2010

E. STADIUM BOULEVARD BRIDGES REPLACEMENT AND IMPROVEMENT PROJECT – COST BENEFIT ANALYSIS

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E. STADIUM BOULEVARD BRIDGES REPLACEMENT AND IMPROVEMENT PROJECT

TIGER II FUNDING APPLICATION

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The E. Stadium Boulevard Bridges Replacement and Improvement Project is comprised of the replacement of the E. Stadium Boulevard Bridge over S. State Street and the E. Stadium Boulevard Bridge over the Ann Arbor Railroad within the City of Ann Arbor Michigan. The project limits extend from Kipke Drive to a point 200' west of S. Industrial Highway. Improvements consist of the reconstruction of E. Stadium Boulevard with the inclusion of on-street bikelanes and an 11' wide sidewalk on the north and an 8' wide sidewalk on the south side of the roadway that will allow for the completion of the pedestrian network along E. Stadium Boulevard; adding two staircases to provide pedestrian access between E. Stadium Boulevard and S. State Street; adding to, and improving, the existing storm water system to improve storm water quality by adding in-line filtration devices; replacing the existing incandescent street lights with energy-efficient LED light fixtures; and, replacing and upsizing about 1,000 feet of an existing raw water transmission main as part of on-going projects to update and maintain this element of the water distribution system that provides about 10% of the City of Ann Arbor's drinking water supply.

The project is located adjacent to the University of Michigan Facility Operations Center and less than one quarter-mile from the University's 109,901-seat football stadium and the 15,000-seat Chrysler Area. A High School with approximately 2,300 students and several Middle Schools are located on, or near, E. Stadium Boulevard. There are two fire stations located within two miles of the E. Stadium Boulevard Bridges as well.

This project is primarily a "State of Good Repair Project" as such the design and construction of the proposed facilities will provide safe and reliable infrastructure for the foreseeable future. Also, the proposed project will restore the ability for people and commerce to once again fully utilize the Stadium Boulevard Corridor by eliminating the weight restrictions upon the bridges, provide proper horizontal and vertical clearances, and eliminate unnecessary facility owner and user costs associated with delays caused by detours.

There are several groups that will directly benefit from the replacement of the E. Stadium Boulevard Bridges. They are motorists, commercial traffic, pedestrians, bicyclists, low income residents, and the University of Michigan.

The Cost-benefit Analysis (CBA) performed for the subject project included several assumptions. The CBA reflects the difference between the two plausible options for the project; they are Scenario A and Scenario B.

Scenario A - replace bridges in 2011, or the best-case option, includes the receipt of the requested $13.9M in TIGER II funding and consequent construction of the project beginning in 2011.

Scenario B – replace bridges in 2024, or the worst-case option, is based upon the premise that the City of Ann Arbor does not receive the requested TIGER II Funding and needs to procure the project funding from within.

The replacement of the bridges will result in a significant benefit in the form of savings of delay, crash, and operations and maintenance costs as compared to the alternative of closing the bridges. The Cost-benefit Analysis that was performed shows that about **$252M** (Net Present Value – 2010 dollars) will be saved by the City of Ann Arbor and Society by the replacement of the bridges. This includes the reduction of about $33,166,000 each year of delay, vehicle operation, and crash costs associated with traveling the detour. **The resultant cost-benefit ratio is about 11.01.**

Upon review of the BCA performed for this project, it is clear that Scenario A – replacement of the bridges in 2011, provides the lowest overall cost option with an estimated total net present value cost of about $115,980,000. We recommend that this alternative and project be supported and funded.

E. Stadium Boulevard Bridges Replacement and Improvement Project

TIGER II - Benefit Cost Analysis

Section I

Project Summary

The E. Stadium Boulevard Bridges Replacement and Improvement Project consists of the replacement of the E. Stadium Boulevard Bridge over S. State Street and the E. Stadium Boulevard Bridge over the Ann Arbor Railroad within the City of Ann Arbor Michigan. Figure 1 shows the approximate location of the City of Ann Arbor and its relative location within the State of Michigan.

Figure 1 Drawing of the State of Michigan and the City of Ann Arbor

Figure 1a, provides a map that shows the project's location with respect to the City of Ann Arbor boundaries. Note, the City's boundaries generally follow the "freeway" ring.

