Executive Summary
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July, 2010

I. Preface
The Memphis Metropolitan Area faces transportation issues related to the Norfolk-Southern Railroad on a daily basis. Commuters, emergency responders, school buses, and mass transit are all affected by daily rail traffic. These issues led to the initiation of this study by the Memphis Area Metropolitan Planning Organization to evaluate the potential of providing crossing improvements along the Norfolk-Southern Railroad.

II. Introduction
The purpose of the study was to analyze the impact of crossing improvements along the Norfolk-Southern Railroad. The study was guided by the principles and goals of the Memphis Urban Area Long Range Transportation Plan (LRTP), the Shelby County Unified Development Code (UDC), and the Sustainable Shelby Initiative.

III. Limits of Study
The Poplar Southern Corridor Study evaluates the arterial road crossings of the railroad from East Parkway in Mid-town Memphis to Rossville in Fayette County. The corridor is ½ mile wide, centered on the railroad centerline.

The following sixteen arterial roads that cross the Norfolk Southern Railroad at-grade within the study corridor limits were evaluated:

- Semmes Street
- Highland Avenue
- Goodlett Street
- Perkins Road Extended
- Mendenhall Road
- White Station Road
- Estate Drive
- Massey Road
- Kirby Parkway
- West Street
- Germantown Road
- Poplar Pike
- Hacks Cross Road
- Forest Hill Irene Road
- Houston Levee Road
- Byhalia Road
The impacts of an arterial road-railroad crossing to local neighborhoods, offices, and retail establishments, either at-grade or grade separated, reach well beyond the ½ mile study corridor. While these impacts are understood, the analysis and findings of this study were limited to the ½ mile corridor.

IV. Project Approach

A. Public Involvement
   This study utilized a multi-pronged approach to public involvement, including print media, radio, television, internet, neighborhood meetings, and stakeholder meetings. This outreach was used to identify the concerns and issues within the corridor and to discuss potential solutions to resolve those issues. Input from these meetings was used to identify and evaluate the potential solutions.

B. Data Collection
   Data was collected from local, state, and federal sources as well as Norfolk-Southern Railroad representatives. Some of the data collected included existing redevelopment and transportation plans, historic traffic data, projected future traffic data, crash data, crossing inventories, utilities, emergency vehicle information, school bus routes, rail vehicle and geometric information, socioeconomic base and horizon year data, environmental information, and traffic generators.

C. Selection of the Two Representative Crossings
   A preliminary matrix ranking system, based on the methodology and format used by the MPO and the Engineering Technical Committee for ranking Transportation Improvement Plan projects was formulated to assist with identification of the representative crossings. The roadway-railroad crossing locations were further evaluated based on the density of the adjacent land use and the vertical geometry of the road and railroad. From the matrix and additional evaluations, two crossings were identified as being most representative of the other fourteen roadway-railroad grade crossings – Mendenhall Road and Houston Levee Road.

The Mendenhall Road crossing represents the typical urban crossing with more dense commercial and office land uses as well as an existing vertical grade difference between the road and the railroad.

Houston Levee Road crossing represents a more suburban crossing with less dense commercial land uses and a relatively flat grade crossing.
V. Alternative Solutions

Four potential alternative solutions were identified for each representative crossing:

1. Adjust elevations such that the rail goes over the road
2. Adjust elevations such that the road goes over the rail
3. Safety improvements
4. “Do-nothing”

For the Mendenhall Road crossing, it was determined that the best alternative was to leave the railroad at its current elevation and lower the road. This minimizes the impact to adjacent rail crossings when compared to other build alternatives.

It was determined that the best alternative for the Houston Levee crossing was to raise the rail and lower the road to create the grade separation. This minimizes the impact to the roadway and adjacent property and allows the storm drainage and sanitary sewer to remain gravity flow.

VI. Mendenhall Road Alternative Analysis

A. Description of the Alternative

The alternative selected for the Mendenhall Road crossing was a grade-separation constructed by lowering Mendenhall Road and Poplar Avenue approximately 28 feet and constructing a railroad bridge at the same approximate elevation as the existing rail.

B. Construction Impacts

Construction impacts for Mendenhall Road include traffic impacts throughout the construction period (up to two years) including the introduction of lane closures on Poplar and the complete closing Mendenhall during at least one phase of the construction. Changes to the existing grades will impact the surrounding properties. The intersection at Mendenhall Road and Poplar Avenue serves a well-established local retail and office community as well as the residents of area neighborhoods. The construction of a grade-separated crossing will have a negative impact to the residents and businesses due to traffic detours during the construction period. However, the redevelopment opportunities may allow the introduction of a true mixed-use community, which could increase the neighborhood continuity and sustainability.
C. Community Impacts
Positive impacts post construction include improved safety due to the removal of the potential for vehicle/rail crashes, reduced congestion due to reductions in delays caused by the railroad at-grade crossing, and regional and local economic benefits including travel time savings resulting in an improvement to air quality. Negative impacts include the loss of business during construction and possible relocation of existing businesses that may not return after the construction period.

However, redevelopment of these parcels would likely result in the property being developed with more density and with a true mixed-use approach, resulting in a combination of retail, commercial, office and residential uses.

D. Opinion of Probable Cost
The grade-separated crossing improvements include costs associated with right-of-way (acquisition, relocation and damages), utility relocation, construction costs, and engineering. The total cost to public agencies associated with construction of the grade-separated crossing improvements is projected to be $63.9 million.

The total cost for redevelopment of the impacted properties would be borne by private developers and would include the proposed building costs and amenities. The redevelopment cost is estimated to be $94.1 million.

Costs or benefits to properties outside the corridor study limits have not been quantified or included in this evaluation because they are beyond the physical limits of this study.

E. Benefit/Cost Ratio
A benefit/cost analysis was performed for the public agency costs associated with the grade-separated crossing improvements. This analysis for the Mendenhall Road grade-separated crossing resulted in a benefit to cost ratio of less than 1.0, indicating that the project would not be viable.

VII. Houston Levee Road Alternative Analysis

A. Description of the Alternative
The alternative selected for the Houston Levee Road crossing was a grade-separation constructed by lowering Houston Levee Road and Poplar Avenue approximately 12 feet and raising the railroad profile 15 feet in order to achieve the required vertical separation.
B. Construction Impacts

Construction impacts for the Houston Levee Road crossing include traffic impacts throughout the construction period (up to two years), such as lane closures on Poplar Avenue and the temporary closure of Houston Levee Road during one phase of the construction. Changes to the existing grades would impact access to the surrounding properties. The closure of Houston Levee Road would have a negative impact on the surrounding retail centers.

C. Community Impacts

Positive impacts include improved safety resulting from the removal of the potential for vehicle/rail crashes, reduced congestion resulting from delays when the trains pass through the intersection, and regional and local economic benefits including travel time savings resulting in an improvement to air quality. Negative impacts include the loss of current businesses during construction.

Redevelopment of the adjacent parcels may result in the property being developed with more density and with a mixed-use approach that could include office and retail components.

D. Opinion of Probable Cost

The grade-separated crossing improvements include costs associated with right-of-way (acquisition, relocation and damages), utility relocation, construction costs, and engineering. The total cost to public agencies associated with construction of the grade-separated crossing improvements is projected to be $43.5 million.

The costs associated with the redevelopment of the adjacent properties at each intersection would be borne by private developers and would include proposed building costs and amenities. The total redevelopment cost is estimated to be $28.5 million.

Costs or benefits to properties outside the corridor study limits have not been quantified or included in this evaluation because they are beyond the physical limits of this study.

E. Benefit/Cost Ratio

A benefit/cost analysis was performed for the public agency costs related to the grade-separated crossing improvements. This analysis for the Houston Levee Road grade-separated crossing showed a benefit to cost ratio greater than 1.0, indicating this to be a viable project. The impacts to adjacent properties are less at the Houston Levee Road crossing than those at the Mendenhall crossing resulting in a better benefit-cost ratio.
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I. Preface
The Memphis Metropolitan Area faces transportation issues related to the Norfolk-Southern Railroad on a daily basis. Commuters, emergency responders, school buses, and mass transit are all affected by daily rail traffic. These issues led to the initiation of this study to evaluate the potential of providing crossing improvements along the Norfolk-Southern Railroad.

II. Introduction

A. Purpose
The purpose of the Poplar Southern/Corridor Study is to determine the potential impacts of roadway crossing improvements along the Norfolk Southern Railroad. The study evaluates the impact crossing improvements will have on the adjacent properties.

The study was guided by the goals of the Memphis Urban Area Long Range Transportation Plan (LRTP). Goals 1, 3, 4, 8, and 10, of the Long Range Transportation Plan specifically apply to this study. The study goals and the corresponding LRTP goals are listed below.

- **Study Goal #1:** Increase accessibility and mobility for users of the transportation system.
  LRTP Goal #1: Increase accessibility and mobility for people using the Memphis MPO’s regional transportation network through transit and shared ride modes.
- **Study Goal #2:** Increase the safety of the transportation system for motorized and non-motorized users.
  LRTP Goal #8: Increase the safety and security of the transportation system for motorized and non-motorized users.
- **Study Goal #3:** Promote efficient and sustainable land use and development patterns to meet existing and future transportation needs.
  LRTP Goal #3: Promote efficient land use and development patterns to ensure safety, economic vitality, and to meet existing and future transportation needs.
- **Study Goal #4:** Encourage improvements to and the expansion of freight facilities.
  LRTP Goal #10: Encourage improvements to and the expansion of freight facilities to ensure that Memphis maintains its leading role in global logistics.
- **Study Goal #5:** Encourage conservation of energy resources and minimize the negative community and environmental impacts.
  LRTP Goal #4: Encourage conservation of energy resources in addition to minimizing the adverse impacts transportation has on
social, economical, and environmental attributes of the community.

A table listing all of the Memphis Urban Area Long Range Transportation Plan’s Goals and Objectives can be found in Appendix A.

B. Guiding Principles
The study was guided by the principles and goals of the Memphis Urban Area Long Range Transportation Plan (LRTP), the Shelby County Unified Development Code (UDC pending approval), and the Sustainable Shelby Initiative.

III. Limits of Study

A. Extents
The study evaluates sixteen roadway at-grade crossings of the Norfolk Southern Railroad line between East Parkway in Memphis, TN and Rossville, TN in Fayette County. The corridor length is approximately 25 miles and the width is ½ mile, centered on the Norfolk Southern Railroad centerline.

