AUSTIN MOBILITY

EAST RIVERSIDE DRIVE CORRIDOR DEVELOPMENT PROGRAM

DECEMBER 2013

HDR

TABLE OF CONTENTS

EXECUTIVE SUMMARY

CHAPTER 1 - INTRODUCTION

CHAPTER 2 - PUBLIC INVOLVEMENT

CHAPTER 3 - EXISTING CORRIDOR CONDITIONS

TABLE OF CONTENTS

CHAPTER 4 - FUTURE CHARACTERISTICS

CHAPTER 5 - IMPROVEMENT TOOLS

CHAPTER 6 - RECOMMENDATIONS

CHAPTER 7 - PROJECT IMPLEMENTATION

CHAPTER 8 - FUTURE LAND USE MANAGEMENT STRATEGIES

TABLE OF CONTENTS

EXECUTIVE SUMMARY

PROGRAM GOALS

The goal of the East Riverside Drive Corridor Development Program is to develop a set of recommendations to improve safety, mobility and quality of life along Riverside Drive between IH 35 and SH 71. This program would transform the East Riverside Drive Corridor from a "through" place to a "to" place by taking the vision of the East Riverside Drive Master Plan and outline an execution plan to make this vision a reality. This report involves a multi-faceted "Complete Street" approach to provide a well developed and high quality plan which provides a dynamic, pedestrian friendly environment while offering multimodal access to areas of work, residence and recreation.

PROJECT PURPOSE AND PROCESS

The purpose of the East Riverside Corridor Development Report was to evaluate mobility options that improve the quality of life of all users and fulfills the master plan vision of the corridor. Mobility components of the corridor that were evaluated included pedestrian and bicycle facilities, roadway operations and safety, and high capacity transit as proposed by the City of Austin.

In developing the East Riverside Corridor Development Plan it was important to understand the community and stakeholders within the corridor, its existing and future issues, and develop recommendations that may be used in implementing change. The strategies used for successful public involvement and community engagement included community focus group meetings, public open house meetings and community outreach tactics.

An assessment of the existing characteristics helped identify current issues such as safety, roadway deficiencies, environmental and land use constraints, and motorized and non-motorized mobility along the corridor. In addition, this assessment helped to create a benchmark to measure against in order to develop the appropriate short-, medium-, and long-term roadway improvements that will increase the versatility of the corridor and improve the quality of life for all users of East Riverside Drive.

An evaluation of future roadway improvements, multimodal improvements, development activities and the subsequent impacts on traffic volumes and traffic operations enabled this study to achieve the visions and goals of the East Riverside Corridor Master Plan and Regulating Plan.

The findings and results of the plan development tasks were established to develop physical recommendations and alternative improvements within the corridor that meet the project goals and provide implementable solutions.

EXISTING CORRIDOR CHARACTERISTICS AND CONSTRAINTS

The character of East Riverside Drive changes heading east from IH 35 to SH 71 (Ben White Boulevard). Growth and development along the corridor is the densest near IH 35 and dissipates eastward along the corridor. East Riverside Drive can be characterized by several existing neighborhoods and development types. This is evident in three segments of the corridor:

- Segment 1: IH 35 to Willow Creek Drive
- Segment 2: Willow Creek Drive to Wickersham Lane
- Segment 3: Wickersham Lane to SH 71

These three segments are further discussed in **Chapter 3** and depicted in **Figure 3-2**.

IH 35 to Willow Creek Drive

The section of East Riverside Drive from IH 35 to Willow Creek Drive is mostly characterized by multifamily housing on the north side and single-family housing on the south side. In this section of East Riverside Drive new development is actively taking place. The new South Shore mixed-use development at Lakeshore Boulevard has recently been constructed and businesses such as Emo's East and Beauty Bar have already been built. Along the east side of this segment there is a predominance of independent and chain fast-food restaurants and strip malls that house several vacant and/or under-utilized spaces and large parking lots. Lakeshore Boulevard is also a well-traveled roadway by both cars and bicyclists as it provides access to one of Austin's most important amenities, Lady Bird Lake. The existing right-of-way along East Riverside Drive in this segment ranges from 115 feet to 216 feet.

Willow Creek Drive to Wickersham Lane

This segment of the corridor includes the Pleasant Valley Road intersection and encompasses a large grass median that divides East Riverside Drive. This median is also the widest part of existing right-of-way which ranges from 147 feet to 345 feet and has a significantly steep grade. The south side of Riverside Drive contains the Mountain Ranch and Country Club multi-family apartments and several stand-alone businesses. The north side is mostly strip malls and large parking lots. The H-E-B grocery store is the major anchor here, located at the Pleasant Valley Road intersection.

Wickersham Lane to SH 71

The character of this segment of East Riverside Drive is dominated by single and multi-family housing on the west side closer to Wickersham Lane. A portion of the multi-family units in this segment are utilized as student housing from both the University of Texas and Austin Community College. The corner of East Riverside Drive and Faro Drive contains a fire station and a group home owned by Casey Family Programs. East of Faro Drive is predominately open space and undeveloped land with a light mix of single-family homes and commercial and institutional uses such as gas stations and a church. Multi-family condominiums are located on the corner of Frontier Valley Drive across the street from Riverside Rehab and Healthcare. There is also a manufactured housing park on the south side across Riverside Drive and newly constructed hotel suites adjacent to SH 71. The existing right-of-way width along this segment is the most constraining from 117 feet to 143 feet. At the intersection of East Riverside Drive and SH 71 a new interchange is currently being constructed. This will eliminate congestion for through traffic along SH 71.

PROJECT GOALS AND DESIGN CONSIDERATIONS

The goal of this project is to meet the future mobility needs of the area and to create a plan for this corridor that will encourage development in a planned environment, transforming this corridor from a "through" place to a "to" place. Goals that would be accomplished by implementing the recommendations mentioned within this report are:

- A multi-modal corridor that accommodates pedestrians, cyclists, automobiles and transit.
- A corridor that meets the standards and elements set forth by the East Riverside Drive Master Plan and Regulating Plan.
- Bicycle accommodations and pedestrian improvements to the adjacent roadway network.
- Roadway improvements that include, intersection and sidewalk improvements, cycle tracks, lane reductions, and median and driveway closures/modifications along East Riverside Drive.
- Meet the needs expressed by the impacted public.
- Sustainable design and landscaping elements.

In addition to the functional recommendations for this area, design considerations were recommended to achieve the project goals as well. Recommended design considerations are as follows:

- Implement a "complete streets" design that incorporates several modes of travel including automobiles, walking, cycling and transit.
- Design East Riverside Drive to accommodate the existing and future surrounding land uses and zoning. Use the East Riverside Drive Master Plan and Regulating Plan as guidance for design implementation.
- Select roadway design methods that safely increase the movement of people and traffic during peak hours.
- Accommodate severe drought conditions by incorporating sustainable landscape design practices such as xeriscaping or use of native trees and plants.
- Create a public space that accommodates local automobile traffic while developing a scaled environment for pedestrians and cyclists.

FUTURE CORRIDOR CHARACTERISTICS AND RECOMMENDATIONS

The roadway improvements to East Riverside Drive are meant to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders. The recommended improvements are different than traditional roadway improvements because the goal is not necessarily to move vehicles, but to move people and improve the quality of life of the residents and users of the East Riverside Drive Corridor. Short-, medium-, and long-term improvements were identified and are discussed below.

Short-, Medium- and Long-Term Improvements

Short-and medium-term improvements are low cost improvements to immediately improve the safety, mobility, and access along the East Riverside Drive Corridor and its surrounding roadway network. These improvements are scheduled to be implemented over a five to ten year period based on the funding timeframe of future City bond programs or other available funding mechanisms. These improvements include:

Short-term Improvements:

- Intersection improvements such as lane reconfigurations and the replacement of striping, signage, signals, ramps, and pavement,
- Pedestrian improvements such as sidewalk additions and replacements, and
- Bicycle improvements such as the addition of signage, sharrow markings and bicycle lane along selected cross streets. Because the long-term improvements are going to focus primarily on the East Riverside Corridor roadway specifically, the short-term bicycle improvements focused exclusively on cross street improvements.

Medium-term Improvements:

- Access management improvements such as driveway closures and median consolidation/closures.

Long-term Improvements:

The long-term improvements that are recommended for East Riverside Drive are meant to change the overall physical operation of the corridor and be constructed with the planning horizon year 2025. Key long-term improvements include:

- The travel lanes along Riverside Drive are reduced from three lanes in each direction to two lanes in each direction.
- Center running high capacity transit that is assumed to extend from west of IH 35 to SH 71.
- The construction of a 7 to 8-foot cycle track along east and westbound lanes that is buffered from the roadway and sidewalk.
- Sidewalks along the corridor will be extended to meet the desired 15-foot width as designated by the Riverside Drive Corridor Regulating Plan.
- Pedestrian hybrid beacons are proposed between Grove and Montopolis Streets.
- Landscaping such as street trees along the median and sidewalks.
- Drainage improvements to accommodate roadway and sidewalk improvements.

Additional long-term improvements are discussed in detail in **Chapter 6**.

As improvements show what can be done to enhance the corridor, alternatives show how the improvements can be implemented. There are two recommended roadway alternatives that were developed along East Riverside Drive. In order to minimize or eliminate the need for additional right-of-way to develop the long-term improvements, these alternatives were developed and can be applied to the appropriate sections of the corridor discussed below. **Figure E-1** illustrates the full typical section along East Riverside Drive that accommodates parallel parking on both sides of the roadway while **Figure E-2** depicts the constrained typical section that does not accommodate on-street parking. A detailed discussion of each segment alternative can be viewed in **Chapter 6**.

IH 35 to Willow Creek Drive

This proposed roadway segment, shown in **Chapter 6**, **Figure 6-5**, has a four-lane divided roadway with tree-lined medians and sidewalks. Trees provide a method of traffic calming without having to make changes to the roadway and are aesthetically pleasing. This segment of Riverside Drive has sufficient right-of-way to provide on-street parking on one or both sides of the roadway.

Willow Creek Drive to Wickersham Lane

The proposed design of the space around the Pleasant Valley Road intersection shown in **Chapter 6**, **Figure 6-6** shows the high capacity transit platform integrated with a plaza area and surrounding open space in the median of Riverside Drive. The primary purpose of this alternative is to integrate the multi-modal components (high capacity transit, roadway, bicycle and pedestrian) of the East Riverside Drive plan into a community place. By eliminating the direct through movement of vehicular traffic along Pleasant Valley Drive, this concept is able to make use of the wide median to further enhance the corridor.