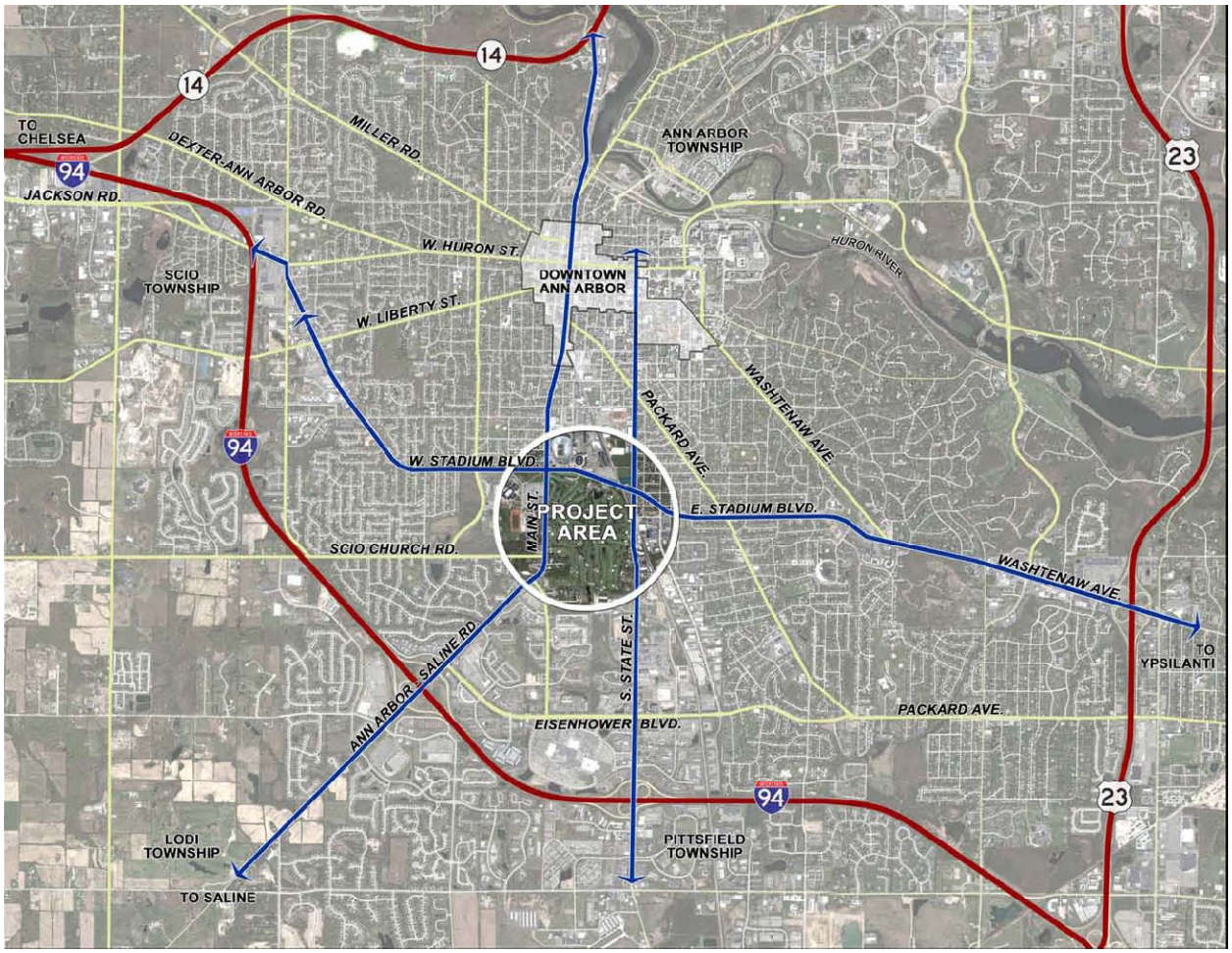

Figure 1a. Vicinity Map depicting project area with respect to City of Ann Arbor boundaries

The subject project's limits extend from Kipke Drive to a point 200' west of S. Industrial Highway within the City of Ann Arbor. Improvements consist of the reconstruction of E. Stadium Boulevard with the inclusion of on-street bikelanes and an 11' wide sidewalk on the north and an 8' wide sidewalk on the south side of the roadway that will allow for the completion of the pedestrian network along E. Stadium Boulevard; adding two staircases to provide pedestrian access between E. Stadium Boulevard and S. State Street; adding to, and improving, the existing storm water system to improve storm water quality by adding in-line filtration devices; replacing the existing incandescent street lights with energy-efficient LED light fixtures; and, replacing and upsizing about 1,000 feet of an existing raw water transmission main as part of on-going projects to update and maintain this element of the water distribution system that provides about 10% of the City of Ann Arbor's drinking water supply.

The **estimated cost of the project is $23M (2010 dollars.)** As shown elsewhere within the Cost-benefit Analysis (CBA), the **Cost-benefit Ratio for this project is 11.01.** Information regarding these numbers, the underlying assumptions, and how the calculations were arrived at will be presented later in this document.

Project Goals

The subject project has several worthy goals that include:

- Complement Urban Growth Strategy
- Enhance Anchor Institution which underpins the regional/state economy
- Maintaining access throughout Washtenaw County – E. Stadium Boulevard is one of three parallel routes connecting the east and west sides of Washtenaw County in the City of Ann Arbor.
- Introduce Multi-modal systems to two corridors that link to county-wide systems.
- Maintain existing, short-line, rail-freight system
- Resolve motor freight issues by eliminating current weight restrictions and providing needed horizontal and vertical clearances
- Minimize project costs over the life-cycle of the project
- Support sustainability by preserving quality of life

Baseline Description of Existing Conditions

E. Stadium Boulevard

E. Stadium Boulevard is a two-way, four/five lane urban arterial roadway that carries approximately 28,000 vehicles per day. E. Stadium Boulevard is one of three parallel routes that carries pedestrian and vehicular traffic in an east-west direction and connects the City of Ann Arbor and Washtenaw County.

E. Stadium Boulevard over S. State Street Bridge

The E. Stadium Boulevard Bridge over S. State Street is a two-way, four-lane bridge that was built in 1928. It underwent a major rehabilitation that included the replacement of the superstructure in 1975.

The existing structure is comprised of side-by-side box beams that are transversely post-tensioned together. The superstructure rests on curtain-wall abutments. **The Federal Sufficiency Rating of the bridge is 20.2 (January 2010.)**

This structure has severely deteriorated over the course of the last several years and we have been forced to reduce the weight limits several times on the bridge in order to safely maintain traffic. It has also been necessary to reduce traffic to one lane in each

direction due to the condition of the box beams. **On November 15, 2009 the southern-most 5 box beams and two lanes of vehicular traffic were removed due to their extremely deteriorated condition.**

E. Stadium Boulevard Bridge over the Ann Arbor Railroad Tracks

The E. Stadium Bridge over the Ann Arbor Railroad is a two-way, four-lane bridge that was built in 1928. It underwent a major rehabilitation in 1975. The deck and interior diaphragms were replaced during the rehabilitation. Improvements were also made to the bridge's approaches, sidewalk, guardrails and curbs during the rehabilitation work.