The study corridor is a part of the Norfolk Southern Railroad’s “Crescent Corridor.” The railroad has a plan to improve this 2,500-mile rail network connecting the south (Gulf Coast) to the northeast (New York Area). The “Crescent Corridor” initiative is planned to increase the train volume along this corridor by diverting up to one million trucks to rail.

B. Arterial Crossings
There are sixteen arterial roads that cross the Norfolk Southern Railroad at-grade within the study limits:

- Semmes Street
- Highland Avenue
- Goodlett Street
- Perkins Road Extended
- Mendenhall Road
- White Station Road
- Estate Drive
- Massey Road
- Kirby Parkway
- West Street
- Germantown Road
- Poplar Pike
Additional minor crossings within the study limits are not considered in this study.

C. Limitations
The primary limiting factor of this study is the “area” in which data was gathered and analyzed. A new grade-separated railroad crossing will not only have a localized impact but will also have an effect, to some degree, on a regional level. The impacts of any arterial crossings to local neighborhoods, offices, and retail establishments reach well beyond the ½ mile limits of study. While these impacts are understood, the analyses and findings of this study are limited to the ½ mile corridor.

IV. Project Approach

A. Public Involvement
This study utilized a multi-pronged approach to public involvement, including print media, radio, television, internet, neighborhood meetings, and stakeholder meetings. This outreach was used to identify the concerns and issues within the corridor and to discuss potential solutions to resolve those issues. Input from these meetings was used to identify and evaluate the potential solutions.

1. Neighborhood Meetings
For the purposes of conducting the neighborhood meetings, the study corridor was divided into four sub-areas: Sub-Area One, from East Parkway to Cherry Road; Sub-Area Two, from Cherry Road to I-240; Sub-Area Three, from I-240 to the Germantown/Collierville City Limits; and Sub-Area Four, from the Germantown/Collierville City Limits to the easternmost limits of the MPO study boundary in Fayette County. The Neighborhood Meetings were scheduled as follows:

- **Sub-Area 1 Meeting** (East Parkway to Cherry Road)
  June 18, 2009, Holiday Inn Hotel – University of Memphis

- **Sub-Area 2 Meeting** (Cherry Road to I-240)
  June 25, 2009, White Station Church of Christ

- **Sub-Area 3 Meeting** (I-240 to Germantown/Collierville City Limits)
  June 30, 2009, Germantown City Hall
Sub-Area 4 Meeting (Germantown/Collierville City Limits to Fayette County) July 14, 2009, Collierville Town Hall

Multiple approaches were taken to notify the public regarding the opportunities to provide input to the study. Media coverage for the study included print, radio, television, and the internet including the study website.

A copy of the press release, the news outlets used and the Public Relations and Public Involvement Report can be found in Appendix B.

Each neighborhood meeting was focused on that particular sub-area, but the entire study limits were discussed and questions were answered pertaining to any crossing within the overall corridor. A formal presentation was made and exhibits and boards were set up around the meeting hall in order to facilitate questions and answers before and after the meeting. There were several reoccurring questions/comments from the meetings including:

- How the results of the study will impact the MPO’s Long Range Transportation Plan
- The role the railroad plays in the study
- The criteria used to determine the representative crossings
- The feasibility/probability of making the recommended improvements
- The aspects which are included/not included within the study
- The benefits/consequences of providing a grade-separated crossing

A complete list of the questions and answers discussed at each of the four neighborhood meetings can be found in Appendix B.

Each attendee was asked to fill out a questionnaire regarding the crossings and the problems experienced. A total of 104 questionnaires were submitted. This information was used as one of the inputs during the project prioritization phase to select the representative crossings to be studied in more detail. Some of the findings from the questionnaires were:

- Congestion was ranked as the most critical issue and safety/security was ranked second.
- Most of those surveyed cross the railroad three to four times per day.
Most said that they would not go more than five miles out of their way to avoid a particular railroad crossing. Most people spend an average of zero to ten minutes per day waiting at a railroad crossing when stopped by a train. Most of those surveyed strongly agreed with the statement that railroad crossings have a significant impact on daily travel.

A copy of all of the questionnaires submitted as well as a compilation of the questionnaire results can be found in Appendix B.

2. Stakeholder Meetings
Five groups of stakeholders were identified to provide input to the Poplar Southern/Corridor Study: the Major Roads/Freight Committee, Norfolk Southern Railroad Representatives, Governmental Interests, Business Community, and Community Interests.

A complete list of the stakeholders can be found in Appendix C.

Stakeholder Meetings were scheduled as follows:

- **Stakeholder Meeting 1**: Major Roads/Freight Committee
  July 21, 2009, Boyle Investment Company

- **Stakeholder Meeting 2**: Norfolk Southern Railroad Representatives
  July 31, 2009, Dalhoff Thomas Daws

- **Stakeholder Meeting 3**: Business Community
  August 12, 2009, Germantown Economic and Community Development Department

- **Stakeholder Meeting 4**: Community Interests
  August 12, 2009, Germantown Economic and Community Development Department

- **Stakeholder Meeting 5**: Governmental Interests
  August 12, 2009, Germantown Economic and Community Development Department

Prior to the meetings, the stakeholders were sent a questionnaire asking for specific information concerning the railroad corridor, including their opinion of the most appropriate/beneficial location for a grade-separated crossing.
There were several reoccurring questions/comments from the meetings, including:

- The nature of redevelopment of the area after a grade-separated crossing is constructed
- Appropriate land uses adjacent to a railroad crossing
- Technical aspects of grade-separated crossings
- Connectivity of arterial roads
- Future operations of the railroad with the opening of the intermodal facility in Fayette County
- Other potential alternatives including relocating the railroad – cost analysis of relocation vs. grade-separated improvements with the possibilities for light rail
- Determining the two representative crossing locations

The meeting agenda, meeting minutes, completed questionnaires, and sign-in sheets for each of the five stakeholder meetings can be found in Appendix C.

B. Data Collection

In order to conduct the analyses required for this Study, data from local, state and federal sources was obtained and reviewed. The paragraphs that follow identify the data obtained and the source of that data.

1. Development and Transportation Planned Improvements

Within the study area, plans have been developed for redevelopment of significant portions of property in three locations. Those plans are the Fairgrounds Redevelopment Plan, the Highland Avenue Redevelopment Plan, and the Germantown Smart Growth Plan. Publicly available data for all three plans were obtained for use in the evaluations. Data obtained included intended land uses and the expected density of development.

The Memphis Urban Area Metropolitan Planning Organization (MPO) completed the Long Range Transportation Plan (LRTP) in March, 2008. The plan and its subsequent amendments were used to identify future roadway improvement projects within the study corridor. The MPO Transportation Improvement Program (TIP) is a four-year plan for allocating transportation funds through the region. The current TIP with amendments was also referenced.
2. **Base Year and Historic Traffic Data Collection**
   The Tennessee Department of Transportation’s (TDOT) Project Planning group collected existing traffic count data at each at-grade public crossing throughout the State in 2005-2007. This traffic count data was collected, in part, to update the Federal Railroad Administration’s (FRA) rail crossing inventory. Daily traffic counts at one-hour intervals were conducted on the roadway approach to each crossing using automatic traffic counting recorders. In addition to these recent counts, historic daily traffic counts were obtained from TDOT’s Advance traffic Data Analysis and Management (ADAM) database.

3. **Horizon and Interim Analysis Years**
   Consistent with the current LRTP and the Travel Demand Model (TDM) horizon year, the horizon year for this study is 2030. Due to the financial constraints associated with the costs of construction of a grade-separated crossing and the time required for implementation, no interim analysis years are to be evaluated.

4. **Travel Demand Model**
   The Memphis Metropolitan Planning Organization completed the Memphis Urban Area Travel Demand Model (TDM) in 2007. The TDM has been updated with each Transportation Improvement Program (TIP) and Long Range Transportation Plan (LRTP) amendment, with the most current update completed for the July 30, 2009 LRTP Amendment. The TDM boundary includes all of Shelby and DeSoto Counties, and portions of Tipton, Fayette, and Marshall Counties. The boundary of the Poplar Southern Corridor Study is within the TDM boundary. The Memphis TDM is a standard four-step model with enhancements for mode choice and destination choice. The TDM was obtained from the MPO for use in this study. Although several model years are available for use, the horizon year 2030 model will be used for estimating the traffic impacts of the alternatives developed as part of this study.

5. **Crash Data**
   The Federal Railroad Administration (FRA) and the National Highway Traffic Safety Administration (NHTSA) maintain statistics on all rail-crossing crashes. The most current ten years of crash data (1999 through 2009) was obtained from FRA’s Office of Safety Analysis. The crash data reports obtained from FRA contain the following summarized information for each incident/crash:
   - Name of the railroad
   - Date and time of the crash/incident
Location (state, city, county, and highway)
Direction of travel of the train and the motor vehicle
Type of highway user involved (auto, truck, pedestrian, etc.)
Reason for collision
Driver characteristics such as age and gender
Weather conditions at the time of the crash
Type of traffic control
Number of resulting injuries or fatalities and property damage

The number of crashes over the ten-year period was one of the factors used in the ranking criteria. For some crossings, such as Kirby Parkway, a number of safety related improvements have been implemented during the ten-year period. The resulting reduction in the number of crashes at any one intersection was not reflected in the crossing ranking criteria.

6. Inventory of Crossings
An inventory of all of the crossings along the study corridor was obtained from FRA. FRA maintains a database of all of the public and private crossings nationwide. The FRA database is updated by the state Departments of Transportation and the railroad operators. For the crossings along the route, this inventory was updated by the Tennessee Department of Transportation in 2007. The information contained in the FRA database is grouped in five categories:

- Location and classification information
- Railroad information
- Traffic control device information
- Physical characteristics
- Highway/roadway information

This rail crossing inventory data was supplemented with data provided by the University of Memphis. As part of a graduate student project, an inventory was obtained of all the public at-grade crossings along the Norfolk Southern rail line in Shelby County. Crossing information, as well as photographs of adjacent intersections, was provided in a GIS database.

The Tennessee Department of Transportation provided information collected from inventory and railroad/roadway signal interconnect data for all of the crossings in this study area in 2005 through 2007.
As a Stakeholder in the project, Norfolk Southern Railroad assisted in the crossing inventory by providing information and data throughout the study corridor.