Figure E-1: Recommended Full East Riverside Typical Section

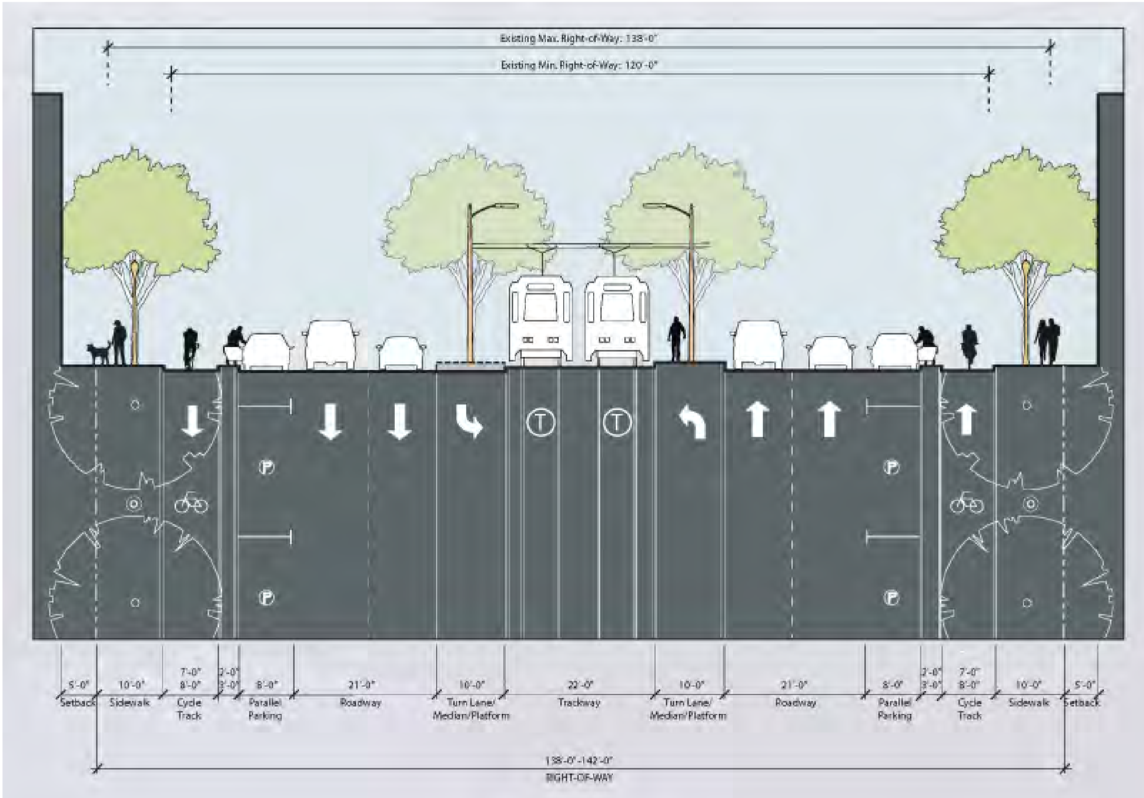
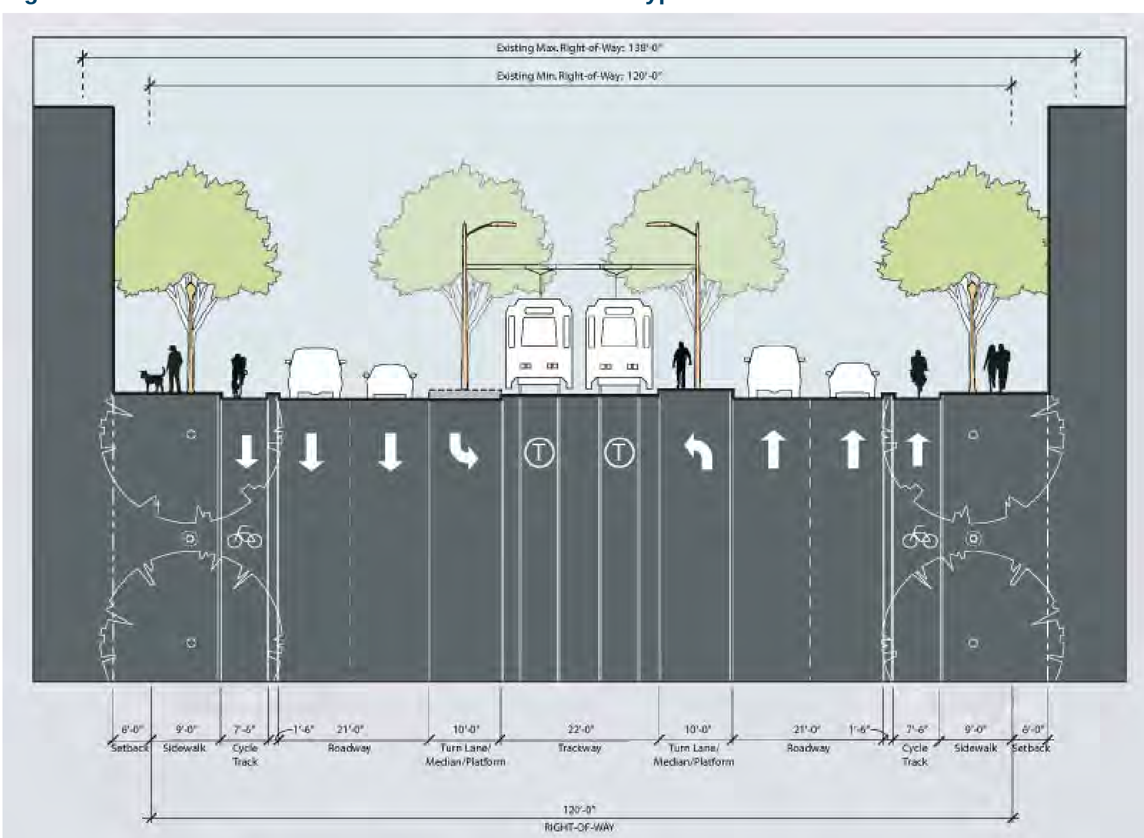


Figure E-2: Recommended Constrained East Riverside Typical Section



Wickersham Lane to SH 71

Similar to the previous two segments, the proposed design of this segment contains tree-lined medians and sidewalks as shown in **Chapter 6**, **Figure 6-7**. The Riverside Corridor Regulating Plan Sub District Map defines this area as future Corridor Mixed Use. Because this segment is constrained by right-of-way width, the constrained typical section is most applicable.

BENEFITS AND RESULTS

The result of this study is a Plan that will execute the vision of the East Riverside Drive Master Plan and stay consistent with the Regulating Plan. The results of the plan are mobility recommendations that would benefit East Riverside Drive. These benefits include:

- The transformation of East Riverside Drive from a "through" place to a "to" place.
- The incorporation of all modes of transportation (walking, cycling, automobile and transit) that is consistent with the East Riverside Driver Master Plan and Regulating Plan.
- The support of adjacent land uses.
- Sustainable infrastructure and design concepts.
- Overall improvement in safety, access control and corridor level-of-service due to operational modifications.
- Improved community connectivity due to improvements to East Riverside Drive's adjacent street network.
- Develop a public space that would create an identity for the East Riverside Corridor and is easily accessible to the adjacent neighborhoods and residents of Austin.

IMPROVEMENT IMPLEMENTATION COSTS AND STRATEGIES

Coordination is needed to preserve the character and operational integrity of the East Riverside Corridor and its future development. It is important to recognize that the built environment, such as transportation infrastructure and development, have had a direct impact on the safety, mobility, and quality of life of the users of the corridor. Strategies that include access management, maintenance, and sustainable growth techniques, will increase the life and structural longevity of East Riverside Drive. Several land use and development strategies were identified and may be applied to the future development of the corridor. Those strategies include:

- Accommodate Motorized and Non-Motorized Users
- Accommodate Bus and High Capacity Transit Users
- Access Management
- Preserve the Functional Area of Intersections (the area of an intersection used by entering and exiting vehicles to complete their trip through the intersection)
- Maintenance (includes general roadway care and low maintenance features such as native trees and plants)

Cost estimations for the East Riverside Drive Corridor improvements were developed and include improvements from the short-, medium- and long-term improvements using the recommended full East Riverside Drive typical section and the recommended constrained East Riverside typical section. Cost estimates are broken down by the three types of recommendations which are shown below in **Table E-1**.

Table E-1: East Riverside Drive Improvements Cost Estimate

	Improvements	Costs*
Short-term	Driveway (closures and consolidations)	2,200,000
	Pedestrian (sidewalk extensions and widening)	
	Bicycle (lanes and "sharrow" markings)	
	Intersection (ramps and striping)	
Medium-term	Median improvements and closures	249,000
Long-term	High capacity transit	358,400,000
	Lane reduction	
	Cycle tracks	
	Pedestrian Hybrid Beacons (PHB)	
	15-foot sidewalks	
	Landscaping	

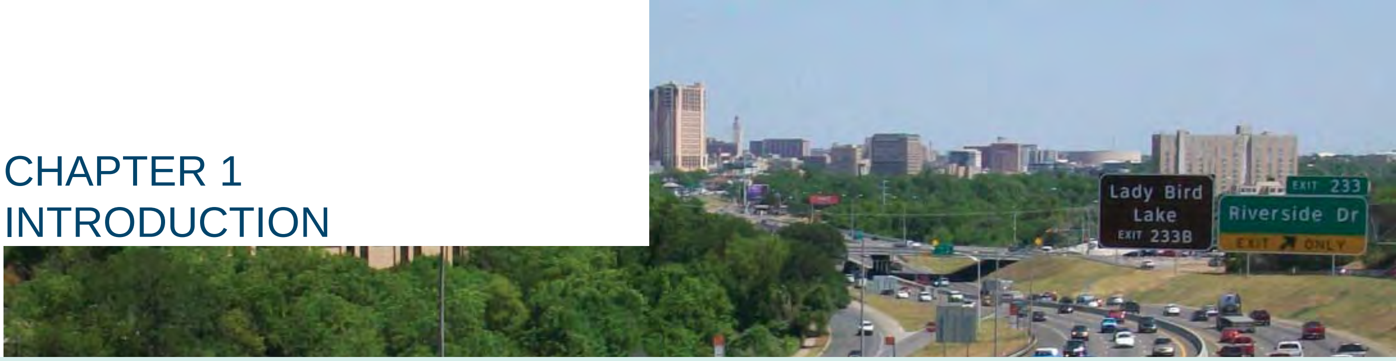
**Costs are based on 2012 dollars.*

For a detailed breakdown in cost and quantities please reference the East Riverside Corridor Cost Estimate Report in **Appendix E**.