The existing structure is comprised of concrete-encased riveted plate girders with diaphragms that are supported by curtain-wall abutments. **The Federal Sufficiency Rating of the bridge is 59.2 (January 2010.)**

Note, this structure is located approximately 350 feet westerly of the E. Stadium Boulevard Bridge over S. State Street. Due to the unique site features surrounding this project, required vertical alignment corrections, needed cross-sections elements, American Railway Engineering Association (AREA) vertical and horizontal clearance requirements, and inadequate capacity of the existing foundations, both bridges must be replaced at the same time.

Bridge Posting

The bridge over S. State Street is posted for 19, 24, and 26 tons for types I, II, and III trucks, respectively. It has a Michigan Operating Rating (computed using the load factor method) of 24 tons for a 77-ton Michigan two-unit truck. The bridge has required load limits beginning in 1995. In the last several years, the City has reduced the allowable load limits on the Stadium Bridge over S. State Street and prohibited the heavy trucks from using the bridges even though there are major University of Michigan Construction projects occurring nearby. The posted loads have been lowered two times since then to their current load limits. Due to the close proximity of the bridges to each other, both bridges are weight-restricted.

Economic Importance of the Project

The project is located adjacent to the University of Michigan Facilities Operation Center and less than one quarter-mile from the University's 109,901-seat football stadium and the 15,000-seat Chrysler Area. A High School with approximately 2,300 students and several Middle Schools are located on, or near, E. Stadium Boulevard. There are two fire stations located within two miles of the E. Stadium Boulevard Bridges as well.

This project is essential for the continued economic health of the City of Ann Arbor, the University of Michigan, which operates two distinct Anchor Institutions within the City, with its Regional Medical Center and Sports Complex, and the State of Michigan as a whole. The University of Michigan's Facility Operations Department is located immediately north of E. Stadium Boulevard, and this department is responsible for the operation and maintenance of all University of Michigan facilities. In addition, there are 1,700 University of Michigan permit parking spaces in the area between West Hoover Avenue, Main Street, Stadium Boulevard and the Ann Arbor Railroad. The Athletic Department facilities, most notably the football stadium and Crisler Arena, are also located adjacent to the project. Service to the Anchor Institution that is the University of Michigan's Sports Complex and the University Hospital must be maintained.

Proposed Project and changes to existing baseline conditions

The proposed project will have important and long-lasting effects on the baseline conditions of central Washtenaw County, the City of Ann Arbor, and the project area. Drawings that illustrate the proposed improvements can be found at the following link: http://www.a2gov.org/government/publicservices/project_management/upcomingprojects/Pages/ConceptualPlans.aspx

The current project design includes several improvements that will implement policies of the USDOT and the City of Ann Arbor, provide improvements to the safety of users of the proposed facilities, increase energy efficiency, promote sustainable development, and provide many other intangible benefits. Some of these items are described below.

This project is primarily a "State of Good Repair Project." As such, the design and construction of the proposed facilities will provide safe and reliable infrastructure for the foreseeable future and will restore the ability for people and commerce to once again fully utilize the Stadium Boulevard Corridor. This will be accomplished by eliminating the weight restrictions upon the bridges, provide proper horizontal and vertical clearances, and eliminate unnecessary facility owner and user costs associated with delays caused by detours.

The project as currently designed will minimize operation and maintenance costs through the inclusion of such items; as concrete pavement that will provide for the lowest life-cycle cost over the lifetime of the pavement; innovative technology on the proposed staircases that will warm the concrete and eliminate the need for snow removal on them during winter months; pre-stressed concrete beams that do not require painting or other routine maintenance; recessed pavement markings that will not be removed by snow plowing equipment; inclusion of low-maintenance landscaping materials; and other related items.

The design of the replacement bridges provides non-motorized improvements to be installed along Stadium Boulevard. Specifically, replacement of the bridges will allow for the completion of on-street bikelanes and a sidewalk along the southside of E. Stadium Boulevard because the existing bridge structures are too narrow to accommodate the needed sidewalks, on-street bikelanes, and existing traffic volumes. Also, the project will provide for the installation of a much-needed, wider sidewalk (proposed 11 feet) along the north side of the roadway and the installation of a new 8 feet wide sidewalk along the south side of E. Stadium Boulevard. These sidewalks will allow the City of Ann Arbor to continue to pursue the fulfillment of the goals as contained in its Non-motorized Transportation Plan and meet the needs of its active community.

The inclusion of the on-street bikelanes, sidewalks along both sides of the roadway, pedestrian connections (staircases) between E. Stadium Boulevard and S. State Street, the design of roadways and bridges that meet all current and relevant AASHTO and AREA Standards, and the design of fully-compliant ADA accessible facilities will improve the safety of the system. This project will also provide the needed clearance to allow the planned Allen Creek Greenway Project to be placed within the existing Ann Arbor Railroad Corridor. Briefly, the Allen Creek Project includes the construction of Non-motorized facilities from Downtown Ann Arbor to the University of Michigan's Athletic Campus/E. Stadium Boulevard (http://www.acgreenwayconservancy.org/). Although we do not have data that specifically predicts the reductions in expected crashes, we fully believe, and confidently predict, that the proposed improvements will create a more safe, comfortable, and attractive experience for all users of the proposed facilities.

Another important improvement associated with this project is the inclusion of storm water quality improvement devices known as "swirl concentrators" or "hydro-dynamic separators." These devices will provide cleaner storm water discharges to the surrounding waterways. This in turn, will have environmental benefits such as reduced pollution and cleaner surface water.