A copy of The Department of Transportation (DOT) and Federal Railroad Administration (FRA) Incident Reports for each of the sixteen crossings analyzed and of Norfolk Southern Railroad’s crossing and rail data (including meeting minutes) can be found in Appendix D.

7. Utilities Information
Utility information was obtained from MLG&W, the Town of Collierville, the City of Germantown, and the City of Memphis for the at-grade crossings selected for further study. This information included the location of sanitary sewer, water, gas, and electric facilities within and adjacent to the study intersections.

8. Emergency Vehicle Information
Emergency vehicle use of rail crossings along the study corridor was determined based on the relative location of police stations, fire stations, and hospitals. The locations of the emergency vehicle origins were obtained from geographic information system (GIS) data provided by the Memphis and Shelby County Department of Regional Services.

9. School Bus Route Information
A listing of crossings used by school buses is contained in the FRA railroad inventory. Based on past experience with this information however, this data is known to be outdated and was of no use in this evaluation. The City of Memphis and Shelby County School systems were contacted to obtain a count of school buses actively using the railroad grade crossings along the corridor on a typical school day.

The Shelby County Schools Transportation Department provided data on the number of schools buses per day that use the crossings within the school district, as well as the total number of students that are on the school buses. The arterial crossings used within Shelby County include:

- West Street
- Germantown Road
- Poplar Pike
- Hacks Cross Road
- Forest Hill Irene Road
- Houston Levee Road
- Byhalia Road

The information provided by the Memphis City Schools GIS/Planning Department was used to evaluate the impacts the crossings have on the city schools, in addition to a map showing the schools located within a one-mile radius of the crossings. The following crossings were ranked by the Memphis City Schools according to the impact they have on the students and facilities:

- Semmes Street
- Perkins Road
- Perkins Extended
- Mendenhall Road
- Estate Drive
- Colonial Avenue
- Highland Avenue
- Goodlett Street
- White Station Road

Information from the Shelby County Schools and Memphis City Schools can be found in the Appendix E of this report.

10. Memphis Area Transit Authority (MATA) Information
The Memphis Area Transit Authority (MATA) supplied information and data relating to mass transit issues within the study corridor, including its citywide routing map.

Information provided by MATA can be found in the Appendix E of this report.

11. Rail Vehicle and Geometric Information
A portion of the information related to the rail vehicles that use the study area crossings is contained in the rail-crossing inventory obtained from FRA. Often times, this information is not current, as the railroad may make frequent changes to service, allowable travel speed, or other operating characteristics. Current rail vehicle operating characteristics and railroad track geometric information was obtained from the Norfolk Southern Railroad. Track charts were provided containing the following information along the study corridor:

- Street name or feature crossed (with an FRA crossing number)
- Maintenance by type and date performed
- Rail traffic density or flows in terms of ton-miles
- Track alignment and layout (horizontal and vertical geometry)
- Locations of siding or passing track
- Types of highway traffic control
- Allowable rail vehicle speed

Additional information, such as train volume per day and desired crossing closures, was provided by the Norfolk Southern Railroad in a written response. No information regarding the impact to rail vehicle volume due to the proposed new rail yard/intermodal facility in Rossville was provided by the railroad.

12. Socioeconomic Base and Horizon Year Data
Base year socioeconomic and demographic data was collected as part of the travel demand model (TDM) development. The base year demographic data was obtained from the US Census Bureau, and employment data was obtained from the University of Tennessee, the US Bureau of Labor Statistics (BLS), and InfoUSA. Using this base information, a national and regional economic forecast was developed for the Memphis Metropolitan Statistical Area (MSA). Using an expert panel and a Delphi process, the regional forecast of growth was disaggregated into sub-county areas, and finally to the traffic analysis zone (TAZ) level. Population and employment forecasts were developed for 2010, 2020, 2030, and 2040 as part of the TDM development.

13. Environmental Information
There are a number of natural and cultural resources in the region. An effort was made, as part of this project, to identify these resources. The following is a listing of the major natural and cultural resource data, as well as other environmental data obtained as part of this project:

- Natural Heritage Inventory – GIS database of the distribution and ecology of rare plants, animals and ecological communities obtained from the Tennessee Department of Environment and Conservation (TDEC)
- Major water features, wetlands, and floodplains - GIS data provided by the MPO
- Superfund sites, hazardous waste generators, toxic chemical release sites, air release sites, and water discharge sites – GIS data from the Environmental Protection Agency (EPA)
14. Major Traffic Generators
A large part of the data collection was focused on the major traffic generators associated with each arterial crossing along the corridor. Generators well beyond the extents of the ½ mile wide corridor impact the amount of traffic at each crossing. This study attempted to consider all of the traffic generators within and beyond the study limits that might have impact on the study. Traffic generator categories researched along the corridor include: shopping and business centers, hospitals, parks/greenways, fire and police stations, and schools. Several of these are both vehicular and pedestrian traffic generators, including schools, parks, shopping centers and restaurants. Other traffic generators include adjacent neighborhoods.

15. Existing Topography
To aid with the alternatives analysis, contour information was obtained from the Shelby County Government in a GIS file format. Two-foot increments contours were provided for the areas surrounding each of the initial sixteen crossings evaluated as part of this study.

16. Arterial Road Crossing Data Exhibits
Arterial Road Crossing Exhibits were developed for each of the sixteen arterial roads that cross the Norfolk Southern Railroad and arranged in order from west to east along the study corridor. Important crossing data related to each road is provided. Each figure illustrates a ¼ mile and ½ mile radius from the crossing and shows the key traffic generators within these areas. A perspective aerial image shows the land uses at each corner of the road and railroad intersection.

The Arterial Road Crossing Data and Analysis exhibits can be found in Appendix F.

17. Preliminary Matrix Ranking System
The methodology for determining the ranking criteria is based on a format similar to that used by the MPO. The major categories addressed were Congestion Relief and Mobility, Economic Opportunities, Safety, Public Support, Environment, and Funding. The Ranking Matrix/ Ranking Criteria chart, shown in Figure 1, ranks
the sixteen arterial road at-grade crossings of the Norfolk Southern Railroad within the study corridor limits. The first chart lists the roads and their rankings from west to east along the study corridor. The second chart lists the roads as they were ranked with the first road listed receiving the highest total point score. The top six arterial road grade crossings are West Street, Byhalia Road, Highland Avenue, Perkins Extended, and Mendenhall Road, with Kirby Parkway and Houston Levee Road equally ranked sixth.

*The Ranking Criteria Matrix and Crossing Attributes can be found in Appendix G.*
**RANKING MATRIX/RANKING CRITERIA**

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<th>Street</th>
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<th>Maximum Truck Speed (Traffic Time)</th>
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**FIGURE 1**

**Arterial Road Crossing**

**POPLAR SOUTHERN / CORRIDOR STUDY**

THIS REPORT WAS PREPARED IN COOPERATION WITH THE U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION, AND THE TENNESSEE DEPARTMENT OF TRANSPORTATION.

**Statistical Analysis and Data Interpretation**

- **Ranking Criteria**
  - Congestion & Traffic Delays
  - Ongoing Opportunities to Improve
  - Safety
  - Public Support
  - Environmental
  - Funding

- **Ranking of Crossings**
  - Congestion & Traffic Delays
  - Ongoing Opportunities to Improve
  - Safety
  - Public Support
  - Environmental
  - Funding

**Notes:**
- **Total Crashes** from FHWA's Accident Report Database, and represent the total number of motor vehicle crashes over a ten-year period.
- **-** Does not reflect motor traffic signal improvements made in 2007.
C. Project Prioritization

1. Selection of Two Representative Crossing Locations

The two crossings to be evaluated in more detail can be used to generally determine the costs and benefits at other similar crossings within the study area. Two criteria were used to categorize crossings with similar characteristics: adjacent land use and vertical roadway and railroad geometry. Three types of land uses were identified for the sixteen crossings: Commercial/Office/Industrial, Residential, and Hybrid (a combination of commercial, office, and residential). The sixteen arterial crossings were then sorted by these criteria. The vertical geometry criterion refers to the existing topographical condition of the roadway and railroad as they approach a grade crossing. This includes those where the roadway approach is at different elevations than the railroad tracks, and those where the roadway approach is generally at the same elevation as the railroad tracks. Within each of these criteria, the sixteen arterial crossings were listed in order of the Preliminary Matrix Ranking System as described previously in Section IV.B.17.

Based on this ranking, six recommended crossings were selected:

- West Street
- Byhalia Road
- Perkins Extended
- Mendenhall Road
- Kirby Parkway
- Houston Levee Road

Through a series of meetings of the MPO staff and the study team, the at-grade crossings at Mendenhall Road and Houston Levee Road were selected as the two crossings having the most similar characteristics and that are the most representative crossings located within the corridor study limits. Mendenhall Road represents an urban crossing with a dense surrounding of commercial, office, and adjacent residential land uses and a difference in elevation between the road and the railroad. Houston Levee Road represents a suburban crossing with less dense commercial land uses nearby, strong road connectivity, and relatively flat vertical geometry.

The MPO meeting agenda, meeting minutes, and progress status reports can be found in Appendix H.
D. Potential Alternative Solutions

Four potential alternative solutions were identified for each of the two representative crossings, as listed below:

**Mendenhall Road**

1. **Do Nothing Alternative** – Existing geometry and traffic control to remain unchanged.
2. **Option A** – Grade separation with the railroad over Mendenhall Road. The railroad would stay in its current location and Mendenhall Road and Poplar Avenue would be lowered approximately 28 feet below the existing grade.
3. **Option B** – Grade separation with the railroad over Mendenhall Road. The grades of the railroad, Mendenhall, and Poplar would be adjusted. The railroad would be raised approximately 17 feet with Poplar Avenue and Mendenhall Road lowered no more than 11 feet below the existing grade in order to maintain gravity drainage flow.
4. **Option C** – Safety improvements. Improvements may include lowering the railroad to remove the existing vertical elevation change at the crossing and installing raised medians along Mendenhall Road or four quadrant gates at the crossing.