NEXT STEPS

The adoption of the East Riverside Corridor Development Plan by the City of Austin represents the first step in making the redevelopment of East Riverside Corridor a reality. More work is needed to implement the Plan's recommendations, analyze the associated costs and benefits, and secure funding for needed improvements. The next steps toward implementation of East Riverside Drive Corridor include:

- Identify funding sources to pay for the improvements along East Riverside Drive. Sources include private, local, regional, state and federal programs.
- Use the East Riverside Drive Regulating Plan for guidance and standards for what is the appropriate development for properties as they relate to adjacent streets, neighborhoods, and the natural environment of the corridor.
- Prioritize "low-hanging fruit." Identify and prioritize short-term improvements that can easily be completed with minimal resources and impacts and build toward long-term improvements.
- Develop a detailed design schematic of the corridor.
- Ongoing public involvement to engage the public and deliver updates on significant information and milestones met during the redevelopment process.



CHAPTER 1
INTRODUCTION

The purpose of the East Riverside Corridor Development Report was to evaluate mobility options that improve the quality of life of all users and fulfills the master plan vision of the corridor. Mobility components of the corridor that were evaluated included pedestrian and bicycle facilities, roadway operations and safety, and the inclusion of the high capacity transit proposed by the City of Austin. The results of this report identify short-, medium- and long-term recommendations, their impacts on the corridor, and the cost of implementation and construction. With the changing characteristics of the East Riverside Corridor, this report was focused on identifying multimodal improvements that were consistent with the East Riverside Corridor Master Plan and Regulating Plan, as well as other improvements planned in the area. With the changes to land use and overall corridor function, the report recognized the need to emphasize this corridor as a destination rather than a corridor that is primarily used as a connection between IH 35 and SH 71. Through the improvements identified in this report, the East Riverside Corridor evolves from a "through" facility to a "to" facility. In order to make this transformation, support the proposed land use development plan, and maintain consistency with the proposed character of the corridor, a complete streets design approach was utilized that maximized the use of all modes of transportation in the corridor.

As defined by the National Complete Streets Coalition, "complete Streets are streets for everyone. They are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and transit riders of all ages and abilities must be able to safely move along and across a complete street. Complete Streets make it easy to cross the street, walk to shops, and bicycle to work. They allow buses to run on time and make it safe for people to walk to and from train stations."

In order to successfully implement a complete streets design, several factors such as vehicular and pedestrian level of service, roadway operations and design, land uses, effects of high capacity transit and City policies were evaluated so that all users of the East Riverside Corridor could have a safe and efficient traveling experience regardless of their mode of transportation.

PROJECT PURPOSE AND GOAL

The East Riverside Corridor Development Program takes the vision of the East Riverside Corridor Master Plan and outlines an execution plan to make the vision a reality. This report involves a multi-faceted approach to provide a well developed and high quality plan which provides a dynamic, pedestrian friendly environment while offering multimodal access to areas of work, residence and recreation. To ensure the implementation of the master plan is consistent with community expectations and is met with support from the community, community outreach initiatives were put in place to integrate input from local residents and businesses.

PROJECT BACKGROUND

As part of the Austin Strategic Mobility Plan (ASMP), the City of Austin and the ASMP team implemented a robust public involvement process that worked with the community, a council-appointed Citizens Task Force, and several other partnering agencies to develop the 2010 Mobility Bond program. The $90 million bond package includes a variety of mobility improvements that include pedestrian, bicycle and transit facilities for selected roadways within the City of Austin. On November 2, 2010, Austin voters approved the bond package including funds to do studies for the following five corridors:

- Airport Boulevard from North Lamar Boulevard to US 183
- East Riverside Drive from IH 35 to US 71
- FM 969 from US 183 to Webberville
- North Lamar Boulevard from US 183 to IH 35
- North Burnet Road from Koenig Lane to MoPac

Each corridor is being studied independently from one another as each corridor is unique in character and has different needs. This report focuses on the East Riverside Corridor and implementation of a multimodal complete streets solution to meet the special needs in the corridor.

As guidance for the corridor of East Riverside Drive, the City of Austin has published the East Riverside Corridor (ERC) Master Plan and the Draft East Riverside Corridor Regulating Plan. The Master Plan is an amendment to the Austin Tomorrow Comprehensive Plan and presents a long-term vision for the area to transform it into an urban mixed use neighborhood that is more pedestrian and bicycle friendly. This plan provides elements that would enhance development design quality and provide a place where people can work, live, and play all within walking distance.

The ERC Regulating Plan addresses the relationship between development and adjacent properties, streets, neighborhoods, and the natural environment. The purpose of this document is to provide guidance on implementing the vision of the ERC Master Plan which supports mixed-use development and current and future transit options.

PROJECT PARTNERS

The City of Austin is funding the East Riverside Corridor Development Program but is partnering with other agencies such as the Texas Department of Transportation (TxDOT), Capital Area Metropolitan Planning Organization (CAMPO), Travis County, Capital Metropolitan Transportation Authority (CapMetro), and the general public.

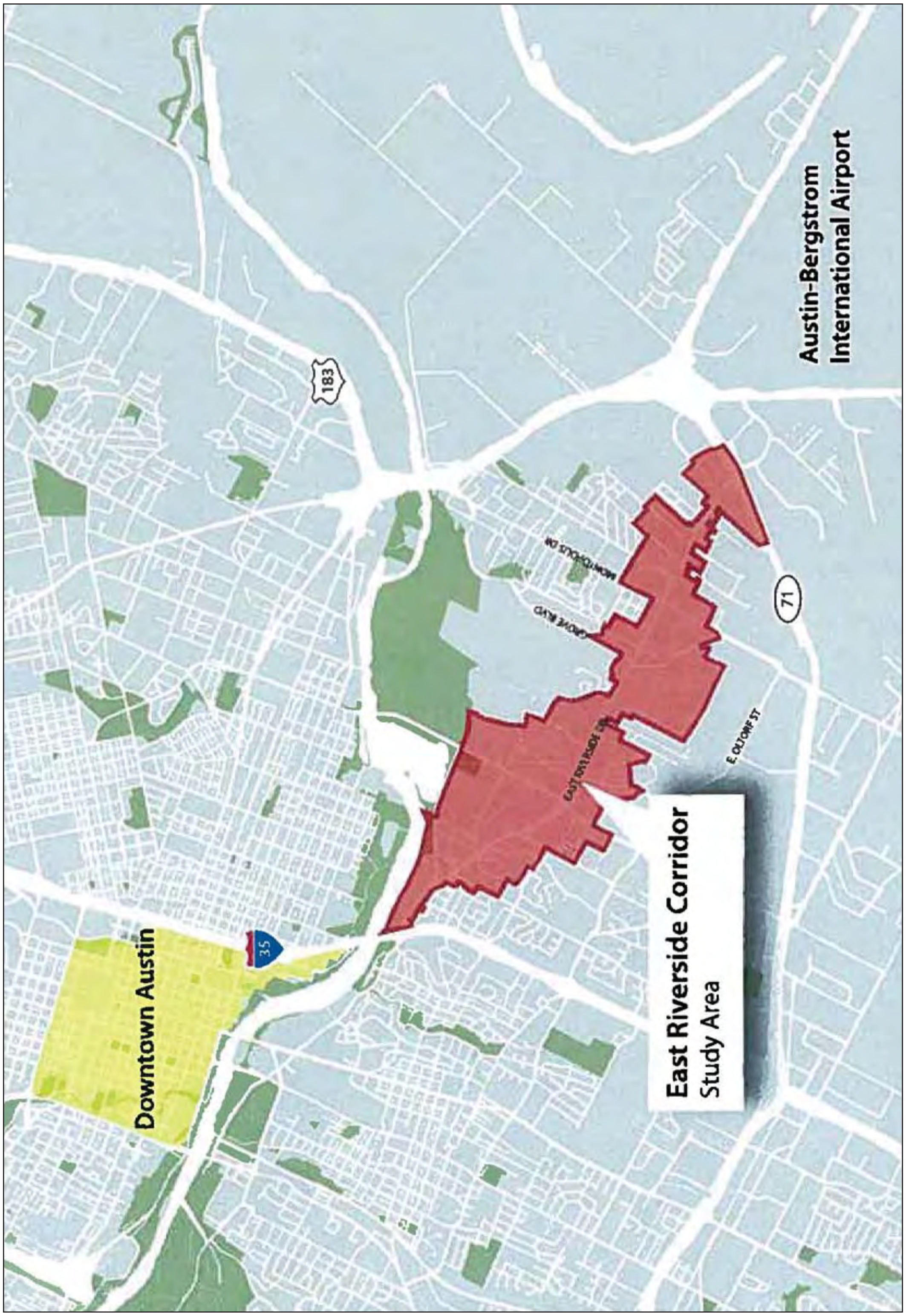
PROJECT PROCESS

The East Riverside Master Plan and the subsequent Regulating Plan provide a general framework for this report. Initially, existing corridor conditions were recorded and analyzed to better understand current uses and to provide a baseline for changes to be made. Future area development and planned multimodal improvements were then considered by this report along with the vision and goals of past studies and plans. Multimodal transportation infrastructure, vehicular mobility, pedestrian and bicycle accessibility and safety, and operational efficiency were identified as tools to improve the study area and from which, recommendations were made. Future land use strategies were recommended to help continue implementing the vision of the East Riverside Corridor Development Program to meet the future needs of the area.

PROJECT AREA

The area encompassed in this report includes the East Riverside/Oltorf Combined Neighborhood Planning Area and the Montopolis Neighborhood Planning Area, as shown in **Figure 1-1**. This includes property adjacent to Riverside Drive from IH-35 to SH 71/Ben White Boulevard. This 1,000 acre area has many existing land uses including commercial, industrial, single family, residential, multi-family apartments and condominiums, and undeveloped land and is home to Baty Elementary School, City of Austin Fire Station #22, the East Riverside Campus of Austin Community College, Roy Guerrero Colorado River Park, Lady Bird Lake Park and Trail, and the Riverside Golf Course.

Figure 1-1: Study Area



CHAPTER 2
PUBLIC INVOLVEMENT

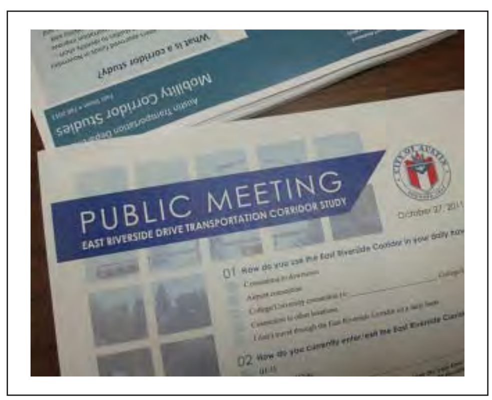
The public plays an important role in shaping the vision and alternatives in all types of planning arenas and the East Riverside Corridor Development Program is no different. The public involvement process is important to the City of Austin because it allows the people who actually live and work near East Riverside Drive and use the corridor on a daily basis to voice their concerns and ideas. The residents and business owners in this area have a vested interest in the corridor's proposed redevelopment and it is important to the City to understand how redevelopment will affect their daily lives and work to develop an alternative that increases the quality of life for all stakeholders involved. The strategies and tactics that were used for successful citizen involvement and community engagement are discussed in this chapter and can be viewed in more detail in the Public Involvement Plan in **Appendix A**.