The project also includes replacement of existing incandescent street lights with energy efficient LED street lights. We currently expect that about 6,600 kilowatt-hours of electricity will be saved annually. This will result in the savings of about $1,800 and the reduction 3.1 tons of CO_2 equivalent of greenhouse gas emissions each year.

Project Justification

The E. Stadium Boulevard Bridges carry vehicular and pedestrian traffic in an east-west direction providing one of the three primary arterial links between the east and west sides of Ann Arbor, central Washtenaw County, and the surrounding communities. Also, because of its proximity to northbound and southbound arterial roadways, and to the downtown business district, the bridges are essential to many commuters. E. Stadium Boulevard is a designated

truck route and also serves commercial traffic using the freeway system (US-23 and I-94.) East and West Stadium Boulevard, with their connections to Maple Rd and Washtenaw Avenue, form a six-mile long major corridor connecting to US-23 on the east, M-14 on the north and I-94 on the west. The corridor also connects to the City of Ypsilanti on the east and to the surrounding township commercial district to the west. The University of Michigan's Facility Operations facility is located immediately north of E. Stadium Boulevard and west of the bridges. It is one of the most traveled corridors in Ann Arbor and Washtenaw County. The project and the proposed bridge over the Ann Arbor Railroad (a short-line, privately-owned, freight railroad) will also provide the needed opportunities to allow both freight and passenger rail traffic to continue along this existing corridor. We strongly believe that within the next 15 to 20 years both freight and passenger rail traffic will dramatically increase due to expected increases in the cost of fossil fuels. This project helps to support this opportunity.

Please see Figure 2. This figure depicts the Key Economic Activity Centers along and surrounding the Stadium Boulevard/Washtenaw Avenue Corridor.

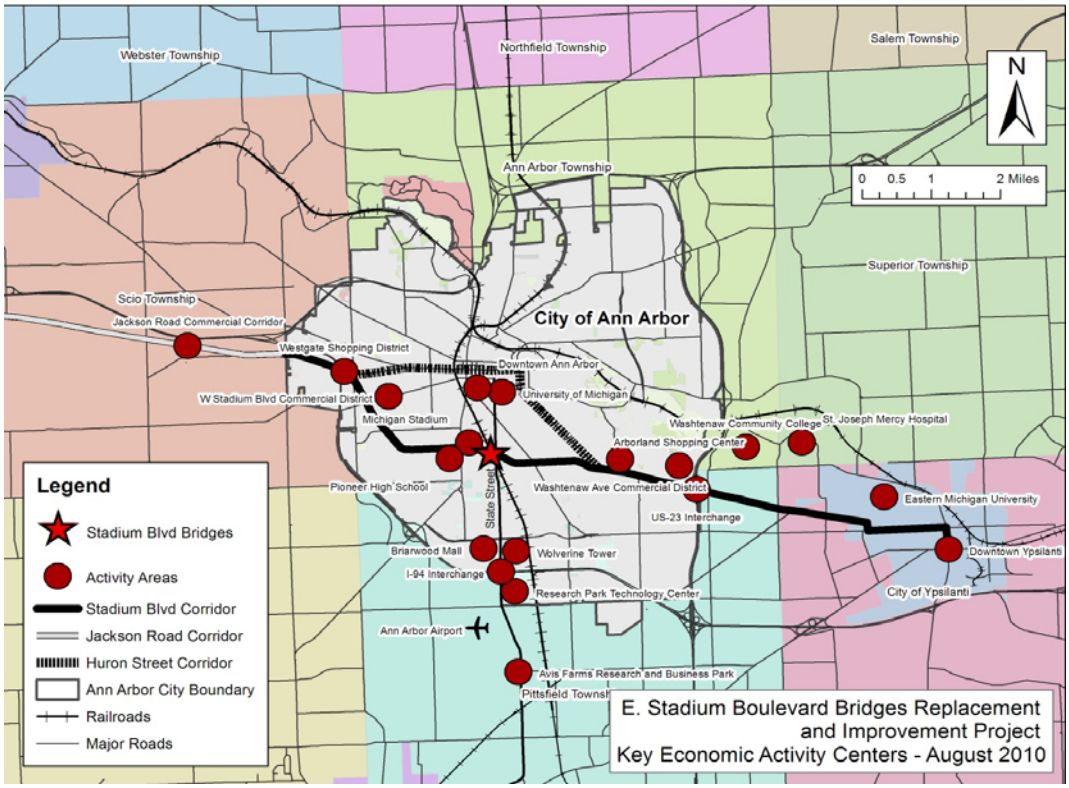

Figure 2. Key Economic Activity Centers

The bridge is located less than one quarter-mile from the University of Michigan's 109,901-seat football stadium and the 15,000-seat Chrysler Area. A High School and several Middle Schools are located on, or near, E. Stadium Boulevard. There are two fire stations located within two miles of the E. Stadium Boulevard Bridges.

This project is essential for the continued economic health of the City of Ann Arbor, the University of Michigan, and the State of Michigan as a whole. The University of Michigan's Facility Operations Department is located immediately north of E. Stadium Boulevard, and this department is responsible for the operation and maintenance of all University of Michigan facilities. In addition, there are 1,700 University of Michigan permit parking spaces in the area between West Hoover Avenue, Main Street, Stadium Boulevard and the Ann Arbor Railroad. The Athletic Department facilities, most notably the football stadium and Crisler Arena, are also located adjacent to the project, and the budgeted revenue from the Athletic Department was $80.2M in FY 09. They (U of M) will be completed with the construction of the addition to the football stadium for the 2010 football season. This work is a significant investment in the economy of the State of Michigan. The bridge project will complement this work and is necessary in order to sustain access to the football stadium and Crisler Arena for the foreseeable future.

The University's facilities, especially those located directly adjacent to the project are of the utmost importance to the City of Ann Arbor and the State of Michigan. Access to these areas must be maintained.