Option A was selected for the detailed study of the Mendenhall Road crossing for several reasons. First, the approach of Mendenhall Road from the south is approximately 12 feet lower vertically than the railroad – 40% of the needed vertical separation. Second, the proximity and impacts to other crossings (i.e., Truse Road, Colonial Road, and White Station Road) limited changing the vertical geometry of the railroad at this location. While raising the elevation of the railroad at this crossing would assist in alleviating potential drainage issues, it would require the permanent closure of the Truse Road crossing and the reconstruction of the White Station Road crossing.

**Houston Levee Road**

1. **Do Nothing Alternative** – Existing geometry and traffic control to remain unchanged.
2. **Option A** – Grade separation with the railroad over Houston Levee Road. The railroad would stay in its current location and Houston Levee Road and Poplar Avenue would be lowered approximately 27 feet below existing grade.
3. **Option B – Grade separation with the railroad over Houston Levee Road.** The grades of the railroad, Houston Levee Road, and Poplar Avenue would be adjusted. The railroad would be raised approximately 15 feet with Poplar Avenue and Houston Levee Road lowered no more than 12 feet below the existing grade in order to maintain gravity drainage flow.

4. **Option C – Safety improvements.** Improvements may include video camera enforcement at the crossing ticketing motorists that violate the gate arms by running through a crossing when a train is approaching. There are a limited number of additional safety improvements that could be made because this crossing has recently been updated.

Option B was selected for detailed study of the Houston Levee Road crossing. The combination of raising the railroad 15 feet and lowering the roadways 12 feet to achieve the required vertical separation limits the construction impacts to adjacent properties. The adjacent crossing locations are far enough away that they would not be impacted.

V. Mendenhall Road Alternative Analysis

Analyses were conducted to determine the construction and community impacts associated with the alternative solution chosen for Mendenhall Road. Due to the change in the elevation of the roads, the improvements made at this intersection would require more than roadway and railroad improvements. The lowering of the roadway system would require a major redevelopment of the immediate area. The information that follows provides a detailed description of the selected alternative and identifies the impacts, redevelopment opportunities, probable costs, and benefit/cost ratios associated with the improvements that potentially could be provided by the grade-separated crossing. The design standards of the Tennessee Department of Transportation, the City of Memphis, and the Norfolk Southern Railroad were used in the development of the alternative solution.

A. Description of the Alternative

The alternative selected for further analysis for the Mendenhall Road crossing was Option A. This option provides for constructing a grade-separated crossing by lowering Mendenhall Road and Poplar Avenue approximately 28 feet and constructing a railroad bridge at the same approximate elevation as the existing rail. Mendenhall Road and
Poplar Avenue would be reconstructed with the same number of lanes using current design standards for lane widths. The current lane widths on Poplar Avenue are substandard, due in part to the restricted right-of-way width. Reconstructing Mendenhall Road and Poplar Avenue to current design standards would require additional right-of-way. Typical Roadway Sections for Poplar Avenue and Mendenhall Road are shown in Figure 2. Roadway profiles were developed using a 40-mile per hour design speed.

The Roadway and Railroad Profiles for the Mendenhall Road crossing can be found in Appendix I.
MENDENHALL ROAD AND POPLAR AVENUE

ROADWAY TYPICAL SECTIONS

MENDENHALL ROAD

POPLAR AVENUE

NOT TO SCALE
B. Construction Impacts

Limits of Construction
The limits of construction necessary for reconstructing the roadway, installing a railroad bridge, and the redevelopment of the impacted adjacent properties are shown on Figure 3. On Mendenhall Road, the construction would begin approximately 100 feet south of Spottswood Avenue and extend to 100 feet north of William Arnold Road. On Poplar Avenue, the construction would begin just east of Erin Drive and extend to approximately 200 west of Truse Parkway.
Mendenhall Road Limits of Study Impacts

The Mendenhall Road Limits of Study Impacts exhibit illustrates the area within the study limits and is approximately 31.2 acres including acreage inside and outside of the right-of-way. The limits are based on the extent of land impacted due to the grade-separated crossing improvements. Due to the extreme change in elevation of the road, Poplar and Mendenhall are lowered approximately 28 feet, the land adjacent to the right-of-way will also be impacted. One of the key components to the success of a business is the visibility and accessibility of the building to the user. Therefore the approach was taken to keep the elevation of the buildings relative to the elevation of the new road. This could be accomplished by grading parcels adjacent to the roadway to an elevation relative to the new roadway elevation. The remaining parcels would be graded so as to take up the necessary grade change at the rear of the properties. Retaining walls, if required, would be located at the rear of the properties. The limits of area line represents the point where the proposed grade ties back into the existing grade.

Mendenhall Road Crossing Data

Current Conditions Prior to Grade-Separated Crossing Improvements

70' Right-of-Way with 4-Thru Lanes
Crash Count (Motor Vehicle/Rail Vehicle): 4 (Based on FRA’s Accident Report Database over a ten year period)
1. **Traffic Impacts**

Construction of a grade-separated crossing is a major undertaking. Maintenance of traffic through the area during construction would require a detailed, multi-staged traffic control plan. This alternative would require lanes and/or entire streets to be closed to complete construction. A schematic staging plan was developed to illustrate maintenance of traffic during construction. The goal was to maintain a minimum of four lanes of traffic on Poplar Avenue throughout construction.

The street closures with their associated detours would have a negative impact on traffic throughout the construction period. Business owners, their employees, and their patrons would feel the effects in lost time and revenue. Emergency responders (police, fire, and ambulance) would have delays and would have to adjust their response routes accordingly. Mass transit would have to adjust their routes likewise. In general, any resident, business, or service located within the neighborhoods surrounding the crossing would have to make adjustments to their travel routines.

For the intersection of Mendenhall Road at Poplar Avenue, traffic control is expected to generally occur in two phases during construction. As part of Phase 1, Mendenhall Road would be closed south of Poplar Avenue. Traffic along Mendenhall Road south of the closure would be routed from Mt. Moriah to Truse Parkway to Poplar Avenue to Mendenhall Road north of Poplar Avenue. It is anticipated that Mendenhall Road south of Poplar Avenue would be closed to traffic throughout the construction. During Phase 2, Mendenhall Road would be closed both north and south of Poplar Avenue. During this phase, traffic would be routed from Mt. Moriah Road to Park Avenue to White Station Road to Sanderlin Avenue to Mendenhall Road. The alternative temporary construction detour routes for the Mendenhall Road crossing are shown in the Mendenhall Road Traffic Control Schematic, Figure 4.
2. Grading Impacts
With the grade changes associated with a grade-separated crossing, a conceptual grading plan was developed to determine the impacts to the adjacent property. One of the key components to the success of a business is the visibility and accessibility of the building to the user. Therefore the approach was taken to keep the elevation of the buildings relative to the elevation of the new road. This could be accomplished by grading parcels adjacent to the roadway to an elevation relative to the new roadway elevation. The remaining parcels would be graded as to take up the necessary grade change at the rear of the properties. The limits of redevelopment line represents the point at which proposed grading ties to the existing topography or at which point a retaining wall is required.

3. Utility Impacts
Utility information for the Poplar Avenue at Mendenhall Road crossing was provided by MLG&W. This information included the location of water, gas, and electric facilities adjacent to the intersection. There were no major electrical transmission towers or gas pipelines identified and utility impacts were limited to local service lines, three phase electrical transmission lines, gas mains, and water mains.

4. Stormwater Management
Of concern for the rail crossing was the improvements required for adequate stormwater drainage. As a result of lowering the roadways, storm drainage would need to be modified based on the new roadway elevations. The revised profile geometry would create a sump condition for stormwater drainage. This intersection would require the installation of a pump station. The proposed station would pump stormwater south along Mendenhall Road to an existing drainage canal flowing to Cherry Bayou. A new closed drainage system would be constructed as part of the roadway reconstruction.

The natural drainage basin would be modified with the improvements. Generally, the ridge separating the Wolf River and Nonconnah Creek drainage basins follows the Poplar Avenue and the Norfolk Southern Railroad. With the Mendenhall Road crossing, construction of a grade separation would result in approximately 11 acres being removed from the Wolf River drainage basin and added to the Nonconnah Creek drainage basin.
C. Neighborhood Impacts

1. Business and Community Impacts

It would be essential that the finished floor elevations of the businesses along Mendenhall Road and Poplar Avenue relate to the new elevations of those roadways. The businesses closest to the intersection would be approximately 28 feet lower than their current elevation. The limits of redevelopment define those parcels that would be affected by the change in elevation required under Option A. During the construction and redevelopment period numerous businesses would have to be relocated (at least temporarily).

The Mendenhall Area Map (Figure 5) illustrates the existing parcels within the limits of the redevelopment area that would be affected by the construction. The figures indicate which businesses would be removed and which would be maintained yet impacted due to the grade-separated crossing improvements specific to each intersection. The businesses impacted and/or removed by improvements to the railroad are highlighted and summarized below.

Retail
- 158,550 SF +/- Removed (53 Businesses)
- 81,784 SF +/- Impacted* (6 Businesses)
Office
- 103,746 SF +/- Removed (14 Offices)
Residential
- 1.05 acres +/- Removed (2 Single-Family Residences)

* Impacted businesses or offices are those that would not be removed due to construction of the grade-separated crossing, but would be impacted by construction due to loss of business, construction impacts, or delays.
D. Post Construction Community Impacts

1. General Neighborhood Impacts
   Construction of the selected alternatives would have an impact on the surrounding neighborhood after the construction period has ended. One notable impact would be the loss of current businesses. While new construction has the potential to attract businesses, there is the possibility that businesses lost during the construction period would either relocate or would remain closed. Another potential impact is the increase in traffic that would result from a grade-separated crossing. The potential of getting caught by a train at non-grade separated crossings would cause many drivers to select routes that include the separation. This would be especially significant at rush hour where commuters, seeking to save time, may find a heavily congested intersection and a resulting delay.

2. Impacts to Safety
   It is anticipated that the safety of the crossing would be improved with construction of the selected alternative. By providing a grade separation, vehicles traveling along Mendenhall Road would not cross the rail line at-grade and conflict points associated with the rail crossing would be eliminated, removing the potential for a vehicle/rail crash. Over a ten-year period from 1999 to 2008, there were four documented cases of a rail/highway vehicle crash at the Mendenhall Road crossing.