OUTREACH ACTIVITIES

At the start of the project in September of 2011, a Public Involvement Plan was developed that conformed to the City's template for the four transportation corridors being launched simultaneously. The East Riverside Corridor Development Program was one of these four projects. Public involvement for the East Riverside Corridor Development Program focused on engaging key existing stakeholder groups that included businesses, neighborhood associations, individual homeowners and tenants, property owners/developers, educational institutions, and houses of worship. The intention was to develop and implement a transparent planning process that would provide all of the stakeholders wishing to get involved with the project team detailed information about the corridor report and gather input from all of the stakeholders.

The project included three community focus group meetings and two public open house meetings. Other outreach activities included issuing press releases to all the local media, mail-outs to addresses along East Riverside Drive, hand-delivery of meeting notices to businesses in the East Riverside Drive study area, and announcements of the public meetings in the City's email transportation newsletters.

PUBLIC MEETINGS



FIRST PUBLIC OPEN HOUSE MEETING - OCTOBER 27, 2011

The first meeting for the general public was held on October 27, 2011 from 6:00 p.m. to 8:00 p.m. in the cafeteria of Travis High School located at 1211 E. Oltorf St. in Austin. In preparation for this meeting, the following activities were implemented.

- A one-page, full-color fact sheet was prepared summarizing the project. This sheet was translated into Spanish for the Spanish-only-speaking audience in the subject area.
- A tabloid-size poster invitation was prepared in both English and Spanish.
- A letter-size invitation was prepared in both English and Spanish and was mailed to all businesses and residents in a large area on either side of East Riverside Drive. As the City was in the process of amending the regulations for the areas along East Riverside Drive, the City mailed over 9,000 copies of the invitations to all addresses in the subject area.
- On October 13, 2011, the tabloid-sized meeting invitation and three different flyers provided by the City were hand-delivered to 300 business addresses in the East Riverside Drive study area.
- Copies of the project fact sheets, in English and Spanish, were handed out at the public open house meeting.
- A survey/comment sheet was distributed to the 100 citizens that attended the meeting and was collected as they left the meeting. The survey/comment sheet findings were organized and tabulated, and reported at the subsequent community focus group meeting. The results of this survey are shown in **Table 2-1**.

Table 2-1: Public Meeting Survey Results

1. How do you use the Riverside Corridor?

Commute to downtown	Airport Connection	College/ University Connection	Connection to other locations	I don't travel on East Riverside Corridor on a daily basis
23	17	6	40	18

2. How do you Currently enter/exit the East Riverside Corridor?

IH 35	US 71	Other
38	17	41

3. What areas within the East Riverside Corridor do you feel are in need of the following improvements? (Please note location and improvement)

Bicycle / Pedestrians	Transit (bus or rail)	Cars
51	38	18

4. If made available, would you use high capacity transit (rail, bus rapid transit) in the East Riverside Corridor for your daily use?

Yes	No
44	21

5. Please rank the following concerning transportation in the East Riverside Corridor. Rank 1-4 with 1 being the most important.*

Enhanced pedestrian experience	Improved automobile access	Improved transit access	Enhanced bicycle access and mobility	I don't travel on East Riverside Corridor on a daily basis
110	166	130	141	18

**Lower scores are higher ranked.*

SECOND PUBLIC OPEN HOUSE MEETING AND BUSINESS OPEN HOUSE MEETING - MARCH 20, 2012

Both of these meetings were held at the Parker Lane United Methodist Church, located at 2105 Parker Lane in Austin. The business meeting was held from 12:00 p.m. to 2:00 p.m., and the general public meeting was held from 4:00 p.m. to 7:00 p.m.

The following activities were implemented to advertise the business meeting:

- A letter-sized invitation flyer was prepared in English and Spanish, similar to the invitation prepared for the October 27, 2011 public open house meeting. This invitation was hand-delivered to the same 300 businesses along East Riverside Drive, as well as emailed to businesses in attendance at the October 27, 2011 meeting and had provided their email addresses.

The following activities were implemented to advertise the evening's general public meeting:

- A letter-sized invitation flyer was prepared in English and Spanish. These invitations were hand-delivered to the same businesses notified for the October 27, 2011 open house meeting.
- The letter-sized flyer in English and Spanish was emailed to the Sector 10 representative of the Austin Neighborhood Council, who emailed it to all the East Riverside Drive area neighborhood associations. This same flyer was emailed to members of the general public that had attended the October 27, 2011 public meeting and had provided their email addresses.
- Information on the general public evening meeting was posted on the KUT and YNN websites for dissemination by these media outlets to their audiences.

- The City issued a press release via its usual Public Involvement channels to the local media announcing the evening open house meeting.
- The City posted the invitation to the evening meeting in its monthly transportation email newsletter, "Austin Mobility go!"
- A general survey/comment card for the public to fill out and leave behind at the evening public meeting was produced and collected as attendees left the meeting.

COMMUNITY FOCUS GROUP MEETINGS

Stakeholder outreach was a vital component of the overall engagement strategy for the corridor study and was intended to complement and enhance engagement opportunities designed for broad public participation. Stakeholder participation at the Community Focus Group meetings was very high and provided important feedback into the corridor study. The main purpose of the Community Focus Group meetings allowed the city to:

- Gather input on the East Riverside Corridor study issues
- Address new ideas and review information before it became public
- Include impacted stakeholders in the decision-making process
- Share information about the transportation corridor study with social and business networks

Because the City of Austin had already established a focus group for the East Riverside Corridor Regulating Plan, the East Riverside Transportation Corridor Report provided a continuation of these Focus Group meetings and included the Regulating Plan as an ongoing agenda item. The Community Focus Group members were invited to participate in three focus group meetings for the Transportation Corridor Report. These were used to gather input on the specific projects/concepts being presented as part of the transportation corridor report.

FOCUS GROUP #1 - SEPTEMBER 14, 2011

The first meeting was held at the Austin City Hall from 6:30 p.m.–8:30 p.m. on September 14, 2011. There were discussions about short-, mid- and long-term improvements that each member of the group favored for East Riverside Drive. In preparation for this meeting a questionnaire was developed for the Focus Group.

Attendees were asked to state their preferences for the following improvements:

- Vehicular/car
- Rail/bus
- Pedestrian
- Bike

The topics discussed during the meeting included:

- Mobility
- Electric vehicle charging stations
- Bicycle use
- Bicycle lanes
- Cycle tracks
- Bicycle safety
- Traffic
- Pedestrian crossing
- Sidewalks
- ADA accessibility
- Rail
- Transit
- Airport connectivity

FOCUS GROUP #2 - NOVEMBER 9, 2011

The Second Meeting was held at One Texas Center from 6:30 p.m.–8:30 p.m. on November 9, 2011. The purpose of the second Focus Group meeting was to review input from the East Riverside Corridor Study Public Open House Meeting held on October 27, 2011 and to update stakeholders on the progress of the transportation study. The topics reviewed from the public open house meeting were the following:

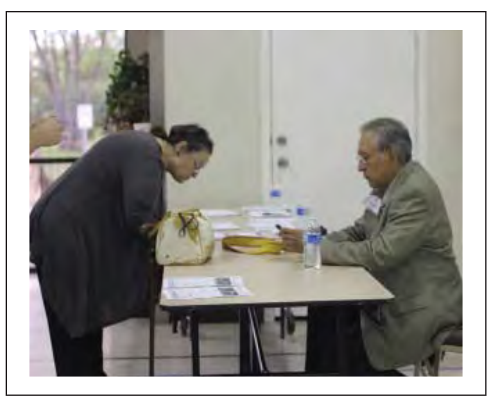
- Regulating Plan Update
- Development Bonus Program
- Questionnaire responses—66 questionnaires were collected at the open house. Topics addressed in the questionnaire included:
  - » Use and access to the corridor
  - » Bicycle and pedestrian
  - » Car
  - » Transit

Topics addressed during the work group discussion included:

- Interchange at SH 71/Ben White and East Riverside Drive
- Demographics
- Pedestrian & bicycle issues
- Changes to existing ROW
- Density in the transportation modeling
- Addressing variables from outside the corridor study area
- Intersection Issues
- Safety
- Driveway consolidation
- Connectivity
- U-turns
- Time frame for short-term solutions
- South Lake Shore Drive
- Bike lanes
- Transit
- Grove Boulevard extension to Montopolis Drive
- Communicating with businesses

THE RIVERSIDE DRIVE CORRIDOR STUDY PROVIDED A CONTINUATION OF FOCUS GROUP MEETINGS AND INCLUDED THE REGULATING PLAN AS AN ONGOING AGENDA ITEM.

FOCUS GROUP #3 - FEBRUARY 9, 2012



The Third Meeting was held at City Hall from 6:30 p.m.–8:30 p.m. on February 9, 2012. The purpose of the third Focus Group Meeting was to present information on existing conditions, traffic modeling analysis and short-, mid- and long-term solutions. The participants were also asked for input on how to effectively present the proposed recommendations at the public meeting scheduled for March 20, 2012. The topics reviewed were the following:

- Project Development Process
  - » Standard intersection layout
  - » Parking
  - » Bicycle improvements
  - » Pedestrian discussion

- Short-term Improvements (0-5 years)
    - » Intersection modifications
    - » Bicycle improvements
    - » Pedestrian improvements
- Mid/Long-term improvements (5-15 years)
    - » Rail
    - » Sidewalks
    - » Driveway consolidation
- Pleasant Valley Intersection Study Concepts—Four study concepts for the Pleasant Valley intersection were presented.

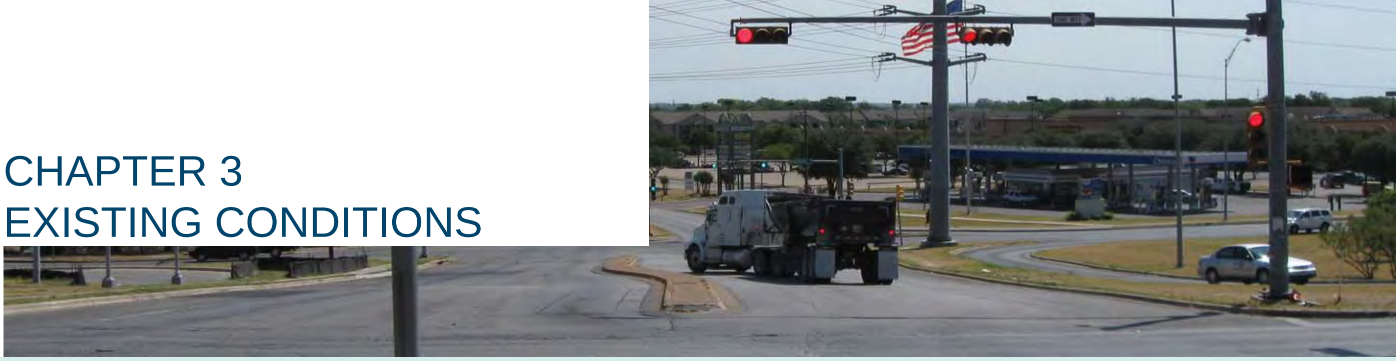
SUMMARY

The next steps for the transportation corridor study and an updated Master Plan were discussed with the group.