Affected Users

There are several groups that will directly benefit from the replacement of the E. Stadium Boulevard Bridges.

A select link analysis was performed in the study area. Figure 3 represents the points within Washtenaw County that contain 10 or more trips each day across the E. Stadium Boulevard Bridges and their origins and destinations. As you can see from this figure, a large segment of Ann Arbor and the surrounding townships utilize the bridges and this corridor.

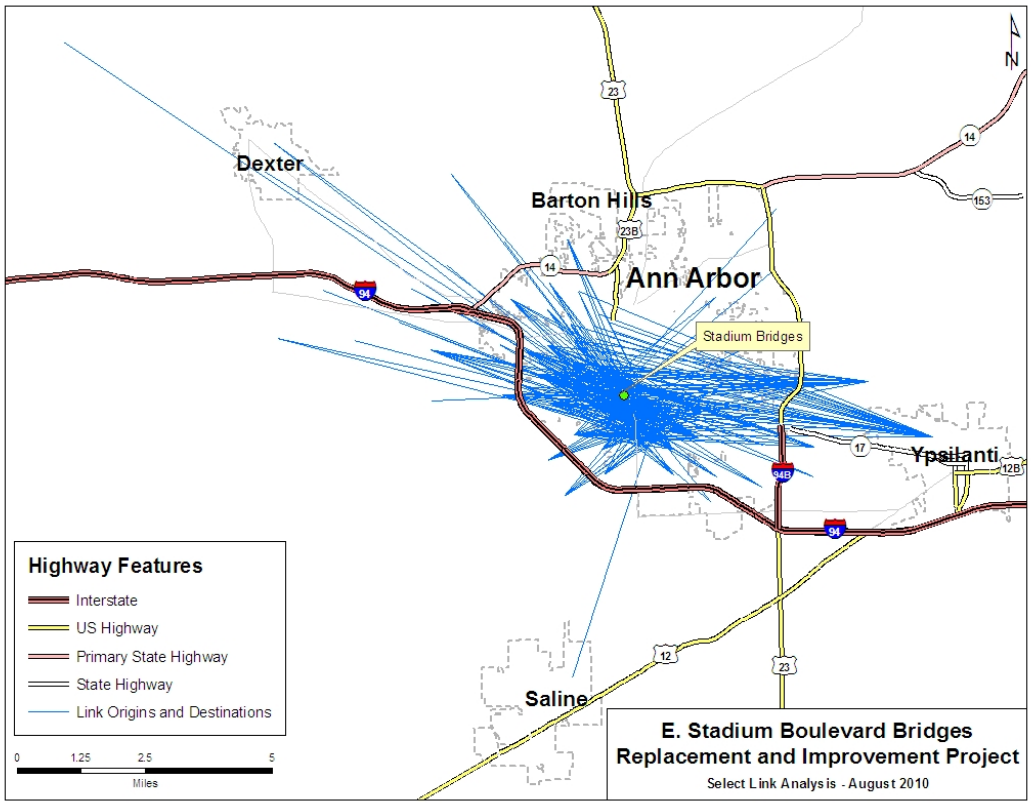

Figure 3. Select Link Analysis and area contributing to the Stadium Boulevard Corridor

Some of the more prominent groups that are affected by the E. Stadium Boulevard Bridges are discussed below:

Motorists and commercial traffic using the corridor will greatly benefit. As described in the sections that follow, we have shown that the benefits associated with performing this project are staggering. **The Cost-benefit Analysis that has been prepared clearly shows the project has a cost/benefit ratio of 11.01.** Considering the anticipated cost of the project is $23M, the expected benefits, or reductions in owner and user costs, is very significant. The largest single component of this benefit is associated with the cost of delay to commercial/truck and personal traffic. Non-commercial vehicles (referred to as personal vehicles in this analysis) are also forced to travel extra distances (about 3.7 miles) in order reach their intended destination(s). As detailed later in this cost-benefit analysis, **the increase in vehicle-miles travelled annually for these trips is about 12,967,000 and the cost associated with this increase is estimated to be about $7,287,000.** Reductions in greenhouse gas emissions, criteria pollutants, and energy consumption is also a large and contributing factor, however these costs were not monetized due to the variability and difficulty in precisely quantifying their estimated costs to society.

However, if they were monetized, their costs would increase the cost-benefit ratio of the project.

More specifically, commercial trucking and other large vehicles will benefit from the replacement of the E. Stadium Boulevard Bridges. Since 1995 the E. Stadium Bridges have had weight reductions in place. Since early 2009, the bridge has had a weight limit of 19, 24, and 26 tons for Type I, II, and III trucks, respectively. This effectively means that the bridges can no longer carry any trucks larger than buses. Thus, trucks and commercial vehicles are also forced to travel extra distances (at least 5.35 miles in length as a portion of the primary detour route is not a truck route) in order reach their intended destination(s). As detailed in the cost-benefit analysis, **the increase in commercial/truck vehicle-miles travelled annually is about 1,367,100 and the cost associated with this increase is estimated to be about $9,740,000.**

The University of Michigan will be a primary beneficiary of the project too. The new bridges and related improvements along E. Stadium Boulevard will allow for uninterrupted access to the University of Michigan's Athletic Campus (comprised of their 109,901 seat football stadium, 15,000 seat basketball arena, baseball and softball stadium, ice hockey facility, and several other facilities) and their Plant Operations Area. These facilities serve an anchor institution comprising the University's presence within Ann Arbor. During the college football season, the University's football stadium consistently holds the most fans attending a college football game. As a result, the spectators bring several million dollars of business to Ann Arbor and the surrounding areas during home football weekends. If access to these facilities is limited, undoubtedly the local economy will suffer. Unfortunately, the resources that can be dedicated to this funding application do not allow the City to fully explore all economic costs of not replacing the E. Stadium Boulevard Bridges on the Ann Arbor and Regional economy. We are confident, however that based on delay costs to users of the facilities alone will justify this funding request.