3. Impacts to Congestion
   Construction of the selected alternatives would reduce congestion at the intersection. By eliminating the at-grade crossing at Mendenhall Road, the route would remain open as trains pass through the area. This would reduce non-recurring delay by allowing vehicles to cycle through the intersection as trains pass through the area. It is estimated that as many as 20 trains per day would use the rail line in the horizon year of 2030. It is also estimated that vehicles encountering a train would experience a three-minute delay on average. Using these estimates and the anticipated number of vehicles using the crossings in the horizon year, approximately 65 to 70 hours of delay per day would be eliminated with a grade separation.

4. Environmental Impacts
   The environmental impacts of constructing the improvements at the Mendenhall Road crossing were reviewed. The environmental issues identified within the study boundaries included impacts to
floodplains, rare species habitat, ecological sites, superfund sites, hazardous waste generators, toxic chemical release sites, air release sites, and water discharge sites. Sites within a ¼ mile radius of the study intersections were noted. The intersection of Poplar Avenue at Mendenhall Road was found to have one air release site located adjacent to the project. There would be positive impacts to air quality provided by the grade separation due to reductions in vehicles delayed and idling as vehicles would no longer be delayed or stopped by railroad activity.

5. Regional and Local Economic Impacts
The REMI (Regional Economic Models, Inc) model, an advanced economic impact modeling software, was used to estimate the total direct, indirect, and induced impacts of the construction of the Mendenhall Road grade separation. There are two major categories of potential impacts:

- One-time impacts, which result from the construction of the improvements occurring once during the construction period.
- Ongoing impacts, which result from increased quality of life, personal income, and labor productivity created by the travel time savings.

Both types of impacts have been evaluated in this report, and the results are highlighted as follows:

- Construction impacts - These impacts are estimated to occur evenly over the life of the construction, and would not recur after the construction period. Based on the analysis, the construction of the underpass would result in the creation of 427 jobs and create a total $50.4 million increase in output to firms in Shelby County.
- Ongoing impacts – The travel time savings created by the grade separation would result in an increase of $2.9 million in output (in 2010 constant dollars) and an associated additional 12 jobs in 2020 within Shelby County on an annual basis. By 2030, the increase in personal income in the region, in 2030 dollars, is estimated to reach close to $2.3 million. These impacts recur year after year.

6. Impacts to Transit
Construction would have a minor impact to adjacent transit routes. Currently, the Mendenhall Road intersection has two bus routes that cross the rail line and a third that travels along Poplar
Avenue. The construction of a grade-separated crossing at this intersection would improve safety and reduce delay for those transit routes.

7. Bicycle Lanes
The rail crossing at Mendenhall Road was investigated to determine if bicycle lanes would be required based on recommendations in the 2030 Long Range Transportation Plan (LRTP). The intersection of Poplar Avenue at Mendenhall Road is not proposed to have bicycle lanes and it is not recommended in the LRTP.

8. Minor Crossing and Street Closures
With construction of the selected alternative for Poplar Avenue at Mendenhall Road, minor streets located adjacent to the crossing would require closure. These streets include Moss Road at Poplar Avenue and Southern Avenue at Mendenhall Road. These road closures would be required because of vertical geometry changes to Mendenhall Road and the Norfolk Southern Railroad. It is recommended that Moss Road, a minor crossing, be converted to a cul-de-sac and the Southern Avenue alignment be modified to intersect Mendenhall Road further to the south. It is also recommended that Black Road be realigned on the east side of Mendenhall Road to align with its west side counterpart.

E. Horizontal and Vertical Rail Geometry
Improvements to the horizontal and vertical geometry for the rail line were established using Norfolk Southern’s design criteria. To minimize the impact to the rail line, horizontal geometry was not modified. The design criteria used for this study can be found in Appendix D.

F. Limits of Redevelopment
The Mendenhall Road Limits of Study Impacts exhibit illustrates the area within the study limits that would be impacted by the railroad and roadway improvements made for a grade-separated crossing. As discussed previously in Section V.B.2, due to the extreme change in elevation of the roads, the land adjacent to the right-of-way would be significantly impacted. (See Figure 3).
G. Conceptual Redevelopment Plan

1. Approach

Changes to the existing roadway elevations, due to the construction of the grade-separated crossing, would require the redevelopment of the area surrounding these crossings. Consistent with the Sustainable Shelby Initiative and the Shelby County Unified Development Code (UDC), redevelopment of these parcels would likely result in the property being developed with more density and with a mixed-use approach.

A mixed-use planning approach with the following components were included: Live/Work Units with office or retail on the first floor and residential above (three-story), Retail (one-story), Mixed-Use Retail and Office (two-story), and Mixed-Use Retail and Residential (six-story). A parking analysis was performed which maximized the building square footage while provided adequate surface parking.

The residential element would serve to increase the population in the area and provide more patrons for the mixed-use retail and office components. Seventeen live-work units south of Poplar Avenue provide buildings with both office and retail space on the bottom floor with residential space above. In addition, a mid-rise retail and residential building would introduce a new concept to the area.

It would be important to maintain the views of the property north and south of the grade separation, which would likely be blocked by a normal 170-foot span bridge. In order to open the views the bridge span for the railroad crossing could be increased from 170 feet to 340 feet, to provide a wider opening at the crossing and allow drivers to see businesses on the opposite side of the railroad track.

The following exhibit, [Figure 6](#), illustrates the Conceptual Redevelopment Plan for the Mendenhall Road crossing. Also included is a Conceptual Redevelopment Plan Products chart, [Figure 7](#), listing the proposed and existing land use products.

While the Conceptual Redevelopment Plan illustrates the specific crossing, the design principles are representative and can be used for other crossings along the corridor to create a redevelopment plan specific to other intersections. The Conceptual
Redevelopment Plan reflects only one possible scenario and should not be considered the only option for redevelopment.
## Mendenhall Road Crossing Conceptual Redevelopment Plan Products

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<th>Existing Total Sq Footages/Units</th>
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<td>A Live/Work (3 Stories)</td>
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<td>B Live/Work (3 Stories)</td>
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<tr>
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<tr>
<td>D Mixed-Use (2 Stories)</td>
<td>53,500 sf Retail (1st Floor) 53,500 sf Office (2nd Floor)</td>
<td>0 sf</td>
</tr>
<tr>
<td>E Mixed-Use Mid Rise (6 Stories)</td>
<td>29,000 sf Retail (1st Floor) Parking Garage (2nd Floor) 84 Units (3rd-6th Floors)</td>
<td>0 sf</td>
</tr>
<tr>
<td>F Office Only</td>
<td>0 sf</td>
<td>103,746 sf</td>
</tr>
<tr>
<td>G Multi-Family Residential</td>
<td>0 units / 0 acres</td>
<td>0 units / 0.39 acres</td>
</tr>
<tr>
<td>H Single-Family Residential</td>
<td>0 residences / 0 acres</td>
<td>2 residences / 0.66 acres</td>
</tr>
</tbody>
</table>

**Total:**
- Retail: 180,100 sf
- Office: 59,800 sf
- Residential: 101 Units

**Limits of Area**
- 31.22 acres (including ROW)
- 8.93 acres (Road and Railroad ROW)
- **22.29 TOTAL ACREAGE (not including ROW)**
2. Conceptual Redevelopment Plan Imaging
Following is a series of redevelopment plan imaging exhibits, Figures 8-11, illustrating the mixed-use redevelopment approach taken at the Mendenhall Road crossing. The redevelopment plan imaging exhibits are based on the Conceptual Redevelopment Plan. These illustrations reflect only one of many possible scenarios for development of the area.
A SketchUp rendering of the Conceptual Redevelopment Plan for the intersection at Mendenhall Road and Poplar Avenue. The plan is a mixed-use concept integrating retail, office and residential uses.

**FIGURE 8**

Limits of Study Impacts

Conceptual Redevelopment Plan
VIEW A: Conceptual bird's eye view looking southeast across the railroad bridge. Uses south of Poplar include: retail, live/work, and mixed-use retail with residential.

VIEW C: Conceptual bird's eye view looking northwest at live/work units fronting Mendenhall. Live/work units are three-stories with office and residential uses.

VIEW B: Conceptual bird's eye view looking northwest across the Mendenhall and Poplar intersection. Retail and two-story mixed-use buildings front Mendenhall.

VIEW D: Conceptual bird's eye view looking northeast at retail and mixed-use buildings. Existing Whole Foods, Office Depot, Clark Tower, and White Station Tower behind.
**VIEW A BEFORE**: Looking east along Poplar, First Tennessee Bank is located at the corner of Poplar and Mendenhall with restaurants and retail buildings adjacent.

**VIEW A AFTER**: Conceptual view looking east at the Mendenhall and Poplar intersection. An improved right-of-way is introduced with street trees located in a grass strip behind the curb and lined with five-foot wide sidewalks. In the northeast quadrant one-story retail uses face Poplar with a mixture of both retail and office buildings facing Mendenhall.
**VIEW B BEFORE:** Looking across Poplar towards the southeast corner of Mendenhall and Poplar.

**VIEW B AFTER:** Conceptual view of the southeast corner of Mendenhall and Poplar. The railroad stayed in its current location and Mendenhall and Poplar are lowered approximately 28 feet below the existing grade.

**VIEW B AFTER:** Conceptual bird’s eye view of the southeast corner of Mendenhall and Poplar. The six-story mixed-use building can be seen over the railroad bridge, adding additional retail square footage on the first floor and residential lofts above, a second floor garage serves as parking for the residents.
H. Opinion of Probable Cost

An opinion of probable cost data sheet was developed to include the probable costs of the proposed roadway and railroad improvements and the associated conceptual redevelopment plan at Mendenhall Road. There are three potential categories of cost related to this project: costs associated with the grade-separated crossing improvements, costs associated with the redevelopment, and costs of impacts beyond the physical limits of this study. The costs associated with the grade-separated crossing improvements are included in the Benefit/Cost Ratio analysis as discussed in the next section. The costs associated with redevelopment are not included in the Benefit/Cost Ratio analysis. The redevelopment cost is not included because it is assumed that economic growth would occur in the city regardless of whether or not the grade separation is built. The improvements at Mendenhall Road could concentrate the economic growth at this intersection instead of other locations in the city; however, the net local economic growth would not change and is viewed only as a geographic shift.

