearing & Grubbing	AC	92	$5,000.00	$460,000
5	Removal Existing Structures	SY	220,665	$225.00	$49,649,625
6	Removal Pavement & Misc. Concrete	SY	397,442	$5.00	$1,987,210
7	Hazardous Material	Location	15	$250,000.00	$3,750,000
8	Contanimated Water	AC	92	$100,000.00	$9,200,000
	Subtotal Group A				$117,857,248
Group B	**ROADWAY EARTHWORK**				
9	Roadway Excavation Incl. Haul	CY	15,000	$15.00	$225,000
10	Select Borrow Incl. Haul	TN	587,301	$7.25	$4,257,932
11	Common Borrow Incl. Haul	CY	5,051,299	$11.00	$55,564,289
12	Embankment Compaction	CY	292,500	$1.75	$511,875
	Subtotal Group B				$60,559,096
Group C	**ROADWAY STRUCTURAL SECTIONS**				
13	Approach Sub-Base	TN	318,816	$11.00	$3,506,976
14	Approach Base	TN	299,994	$15.00	$4,499,910
15	Asphalt Pavement	TN	97,712	$45.00	$4,397,040
16	Concrete Pavement 12"	CY	104,254	$120.00	$12,510,480
	Subtotal Group C				$24,914,406
Group D	**STRUCTURES**				
17	Structure Excavation	CY	73,290	$10.00	$732,900
18	Bridge - River Crossing	SF	320,000	$425.00	$136,000,000
19	Bridge - Roadway	SF	1,191,619	$160.00	$190,659,040
20	Bridge - Retrofit Existing	SF	276,000	$300.00	$82,800,000
21	Bridge - Remove Existing	SF	0	$0.00	$0
22	Retaining Walls - M.S.E.	SF	352,800	$45.00	$15,876,000
23	Retaining Walls - Cut Walls	SF	16,800	$96.00	$1,612,800
24	Retaining Walls - Cast in Place	SF	24,000	$96.00	$2,304,000
25	Drainage - Box Culverts	LF	0	$0.00	$0
26	Noise Walls	SF	277,200	$15.00	$4,158,000
	Subtotal Group D				$434,142,740
Group E	**DRAINAGE**				
27	Inlet Structure	EA	250	$14,000.00	$3,500,000
28	Culvert Pipe PPC 24"	LF	29,568	$45.00	$1,330,560
29	Miscellaneous Drainage	ALLOW	1	$300,000.00	$300,000
30	Edge Drains	LF	18,480	$30.00	$554,400
	Subtotal Group E				$5,684,960

	Alternative 6				
Group F	**TRAFFIC DELINATION & SAFETY**				
31	Metal Beam Guard Rail	LF	91,896	$13.00	$1,194,648
32	Metal Beam Guard Rail Anchors	EA	208	$500.00	$104,000
33	Precast Concrete Barrier Rail	LF	12,672	$25.00	$316,800
34	Cast In Place Concrete Barrier Rail	LF	38,172	$50.00	$1,908,600
35	Impact Atenuators	EA	144	$20,000.00	$2,880,000
36	Traffic Stripping	LF	451,296	$1.75	$789,768
37	Permanent Overhead Signs	EA	12	$150,000.00	$1,800,000
38	Permanent Signs	LS	1	$5,328,000.00	$5,328,000
39	Traffic Signals	LS	1	$3,420,000.00	$3,420,000
40	Highway Lighting	LS	1	$5,400,000.00	$5,400,000
41	IT Systems	LS	1	$1,200,000.00	$1,200,000
42	Pavement Markings	EA	36	$150.00	$5,400
	Subtotal Group F				$24,347,216
Group G	**MAINTENANCE OF TRAFFIC**				
43	Temporary Concrete Barrier Rail	LF	24,000	$11.00	$264,000
44	Temporary Impact Atenuators	EA	24	$50,000.00	$1,200,000
45	Temporary Traffic Stripping	LF	88,704	$1.00	$88,704
46	Temporary Pavement Marking	EA	12	$200.00	$2,400
47	Temporary Sign Boards	EA	18	$12,000.00	$216,000
48	Temporary Signs	LS	1	$360,000.00	$360,000
49	Aggregate Base - Detours	TN	54,000	$15.00	$810,000
50	Asphalt - Detours	TN	36,000	$45.00	$1,620,000
51	Removal Detours	SY	18,000	$5.00	$90,000
52	Removal Traffic Stripping	LF	28,704	$1.00	$28,704
53	Removal Traffic Markings	EA	12	$150.00	$1,800
54	Temporary Bridges	SF	1	$0.00	$0
55	Night Traffic Operation	ALLOW	1	$7,000,000.00	$7,000,000
56	Temporary Roadway Lighting	ALLOW	1	$500,000.00	$500,000
57	Maintain Existing Roadway Lighting	ALLOW	1	$1,800,000.00	$1,800,000
	Subtotal Group G				$13,981,608
Group H	**UTILITIES (CONTRACTOR REQUIRED)**				
58	Sewer Lines	ALLOW	1	$1,000,000.00	$1,000,000
59	Water Lines	ALLOW	1	$1,000,000.00	$1,000,000
	Subtotal Group H				$2,000,000
Group I	**OTHER ITEMS**				
60	Misc. Concrete, Curb, Gutter, Sidewalks	LF	42,240	$50.00	$2,112,000
61	Misc. Concrete, Drainage Ditches	LF	36,960	$25.00	$924,000
62	Temporary Water Pollution Control	AC	92	$50,000.00	$4,600,000
63	Permanent Water Pollution Control	ALLOW	1	$2,000,000.00	$2,000,000
64	Landscaping	AC	23	$5,000.00	$115,000
65	Chain Link Fence	LF	76,344	$12.00	$916,128
66	Non-Identified Items	LS	1	1.5%	$12,883,116
	Subtotal Group I				$23,550,244

Sub Total Facilities		$707,037,518
Preliminary/Final Design	9.5%	$67,168,564
Construction Management - Department	6%	$42,422,251
- Third Party	8%	$56,563,001
Sub Total Design/Management		$166,153,817
Planning Contingency	15%	$106,055,628
Design Contingency	15%	$106,055,628
Construction Reserve	5%	$35,351,876
Sub Total Contingency/Reserve		$247,463,131
Program Capital Expenditure (2005 dollars)		$1,120,654,466

BRIDGE REMOVAL TAKE-OFF

Project: Ohio River I-75

Estimator: L.E. McAfee   Date: 11/25/04

Removal of Brent Spencer Bridge
Assume 276,000 sf of Deck
Steel Structure with Concrete Deck
Schedule 1 yr. for Removal
Use: $75.00 SF

	Quantity	Unit	Rate		Amount
Labor:					
50 Men for 1 yr (2080 hrs) =	104,000	Mh	$75.00		$7,800,000.00
Total Labor					$7,800,000.00

	Quantity	Unit	Rate		Amount
Equipment:					
2 Ea Hoe Rams	24	Mo	$24,000.00		$576,000.00
2 Ea 250 Tn Cranes w/Barges	24	Mo	$59,235.00		$1,421,640.00
4 Ea 50'x200' Muck Barges	48	Mo	$25,000.00		$1,200,000.00
2 Ea 600 Hp Tugs	24	Mo	$46,400.00		$1,113,600.00
Total Equipment:					$4,311,240.00

	Quantity	Unit	Rate		Amount
Disposal:					
Concrete: 5,000 cy x 2 Tn/Cy =	10,000	Tn	$100.00		$1,000,000.00
Steel:	100,000	Tn	$60.00		$6,000,000.00

					Amount
Summary:					
Labor					$7,800,000.00
Equipment					$4,311,240.00
ST&S @ 25% of Labor					$1,950,000.00
Concrete Disposal					$1,000,000.00
Steel Disposal					$6,000,000.00
Bridge Total					$21,061,240.00