As part of the City's commitment to an inclusive and transparent public participation process, a common public approach was implemented to understand the specific needs and conditions of the East Riverside Drive corridor and to address these needs through the implementation of analysis tools and strategies discussed throughout this report. As a result of this process, a final list of solutions and recommendations has been developed to improve short- term, medium-term, and long-term corridor needs.

The project included three community focus group meetings and two public open house meetings. The community focus group meetings were used to gather input on the specific design concepts being developed as part of the transportation corridor study. These concepts were presented to the general public at the public open house meetings.

CHAPTER 3
EXISTING CONDITIONS



This chapter describes the existing land use and character of the transportation network including all of its components along East Riverside Drive. The existing roadway and intersection conditions as well as bicycle and pedestrian facilities were analyzed based on how they interact with the adjacent corridor development.

An assessment of the existing conditions helps identify current issues such as safety, roadway deficiencies, environmental and land use constraints, and motorized and non-motorized mobility along the corridor. In addition, an assessment helps to create a benchmark to measure against in order to develop the appropriate short,- medium- and long-term roadway improvements that will increase the versatility of the corridor and improve the quality of life for all users of East Riverside Drive.

LAND USE

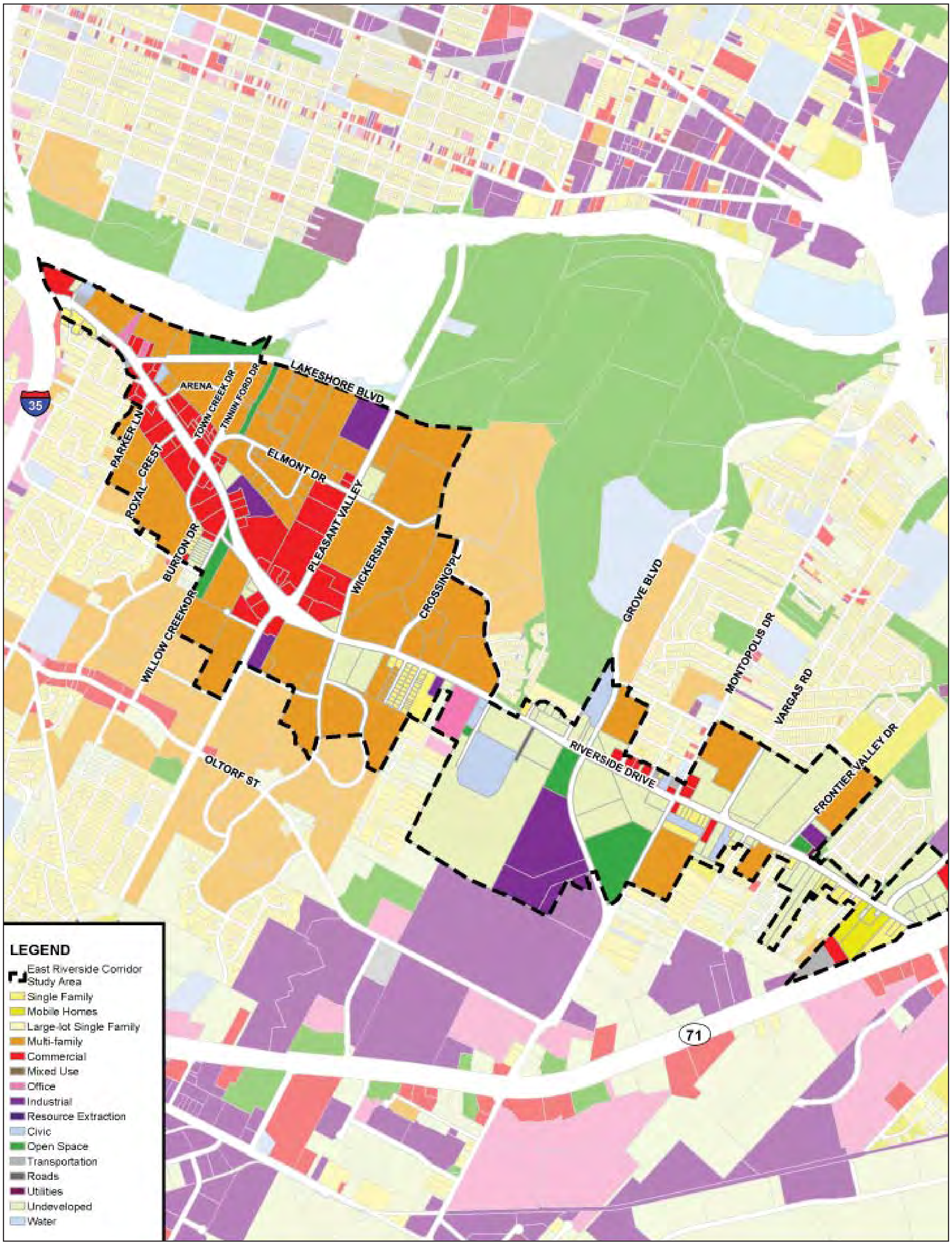
The East Riverside Corridor has served as one of several thoroughfares linking downtown Austin to the airport. Due to its limited aesthetics and aging auto-oriented development along the corridor, East Riverside Drive serves as a “through” corridor primarily serving pass through traffic, rather than a “to” corridor that serves as a destination that attracts people for other uses such as recreation, shopping, or civic art. With the construction of SH 71 and the recent completion of the IH 35 and SH 71 fully directional interchange, the corridor is beginning to change in character as new development is beginning to occur. The East Riverside Corridor contains a mix of retail, commercial, and single and multi-family housing that encompasses more than 800 parcels and approximately 1,200 buildings. Strip shopping malls are located throughout the corridor, in addition to a variety of low-rise buildings and under-utilized and/or vacant retail space. The corridor also contains a high percentage of market-rate affordable housing, including aging multi-family housing that is home to an economically and socially diverse group of residents living in proximity to the roadway. Student housing does exist along the corridor but has declined in occupancy over the past several years. Existing land use along the corridor is shown in **Figure 3-1**.

CHARACTER AREAS

The character of East Riverside Drive changes heading east from IH 35 to SH 71 (Ben White Boulevard). Growth and development along the corridor is the densest near IH 35 and dissipates eastward along the corridor. East Riverside Drive can be characterized by several existing neighborhoods and development types. This is evident in three segments of the corridor:

- Segment 1: IH 35 to Willow Creek Drive
- Segment 2: Willow Creek Drive to Wickersham Lane
- Segment 3: Wickersham Lane to SH 71

Figure 3-1: East Riverside Corridor Land Use Map



Source: City of Austin 2010 Land Use Data

All three segments are shown below in **Figure 3-2**.

Figure 3-2: East Riverside Corridor Character Areas

SEGMENT 1 (IH 35 TO WILLOW CREEK DRIVE)

The section of East Riverside Drive from IH 35 to Willow Creek Drive is mostly characterized by multi-family housing on the north side and single-family housing on the south side. In this section of East Riverside Drive new development is actively taking place. The new South Shore mixed-use development at Lakeshore Boulevard has recently been constructed and businesses such as Emo's East and Beauty Bar have already been built. Along the east side of this segment there is a predominance of several independent and chain fast-food restaurants and strip malls that house several vacant and/or under-utilized spaces and large parking lots. Lakeshore Boulevard is also a well-traveled roadway by both cars and bicyclists as it provides access to one of Austin's most important amenities, Lady Bird Lake. The right-of-way along East Riverside Drive in this segment ranges from 115 feet to 216 feet.

SEGMENT 2 (WILLOW CREEK DRIVE TO WICKERSHAME LANE)

This segment of the corridor includes the Pleasant Valley Road intersection and encompasses a large grass median that divides East Riverside Drive. This median is also the widest part of right-of-way which ranges from 147 feet to 345 feet and had a significantly steep grade. The south side of Riverside Drive contains the Mountain Ranch and Country Club multi-family apartments and several stand-alone businesses. The north side is mostly strip malls and large parking lots. The H-E-B grocery store is the major anchor here, located at the Pleasant Valley Road intersection.

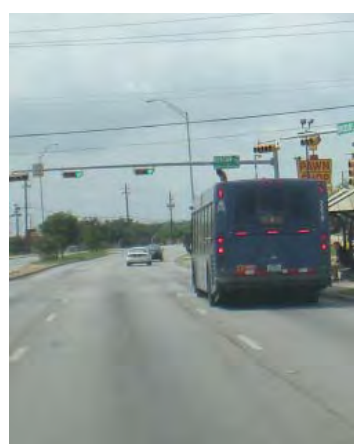
SEGMENT 3 (WICKERSHAM LANE TO SH 71)

The character of this segment of East Riverside Drive is dominated by single and multi-family housing on the west side closer to Wickersham Lane. A portion of the multi-family units in this segment are utilized as student housing from both the University of Texas and Austin Community College. The corner of East Riverside Drive and Faro Drive contains a fire station and a group home owned by Casey Family Programs. East of Faro Drive is predominately open space and undeveloped land with a light mix of single-family homes and commercial and institutional uses such as gas stations and a church. Multi-family condominiums are located on the corner of Frontier Valley Drive across the street from Riverside Rehab and Healthcare. There is also a manufactured housing park on the south side across Riverside Drive and newly constructed hotel suites adjacent to SH 71. The right-of-way width along this segment is the most constraining from 117 feet to 143 feet.