**Category 1:** The grade-separated crossing improvements include costs associated with rights-of-way (acquisition, relocation, and goodwill), utility relocation, construction costs, and preliminary engineering. The total cost associated with grade-separated crossing improvements is $63.9 million, as detailed below:

- Right-of-Way 31.7 million
- Utility Relocation 2.4 million
- Construction Costs 27.1 million
- Preliminary Engineering 2.7 million
  
  **TOTAL 63.9 million**

It is important to note that the railroad bridge cost includes a span twice as long as needed in order to create view corridors to the development on either side of the railroad. This is key to the sustainability of the retail uses in the area.

*The Economic Impact Report can be found in Appendix J.*

**Category 2:** The breakdown of the costs associated with the conceptual redevelopment at the intersection includes demolition of existing facilities and redevelopment costs including proposed building costs and amenities. The total construction redevelopment cost for the Mendenhall Road scenario is estimated to be approximately $94.1 million. This figure does not include the portion of property acquisition and building demolition costs due to right-of-way
improvements included in the Category 1 costs. The probable costs for the redevelopment are only representative of the concept scenario modeled for the intersection. If a different redevelopment program is chosen, then the probable cost of construction would change accordingly.

A detailed listing of the Opinion of Probable Costs for the Mendenhall Road improvements and conceptual redevelopment plan can be found in Appendix K.

Category 3: Costs include all costs or benefits accrued due to impacts outside the study limits. These costs or benefits could include improvements to traffic flow or safety resulting from traffic diversion from other roads or intersections, increased exposure for retail businesses, or increased traffic noise for residential properties. Even though these benefits or impacts may be real, they have not been quantified or included in this evaluation because they are for properties or areas that are beyond the physical limits of this study.

I. Benefit/Cost Ratio

The economic impact evaluation examines the impact of the grade-separated crossing from the perspective of the Memphis Metropolitan Area regional economy.

Benefits
From a project perspective, the benefits include the time savings which accrue to motorists (both passenger car and truck traffic), air quality impacts, and crash reduction savings. The time savings to motorists have been divided into household sector benefits and employment sector benefits. The time savings to the household sector allows motorist to spend a bit more time throughout the years in personal consumption of goods and services, including recreation. This time savings benefit has a moderate impact on increasing the output of the Shelby County economy. The time savings to the employment sector allows each employee to spend a few more hours at work throughout the year, and this contributes to businesses increasing their production of goods and services. The output gains of both sectors were calculated using the REMI model and these benefits increase the overall output of the Shelby County economy.

The proposed community redevelopment activities around the grade-separated crossing have not been included in this benefit cost analysis. Assuming regional demand exists for such development, it is expected that the development would have occurred within Shelby County in any case. The redevelopment activities are viewed as
geographic shifts in economic development activity rather than a net benefit to the County from these transportation improvement projects.

Costs
The costs include:
- Construction of each grade-separated crossing
- Real estate acquisition of affected commercial properties and buildings and residences
- The cost of relocating businesses and residents covering both the physical move and compensation for damages associated with relocating or interrupting an established business

Time Value of Money
The benefit/cost analysis compares dollars at a single point in time. In order to facilitate that comparison, the analysis is based upon the following forecasts and assumptions:
- Inflation – due to the current deep national recession, no inflation is assumed from 2009 through 2012. However, because of considerable deficit spending by the Federal government to counter the current recession, long term inflation is expected by most economists. Inflation is assumed to be 2.0 percent for 2013 and 2.7 percent from 2014 forward.
- Period of Analysis – since the transportation benefits would not begin until 2018 and the improvements would last perhaps 100 years, the analysis was projected to 2050. REMI model results were used until 2030 and then the 2030 benefits were extended forward to 2050.
- Discount Rate – since future dollars are worth less than current year dollars and since the costs are front end loaded (but the benefits extend decades into the future), the selection of a discount rate is extremely important. We applied two different discount rates, seven percent as recommended by the Federal Office of Management and Budget (OMB) and five percent which is more reflective of the current government sector long term borrowing rate.

The benefit/cost analysis for the Mendenhall Road grade-separated crossing showed a benefit to cost ratio of 0.66 with a seven percent annual discount rate and 0.92 using a five percent annual discount rate. From a project perspective, the benefits of additional Shelby County economic output are less than project implementation costs. However, if Shelby County is able to secure State and Federal funding
for approximately half of the total project cost, the Shelby County benefit to cost ratio would be greater than one.

Reference the Economic Impact Report, Appendix J.

VI. Houston Levee Road Alternative Analysis

Analyses were conducted to determine the construction and community impacts associated with the alternative solution chosen for Houston Levee Road. Due to the change in the elevation of the roads, the improvements made at this intersection would require more than roadway and railroad improvements. The lowering of the roadway system would require a major redevelopment of the immediate area. The information that follows provides a detailed description of the selected alternatives and identifies the impacts, redevelopment opportunities, probable costs, and benefit/cost ratios associated with the improvements provided by the grade-separated crossing. The design standards of the Tennessee Department of Transportation, the Town of Collierville, and the Norfolk Southern Railroad were used in the development of the alternative solution.

A. Description of the Alternative

The alternative selected for further analysis for the Houston Levee Road crossing was Option B. This option provides for constructing a grade-separated crossing by lowering Houston Levee Road approximately 12 feet and raising the railroad profile 15 feet in order to achieve the 27-28 feet of separation required. Houston Levee Road south of the intersection would be reconstructed with the same number of lanes using current design standard lane widths. Houston Levee Road north of the intersection would be reconstructed with a six-lane cross section with a raised median. This segment currently has a five-lane cross-section without a median. The addition of this northbound through lane and raised median on Houston Levee Road north of Poplar would require acquisition of additional right-of-way. The typical sections for Houston Levee Road and Poplar Avenue are shown in Figure 12. Roadway profiles were developed using a 40-mile per hour design speed.

The Roadway and Railroad Profiles for the Houston Levee Road crossing can be found in Appendix I.
FIGURE 12

HOUSTON LEVEE ROAD AND POPLAR AVENUE

ROADWAY TYPICAL SECTIONS

NOT TO SCALE
B. Construction Impacts

Limits of Construction
The limits of construction necessary for reconstructing the roadway, the installation of a railroad overpass bridge, and the redevelopment of the impacted adjacent properties are shown on Figure 13. For Poplar Avenue, construction would begin approximately 600 feet east of the Houston Levee Road and Poplar Avenue intersection and extend to approximately 600 feet west of the intersection. For Houston Levee Road, construction would begin approximately 525 feet north of the intersection and extend south to a point approximately 685 feet south of the intersection.
Houston Levee Road Limits of Study Impacts

The Houston Levee Road Limits of Study Impacts exhibit illustrates the area within the study limits and is approximately 25.4 acres including acreage inside and outside of the right-of-way. The limits are based on the extent of land impacted due to the grade-separated crossing improvements. Due to the extreme change in elevation of the road, Poplar Avenue and Houston Levee Road will be lowered approximately 12 feet, the land adjacent to the right-of-way will also be impacted. One of the key components to the success of a business is the visibility and accessibility of the building to the user. Therefore the approach was taken to keep the elevation of the buildings relative to the elevation of the new road. This could be accomplished by grading parcels adjacent to the roadway to an elevation relative to the new roadway elevation. The remaining parcels would be graded to take up the necessary grade change at the rear of the properties. The Limits of Area line represents the point where the proposed grade ties back into the existing grade, or a point where a retaining wall is required.

Houston Levee Road Crossing Data

Current Conditions Prior to Grade-Separated Crossing Improvements


114' Right-of-Way with 4-Thru Lanes

Crash Count (Motor Vehicle/Rail Vehicle): 1

(Based on FRA’s Accident Report Database over a ten year period)
1. Traffic Impacts

Construction of a grade-separated crossing is a major undertaking. Maintenance of traffic through the area during construction would require a detailed, multi-staged traffic control plan and lanes and/or entire streets would need to be closed to complete construction. A schematic staging plan was developed to illustrate maintenance of traffic during construction. For both crossing locations, the goal was to maintain a minimum of four lanes of traffic on Poplar Avenue throughout construction.

The street closures, with their associated detours, would have an impact on traffic throughout the construction period. Business owners, their employees, and their patrons would feel the effects in lost time and revenue. Emergency responders (police, fire, and ambulance) would be impacted by the closures and would have to adjust their response routes accordingly. Mass transit would have to adjust their routes likewise. In general, any resident, business, or service located within the neighborhoods surrounding the crossing would have to make adjustments to their travel routines according to the new detour routing and the added time to navigate it during the construction period.

For the intersection of Houston Levee Road and Poplar Avenue, traffic control would be expected to generally occur in two phases during construction. During Phase 1 of construction, northbound traffic on Houston Levee Road south of Poplar Avenue would be detoured to Winchester Road, Bailey Station Road, and Poplar Avenue to Houston Levee Road north of Poplar Avenue. For Phase 2, two options are available. Option 1, southbound traffic on Houston Levee Road, would require the completion of Crooked Creek Road to Bailey Station Road, as outlined in Collierville Major Road Plan, and detour traffic to Bailey Station and Winchester Roads. Option 2 would detour traffic along Frank Road, Shea Road, and Winchester Road. The alternative temporary construction detour routes for the Houston Levee Road crossing are shown in the Traffic Control Schematic Exhibit, Figure 14.
2. Grading Impacts
With the grade changes associated with a grade-separated crossing, a conceptual grading plan was developed to determine the impacts to the adjacent property. One of the key components to the success of a business is the visibility and accessibility of the building to the user. Therefore the approach was taken to keep the elevation of the buildings relative to the elevation of the new road. This could be accomplished by grading parcels adjacent to the roadway to an elevation relative to the new roadway elevation. The remaining parcels would be graded as to take up the necessary grade change at the rear of the properties. The limits of redevelopment line represents the point at which proposed grading ties to the existing topography or at which point a retaining wall is required.

3. Utility Impacts
Utility locations for the Poplar Avenue at Houston Levee Road crossing were obtained from MLG&W and the Town of Collierville. Gas and electric facility locations were provided by MLG&W, while water and sewer locations were provided by the Town of Collierville. There were no major electrical transmission towers or gas pipelines identified and utility impacts were limited to local service lines, three phase electrical transmission lines, gas mains, and water mains.

4. Stormwater Management
One concern of the grade separation was the improvements required for adequate stormwater drainage. As a result of lowering the roadways, storm drainage would need to be modified based on the new roadway elevations. The drainage for Houston Levee Road would require modifying the existing storm sewer, but it is not anticipated that a pump station would be required. This roadway would not be lowered as much as Mendenhall Road and therefore would require fewer modifications to the existing drainage system.