BRIDGE QUANTITY TAKE-OFF

Project: Ohio River I-75

Bridges						
Findlay Street Bridge:	Length (Ft)	Width (Ft)	Depth (Ft)	Ea	Volume (CY)	
Deck	280.00	180.00	0.67	1.00	1,250.67	
Footings	190.00	20.00	5.00	2.00	1,407.41	
Abutments	180.00	5.00	25.00	2.00	1,666.67	
CIDH	25.00	6.25	3.14	9.00	163.54	
Column	20.00	6.25	3.14	9.00	130.83	
Cap	180.00	5.00	5.00	1.00	166.67	
Curtain Wall	180.00	1.00	6.00	2.00	80.00	
Wing Walls	31.00	1.50	31.00	2.00	106.78	
Intermediate Diaphrams	5.00	0.67	5.00	490.00	303.98	
Intermediate Caps	5.00	5.00	5.00	105.00	486.11	Note: Assume typical bridge design for ASHTO bridges
Barrier Rail	340.00	1.00	2.50	2.00	62.96	Findlay Street Bridge is 5825.62 cy / 50,400 sf = .116 cy / per square foot of deck
Findlay Street Bridge Total:					5,825.62	

Overpasses OH	Length (Ft.)	Width (Ft.)	SF of Deck	CY per SF	Volume (CY)
Liberty Street Bridge:	280.00	160.00	44,800.00	0.116	5,196.80
Ezzard Charles Dr. Br. (2 ea)	280.00	60.00	33,600.00	0.116	3,897.60
Freeman Ave Ramp	280.00	60.00	16,800.00	0.116	1,948.80
Linn Street Bridge	520.00	90.00	46,800.00	0.116	5,428.80
9th St. Connector + Ramp	540.00	40.00	21,600.00	0.116	2,505.60
"	220.00	35.00	7,700.00	0.116	893.20
7th Street Bridge	740.00	95.00	70,300.00	0.116	8,154.80
6th Street + Ramps (3 ea)	880.00	100.00	88,000.00	0.116	10,208.00
West	280.00	50.00	14,000.00	0.116	1,624.00
West	220.00	40.00	8,800.00	0.116	1,020.80
East	200.00	60.00	12,000.00	0.116	1,392.00
5th Street Ramp	800.00	60.00	48,000.00	0.116	5,568.00
	120.00	20.00	2,400.00	0.116	278.40
S.B. I-71 Ramp	280.00	60.00	16,800.00	0.116	1,948.80
Bridge Subtotal			431,600.00		55,891.22

Underpasses KY & OH	Length (Ft.)	Width (Ft.)	SF of Deck	CY per SF	Volume (CY)
I-75/I-71	680.00	200.00	136,000.00	0.116	15,776.00
West 9th Street	168.00	200.00	67,200.00	0.116	7,795.20
West 5th Street	180.00	40.00	7,200.00	0.116	835.20
West 4th Street	400.00	40.00	16,000.00	0.116	1,856.00
West 3rd Street	200.00	80.00	16,000.00	0.116	1,856.00
Mehring Street	200.00	80.00	16,000.00	0.116	1,856.00
Railroad	260.00	160.00	41,600.00	0.116	4,825.60
Bridge Subtotal			300,000.00		34,800.00

Bridge Totals:			731,600.00		90,691.22

ROADWORK QUANTITY TAKE-OFF

Project: Ohio River I-75

Estimator: L.E. McAfee   Date: 11/25/04

Roadway Excavation				
	Length (Ft)	Width (Ft)	Depth (Ft)	Volume (CY)
Ramp R	680.00	10.00	36.00	9,066.67
Ramp Q	800.00	4.00	36.00	4,266.67
S.B. I-71/I-75	160.00	2.00	36.00	426.67
Roadway Excavation Total				13,760.00

Common Borrow				
	Length (Ft)	Width (Ft)	Depth (Ft)	Volume (CY)
Ohio I-75	200.00	180.00	22.00	29,333.33
	200.00	160.00	22.00	26,074.07
	1280.00	190.00	2.00	18,014.81
Gest Street	80.00	100.00	20.00	5,925.93
Ohio N.B. I-75	1700.00	192.00	50.00	604,444.44
	300.00	192.00	2.00	4,266.67
6th Street Ramp	200.00	70.00	26.00	13,481.48
5th Street Ramp	175.00	98.00	20.00	12,703.70
Ohio S.B. I-75	1100.00	96.00	45.00	176,000.00
S.B. I-71 Ramp	482.00	60.00	36.00	38,560.00
N.B. I-71 Ramp	1300.00	60.00	36.00	104,000.00
Pete Rose Way	2500.00	60.00	70.00	388,888.89
KY 4th Street Ramp	800.00	50.00	28.00	41,481.48
River Crossing	900.00	192.00	90.00	576,000.00
	1700.00	192.00	60.00	725,333.33
KY 5th Street Ramp	1000.00	65.00	36.00	86,666.67
KY N.B. I-71/I-75	1700.00	192.00	40.00	483,555.56
	152.00	192.00	20.00	21,617.78
KY S.B. I-71/I-75	900.00	192.00	40.00	256,000.00
	200.00	192.00	25.00	35,555.56
Ramp G	1800.00	36.00	30.00	72,000.00
	50.00	36.00	25.00	1,666.67
	100.00	36.00	25.00	3,333.33
Ramp R	500.00	48.00	5.00	4,444.44
KY I-71/I-75	20.00	192.00	20.00	2,844.44
	675.00	192.00	25.00	120,000.00
	1175.00	192.00	4.00	33,422.22
Common Borrow Total				3,885,614.81

ROADWORK QUANTITY TAKE-OFF

Project: Ohio River I-75

Date: 11/25/04

Mainline Stations:					Concrete				Asphalt				Base Rock				Sub Base Rock			
Station	Station	Length (Ft)	Width (Ft)	Area (SF)	Width (Ft)	Area (SF)	Thick (Ft)	Volume (CY)	Width (Ft)	Area (SF)	Thick (Ft)	Volume (Tn)	Width (Ft)	Area (SF)	Thick (Ft)	Volume (Tn)	Width (Ft)	Area (SF)	Thick (FT)	Volume (Tn)
157.40	165.00	760.00	192.00	145,920.00	168.00	127,680.00	1.00	4,728.89	24.00	18,240.00	0.83	981.24	192.00	145,920.00	0.83	6,728.53	192.00	145,920.00	1.50	12,160.00
165.00	223.00	5,800.00	168.00	974,400.00	144.00	835,200.00	1.00	30,933.33	24.00	139,200.00	0.83	7,488.44	168.00	974,400.00	0.83	44,930.67	168.00	974,400.00	1.50	81,200.00
223.00	225.00	200.00	192.00	38,400.00	168.00	33,600.00	1.00	1,244.44	24.00	4,800.00	0.83	258.22	192.00	38,400.00	0.83	1,770.67	192.00	38,400.00	1.50	3,200.00
241.00	260.00	1,900.00	96.00	182,400.00	72.00	136,800.00	1.00	5,066.67	24.00	45,600.00	0.83	2,453.11	96.00	182,400.00	0.83	8,410.67	96.00	182,400.00	1.50	15,200.00
241.00	258.50	1,750.00	72.00	126,000.00	48.00	84,000.00	1.00	3,111.11	24.00	42,000.00	0.83	2,259.44	72.00	126,000.00	0.83	5,810.00	72.00	126,000.00	1.50	10,500.00
260.00	343.00	8,300.00	72.00	597,600.00	48.00	398,400.00	1.00	14,755.56	24.00	199,200.00	0.83	10,716.22	72.00	597,600.00	0.83	27,556.00	72.00	597,600.00	1.50	49,800.00
258.50	282.50	2,400.00	48.00	115,200.00	36.00	86,400.00	1.00	3,200.00	12.00	28,800.00	0.83	1,549.33	48.00	115,200.00	0.83	5,312.00	48.00	115,200.00	1.50	9,600.00
258.50	266.50	800.00	36.00	28,800.00	24.00	19,200.00	1.00	711.11	12.00	9,600.00	0.83	516.44	36.00	28,800.00	0.83	1,328.00	36.00	28,800.00	1.50	2,400.00
277.00	282.50	550.00	60.00	33,000.00	48.00	26,400.00	1.00	977.78	12.00	6,600.00	0.83	355.06	60.00	33,000.00	0.83	1,521.67	60.00	33,000.00	1.50	2,750.00
282.50	299.00	1,650.00	96.00	158,400.00	84.00	138,600.00	1.00	5,133.33	12.00	19,800.00	0.83	1,065.17	96.00	158,400.00	0.83	7,304.00	96.00	158,400.00	1.50	13,200.00
299.00	345.50	4,650.00	72.00	334,800.00	60.00	279,000.00	1.00	10,333.33	12.00	55,800.00	0.83	3,001.83	72.00	334,800.00	0.83	15,438.00	72.00	334,800.00	1.50	27,900.00
Mainline Totals		28,760.00		2,734,920.00		2,165,280.00		80,195.56		569,640.00		30,644.52		2,734,920.00		126,110.20		2,734,920.00		227,910.00