Because of the planned improvements, pedestrians will benefit because of the improved connectivity created by the inclusion of sidewalks with the project. The planned sidewalks will link neighborhoods to schools, recreational opportunities, and businesses that weren't previously available. Also, the staircases that are planned between E. Stadium Boulevard and S. State Street will also provide connections that previously were unavailable that will further increase mobility, connectivity, and safety. The design of the sidewalks will allow pedestrians for the first time to cross E. Stadium Boulevard without the need to physically cross E. Stadium Boulevard itself.

The planned improvements will also benefit two transit agencies currently operating within Washtenaw County. They are the Ann Arbor Transportation Authority (AATA) and the University of Michigan Transportation Department. The Ann Arbor Public Schools also operate

over 40 buses within the project area. The patrons of these entities will be able to continue to use E. Stadium Boulevard because the replacement of the bridges will allow continued use of the bridges for these vehicles. If the bridges are not replaced, buses will be forced to drive through a detour route that is approximately five miles long. This will add considerable extra time and expense due to delays, increased fuel consumption, increased vehicle emissions, and societal costs due to increased numbers of crashes along the detour route itself.

Low-income residents will also benefit from this project as the Non-motorized elements of the project provides better access to mass transportation and transportation options other than single-occupant vehicles. The planned sidewalks and on-street bikelanes will allow students to either walk or bike to school on properly designed and placed facilities that will allow them to most-effectively choose a route that minimizes conflict points along their journey. The improved access to multiple transportation options will in turn allow them to become more independent and provide a greater array of more affordable transportation options.

The Bicycle Community benefits from the project as well. As described earlier in this document, the project includes the addition of on-street bikelanes and sidewalks on both sides of the roadway. Also, this segment of E. Stadium Boulevard will be the second-to-last segment of on-street bike lanes from Maple Road on the northerly end to S. Industrial Highway on the easterly end. This project is being planned and constructed in full accordance with USDOT Policy for providing these types of facilities. Further, the sidewalks will enhance the opportunity for bicyclist and pedestrians alike as bicyclists that are not as comfortable riding within the roadway will have the opportunity to ride on sidewalks of sufficient width. This will also benefit young families that wish to take their children on bike rides and/or walks.

Expected Economic Benefits

As previously described, E. Stadium Boulevard due to its location within the City of Ann Arbor and Washtenaw County, provides 1 of 3 east-west arterial links in the transportation network. E. Stadium Boulevard is also a truck route and serves traffic that uses US-23 and I-94. It is one of the most travelled corridors in Ann Arbor and Washtenaw County, thus it is of primary importance to our economy. Consequently, this is a State-of-good-repair Project.

The replacement of the bridges will result in significant benefits in the form of savings of delay, crash, and operations and maintenance costs as compared to the alternative of not replacing the bridges. The Cost-benefit Analysis that was performed for this project shows that about **$253M** (Net Present Value – 2010 dollars) will be saved by the City of Ann Arbor and Society by the replacement of the bridges. This includes the reduction of about **$33,166,000 annually** of delay, vehicle operation, and crash costs associated with traveling the detour. These values are tabulated below.

Replacement of the bridges will eliminate the need for people to circumnavigate the detour route when the bridges can no longer function and carry vehicular traffic. For instance, by replacing the bridges VMT and VHT will be significantly reduced. The following chart better illustrates these values:

East Stadium Boulevard Bridges Replacement and Improvement Project

Annual Benefit (Reductions): Elimination of driving Detour Routes

	Personal	Commercial/Truck	Total
Avoided Delays ((VHT) hours)	941,000	87,700	1,028,000
Avoided add'l ((VMT) miles)	12,967,000	1,367,100	14,334,100
Reduction in Crash Costs ($)	n/a	n/a	597,000
Reduction in CO_2 Emissions (tons)	5,200	502,700	507,900

Also, the reductions in VHT, VMT, and Crash Costs have significant annual reductions in expenditures associated with these values. They are as follows:

East Stadium Boulevard Bridges Replacement and Improvement Project

Annual Benefit Costs Related to elimination of driving Detour Routes ($2010)

	Personal	Commercial/Truck	Total
Reduction in VHT	$13,409,000	$2,133,000	$15,542,000
Reduction in VMT	$7,287,000	$9,740,000	$17,027,000
Crash Costs*	n/a	n/a	$597,000
Totals	**$20,696,000**	**$11,873,000**	**$33,166,000**

*This value is not differentiated between personal and commercial travel

The estimated cost of the project is $23,000,000. The Net Present Value of all benefits accrued to this project is $253,280,000. **The resultant cost-benefit ratio is 11.01.**

Other savings that were not monetized in this analysis also include, but are not limited to, items such as reduction in fuel consumption, vehicle emissions, increased maintenance of surrounding roadways, and other related costs. Also, the project will allow the corridor and all of its users, including commercial freight traffic, to return to "normal" operation. The return to normal operation will include realized indirect benefits. For example, during athletic and special events at the University of Michigan's Football Stadium patrons will want to stay in the area and frequent restaurants, bars, and shop as they normally would. The Anderson Economic Group has estimated that Out of Town visitors spend over $250 on lodging, food, tickets, and incidentals when visiting for a football game. The estimated number of out-of-state fans each year visiting the stadium is about 132,000 people (according to the University of Michigan Athletic Department.) That equates to roughly $33M annually. Even a small decrease in visitor

spending will have a huge impact on local retail that depends on football games to make it through the fiscal year. The restoration of these economic benefits will remove the significant drag on the regional economy and allow people and commerce to return to normal.