ROADWAY CHARACTERISTICS

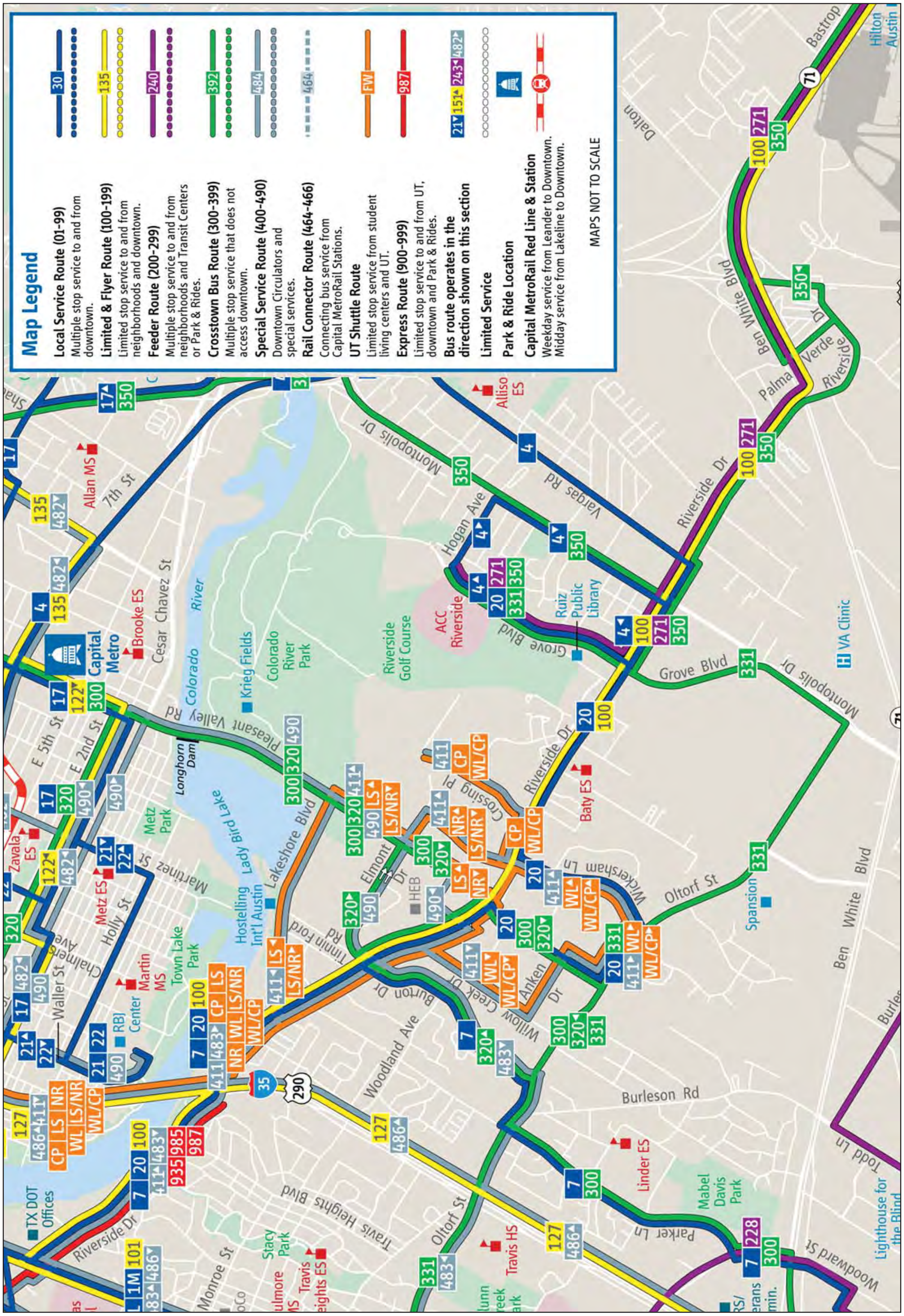
Currently, East Riverside Drive is a six-lane divided roadway between IH 35 and SH 71 and includes 15 signalized intersections and numerous unsignalized intersections. The entire corridor has a significant number of commercial driveways as access management strategies have not been implemented for this corridor. The speed limit on East Riverside Drive is 35 miles per hour (mph) between IH 35 and Crossing Place, 40 mph between Crossing Place and Montopolis Drive and 45 mph between Montopolis Drive and SH 71. The speed limit along South Pleasant Valley Road is 35 mph within the study area. The intersections of East Riverside Drive with IH 35, South Pleasant Valley Road, Montopolis Drive and SH 71 experience significant delay during the peak hours. Buses are prevalent along the corridor and are operated by Capital Metropolitan Transit Authority (Cap Metro) including the University of Texas shuttle system. On-street parking is not currently provided along East Riverside Drive.

TRANSIT SERVICES



The East Riverside Corridor is one of the highest transit ridership corridors for Capital Metro. The high ridership is a result of a high concentration of student housing along the corridor and because of the economically challenged residents that depend on transit as their main mode of transportation. The Capital Metro buses have curbside stops either near-side or far-side of the intersections and this, coupled with heavy ridership and related long dwell times at the stations, result in buses often blocking through travel lanes resulting in operational issues. Due to Capital Metro's heavy ridership high capacity transit is planned along the East Riverside Corridor not only as a means to divert people from using their vehicles as a primary mode of transportation but to connect Central Austin with Austin-Bergstrom International Airport and to support the density and economic development envisioned by East Riverside Corridor Master Plan. **Figure 3-3** shows the existing bus system routes in the vicinity of the East Riverside Corridor.

Figure 3-3: East Riverside Bus System Map



PEDESTRIAN FACILITIES

There are continuous sidewalks on both sides of East Riverside Drive that range from 4 feet to 8 feet in width. Although sidewalks are provided, not all sidewalk designs are adequate for the high pedestrian traffic. The sidewalks are either directly adjacent to the back of curb or separated by a narrow buffer. All signalized intersections are equipped with pedestrian signals, push buttons, curb ramps, and crosswalks. Signalized intersections with long distances between them result in pedestrians crossing mid-block which is less safe than crossing at a signalized intersection. Raised medians exist in many places along the East Riverside Corridor and are used as pedestrian refuge for mid-block crossings.

BICYCLE FACILITIES

There is currently a multi-use path that runs parallel to Lakeshore Boulevard and the Lady Bird Lake shoreline. In addition, bike lanes are available along both sides of Parker Lane and Pleasant Valley Road, but they do not continue through the intersection of Pleasant Valley and East Riverside Drive. There are no dedicated bicycle lanes or paved shoulders along East Riverside Drive. High quality bicycle facilities on East Riverside Drive are critical because it is a relatively high speed and high volume roadway and there are limited alternate routes. Only the most confident cyclists who have no other alternative route use these streets for bicycling. Bicycle facilities are generally absent along adjacent parallel roadways (with the exception of Lakeshore Boulevard) and also along roadways intersecting East Riverside Drive. Safety is a major concern for the bicycle stakeholders in the area.

LANDSCAPE CHARACTERISTICS

While this corridor is transitional in character related to the proposed land use plan, there are numerous opportunities for landscaping enhancements.

East Riverside Drive is a slightly rolling corridor that contains a large open spaced median at the Pleasant Valley Road intersection. The current aesthetics of the corridor lack quality architecture, art and landscaping amenities due to the transitional state of the corridor and the dominance of commercial signs and large surface parking lots. Furthermore, much of the landscaping that exists in the East Riverside Drive median has become overgrown and creates sight distance issues for turning vehicles.

Overgrown landscaping creates sight distance issues for vehicles.

Riverside Drive between IH 35 and SH71 spans five watersheds. The watersheds drain from south to north, outfalling in the Colorado River between IH 35 and SH 71, except for the Carson Creek watershed, which outfalls in the Colorado River east of SH 71.

DRAINAGE CHARACTERISTICS AND ISSUES

Fourteen drainage systems, consisting of pipes, culverts, and/or bridges, were identified along East Riverside Drive, based on data from a site visit, the City of Austin storm drain GIS shapefile, the City-provided HEC-RAS model, and record drawings. Each system collects runoff south of and along East Riverside Drive, conveys flows under East Riverside Drive, and eventually outfalls into the Colorado River, east of IH 35. All drainage north of East Riverside Drive flows in a northerly direction and outfalls into the Colorado River. A map of the location of the drainage systems and major existing draining structures is provided in East Riverside Corridor Study Drainage Report in **Appendix B**.

Table 3-1 summarizes the locations of each system's major conveyance structures along East Riverside Dr., its watershed, and the types of data sources used to identify its level of service or source used to model and analyze the system. A description of each of the fourteen drainage systems and their recommendations for improvement can be viewed in the East Riverside Corridor Study Drainage Report in **Appendix B**.

Table 3-1. Identified Drainage Systems Along East Riverside Drive

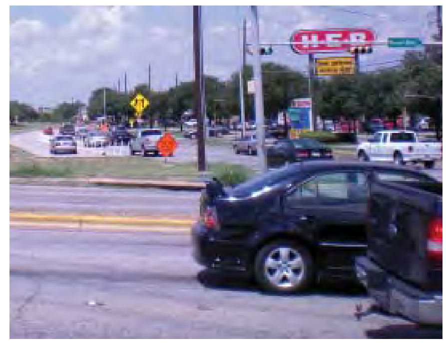
Drainage System	Crossing Location Under E Riverside Dr	Watershed	Data Source
1	At IH 35	Harper's Branch	HEC-RAS model
2	At IH 35	Harper's Branch	HEC-RAS model
3	At IH 35	Harper's Branch	HEC-RAS model
4	At Arena Dr	Town Lake	Record Drawings
5	At Burton Dr	Town Lake	Record Drawings
6	At Willow Creek Dr	Town Lake	Record Drawings
7	Near Wickersham Ln	Country Club West	HEC-RAS model and Record Drawings
8	Between Kenneth Ave and Riverside Farms Rd	Country Club West	HEC-RAS model and Record Drawings
9	Between Faro Dr and Penick Dr	Country Club East	HEC-RAS model and Record Drawings
10	Between Country Club Rd and Grove Blvd	Country Club East	HEC-RAS model and Record Drawings
11	Between Grove Blvd and Clubview Ave	Country Club East	HEC-RAS model and Record Drawings
12	At Vargas Rd	Country Club East	Record Drawings
13	Between Frontier Valley and Anise Dr	Carson Creek	Record Drawings
14	At Coriander Dr	Carson Creek	Record Drawings

An analysis of East Riverside Drive's current overall traffic operations is important because it defines what improvements are required to accommodate existing and future growth along the corridor and maintain corridor access while improving the mobility for bicycle and pedestrian users. The next few sections will discuss peak hour volumes for vehicles and pedestrians as well as intersection and multimodal level of service (LOS). Peak hour volumes account for traffic at the busiest times of the day, which are typically morning and evening commute times, while the LOS measures the roadway's efficiency and effectiveness of moving traffic at peak hours. A more detailed discussion of the traffic operations analysis can be reviewed in the 2035 Travel Demand Analysis in **Appendix C**.