Ramps:									Asphalt				Base Rock				Sub Base Rock			
		Length (Ft)	Width (Ft)	Area (SF)					Width (Ft)	Area (SF)	Thick (Ft)	Volume (Tn)	Width (Ft)	Area (SF)	Thick (Ft)	Volume (Tn)	Width (Ft)	Area (SF)	Thick (FT)	Volume (Tn)
Ramp A & B KY		2,200.00	24.00	52,800.00		0.00		0.00	24.00	52,800.00	1.33	4,551.56	24.00	52,800.00	0.83	2,434.67	24.00	52,800.00	1.00	2,933.33
Ramp Q		2,200.00	24.00	52,800.00		0.00		0.00	24.00	52,800.00	1.33	4,551.56	24.00	52,800.00	0.83	2,434.67	24.00	52,800.00	1.00	2,933.33
Ramp G		3,200.00	24.00	76,800.00		0.00		0.00	24.00	76,800.00	1.33	6,620.44	24.00	76,800.00	0.83	3,541.33	24.00	76,800.00	1.00	4,266.67
Ramp 4th St. KY		1,200.00	24.00	28,800.00		0.00		0.00	24.00	28,800.00	1.33	2,482.67	24.00	28,800.00	0.83	1,328.00	24.00	28,800.00	1.00	1,600.00
Ramp 5th St. KY		800.00	24.00	19,200.00		0.00		0.00	24.00	19,200.00	1.33	1,655.11	24.00	19,200.00	0.83	885.33	24.00	19,200.00	1.00	1,066.67
Ramp 5th St. KY		600.00	24.00	14,400.00		0.00		0.00	24.00	14,400.00	1.33	1,241.33	24.00	14,400.00	0.83	664.00	24.00	14,400.00	1.00	800.00
Ramp Pike St.		800.00	24.00	19,200.00		0.00		0.00	24.00	19,200.00	1.33	1,655.11	24.00	19,200.00	0.83	885.33	24.00	19,200.00	1.00	1,066.67
Ramp 9th & Wenchel		2,000.00	24.00	48,000.00		0.00		0.00	24.00	48,000.00	1.33	4,137.78	24.00	48,000.00	0.83	2,213.33	24.00	48,000.00	1.00	2,666.67
Ramp Totals		13,000.00		312,000.00						312,000.00		26,895.56		312,000.00		14,386.67		312,000.00		17,333.33

Bridge Approaches:					Embankment				Asphalt				Base Rock							
		Length (Ft)	Width (Ft)	Area (SF)	Width (Ft)	Area (SF)	Thick (Ft)	Volume (CY)	Width (Ft)	Area (SF)	Thick (Ft)	Volume (Tn)	Width (Ft)	Area (SF)	Thick (Ft)	Volume (Tn)				
Findlay Street (2 Ea)		144.31	180.00	51,951.60	180.00	25,975.80	35.00	33,672.33	180.00	51,951.60	0.83	2,794.80	180.00	51,951.60	0.83	2,395.55	0.00	0.00	0.00	0.00
Liberty Street (2 Ea)		144.31	160.00	46,179.20	160.00	23,089.60	35.00	29,930.96	160.00	46,179.20	0.83	2,484.27	160.00	46,179.20	0.83	2,129.37	0.00	0.00	0.00	0.00
Ezzard Chrls Dr. (4 Ea)		144.31	60.00	17,317.20	60.00	17,317.20	35.00	22,448.22	60.00	34,634.40	0.83	1,863.20	60.00	34,634.40	0.83	1,597.03	0.00	0.00	0.00	0.00
Freeman Ave Ramp (2 E		144.31	60.00	17,317.20	60.00	8,658.60	35.00	11,224.11	60.00	17,317.20	0.83	931.60	60.00	17,317.20	0.83	798.52	0.00	0.00	0.00	0.00
Linn Street (2 Ea)		144.31	90.00	25,975.80	90.00	12,987.90	35.00	16,836.17	90.00	25,975.80	0.83	1,397.40	90.00	25,975.80	0.83	1,197.77	0.00	0.00	0.00	0.00
9th St. Connector + Rmp		144.31	75.00	16,234.88	75.00	16,234.88	35.00	21,045.21	40.00	17,317.20	0.83	931.60	40.00	17,317.20	0.83	798.52	0.00	0.00	0.00	0.00
7st Street (2 Ea)		144.31	95.00	27,418.90	95.00	13,709.45	35.00	17,771.51	95.00	27,418.90	0.83	1,475.04	95.00	27,418.90	0.83	1,264.32	0.00	0.00	0.00	0.00
6th Street (3 Ea)		144.31	250.00	54,116.25	250.00	36,077.50	35.00	46,767.13	160.00	69,268.80	0.83	3,726.40	160.00	69,268.80	0.83	3,194.06	0.00	0.00	0.00	0.00
5th Street Ramp		144.31	140.00	20,203.40	80.00	11,544.80	35.00	14,965.48	140.00	20,203.40	0.83	1,086.87	140.00	20,203.40	0.83	931.60	0.00	0.00	0.00	0.00
S.B. I-71 Ramp (2 Ea)		144.31	60.00	17,317.20	60.00	8,658.60	35.00	11,224.11	60.00	17,317.20	0.83	931.60	60.00	17,317.20	0.83	798.52	0.00	0.00	0.00	0.00
Bridge Approaches Totals:				294,031.63		174,254.33		225,885.24		327,583.70		17,622.79		327,583.70		15,105.25				

MISCELLANEOUS QUANTITY TAKE-OFF

Project: Ohio River I-75

Estimator: L.E. McAfee Date: 11/25/04

Seeding, Fertilizing & Mulching						
	Length (Ft)	Width (Ft)	Volume (SF)	SF per Acre	Volume (Acre)	
Main Roadway I-75 (2 ea)	18,480.00	20.00	739,200.00	43,560.00	16.97	Note: Main roadway is 3.5 miles with avg 20' heigh slopes
Ramps (2 ea)	8,987.00	45.00	808,830.00	43,560.00	18.57	Note: 10 major ramps and 10 major bridge approaches avg. 45' high slopes
Seeding, Fertilizing & Mulching Total					35.54	

Beam Guardrail:						
	Length (Ft)	No. of Bridges	No. for Ea		Volume (LF)	
Bridges	100.00	11.00	12.00		13,200.00	Note: 100 LF each end of all bridges & retaining walls
Fill Slopes	10,560.00	0.00	6.00		63,360.00	Note: Along all fill slope main line
Beam Guardrail Total:					76,560.00	