SECTION II

Description of the Cost-benefit Assumptions and Analysis

The Cost-benefit Analysis (CBA) performed for the subject project included several assumptions. The CBA reflects the difference between the two plausible options for the project; they are Scenario A and Scenario B.

Scenario A – replace the bridges in 2011, or the best-cast option, includes the receipt of the requested $13.9M in TIGER II funding and consequent construction of the project beginning in 2011. Hereafter, this will be referred to as Scenario A

Scenario B – replace the bridges in 2024, or the worst-case option, is based upon the premise that the City of Ann Arbor does not receive the requested TIGER II Funding and needs to procure the project funding from within. Hereafter, this will be referred to as Scenario B.

In both Scenarios, it is assumed that it will take about one-and-a-half years to construct the project. It is further assumed that E. Stadium Boulevard will be completely closed to traffic during the construction of the project. The needed detour routes for commercial and non-commercial traffic are the same for both Scenarios. Appended to this cost benefit analysis is a drawing that represents the detour routes described and analyzed. The General Operations and Maintenance Costs are assumed to be identical in both scenarios after the bridges have been replaced.

A spreadsheet has been created that comprises the CBA. The spreadsheet is entitled "esb cba-fin." This spreadsheet contains several tabs that calculate the discounted benefits (costs) associated with the cost differential of the scenarios and the actual cost benefit ratio, calculate delay and vehicle operation costs with personal (non-business) and commercial/truck trips, costs to the Ann Arbor Public School System associated with their buses being delayed in detour traffic, general operations and maintenance costs, estimated capital maintenance costs, remaining service life calculations, vehicle crash costs, vehicle emissions estimates, field measured times to drive the detour routes, and estimated costs associated with maintaining the bridges in Scenario A while the City of Ann Arbor saves money to pay for the project itself within Scenario B. Data or reference information used in the spreadsheet is contained within the spreadsheet itself. All calculations are described within the individual spreadsheet tabs as well. All dollar estimates within the analysis are in 2010 dollars prior to discounting. In accordance with the instructions contained within the NOFA, we have used a discount rate of 3%.

This CBA estimates and summarizes the benefits (costs) associated with each scenario that we believe we can predict based upon our knowledge, experience, and available data. There are other benefits (costs) that we are certain will occur, but we have no reliable data source or studies to rely upon as a basis for inclusion into the CBA. For example, in Scenario B while the City is saving money to pay for the bridges replacement ourselves, during the college football season, access to the University of Michigan's Stadium will be limited and/or difficult. As a result, we believe that patrons will not be as willing to stay in town and frequent the many local restaurants, bars, and hotels because of the traffic congestion. Thus, we have elected to not include theses costs in this analysis, but if they were to be included, they would increase the costs to society that are associated with the project.

Description of Scenario A – replace bridges in 2011

This Scenario includes reconstructing the bridges and roadway beginning in calendar year 2011 and completing the work in about one-and-a-half years. During construction the roadway will be completely closed to traffic and detoured as indicated on the attached detour drawing. After the construction has been completed, the CBA assumes that capital preventative maintenance work will be performed upon the bridges and roadway in five year intervals according to Michigan Department of Transportation standard protocols. The analysis continues until the year 2025 at which time the salvage value (pro-rated remaining portion of the improvements value) has been subtracted to determine the net value of the capital investment.

Description of Scenario B – replace bridges in 2024

For the purposes of this analysis, this Scenario entails reconstructing the bridges and roadway beginning in calendar year 2024 and completing the work in about one-and-a-half years. Currently, the existing E. Stadium Boulevard Bridge over S. State Street has had five beams removed and has been reduced to one lane of traffic in each direction. For the purposes of this analysis, we have assumed that the bridge over S. State Street would be able to support vehicular traffic until approximately 2015. We have also estimated that the current Operations and Maintenance Costs will continue until 2015 along with some minor costs associated with increased inspections of the bridge to ensure its safety.

Due to the limited funding available to us to maintain our existing roadway network and replace these structures, we could begin deferring other roadway projects in order to save the needed funds to pay for the work. We would not defer all other roadway work as that will be counter-productive and lead to significant damage to our transportation network. It appears that in 2023 we will have obtained the needed capital to pay for the project ourselves such that we can begin construction in calendar year 2024. Construction is expected to be completed in about eighteen months (similar to Scenario A) and the salvage value (pro-rated remaining

portion of the improvements value) has been subtracted to determine the net value of the capital investment. The analysis ends in calendar year 2025 with the completion of the construction of the bridges and roadway improvements.

Results of the Benefit Cost Analysis

In the analysis we calculated all costs of the owner and society that could be reliably monetized given the resources and time available to prepare and submit this funding application. Consequently, it was necessary to make certain assumptions commensurate with the resources available to perform the analysis itself. In accordance with the instructions contained within the NOFA, the costs were discounted accordingly.