TRAFFIC OPERATIONS ANALYSIS

METHODOLOGY

The East Riverside Corridor traffic operations analysis was performed using VISSIM 5.10 for existing year 2011 and the planning horizon year of 2035, which was established by the City of Austin at the beginning of this project. VISSIM is classified as a microscopic simulation model because it models vehicles as individual units and updates them every second. After defining the street geometry, traffic control and vehicular volumes, VISSIM outputs many measures of effectiveness (MOEs) such as average delay, queue length, speed etc. that can then be used to evaluate operational performance and provide a basis for comparison of alternatives. A key component of the modeling effort is the calibration and validation of the existing conditions model which was performed as per the methodology in FHWA's Traffic Analysis Toolbox. While the VISSIM models provide a wide variety of MOEs, only a few MOEs that focus on the scope of this project were used to establish existing traffic operations. The MOEs that were evaluated for the existing conditions analysis include travel time, network delay, network vehicles, average speed and intersection LOS at AM and PM peak hours.



TRAFFIC VOLUMES

Extensive data collection was performed to obtain information on existing conditions along the East Riverside Corridor. The following data was collected in the field as part of this study:

- 24-hour bi-directional vehicular traffic volume counts
- AM (7-9) and PM (4-6) peak hour intersection turning movements including pedestrian crossings
- AM and PM peak hour vehicular travel time runs
- Field observations during the peak hours to document operations
- Existing roadway and intersection geometrics

In addition to this data, the following information was obtained from various agencies:

- Crash data provided by the City of Austin
- ROW data from City of Austin GIS Maps
- Traffic Signal Timing Information from the City
- Transit route and ridership information from Capital Metro
- Bicycle route and plans from Austin Bike Plan

The 24-hour bi-directional tube counts were collected at six locations along the corridor to identify the volume of traffic flowing through the corridor at various locations. AM and PM turning movement counts (TMCs) were collected at all signalized and one unsignalized intersection along the corridor. The tube counts, TMCs and travel time were collected in the summer while school was not in session. Therefore, the summer counts were adjusted by 10 percent to reflect normal weekday traffic volumes along the corridor when schools are in session. A summary of the adjusted peak hour traffic volumes along the East Riverside Corridor are identified in **Table 3-2** and shown in **Figure 3-4**.

Table 3-2: Existing Peak Hour Traffic Volumes 2011

Location	AM Peak (vph)	PM Peak (vph)
East Riverside Drive, east of IH 35 (near Summit Street)	2,805	3,032
East Riverside Drive, between Arena Drive/Parker Lane and Royal Crest Drive	2,146	2,415
East Riverside Drive, between Grove Boulevard and Montopolis Drive	1,371	2,069
East Riverside Drive, west of SH 71	1,200	1,700
Pleasant Valley Road, north of East Riverside Drive (near HEB)	936	1,683
Pleasant Valley Road, north of Lakeshore Boulevard	1,431	2,646

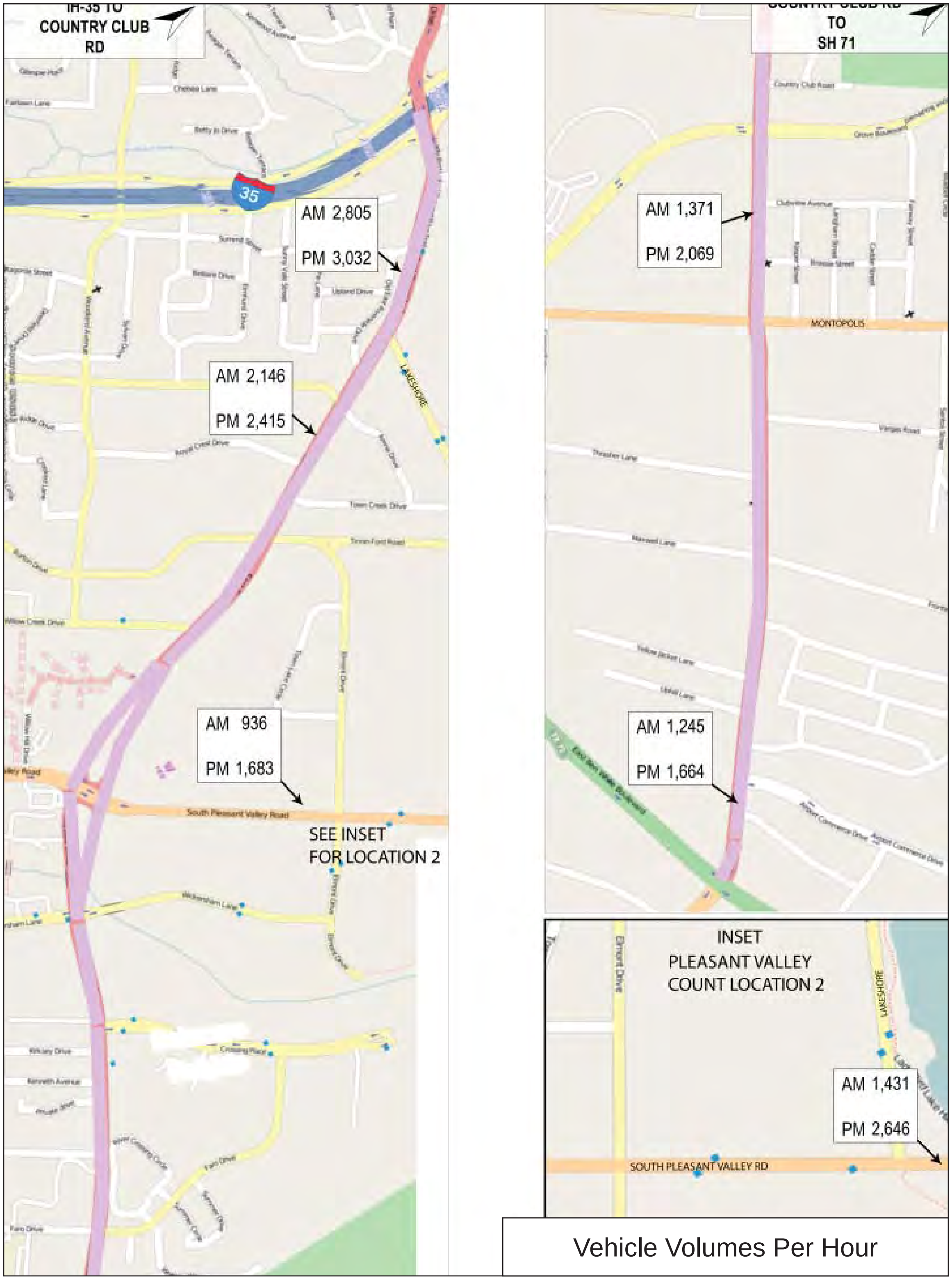
PEDESTRIAN VOLUMES

Pedestrian volumes were collected at all signalized intersections within the study area to identify current pedestrian activity along the East Riverside Corridor. Intersections with the highest concentrations of pedestrian activity during the peak periods are summarized in **Table 3-3**.

Table 3-3: Existing Peak Hour Pedestrian Volumes

Intersections	AM Peak (ped/hr)	PM PEAK (ped/hr)
East Riverside Drive and Montopolis Drive	13	30
East Riverside Drive and Grove Boulevard	12	22
East Riverside Drive and Burton/Tinnin Ford Road	8	22
East Riverside Drive and Crossing Place	11	19
East Riverside Drive and Willow Creek Drive	9	20
East Riverside Drive and Royal Crest Drive	8	19

Figure 3-4: Existing Peak Hour Traffic Volumes 2011



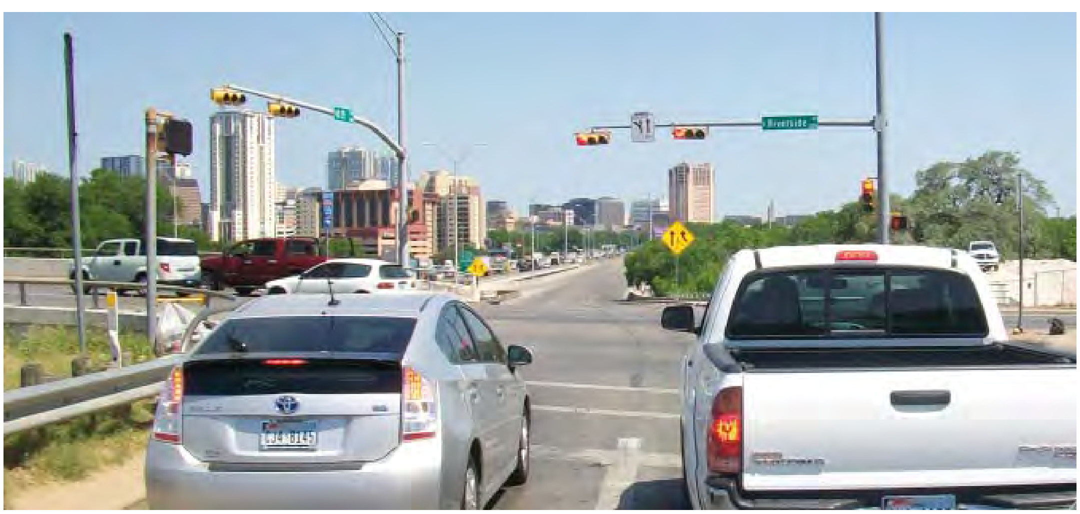
INTERSECTION LEVEL-OF-SERVICE

Intersection LOS is an important MOE for evaluating the existing conditions at the intersections along the East Riverside Corridor. LOS is a qualitative measure of operating conditions based on control delay for intersections. LOS is given a letter designation from A to F, where LOS A represents free-flow conditions and LOS F represents heavy congestion. LOS D is typically considered acceptable in the City of Austin. Control delay criteria for various LOS classifications are summarized in **Table 3-4**.

Table 3-4: Level-of-Service Definitions for Intersections

Level-of-Service (LOS)	Control Delay (sec/veh)		Description
	Signalized Intersections	Unsignalized Intersections	
A	<= 10.0	<= 10.0	Very low vehicle delays, free traffic flow, signal progression extremely favorable, most vehicles arrive during given signal phase.
B	10.1 to 20.0	10.1 to 15.0	Good signal progression, more vehicles stop and experience higher delays than for LOS A.
C	20.1 to 35.0	15.1 to 25.0	Stable traffic flow, fair signal progression, significant number of vehicles stop at signals.
D	35.1 to 55.0	25.1 to 35.0	Noticeable traffic congestion, longer delays and unfavorable signal progression, many vehicles stop at signals.
E	55.1 to 80.0	35.1 to 50.0	Limit of acceptable vehicle delay, unstable traffic flow, poor signal progression, traffic near roadway capacity, frequent cycle failures.
F	> 80.0	> 50.0	Unacceptable delay, extremely unstable flow, heavy congestion, traffic exceeds roadway capacity, stop-and-go conditions.

Source: Highway Capacity Manual, Transportation Research Board, 2000.