Beam Guardrail Anchor:						
	Length (Ft)	No. of Bridges	No. for Ea		Volume (EA)	
Bridges	0.00	11.00	12.00		132.00	Note: Assume 1 each at end of each run of rail and every 500 ft.
Main Line	21,120.00	0.00	500.00		42.24	Along all fill slope main line
Beam Guardrail Anchor Total:					174.24	

Permanent Impact Attenuator						
			Ea	# of Bridges	Volume (EA)	
Typical			12.00	10.00	120.00	Note: Assume use at ongoing traffic at bridges north & south bound
Permanent Impact Attenuator Total:					120.00	

Traffic Stripping						
	Length (Ft)			Quantity	Volume (LF)	
Main Line	18,480.00			16.00	295,680.00	Note: 3.5 miles x 16 stripes
Ramps	40,200.00				40,200.00	Note: 3 & 4 stripes per ramp
Misc Connecting Side Streets	40,200.00			20.00	40,200.00	Note: Use same quantity as ramps
Traffic Stripping Total:					376,080.00	

Precast Concrete Barrier						
	LF				Volume (LF)	
Typical	38,000.00	0.278			10,560.20	Note: Assume use of 27% quantity of cast in place barrier. Multiple re-use with traffic switch
Landscaping Total:					10,560.20	

Permanent Signing:						
	Quantity	Each	Amount		Total	
Main Line	8.00		$500,000.00		$4,000,000.00	Note: 4 each at Kentucky and Ohio
Bridges	10.00	12.00	$2,000.00		$240,000.00	Note: 10 bridges, 8 each per bridge
Ramps & Side Streets	10.00	10.00	$2,000.00		$200,000.00	Note: Ramps 10 each, side streets 10 each
Permanent Signing Total:					$4,440,000.00	

MISCELLANEOUS QUANTITY TAKE-OFF

Project: Ohio River I-75

Estimator: L.E. McAfee Date: 11/25/04

Illumination System						
	Quantity	Each	Amount		Total	
Bridges	10.00	8.00	$50,000.00		$4,000,000.00	Note: 2 each intersections per bridge
Ramps	10.00	1.00	$50,000.00		$500,000.00	Note: Light all ramps & intersections
Illumination System Total:					$4,500,000.00	

Traffic Signal & Controller						
	Quantity	Each	Amount		Total	
Signals:						
Bridges	10.00	10.00	$10,000.00		$1,000,000.00	
Ramps	10.00	2.00	$10,000.00		$200,000.00	
Controller:						
Bridges	10.00	10.00	$15,000.00		$1,500,000.00	
Ramps	1.00	10.00	$15,000.00		$150,000.00	Note: Use at all intersections
Traffic Signal & Controller Total:					$2,850,000.00	

Grate & Inlet Basins						
	Length (Ft)	Width (Ft)			Volume (EA)	
Grate & Inlet Basins	36,960.00	200.00			184.80	Note: Assume 1 ea inlet every 200 ft of roadway, use 3.5 miles x 2 roadbeds
Grate & Inlet Basins Total					184.80	

Culvert Pipe						
	Length (Ft)	Width (Ft)	LF per Location		Volume (LF)	
PCC 24"	18,480.00	500.00	200.00		7,392.00	Note: Use 500 ft in full section of I-75, 200 ft runs
Culvert Pipe Total:					7,392.00	

MISCELLANEOUS QUANTITY TAKE-OFF

Project: Ohio River I-75

Estimator: L.E. McAfee Date: 11/25/04

Retaining Walls MSE:						
	Length (LF)	Height (LF)	Ea	# of Bridges	Volume (SF)	
Typical	140.00	35.00	4.00	18.00	352,800.00	
Retaining Walls MSE Total:					352,800.00	

Structure Excavation:						
	Length (Ft)	Height (Ft)	Depth (Ft)	Quantity	Volume (CY)	
Typical	194.00	24.00	5.00	34.00	29,315.56	
Structure Excavation Total:					29,315.56	Note: Assume 2 abutment footings per bridge with a 2 ft. relief

K-Rail						
	Length (Ft)				Length (Ft)	
Typical	31,810.00				31,810.00	
K-Rail Total:					31,810.00	Note: Assume 1 LF of k-rail for every LF of roadway including ramps

Right of Way Fencing						
	Length (Ft)				Length (Ft)	
Typical	63,620.00				63,620.00	
Right of Way Fencing Total:					63,620.00	Note: Assume 2 LF of right of way fencing for every LF of roadway including ramps

Clearing & Grubbing:						
	Length (Ft)	Width (Ft)	Volume (SF)	SF per Acre	Volume (Acre)	
Typical	18,810.00	192.00	3,611,520.00	43,560.00	82.91	
Clearing & Grubbing Total:					82.91	Note: Assume project length of 3.563 miles with 14 lanes plus shoulders = 192 ft.

and not deducting for Ohio River Bridge of which should account for overpasses and surface streets

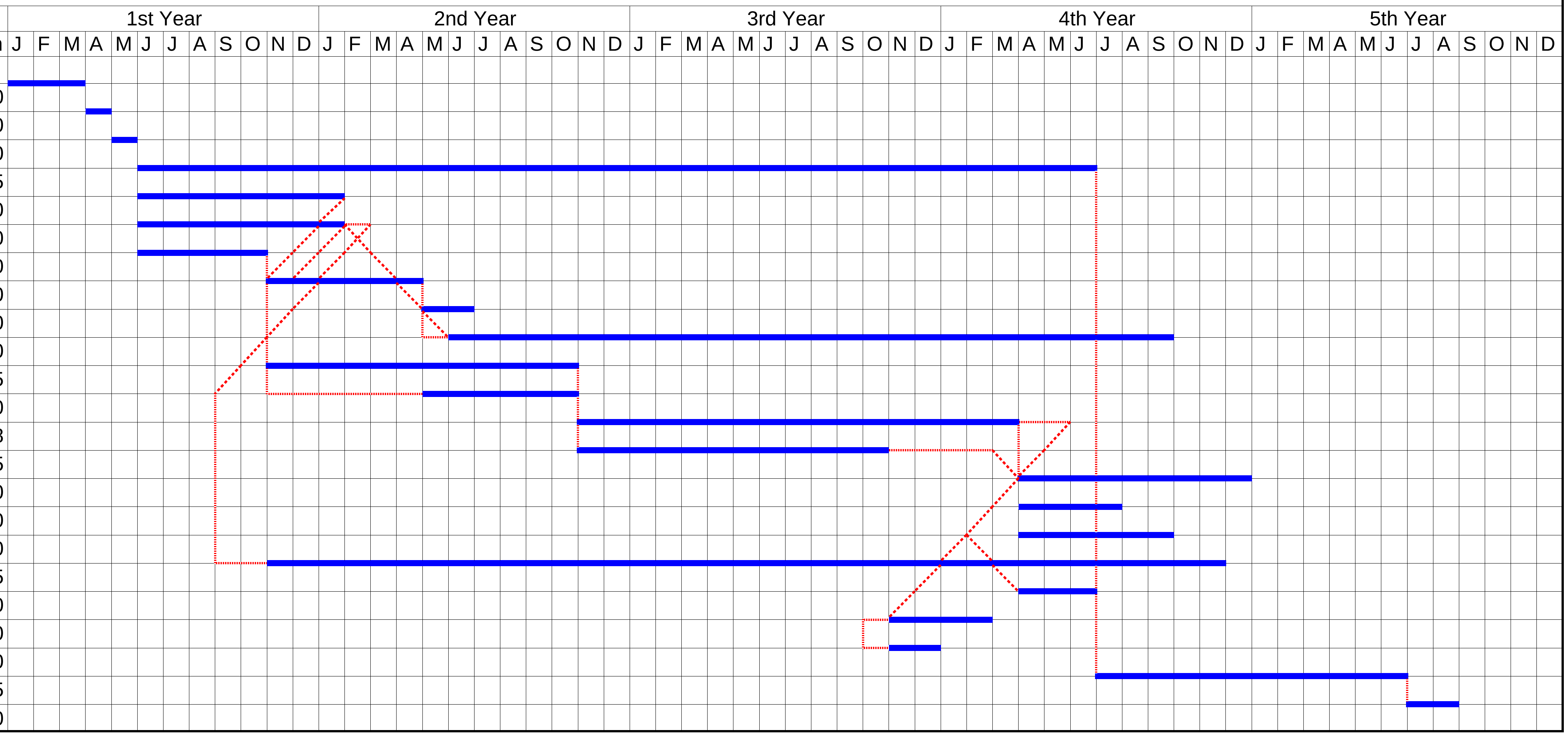
Remove Structures:					
	Length (Ft)	Width (Ft)	No. of Levels		Volume (SF)
Augusta Ave. Building	180.00	60.00	1.00		10,800.00
Holiday Inn Building	245.00	80.00	5.00		98,000.00
Lexus	180.00	260.00	1.00		46,800.00
Raddison Hotel	220.00	170.00	10.00		374,000.00
Remove Structures Total					529,600.00