The spreadsheet tab entitled "Cost-Benefit" contains the calculations of the actual cost benefit ratio. Scenario A had an estimated total cost over the analysis period of about $114,664,000. Scenario B had an estimated total cost over the analysis period of $456,230,000. The derivation of these costs were taken from the two spreadsheet tabs entitled "Scenario A – 2011 constr" and "Scenario B – 2024 constr" respectively. The BCA reveals that the Net Present Value (measured in 2010 dollars) between the difference in costs between Scenario A and B is about $253,280,000. All costs were discounted at 3% as directed in the NOFA for governmental spending. The estimated total cost of the subject project is $23,000,000. **This provides a benefit cost ratio of 11.01.**

The study has shown that due to the proposed detour route being in operation, there will be about **an additional 14,334,100 vehicle-miles travelled each year**. Also, there will be about **an additional 1,028,000 vehicle-hours travelled each year** as well. The additional vehicle-miles are because of traffic being forced to travel along the detour route. These additional vehicle-miles will generate an additional 830,000 pounds of Volatile Organic Compounds (VOC), 507,900 pounds of CO_2, 8,932,000 pounds of NO_x, 6,082,000 pounds of CO, and 470,000 pounds of PM_{10} each year. Further, there will be at least an additional 729,000 gallons of gasoline wasted each year due to the detour route implementation. Additional diesel fuel usage will also be significant, but we have not been able to reliably calculate it and as a result we are not presenting a quantity or value for it here. These types of needless usages and costs should be minimized to the greatest extent possible.

The largest component of cost is associated with the delay costs of the facility. Due to the complexity of the roadway network surrounding the project site, it is not possible to accurately predict the travel patterns of all users of the roadway network. As a result, during the preliminary engineering work performed on the project, we studied the potential project detour routes. During this investigation, we determined that about 40% of the existing traffic along E. Stadium Boulevard would follow the posted detour route. We also determined that another 20% of the existing traffic would use an assumed alternate detour route. Finally, we

determined that due to the congestion within the project area, the remaining 40% of the existing traffic will take detour routes completely outside of the project study area. Information that further describes these estimates and conclusions is described in the above referenced spreadsheet. These incremental delays, vehicle operation, and crash costs are calculated to be about $33,166,000 per calendar year.

Benefits Related to Primary Selection Criteria

Long-term Outcomes

State of Good Repair

As stated previously this is a State of Good Repair Project. As such, the benefits of the project are derived primarily from the City's ability to create and maintain a state of good repair. Therefore, by implementing this project as soon as possible, it will be possible to effect the reduction in the significant delay, vehicle operation, and crash costs. The estimated benefits of **$33,166,000** annually are directly related to having and maintaining a State of Good Repair and a fully-functioning roadway network. Also, as discussed and enumerated within the funding application, there are many other non-monetized benefits as well.

Economic Competitiveness

The City of Ann Arbor, and Washtenaw County, as a whole will be significantly more economically competitive when this project is implemented. This is because the commercial-truck traffic will be able to return to normal operation. The project benefits that are directly related to this selection criterion are about **$11,873,000.** Also, because E. Stadium Boulevard will be fully open to all forms of traffic, local businesses, transportation providers, and residents will be able to travel efficiently and effectively through the project area. For example, parents and/or students will be able to once again quickly and easily travel to the local high school (Pioneer High School – 2,300 students) that is located just west of the project without navigating a circuitous route. Also, access to the University Plant Operations area will be available without restrictions as to vehicle size and/or weight because the bridges will be fully open. Finally, the project will create about 250 job-years that will benefit the local and state economy. These types of rich benefits that will be reaped from the project will eliminate the extremely significant drag on the local economy associated with delay. Consequently, the funds that would have been expended upon extra fuel, vehicle depreciation, wasted time, and other related items will be able to used on more productive uses to society. This project undoubtedly will increase our economic competitiveness.

Livability

The non-monetized benefits to society created by this project are central to this selection criterion. For example, the increased access created by this project such as fully-compliant ADA facilities, improved and expanded park land, and on-street bikelanes illustrate these types of benefits. More specifically, the redesigned bridges will be much nicer neighbors: residents of the Stadium/State neighborhoods will benefit from the enlargement and enhancement of Rose-White Park, more walking/cycling networks for our active population, and aesthetic enhancements of the transportation facilities. A key element of this improved access is that the Non-motorized elements of the project are available to disadvantaged communities such as students, non-drivers, and people with disabilities because of their direct proximity to them; they (non-motorized facilities) are directly connected to the residential and other properties. Local businesses will be better connected to all transportation modes and benefit from increased non-motorized traffic. Thus, livability will be improved with the investment in this project.

Environmental Sustainability

The benefits of the project relating to this selection criterion again come from the reduction of delay. By eliminating delay, the additional VMT of 14,334,000 that are created by driving the detour routes is no longer necessary. **This amounts to $17,027,000 annually.** When the additional VMT is eliminated, also the wasted gasoline and diesel fuel is eliminated, as well as the greenhouse gas emissions and pollution. These additional vehicle-miles will generate an additional 830,000 pounds of Volatile Organic Compounds (VOC), 507,900 pounds of CO_2, 8,932,000 pounds of NO_x, 6,082,000 pounds of CO, and 470,000 pounds of PM_{10} each year. Further, there will be at least an additional 729,000 gallons of gasoline wasted each year due to the detour route implementation. By eliminating these emissions the environment can only be benefitted.

Safety

The benefits of the project relating to this selection criterion are **$597,000 annually.** This is due to the reduction of 34 crashes annually because the VMT is not increasing as estimated because traffic will not be forced to travel the detour route. Also, the project design includes bridges and roadways that meet AASHTO Standards, as well as AREA Standards. This will increase the safety of the roadway and bridges as well.

Conclusion

Upon review of the BCA performed for this project, it is clear that **Scenario A – replace bridges in 2011** provides the lowest overall cost option with an estimated total net present value cost of about **$114,644,000.** This scenario minimizes delay, vehicle operation, and crash costs. In turn, due to the reduction in delay and vehicle-miles travelled, vehicular emissions are reduced as well. Consequently, this Scenario will have the greatest benefit to society due to reduced delay, vehicle operation, crash, pollution, environmental impacts, and many other non-monetized impacts as discussed within the funding application.

Therefore, as a result of the performed analysis, **Scenario A – replace bridges in 2011** is the most feasible and prudent project alternative available. We recommend that it be supported and funded.