The natural drainage basin would be modified with the improvements. Generally, the ridge separating the Wolf River and Nonconnah Creek drainage basins follows the Poplar Avenue and the Norfolk Southern Railroad. With construction of a grade separation at Houston Levee Road, approximately two acres of drainage would be moved from the Nonconnah Creek basin and added to the Wolf River basin.
C. Neighborhood Impacts

1. Business and Community Impacts
   It is essential that the finished floor elevations of the businesses along Houston Levee Road and Poplar Avenue relate to the new elevations of those roadways. The businesses closest to the intersection would be approximately 12 feet lower than their current elevation. The limits of redevelopment define those parcels that would be affected by the change in elevation required under Option B. During the construction and redevelopment period several businesses would have to be relocated (at least temporarily).

   The Houston Levee Area Map (Figure 15) illustrates the existing zoning of the parcels within the limits of the redevelopment area that would be affected by the construction. The figures indicate which businesses would be removed and which would be maintained yet impacted due to the grade-separated crossing improvements specific to each intersection. The businesses impacted and/or removed by improvements to the railroad are highlighted and summarized below.

   **Retail**
   - 47,207 SF +/- Removed: (4 Businesses)
   - 46,516 SF +/- Impacted*: (17 Businesses)

   **Office**
   - 3,536 SF +/- Removed: (1 Office)
   - 9,434 SF +/- Impacted: (3 Offices)

   * Impacted businesses or offices are those that would not be removed due to construction of the grade-separated crossing, but would be impacted by construction due to loss of business, construction impacts, or delays.
**Figure 15**

**HOUSTON LEVEE AREA MAP**

**Parcel ID**

<table>
<thead>
<tr>
<th>PARCEL ID</th>
<th>ACREAGE</th>
<th>ZONING</th>
<th>BUSINESSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.27 AC</td>
<td>GC</td>
<td>Ridgeway Country Club</td>
</tr>
<tr>
<td>B</td>
<td>2.87 AC</td>
<td>GC</td>
<td>The Collection of Houston Levee</td>
</tr>
<tr>
<td>C</td>
<td>0.83 AC</td>
<td>GC</td>
<td>Independent Bank</td>
</tr>
<tr>
<td>D</td>
<td>4.91 AC</td>
<td>GC</td>
<td>Christian Heritage Church</td>
</tr>
<tr>
<td>E</td>
<td>1.57 AC</td>
<td>PUD</td>
<td>Ballard PO - Retail</td>
</tr>
<tr>
<td>F</td>
<td>1.11 AC</td>
<td>PUD</td>
<td>Ballard PO - Retail Outparcel (Vacant)</td>
</tr>
<tr>
<td>G</td>
<td>1.56 AC</td>
<td>PUD</td>
<td>Ballard PO - Retail Outparcel (Vacant)</td>
</tr>
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<td>H</td>
<td>9.84 AC</td>
<td>PUD</td>
<td>Lifetime Fitness</td>
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<td>I</td>
<td>9.3 AC</td>
<td>GC</td>
<td>Landers Ford</td>
</tr>
<tr>
<td>J</td>
<td>2.35 AC</td>
<td>GC</td>
<td>Shops at Houston Levee</td>
</tr>
<tr>
<td>K</td>
<td>1.8 AC</td>
<td>GC</td>
<td>Children's Dental Care</td>
</tr>
<tr>
<td>L</td>
<td>0.61 AC</td>
<td>SCC</td>
<td>Sloane's Square</td>
</tr>
</tbody>
</table>

**Zoning Legend**

- GC: General Commercial
- PUD: Planned Unit Development (Overlay)
- R-1: Low Density Residential
- R-2: Medium Density Residential
- R-3: High Density Residential

**Businesses**

- A. Bangkok Alley
- B. Bella Windows & Doors
- C. Beauty Supply
- D. Richard & Co. Salon
- E. Kathy's Nails
- F. Century 21
- G. Chiropractic Memphis
- H. Superstore Exercise Equipment
- I. A's A-Pizza
- J. Timothy's Custom Framing
- K. 10. Tidewater's Custom Framing
- L. 24,480 +/-

**Forecasted Changes**

- A. 1.08 +/-
- B. 2.57 +/-
- C. 1.63 +/-
- D. 1.77 +/-
- E. 2.02 +/-
- F. 1.8 +/-
- G. 2.77 +/-
- H. 3.92 +/-
- I. 3.08 +/-
- J. 3.55 +/-
- K. 3.15 +/-
- L. 3.95 +/-

**Total**

- 12.26 +/-

**Zoning**

- GC: General Commercial
- SCC: Shopping Center Commercial
- R-1: Low Density Residential
- R-2: Medium Density Residential
- R-3: High Density Residential

**Source:** Shelby County Register of Deeds
D. Post Construction Community Impacts

1. General Neighborhood Impacts
   Construction of the selected alternatives would have an impact on the surrounding neighborhood after the construction period. One notable impact is the loss of current businesses. While new construction has the potential to attract businesses, there is the possibility that businesses closed during the construction period would either relocate or would remain closed. Another impact is the increase in traffic that would result from a grade-separated crossing. The potential of getting caught by a train at non-grade separated crossings would cause many drivers to select routes that include the separation. This is especially significant at rush hour where commuters, seeking to save time, may find a heavily congested intersection and a resulting delay.

2. Impacts to Safety
   It is anticipated that the safety of the crossing would be improved with construction of the selected alternative. By providing a grade separation, vehicles traveling along Houston Levee Road would not cross the rail line at-grade and conflict points associated with the rail crossing would be eliminated, removing the potential for a vehicle/rail crash. Over a ten-year period from 1999 to 2008, there was one documented case of a rail/highway vehicle crash at the Houston Levee Road crossing.

3. Impacts to Congestion
   Construction of the selected alternatives would reduce congestion at the intersection. By eliminating the at-grade crossing at Houston Levee Road, the route would remain open as trains pass through the area. This would reduce non-recurring delay by allowing vehicles to cycle through the intersection as trains pass through the area. It is estimated that as many as 20 trains per day would use the rail line in the horizon year of 2030. It is also estimated that vehicles encountering a train would experience a three-minute delay on average. Using these estimates and the anticipated number of vehicles using the crossings in the horizon year, approximately 65 to 70 hours of delay per day would be eliminated with a grade separation.

4. Environmental Impacts
   The environmental impacts of constructing the improvements at the Houston Levee Road crossing were reviewed. The environmental issues identified within the study boundaries included impacts to floodplains, rare species habitat, ecological
sites, superfund sites, hazardous waste generators, toxic chemical release sites, air release sites, and water discharge sites. Sites within a ¼ mile radius of the study intersections were noted. The intersection of Poplar Avenue at Houston Levee Road was found to have no environmental issues. There would be positive impacts to air quality provided by the grade separation due to reductions in vehicles delayed and idling as vehicles would no longer be delayed or stopped by railroad activity.

5. Regional and Local Economic Impacts

The REMI (Regional Economic Models, Inc) model, an advanced economic impact modeling software, was used to estimate the total direct, indirect, and induced impacts of the construction of the Houston Levee Road grade separation. There are two major categories of impacts:

- One-time impacts, which result from the construction of the improvements occurring once during the construction period.
- Ongoing impacts, which result from increased quality of life, personal income, and labor productivity created by the travel time savings.

Both types of impacts have been evaluated in this report, and the results are highlighted as follows:

- Construction impacts - These impacts are estimated to occur evenly during construction, and would not recur after the construction period is over. It is estimated that the construction of the underpass would result in the creation of 358 jobs and create a total $42.1 million increase in output to firms in Shelby County.
- Ongoing impacts – The travel time savings created by the two grade separations would result in an increase of $3.0 million in output (in 2010 constant dollars) and an associated additional 13 jobs in 2020 within Shelby County on an annual basis. By 2030, the increase in personal income in the region, in 2030 dollars, is estimated to reach close to $2.4 million. These impacts recur year after year.

6. Impacts to Transit

Construction would have a minor impact to adjacent transit routes and for the intersection of Poplar Avenue at Houston Levee Road. This intersection has only one bus route that travels along Poplar Avenue and does not cross the rail line.
7. Bicycle Lanes
The rail crossing at Houston Levee Road was investigated to determine if bicycle lanes would be required based on recommendations in the 2030 Long Range Transportation Plan (LRTP). For the intersection of Poplar Avenue at Houston Levee, wide outside lanes are recommended and these improvements are included in the proposed typical section.

8. Minor Crossings and Street Closures
The intersection of Poplar Avenue at Houston Levee Road is not expected to have any streets that would require closure with construction of the selected alternative.

E. Horizontal and Vertical Rail Geometry
Improvements to the horizontal and vertical geometry for the rail line were established using Norfolk Southern's design criteria. To minimize the impact to the rail line, horizontal geometry was not modified for either crossing. The design criteria used for this study can be found in Appendix D.

F. Limits of Redevelopment
The Houston Levee Road Limits of Study Impacts exhibit illustrates the area within the study limits that would be impacted by the railroad and roadway improvements made for a grade-separated crossing. As discussed previously in Section VI.B.2, due to the change in elevation of the roads, the land adjacent to the right-of-way would be significantly impacted.

G. Conceptual Redevelopment Plan
1. Approach
Changes to the existing roadway elevations, due to the construction of the grade-separated crossing, requires the redevelopment of the area surrounding these crossings. Consistent with the Town of Collierville, redevelopment of these parcels would likely result in the property being developed with more density and with a mixed-use approach.

The existing uses on the northwest, southwest, and southeast quadrants of the intersection of Houston Levee Road and Poplar Avenue consists of one-story retail out parcels and shopping center and it is recommended to maintain this existing development pattern at this intersection. For the car dealership parcel in the northeast quadrant of the intersection, higher
potential use may be appropriate. To add density and variety, a
mixed-use approach was taken that would include Multi-level
Office (two-story) and Retail (one-story). The mixed-use concept
for this area would add an additional 38,464 SF of office space
and 12,793 SF of retail space. A parking analysis was performed
which maximized the building square footage while providing
adequate surface parking.