Landscaping:						
	# of Areas	Acre			Volume (Acre)	
Typical	25.00	0.75			18.75	
Landscaping Total:					18.75	Note: Assume all gore and ramp areas

OHIO RIVER BRIDGE

Schedule

Task Name	Duration Days
Advertise for Bid	90
Bid & Award	30
Mobilization	30
Construct Ohio River Bridge	1095
Utility Relocation	270
Detour Traffic Ohio	270
Detour Traffic Kentucky	180
Select Borrow Bridge Abuts	180
Structure Excavation	60
Construct Bridges (OH & KY)	900
Embank Fill Mainline	365
Embank Fill Ramps	160
Structural Section Mainline	548
Pave Rams & Side Streets	365
Install Guard & K-Rail	270
Install Fencing	120
Install Signage	180
Install Electrical	1095
Striping	90
Landscaping	120
Seeding & Mulching	60
Remove Brent Spence Br	365
Punch List Complete	60



II. Right-of-Way Costs

Brent Spence Bridge

Constructability/Feasibility

Item No. 6-17.00

	Parcel ID #	Owner	Property Address	Deed Book	Page	Land Use	Relocation Cost	Land Value	Improve Value	2004 tax Value	Alt 1 Impact	Alt 1 RW-Ease FEE	Alt 2 Impact	Alt 2 RW-Ease FEE	Alt 4 Impact	Alt 4 RW-Ease FEE	Alt 5 Impact	Alt 5 RW-Ease FEE	Alt 6 Impact	Alt 6 RW-Ease FEE	*Alt 4 5LN Impact	*Alt 4 5LN RW-Ease FEE
1	040-34-02-005.00	Gateway Hotel	202-04 Crescent Ave.	1173	347	Hotel		$1,555,500	$4,075,000	$5,630,500	20% Air only	$1,126,100	20% Air only	$1,126,100	0%	$0	0%	$0	10% Air only	$563,050	0%	$0
2	040-34-01-001.00	Willie's of N. Kentucky INC	401-A Crescent Ave.	C 1378	289	Paved Lot		$104,500	$50,000	$154,500	100% no struct	$154,500	100% no structures	$154,500	0%	$0	0%	$0	100% no Struc	$154,500	0%	$0
3	040-34-01-001.02	Willie's of N. Kentucky INC	401 Crescent Ave.	C 1378	289	Restaurant/Bar	$125,000.00	$645,500	$900,000	$1,545,500	100%	$1,545,500	100%	$1,545,500	0%	$0	0%	$0	100%	$1,545,500	0%	$0
4	040-43-02-002.00	I-75 PKG Liquors & Wines INC	431-529 Crescent Ave.	565	556	Other Retail	$50,000.00	$298,000	$552,000	$850,000	100%	$850,000	100%	$850,000	0%	$0	0%	$0	100%	$850,000	0%	$0
5	040-43-02-003.00	Kelly L. Wagoner	601-03 Crescent Ave.	C 2273	321	Single Family	$27,500.00	$5,000	$94,200	$99,200	100%	$99,200	100%	$99,200	0%	$0	0%	$0	100%	$99,200	0%	$0
6	040-43-02-004.00	Connie Roberts	605 Crescent Ave.	C 988	43	Single Family	$27,500.00	$5,000	$40,000	$45,000	100%	$45,000	100%	$45,000	0%	$0	0%	$0	100%	$45,000	0%	$0
7	040-43-02-005.00	Jack Readnour	607 Crescent Ave.	C 1393	209	Single Family	$27,500.00	$6,000	$0	$6,000	100%	$6,000	100%	$6,000	0%	$0	0%	$0	100%	$6,000	0%	$0
8	040-43-02-006.00	Kelly S. Mattingly & Micheal Kra	609 Crescent Ave.	C 1449	118	Two Family	$14,000.00	$5,000	$55,000	$60,000	100%	$60,000	100%	$60,000	0%	$0	0%	$0	100%	$60,000	0%	$0
9	040-43-02-007.00	Mark R. Hanauer	611-13 Crescent Ave.	C 1815	144	Single Family	$27,500.00	$20,000	$39,900	$59,900	100%	$59,900	100%	$59,900	0%	$0	0%	$0	100%	$59,900	0%	$0
10	040-43-02-008.00	Tony Saberton	615-17 Crescent Ave.	C 1531	264	Single Family	$27,500.00	$20,000	$36,000	$56,000	100%	$56,000	100%	$56,000	0%	$0	0%	$0	100%	$56,000	0%	$0
11	040-43-02-009.01	Kelly S. Mattingly	619 Crescent Ave.	C 1452	301	Single Family	$27,500.00	$5,000	$25,000	$30,000	100%	$30,000	100%	$30,000	0%	$0	0%	$0	100%	$30,000	0%	$0
12	040-43-02-009.02	Kelly S. Mattingly	621 Crescent Ave.	C 1425	326	Single Family	$27,500.00	$5,000	$25,000	$30,000	100%	$30,000	100%	$30,000	0%	$0	0%	$0	100%	$30,000	0%	$0
13	040-43-02-009.03	Michael Kramer	623 Crescent Ave.	C 174	58	Vacant Land		$5,000	$0	$5,000	100%	$5,000	100%	$5,000	0%	$0	0%	$0	100%	$5,000	0%	$0
14	040-43-02-009.4	Joseph W & Norma Cotton	625 Crescent Ave.	913	230	Single Family	$27,500.00	$4,000	$15,000	$19,000	100%	$19,000	100%	$19,000	0%	$0	0%	$0	100%	$19,000	0%	$0
15	404-43-02-009.05	Axut Building LLC	627-33 Crescent Ave.	C 2237	231	Vacant Land		$52,000	$0	$52,000	100%	$52,000	100%	$52,000	0%	$0	0%	$0	100%	$52,000	0%	$0
16	040-43-03-024.00	Jamie J Wurzelbacher	624 Crescent Ave.	C 2220	119	Vacant Land		$3,000	$0	$3,000	100%	$3,000	100%	$3,000	0%	$0	0%	$0	100%	$3,000	0%	$0
17	040-43-03-023.00	Jamie J Wurzelbacher	628 Crescent Ave.	C 1979	149	Single Family	$27,500.00	$4,000	$5,000	$9,000	100%	$9,000	100%	$9,000	0%	$0	0%	$0	100%	$9,000	0%	$0
18	040-43-03-022.00	Clement L Bezold jr.	630 Crescent Ave.	C 1196	113	Vacant Land		$1,000	$0	$1,000	100%	$1,000	100%	$1,000	0%	$0	0%	$0	100%	$1,000	0%	$0
19	040-43-03-028.00	I-75 PKG Liquors & Wines INC	502 Crescent Ave.	1017	300	Paved Lot		$40,000	$15,000	$55,000	100%	$55,000	100%	$55,000	0%	$0	0%	$0	100%	$55,000	0%	$0
20	040-34-03-004.00	Corken Steel Products	680 4th St W	462	87	MFG or Assembly		$456,500	$143,500	$600,000	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0
21	040-34-03-001.00	Paul W Edington jr.	677 3rd St W	C 457	301	MFG or Assembly		$179,000	$56,000	$235,000	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0
22	040-43-02-010.00	David Johnson	635 Crescent Ave.	C 1153	237	Single Family		$4,000	$6,000	$10,000	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0
23	040-463-02-011.00	Axut Building LLC	637-39 Crescent Ave.	C 2190	14	Single Family		$6,000	$20,000	$26,000	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0
24	040-43-02-012.00	Robert J & Julie Mann	641 Crescent Ave.	998	250	Single Family		$4,000	$45,000	$49,000	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0
25	040-43-02-013.00	Becker Family LTD PTN	643-723 Crescent Ave.	1112	77	Vacant Land		$70,000	$0	$70,000	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0	0%	$0
26	040-44-10-010.01	Stuart W. Epperson *	Philadelphia St.	C 1224	147	Radio Tower	$10,000.00	$149,000	$0	$149,000	0%	$0	0%	$0	10% No Struct.	$14,900	100% (tower)	$149,000	100% (tower)	$149,000	10% No Struct.	$14,900
27	040-44-10-010-00	City Of Covington	847 Philadelphia St.	794	220	City Owned	$5,000.00	$133,500	$116,500	$250,000	80%	$200,000	80%	$200,000	0%	$0	50%	$125,000	80%	$200,000	0%	$0
28	040-43-05-003.00	City Of Covington	501 Philadelphia St	573	506	Park/Recreation		$500,000	$650,000	$1,150,000	15%	$172,500	0%	$0	10% No Struct	$115,000	30%	$345,000	15%	$172,500	10% No Struct	$115,000
29	040-44-19-004.00	Robert G & Blanche Marshall	555 Pike St	1149	313	Auto Dealership	$20,000.00	$105,000	$112,000	$217,000	100%	$217,000	100%	$217,000	0%	$0	100%	$217,000	100%	$217,000	0%	$0
30	040-44-19-013.00	Kenneth A Lewis	Jillian's Way	C 913	235	Other Retail	$100,000.00	$1,000,000	$2,600,000	$3,600,000	10% air only	$360,000	10%	$360,000	0	$0	50% No struc.	$1,440,000	20%	$720,000	0	$0
35	040-44-20-007.01	Charles E & Michaelle Thorn	540 Watkins St.	C 1214	236	Single Family	$27,500.00	$4,000	$55,000	$59,000	50% no struc	$59,000	50% Air	$59,000	0%	$0	50% No sruc.	$59,000	0%	$0	0%	$0
36	040-44-20-005.00	DNS Properties LLC	533-41 12Th St W	C 1226	172	Auto Service	$30,000.00	$100,000	$160,000	$260,000	10% air only	$26,000	10% air only	$26,000	0%	$0	50% No sruc.	$130,000	0%	$0	0%	$0
37	040-44-19-003.00	MCY Properties LLC	537 Pike St.	C 230	135	Other Retail	$30,000.00	$94,000	$136,000	$230,000	0%	$0	0%	$0	0%	$0	100%	$230,000	0%	$0	0%	$0
38	040-44-19-005.04	MCY Properties LLC	537-A Pike St.	C 230	135	Vacant lot		$1,000	$0	$1,000	0%	$0	0%	$0	0%	$0	50% No sruc.	$1,000	0%	$0	0%	$0
39	040-44-12-001.00	Robert & Blanche Marshall	550 Pike St.	896	44	Auto Dealership	$100,000.00	$472,500	$1,014,000	$1,486,500	20% air only	$297,300	20% air only	$297,300	0%	$0	100%	$1,486,500	0%	$0	0%	$0
40	040-44-11-011.00	M & S Investments	928 Willow Run	C 1863	15	Other Retail	$20,000.00	$38,000	$72,000	$110,000	100%	$110,000	100%	$110,000	0%	$0	0%	$0	0%	$0	0%	$0
41	040-44-11-001.00	Oakland Properties Inc	902-26 Willow Run	C 1247	205	Office Bldg	$100,000.00	$135,000	$453,500	$588,500	100%	$588,500	100%	$588,500	0%	$0	0%	$0	0%	$0	0%	$0
42	040-43-04-003.00	ACCD Company	626-42 5Th St W	561	582	Hotel	$400,000.00	$1,500,000	$4,447,000	$5,947,000	0%	$0	100%	$5,947,000	100%	$5,947,000	100%	$5,947,000	0%	$0	100%	$5,947,000
43	040-43-04-002.03	Ashford Hospitality	620 5th St W	C 2000	261	Paved Lot		$570,000	$30,000	$600,000	0%	$0	100%	$600,000	0%	$0	100%	$600,000	0%	$0	0%	$0
44	040-34-05-001.00	City Of Covington	621-53 3rd St W	C 1971	198	Auto Dealership	$100,000.00	$2,000,000	$2,344,000	$4,344,000	0%	$0	100%	$4,344,000	100%	$4,344,000	100%	$4,344,000	0%	$0	60%	$2,606,400
45	040-34-04-006.00	BRE/ESA Prperties LLC	640-50 3rd St W	C 2192	172	Hotel	$400,000.00	$1,525,000	$3,223,000	$4,748,000	0%	$0	100%	$4,748,000	100%	$4,748,000	100%	$4,748,000	0%	$0	100%	$4,748,000
46	040-34-01-001.05	Lawrence Callahan	526 Western Ave	C 57	127	Landominium	$27,500.00	$30,000	$145,000	$175,000	*	*	*	*	*	*	*	*	*	*	*	*
46	040-34-01-001.06	Larry D Jenkins	524 Western Ave	C 1896	312	Landominium	$27,500.00	$30,000	$176,000	$206,000	*	*	*	*	*	*	*	*	*	*	*	*
46	040-34-01-001.003	Richard Kessler & Kimberly *	522 Western Ave	C 47	88	Landominium	$27,500.00	$20,000	$139,000	$159,000	*	*	*	*	*	*	*	*	*	*	*	*
46	040-34-01-001.04	Raymond & Deborah Reinhart	520 Western Ave	C 1256	110	Landominium	$27,500.00	$30,000	$145,000	$175,000	*	*	*	*	*	*	*	*	*	*	*	*
46										$715,000	100%	$715,000	100%	$715,000	0%	$0	0%	$0	0%	$0	0%	$0
47	040-34-01-001.07	Jason R Merrill	518 Western Ave.	C 1671	110	Single Family	$27,500.00	$30,000	$197,500	$227,500	*	*	*	*	*	*	*	*	*	*	*	*
47	040-34-01-001.08	Audrey Blair-Gentry	516 Western Ave.	C 2169	118	Single Family	$27,500.00	$30,000	$217,000	$247,000	*	*	*	*	*	*	*	*	*	*	*	*
47	040-34-01-001.09	Brent Bleh jr.	514 Western Ave.	C 138	172	Landominium	$27,500.00	$30,000	$140,000	$170,000	*	*	*	*	*	*	*	*	*	*	*	*
47	040-34-01-001.10	Jeffrey & Leslie Hendricks	512 Western Ave.	C 1174	150	Landominium	$27,500.00	$170,000	$30,000	$200,000	*	*	*	*	*	*	*	*	*	*	*	*
47										$844,500	100%	$844,500	100%	$844,500	0%	$0	0%	$0	0%	$0	0%	$0
48	040-34-01-001.11	Mary D Sutton	510 Western Ave.	C 1180	183	Landominium	$27,500.00	$30,000	$313,000	$343,000	*	*	*	*	*	*	*	*	*	*	*	*
48	040-34-01-001.12	Danny R & Neva J Francis	508 Western Ave.	C 2250	307	Landominium	$27,500.00	$30,000	$290,000	$320,000	*	*	*	*	*	*	*	*	*	*	*	*
										$663,000	100%	$663,000	100%	$663,000	0%	$0	0%	$0	0%	$0	0%	$0
49	040-34-01-001.01	Lawrence W Grouse	504-06 Western Ave	1062	39	Vacant Land		$60,000	$540,000	$600,000	100%	$600,000	100%	$600,000	0%	$0	0%	$0	0%	$0	0%	$0
50	04-3-43-05-026.00	City of Covington	741 Dalton St	781	286	Swim Club		$38,500	$80,000	$118,500	100%	$118,500	100%	$118,500	0%	$0	0%	$0	0%	$0	0%	$0
												***********		***********		***********		***********		***********		***********
							$2,054,000.00					$9,177,500		$24,644,000		$15,168,900		$19,821,500		$5,101,650		$13,431,300