The construction of the grade-separated crossings would likely
block the views of businesses on the opposite side of the railroad
track. Presently, drivers at Houston Levee Road and Poplar Avenue
can easily see businesses on the south side of the tracks from
Poplar Avenue. With the construction of a grade separation at this
location, those views would be blocked causing a negative
impact to the existing retail centers. In an effort to open the views
at this intersection, the proposed improvements increased the
bridge span for the railroad crossing from 170 feet to 340 feet.

The following exhibit, Figure 16, illustrates the Conceptual
Redevelopment Plan for the Houston Levee Road crossing. Also
included is a Conceptual Redevelopment Plan Products chart,
Figure 17, listing the proposed and existing land use products.

While the Conceptual Redevelopment Plan illustrates the specific
crossing, the design principles are representative and can be used
for other crossings along the corridor to create a redevelopment
plan specific to other intersections. The Conceptual
Redevelopment Plan reflects only one possible scenario and
should not be considered the only option for redevelopment.
<table>
<thead>
<tr>
<th>Redevelopment Products</th>
<th>Proposed Total Sq Footages/Units</th>
<th>Existing Total Sq Footages/Units</th>
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<tbody>
<tr>
<td>A Office</td>
<td>42,000 sf (1st &amp; 2nd Floors)</td>
<td>3,536 sf</td>
</tr>
<tr>
<td>B Retail</td>
<td>60,000 sf (1st Floor)</td>
<td>47,207 sf</td>
</tr>
<tr>
<td>Total:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retail</td>
<td>60,000 sf</td>
<td>47,207 sf</td>
</tr>
<tr>
<td>Office</td>
<td>42,000 sf</td>
<td>3,536 sf</td>
</tr>
<tr>
<td>Residential</td>
<td>0 Units</td>
<td>0 Units</td>
</tr>
</tbody>
</table>

**Limits of Area**
- 25.42 acres (including ROW)
- 9.74 acres (Road and Railroad ROW)
- 15.68 TOTAL ACREAGE (not including ROW)
2. Conceptual Redevelopment Plan Imaging

Following is a series of redevelopment plan imaging exhibits, **Figures 18-21**, illustrating the mixed-use redevelopment approach taken at the Mendenhall Road crossing. The redevelopment plan imaging exhibits are based on the Conceptual Redevelopment Plan. These illustrations reflect only one of many possible scenarios for development of the area.
A SketchUp rendering of the Conceptual Redevelopment Plan for the intersection of Houston Levee Road and Poplar Avenue. The plan maintains retail uses in the northwest, southwest, and southeast quadrants, while introducing a mixed-use component consisting of multi-level office and retail to the northeast quadrant.
HOUSTON LEVEE CONCEPTUAL REDEVELOPMENT IMAGING

VIEW A: Conceptual bird's eye view looking northwest across the railroad bridge. Existing retail stores remain with modifications and redevelopment of existing outparcel.

VIEW B: Conceptual bird's eye view looking at the northeast quadrant. Mixed-use concept includes retail fronting Houston Levee and Poplar with multi-level office behind.

VIEW C: Conceptual bird's eye view looking southwest across railroad bridge. An improved right-of-way is illustrated with sidewalks, medians, shared drive lanes, and street trees.

VIEW D: Conceptual bird's eye view looking south across the railroad bridge. Increased bridge spans opens the views from the north and south sides of Poplar.
**VIEW A BEFORE:** Existing view of the northeast corner of Houston Levee and Poplar. The railroad is at-grade with improved signalization.

**VIEW A AFTER:** Conceptual view of the northeast corner of Houston Levee and Poplar. The railroad is raised fifteen feet from its current location and Houston Levee and Poplar are lowered twelve feet. A mixed-use plan is introduced with retail and multi-level office.

**VIEW A AFTER:** Conceptual bird’s eye view of the northeast corner of Houston Levee and Poplar.
**VIEW B BEFORE:** Existing view at the southwest corner of Houston Levee and Poplar. The railroad is at-grade with improved signalization.

**VIEW B AFTER:** Conceptual view of the southwest corner of Houston Levee and Poplar. On the south side of Poplar one-story retail outparcels are reintroduced.

**VIEW B AFTER:** Conceptual bird's eye view of the southwest corner of Houston Levee and Poplar looking across the railroad bridge. The columns supporting the railroad bridge are spaced further apart to provide views from both sides of the intersection.
H. Opinion of Probable Cost

An opinion of probable cost data sheet was developed to include the probable costs of the proposed roadway and railroad improvements and the associated conceptual redevelopment plan at Houston Levee Road. There are three potential categories of cost related to this project: costs associated with the grade-separated crossing improvements, costs associated with the redevelopment, and costs of impacts beyond the physical limits of this study. Category 1 costs includes the costs associated with the grade-separated crossing improvements which are included in the Benefit/Cost Ratio analysis as discussed in the next section. Category 2 costs include the costs associated with redevelopment, which are not included in the Benefit/Cost Ratio analysis. The redevelopment cost is not included because it is assumed that economic growth would occur in the city regardless of whether or not the grade separation is built. The improvements at Houston Levee Road could concentrate the economic growth at this intersection instead of other locations in the city; however, the net local economic growth would not change and is viewed only as a geographic shift.

Category 1: The grade-separated crossing improvements include costs associated with rights-of-way (acquisition, relocation and goodwill), utility relocation, construction costs, and preliminary engineering. The total cost associated with grade-separated crossing improvements is estimated to be $43.5 million, as detailed below:

- Rights-of-Way 14.9 million
- Utility Relocation 1.9 million
- Construction Costs 24.3 million
- Preliminary Engineering 2.4 million

TOTAL 43.5 million

It is important to note that the railroad bridge cost covers a span twice as long as needed in order to create view corridors to the development on either side of the railroad. This would be key to the sustainability of the retail uses in the area.

The Economic Impact Report can be found in Appendix J.

Category 2: The breakdown of the costs associated with the conceptual redevelopment plan at the intersection includes demolition of existing facilities and redevelopment costs including proposed building costs and amenities. The total construction redevelopment cost for the Houston Levee Road scenario is estimated
to be approximately $28.5 million. This figure does not include the portion of property acquisition and building demolition costs due to right-of-way improvements included in the Category 1 costs. The probable costs for the redevelopment are only representative of the concept scenario modeled for the intersection. If a differing redevelopment program is chosen, then the probable cost of construction would change accordingly.

A detailed listing of the Opinion of Probable Costs for the Mendenhall Road improvements and conceptual redevelopment plan can be found in Appendix K.

Category 3: Costs include all costs or benefits accrued due to impacts outside the study limits. These costs or benefits could include improvements to traffic flow or safety resulting from traffic diversion from other roads or intersections, increased exposure for retail businesses, or increased traffic noise for residential properties. Even though these benefits or impacts may be real, they have not been quantified or included in this evaluation because they are for properties or areas that are beyond the physical limits of this study.

I. Benefit/Cost Ratio
The economic impact evaluation examines the impact of the grade-separated crossing from the perspective of the Memphis Metropolitan Area regional economy.

Benefits
From a project perspective, the benefits include the time savings which accrue to motorists (both passenger car and truck traffic), air quality impacts, and crash reduction savings. The time savings to motorists have been divided into household sector benefits and employment sector benefits. The time savings to the household sector allows motorist to spend a bit more time throughout the years in personal consumption of goods and services, including recreation. This time savings benefit has a moderate impact on increasing the output of the Shelby County economy. The time savings to the employment sector allows each employee to spend a few more hours at work throughout the year, and this contributes to businesses increasing their production of goods and services. The output gains of both sectors were calculated using the REMI model and these benefits increase the overall output of the Shelby County economy.

The proposed community redevelopment activities around these grade-separated crossings have not been included in this benefit cost analysis. Assuming regional demand exists for such development, it is
expected that the development would have occurred within Shelby County in any case. The redevelopment activities are viewed as geographic shifts in economic development activity rather than a net benefit to the County from these transportation improvement projects.

Costs
The costs include:

- Construction of each grade-separated crossing
- Real estate acquisition of affected commercial properties and buildings
- The cost of relocating businesses covering both the physical move and compensation for damages associated with relocating or interrupting an established business

Time Value of Money
The benefit/cost analysis compares dollars at a single point in time. In order to facilitate that comparison, the analysis is based upon the following forecasts and assumptions:

- Inflation – due to the current deep national recession, no inflation is assumed from 2009 through 2012. However, because of considerable deficit spending by the Federal government to counter the current recession, long term inflation is expected by most economists. Inflation is assumed to be 2.0 percent for 2013 and 2.7 percent from 2014 forward.
- Period of Analysis – since the transportation benefits would not begin until 2018 and the improvements would last perhaps 100 years, the analysis was projected to 2050. REMI model results were used until 2030 and then the 2030 benefits were extended forward to 2050.
- Discount Rate – since future dollars are worth less than current year dollars and since the costs are front end loaded but the benefits extend decades into the future, the selection of a discount rate is extremely important. We applied two different discount rates, seven percent as recommended by the Federal Office of Management and Budget (OMB) and five percent which is more reflective of the current government sector long term borrowing rate.

The benefit/cost analysis for the Houston Levee Road grade-separated crossing showed a benefit to cost ratio of 1.08 with a seven percent annual discount rate and 1.50 using a five percent annual discount rate. Since the travel benefits do not differ greatly for the two locations and the costs at the Houston Levee Road crossing are considerably less, the Houston Levee Road grade-
separated crossing and others similar to it should be the higher priority projects. With any State or Federal funding assistance, the Houston Levee Road grade-separated crossing the benefit cost ratio would increase and the project would continue to be a worthwhile construction project.

Reference the Economic Impact Report, Appendix J.

VII. Summary

Based on input from the public meetings, five stakeholder meetings, the data collected and analyzed, the sixteen arterial crossings were screened. From this analysis, it was determined that Mendenhall Road and Houston Levee Road would be used as the two crossings most representative of the majority of the crossings along the corridor.

A benefit/cost analysis was performed for each representative crossing. It was determined that the benefits associated with the grade separations in locations similar to Mendenhall Road would not be sufficient to justify the costs of construction if funded with local funds. However, for those locations similar to the Houston Levee Road crossing, the benefits would exceed the construction costs and the projects may be justified. If other funding sources were obtained for the construction of grade separations at any locations similar to these two, the benefits to the local area would exceed the construction costs and the projects may be considered viable.