Brent Spence Bridge

Constructability/Feasibility

Item No. 6-17.00

Dollar Values Are 2004 PVA Fair Market Value

	Parcel ID #	Owner	Property Address	Land Use	Relocation Cost	Land Value	Improve Value	2004 tax Value	Alt 1 Impact	Alt 1 RW-Ease FEE	Alt 2 Impact	Alt 2 RW-Ease FEE	Alt 4 Impact	Alt 4 RW-Ease FEE	Alt 5 Impact	Alt 5 RW-Ease FEE	Alt 6 Impact	Alt 6 RW-Ease FEE	*Alt 4 5LN Impact	*Alt 4 5LN RW-Ease FEE
100	137-0002-0152-00	City of Cincinnati	857 Mehring Way		$5,000.00	$607,200	$259,700	$866,900	15% Air space	$130,035	15% Air space	$130,035	0%	$0	0%	$0	Air only	$130,035	0%	$0
101	137-0002-0035-00	Kuhr Family LTD PTNSHP	824 Mehring Way	Other Industrial Structures	$30,000.00	$8,000	$78,400	$86,400	100%	$108,700	100%	$108,700	0%	$0	0%	$0	100%	$108,700	0%	$0
	137-0002-0036-00		768 Front Street	Other Industrial Structures		$4,200		$4,200	*****	*****	*****	*****	*	*****	*	*****	*	*****	*	*****
	137-0002-0037-00		Front Street	Commercial Vacant Land		$4,300		$4,300	*****	*****	*****	*****	*	*****	*	*****	*	*****	*	*****
	137-0002-0160-00		772 Front Street	Other Industrial Structures		$4,200		$4,200	*****	*****	*****	*****	*	*****	*	*****	*	*****	*	*****
	137-0002-0032-00		Mehring Way	Commercial Vacant Land		$9,600		$9,600	*****	*****	*****	*****	*	*****	*	*****	*	*****	*	*****
102	137-0002-0039-00	Kuhr Family LTD PTNSHP	237 Gest Street	Other Industrial Structures	$30,000.00	$56,200	$69,900	$126,100	100%	$126,100	100%	$126,100	0%	$0	0%	$0	100%	$126,100	0%	$0
103	137-0002-0001-00	Queensgate South Realty	W. 3rd Street	Other Industrial Structures	$5,000.00	$250,000	$23,500	$273,500	100% Ab.build	$273,500	100%	$273,500	0%	$0	0%	$0	100%	$273,500	0%	$0
104	137-0001-0114-00	City of Cincinnati	W. 3rd Street	Municipality Owned	Vacant	$63,600	$86,700	$150,300	100% Ab. build	$150,300	100%	$150,300	0%	$0	0%	$0	100%	$150,300	0%	$0
105	147-0007-0040-00	Townview Partners	360 Gest Street	Office Bldgs		$690,500	$2,382,900	$3,073,400	0%	$0	0%	$0	0%	$0	0%	$0	20% Air only	$614,680	0%	$0
106	137-0001-0040-00	Interstate Brands Corporation	747 W. 5th Street	Food & Drink Proc Plants & Storage	$100,000.00	$266,400	$554,000	$820,400	100%	$1,051,400	100%	$1,051,400	0%	$0	0%	$0	100%	$1,051,400	0%	$0
	137-0001-0015-00		805 W. 5th Street			$231,000		$231,000	*****	*****	*****	*****	*	*****	*	*****	*	*****	*	*****
107	136-0004-0241-00	Caldwell Realty Company	500 Gest Street	Industrial Warehouse		$837,100	$1,625,800	$2,462,900	0%	$0	0%	$0	0%	$0	0%	$0	30% Air only	$738,870	0%	$0
108	147-0007-0258-00	CG&E Company	Gest Street	Commercial / Utility		$1,063,200	$2,817,600	$3,880,800	0%	$0	0%	$0	0%	$0	0%	$0	25% Air only	$970,200	0%	$0
109									*****	*****	*****	*****	*	*****	*	*****	0%	*****	*	*****
110	136-0001-0234-00	Premier Office Park LLC	644 Linn Street	Office Bldgs		$1,342,400	$7,076,900	$8,419,300	10% air oonly	$841,930	10% air only	$841,930	0%	$0	0%	$0	30% Air only	$2,525,790	0%	$0
111	136-0001-0114-00	Goodman Ronald TR	844 W 7th Street	Automotive Service Station	$100,000.00	$257,800	$187,200	$445,000	100%	$445,000	100%	$445,000	0%	$0	0%	$0	100%	$445,000	0%	$0
112	139-0003-0242-00	Fuller Properties LLC	900 W 8th Street	Automobile Sales and Service	$50,000.00	$1,261,420	$1,000,000	$2,261,420	100%	$2,261,420	100%	$2,261,420	0%	$0	100%	$2,261,420	100%	$2,261,420	0%	$0
113	138-0005-0059-00	Provident Bank The	717 Linn Street	Full Service Bank	$50,000.00	$202,300	$234,700	$437,000	100%	$437,000	100%	$437,000	0%	$0	0%	$0	100%	$437,000	0%	$0
114								$0	*****	*****	*****	*****	*	*****		*****	*	*****	*	*****
115	137-0002-0065-00	Longworth Hall LLC	Front Street	Commercial Vacant Land		$42,800		$42,800	100%	$42,800	100%	$42,800	0%	$0	0%	$0	0%	$0	0%	$0
116	147-0004-0201-00	Vontz Realty Co	800 W 5th Street	Food & Drink Proc Plants & Storage	$30,000.00	$176,600	$590,400	$767,000	100%	$1,282,800	100%	$767,000	0%	$0	0%	$0	100%	$1,282,800	0%	$0
	136-0004-0242-00	West Fifth Lofts LLC	840 W 5th Street			$127,900	$192,500	$320,400	*****	*****	*****	*****	*	*****	*	*****	*	*****	*	*****
	136-0004-0243-00	Hudepohl Square LLC	801 W 6th Street	Other Industrial Structures	Vacant	$109,100	$86,300	$195,400	*****	*****	*****	*****	*	*****	*	*****	*	*****	*	*****
117	137-0003-0083-00	Hilltop Concrete Corp	Smith Street	Industrial Vacant Land		$336,900		$336,900	0%	$0	20% air only	$67,380	20% air only	$67,380	20% air only	$101,780	0%	$0	20% air only	$67,380
	137-0003-0079-00	Hilltop Concrete Corp	Mehring Way	Industrial Vacant Land		$155,500		$155,500	*****	*****	*****	*****	*	*****	*	*****	*	*****	*	*****
	137-0003-0091-00	Hilltop Basic Resources	Smith Street	Industrial Vacant Land		$16,500		$16,500	*****	*****	*****	*****	*	*****	*	*****	*	*****	*	*****
118	137-0003-0044-00	Corman Robert	603 W Pete Rose Way	Restaurant; cafeteria and/or bar	Vacant	$49,700	$72,200	$121,900	0%	$0	100%	$156,600	100%	$156,600	100%	$156,600	0%	$0	100%	$156,600
	137-0003-0028-00	Corman Robert	603 W Pete Rose Way	Industrial Vacant Land		$34,700		$34,700	*	*****	*	*****	*	*****	*	*****	*	*****	*	*****
119	147-0006-0068-00	Cincinnati City of	W Pete Rose Way	Parking Garage / Lots		$185,300	$8,500	$193,800	0%	$0	100 %Air only	$763,800	air only	$763,800	air only	$763,800	0%	$0	air only	$763,800
	117-0006-0070-00		220 W Pete Rose Way	Industrial Vacant Land		$145,200		$145,200	*	*****	*	*****	*	*****	*	*****	*	*****	*	*****
	82-0001-0036-00		W Pete Rose Way	Commercial Vacant Land		$620,300		$620,300	*	*****	*	*****	*	*****	*	*****	*	*****	*	*****
	82-0001-0038-00		215 Central Ave	Commercial Vacant Land		$909,800		$909,800	*	*****	*	*****	*	*****	*	*****	*	*****	*	*****
	82-0001-0040-00		205 Central Ave	Industrial Vacant Land		$480,700		$480,700	*	*****	*	*****	*	*****	*	*****	*	*****	*	*****
	147-0006-0071-00		205 Central Ave	Commercial Vacant Land		$404,300		$404,300	*	*****	*	*****	*	*****	*	*****	*	*****	*	*****
	82-0001-0046-00		W Third Street	Industrial Vacant Land		$218,500		$218,500	*	*****	*	*****	*	*****	*	*****	*	*****	*	*****
	147-0006-0077-00		513 W Third Street	Industrial Vacant Land		$82,600		$82,600	*	*****	*	*****	*	*****	*	*****	*	*****	*	*****
120	136-0003-0231-00	Tappan Properties	635 W 7th Street	Office Bldgs	$100,000.00	$784,100	$3,527,800	$4,311,900	0%	$0	0%	$0	0%	$0	100%	$4,311,900	0%	$0	0%	$0
121	146-0006-0115-00	Automatic Data Processing	W 7th Street	Commercial Vacant Land		$1,521,140		$1,521,140	0%	$0	0%	$0	0%	$0	15% air space	$228,171	0%	$0	0%	$0
122	134-0006-0105-00	Interstate Brands Corporation	930 Cutter Street	Food & Drink Proc Plants & Storage		$429,900	$449,100	$879,000	0%	$0	0%	$0	0%	$0	15% air space	$131,850	0%	$0	0%	$0
123	134-0006-0246-90	City of Cincinnati	Linn Street	Municipality Owned		$461,000		$461,000	0%	$0	0%	$0	0%	$0	15% air space	$69,150	0%	$0	0%	$0
124	136-0001-0060-00	8th & Linn Hospitality LLC	800 W 8th Street	Hotel		$821,300	$3,257,700	$4,079,000	0%	$0	0%	$0	0%	$0	100%	$4,079,000	0%	$0	0%	$0
125	136-0001-0238-00	Provident Bank The	801 Linn Street	Office Bldgs	$1,000,000.00	$717,900	$3,276,900	$3,994,800	10% air only	$399,480	0%	$0	0%	$0	100%	$3,994,800	0%	$0	0%	$0
126	134-0006-0245-00	Monnie Terrance R TR	817 W Court Street	Office Bldgs	$20,000.00	$56,800	$98,400	$155,200	0%	$0	0%	$0	0%	$0	100%	$155,200	0%	$0	0%	$0
127	185-0004-0035-00	Cincinnati Enquirer Inc	1531 Western Ave	Light Manufacturing & assembly	$150,000.00	$541,700	$3,713,100	$4,254,800	0%	$0	0%	$0	0%	$0	100%	$4,254,800	0%	$0	0%	$0
128	184-0004-0203-00	BMH Holdings LLC	1605 Western Ave	Industrial Warehouse	$50,000.00	$197,500	$257,300	$454,800	0	$0	0%	$0	0%	$0	100%	$454,800	0	$0	0%	$0
129	137-0003-0059-00	Hilltop Concrete Corp	612 Mehring Way	Other Industrial Structures	$75,000.00	$84,600	$4,000	$88,600	0	$0	Air only	$88,600	Air only	$88,600	100%	$153,400	0%	$0	Air only	$88,600
	137-0003-0054-00	Hilltop Basic Resources	Augusta Ave	Industrial Vacant Land		$32,400		$32,400	*	*****	*	*****	*	*****	*	*****	*	*****	*	*****
	137-0003-0053-00	Hilltop Concrete Corp	Augusta Ave	Industrial Vacant Land		$32,400		$32,400	*	*****	*	*****	*	*****	*	*****	*	*****	*	*****
130	137-0003-0089-00	Central Railroad Co of Indiana		Railroad Real used in operation		$900,000		$900,000	0%	$0	0%	$0	Air only	$450,000	air only	$450,000	0%	$0	Air only	$450,000
	137-0003-0036-00			Railroad Real used in operation		$900,000		$900,000	*	*****	*	*****	*	*****	*	*****	*	*****	*	*****
131	137-0003-0037-00	Covington & Cincinnati Elevated Railroad		Railroad Real used in operation				$0	0	$0	0	$0	Air only	$0	air only	$0	0	$0	Air only	$0
132	145-0004-0161-00	City of Cincinnati	514 W 3rd Street	Small detached retail store		$277,400	$7,000	$284,400	0	$0	0	$0	0%	$0	air only	$0	100% Air only	$0	0%	$0
133	147-0007-0229-00	City of Cincinnati	612 W 3rd Street	Commercial Vacant Land		$179,200		$179,200	0	$0	0	$0	0%	$0	0%	$0	20% Air space	$0	0%	$0
134	138-0005-0058-00	Budig Realty LLC	645 Linn Street	Light Manufacturing & assembly	$100,000.00	$737,800	$3,075,500	$3,813,300	100%	$3,813,300	100%	$3,813,300	0%	$0	0%	$0	0%	$0	0%	$0
135	147-0004-0001-00	CCA Properties of America LLC	865 Carlisle Ave	Other Industrial Structures		$104,300	$18,500	$122,800	100%	$122,800	100%	$122,800	0%	$0	0%	$0	0%	$0	0%	$0
	136-0004-0149-00		855 W 6th Street	Other Industrial Structures		$108,600	$3,523,200	$3,631,800	*	*****	*	*****	*	*****	*	*****	0%	*****	*	*****
136	137-0003-0070-00	CG&E Company	Front Street	Commercial / Utility		$801,800	$1,153,500	$1,955,300	0%	$0	10% air only	$195,530	10% air only	$195,530	65% air only	$1,270,945	0%	$0	10% air only	$195,530
137	138-0005-0031-00	Quincy & Marlowe Enterprises LLC	909 8th Street	Office Bldgs	$20,000.00	$52,300	$226,700	$279,000	100%	$279,000	100%	$279,000	0%	$0	0%	$0	0%	$0	0%	$0
					$1,915,000.00					$11,765,565		$12,122,195		$1,721,910		$22,837,616		$11,115,795		$1,721,910