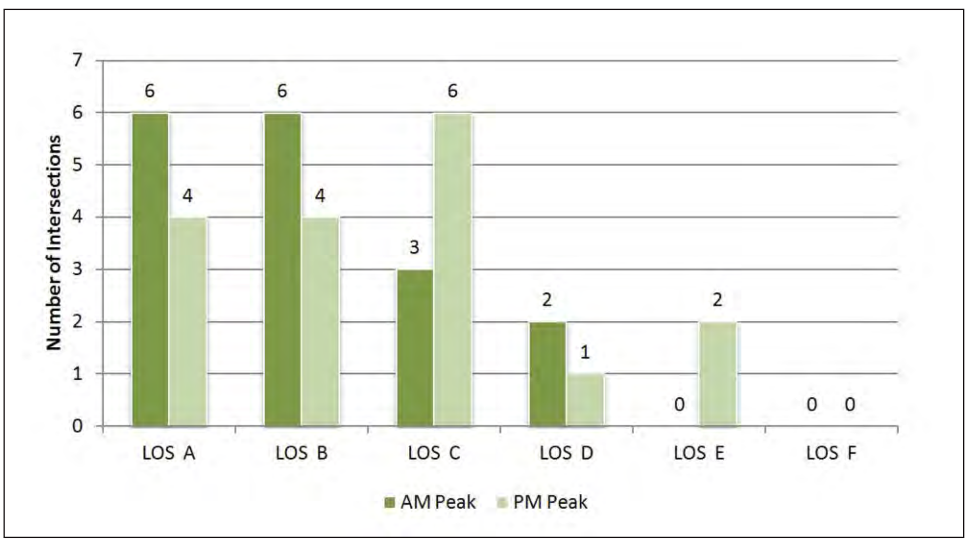
Northbound IH 35 at East Riverside Drive

As shown in **Table 3-5** and **Figure 3-5**, the majority of the intersections along the corridor operate at an acceptable LOS of A, B, C, or D during the AM and PM peak hours. The Riverside Drive intersection with IH 35 and SH 71 operates at LOS E in the PM peak hour. There are currently no intersections operating at LOS F during the peak periods.

Table 3-5: Signalized Intersections Levels of Service – Existing (2011)

Intersections	AM Peak Hour	PM PEAK Hour
East Riverside Drive and IH 35 SB	C	E
East Riverside Drive and IH 35 NB	C	C
East Riverside Drive and Lakeshore Boulevard	B	A
East Riverside Drive and Arena/Parker Lane	B	B
East Riverside Drive and Royal Crest Drive	A	A
East Riverside Drive and Burton/Tinnin Ford Road	B	B
East Riverside Drive and Willow Creek Drive	A	C
East Riverside Drive WB and Pleasant Valley Road	B	C
East Riverside Drive EB and Pleasant Valley Road	C	C
East Riverside Drive and Wickersham Lane	B	C
East Riverside Drive and Crossing Place	A	A
East Riverside Drive and Faro Drive	A	A
East Riverside Drive and Grove Boulevard	A	B
East Riverside Drive and Montopolis Drive	D	D
Elmont Drive and Pleasant Valley Road	A	B
Lakeshore Boulevard and Pleasant Valley Road	B	C
East Riverside Drive and SH 71	D	E

Figure 3-5: Existing Intersection LOS (2011)



MULTIMODAL LEVEL-OF-SERVICE

Like the intersection LOS analysis in the previous section, a multimodal LOS analysis was performed to measure the overall functionality of East Riverside Drive's pedestrian, bicycle, and transit uses.

The multimodal LOS methodology was developed under National Cooperative Highway Research Program (NCHRP) 3-70. The methodology uses various equations to calculate numerical scores for transit, bicycle, and pedestrian modes. The scores are converted to LOS based on the threshold values shown in **Table 3-6**. The NCHRP 3-70 methodology was documented in NCHRP Report 616: Multimodal Level of Service for Urban Streets.

Table 3-6: Multimodal Level-Of-Service Threshold Values

LOS Model Score	LOS Letter Grade
Model <= 2.00	A
2.00 < Model <= 2.75	B
2.75 < Model <= 3.50	C
3.50 < Model <= 4.25	D
4.25 < Model <= 5.00	E
Model > 5.00	F

Source: NCHRP Report 616: Multimodal Level of Service for Urban Streets

Multimodal LOS was analyzed using the Complete Streets LOS (CSLOS) software, which implements the NCHRP 3-70 methodology. **Table 3-7** presents the overall facility multimodal LOS scores and LOS under existing conditions for the East Riverside Drive Corridor. The analysis was performed for the peak direction along East Riverside Drive, which is westbound in the AM peak and eastbound in the PM peak.

Table 3-7: Existing Facility Multimodal LOS

Mode	AM Peak Westbound East Riverside Drive		PM Peak Eastbound East Riverside Drive	
	Score	LOS	Score	LOS
Transit	3.05	C	4.10	D
Bicycle	4.40	E	4.53	E
Pedestrian	3.51	D	3.69	D

The existing transit LOS on East Riverside Drive is adequate due to the availability of many bus routes and relatively frequent bus arrivals. Transit LOS is also affected by auto speed along East Riverside Drive. The westbound direction in the AM has better transit LOS than the eastbound direction in the PM, primarily because the westbound direction has more bus routes and stops.

The existing pedestrian LOS is D in both the AM and PM peak periods. The presence of continuous sidewalks along East Riverside Drive is a positive factor for the pedestrian LOS, but the lack of buffer zone between the curb lane and the sidewalk degrades the pedestrian LOS.

The existing bicycle LOS is the worst among the three modes mainly because there is currently no bike lane or paved shoulder along East Riverside Drive. The poor bicycle LOS is also associated with the presence of numerous driveways along the corridor.

THE EXISTING TRANSIT LOS ON EAST RIVERSIDE DRIVE IS ADEQUATE DUE TO THE MANY BUS ROUTES AND RELATIVELY FREQUENT BUS ARRIVALS.

CRASH ANALYSIS

The main purpose of a crash analysis is to identify crash patterns and develop mitigation measures to prevent similar crashes. The crash analysis for East Riverside Drive was based on crash data provided by the City of Austin from January of 2009 through July of 2011. The crash data was reported for the following crash severity:

- Property Damage Only (PDO)
- Injury
- Fatal

The total crashes by severity for the corridor are shown in **Table 3-8**. East Riverside Drive experienced the highest total crashes in 2009. Although the 2011 crash data was incomplete, the overall trend showed a decreasing total number of crashes over the three-year period.

Table 3-8: Total Crashes January 2009 to July 2011

Month/Year	PDO	Injury	Fatal	Total
Jan – Dec 2009	116	125	0	241
Jan – Dec 2010	119	106	1	226
Jan – Jul 2011	63	50	2	115
Total	298	281	3	582

Crash rates are calculated to allow comparisons of different facilities and to determine if facilities are experiencing an above-average frequency of crashes. Crash rates for East Riverside Drive were calculated for the selected intersections and segments.

CRASH RATE BY INTERSECTION

Crash rate by intersection normalizes the reported crashes at an intersection to the exposure in terms of million entering vehicles (MEV).

The crash rate for a given year is the reported crashes divided by the MEV. **Table 3-9** provides a summary of the crash rates in 2009 through July 2011 for the top five intersections with the highest crash rates.

Year	Intersection	TEV[1]	MEV	Reported Crashes	Crashes per MEV
2009	Riverside Drive and Pleasant Valley Road	54,505	19.8943	29	1.46
	Riverside Drive and Wickersham Lane	39,292	14.3416	20	1.39
	Riverside Drive and Willow Creek Drive	34,636	12.6421	14	1.11
	Riverside Drive and Burton/Tinnin Ford Road	35,827	13.0769	10	0.76
	Riverside Drive and IH 35	77,102	28.1422	20	0.71
2010	Riverside Drive and Burton/Tinnin Ford Road	36,626	13.3685	19	1.42
	Riverside Drive and Willow Creek Drive	35,409	12.9243	18	1.39
	Riverside Drive and Pleasant Valley Road	55,721	20.3382	22	1.08
	Riverside Drive and Crossing Place	36,096	13.1750	14	1.06
	Riverside Drive and Grove Boulevard	32,197	11.7519	9	0.77

[1]TEV (Total Entering Vehicles)

Table 3-9: Top Five Intersections with the Highest Crash Rates

The three intersections that made the top five lists for both 2009 and 2010 are East Riverside Drive at Pleasant Valley Road, Willow Creek Drive and Burton/Tinnin Ford Road.

CRASH RATE BY SEGMENT

Crash rate by segment is the reported crashes per 100 million vehicle miles of travel (100MVM) along the roadway segment.

The crash rate for a given year is the reported crashes on a roadway segment divided by the 100MVM. A summary of the crash rates in 2009 through 2011for the four segments along East Riverside Drive, where average daily traffic (ADT) data was collected in the field, is summarized in **Table 3-10**.

Table 3-10: Crash Rate by Segment (Average Annual Daily Traffic)

Segment	Years	AADT	Length (miles)	100 MVM	Total Crashes	Crash Rate
IH 35 to Lakeshore (Segment 1)	2009	44,060	0.32	.0515	14	272.04
	2010	45,043		.0526	13	247.10
	2011	46,047		.0314	7	260.31
Arena/Parker to Royal Crest (Segment 1)	2009	34,688	0.10	.0127	6	473.89
	2010	35,462		.0129	3	231.77
	2011	36,253		.0077	1	151.14
Grove to Montopolis (Segment 3)	2009	22,166	0.30	.0243	2	82.40
	2010	22,661		.0248	3	120.90
	2011	23,166		.0148	0	0.00
Montopolis to SH 71 (Segment 3)	2009	18,548	0.87	.0589	11	186.76
	2010	18,961		.0602	19	315.56
	2011	19,384		.0359	4	129.97

The Texas Department of Transportation (TxDOT) maintains a statewide automated database for all reported motor vehicle traffic crashes since 2003, and the statistics are available through TxDOT's website. The Texas statewide crash rates in 2008 – 2010 are listed in **Table 3-11**. For a comparable facility, the statewide crash rate is approximately 117 and 118 crashes per 100MVM in 2009 and 2010, respectively. The East Riverside Drive crash rates in 2009 and 2010 were generally higher than the statewide rates.

Table 3-11: Texas Statewide Crash Rates

Road Type	Traffic Crashes per 100 million vehicle miles of travel in Urban Area		
	2009	2010	2011
4 or more lanes, divided	117.01	118.53	106.93

CHAPTER 4
FUTURE CHARACTERISTICS

The East Riverside Corridor Development Program envisions a comprehensive transportation infrastructure that facilitates and encourages walking, bicycle, car, and transit uses, both within and outside the study area. In order to achieve this goal, the East Riverside Corridor Master Plan proposes short walking blocks, mixed-use development, bicycle facilities, and a high frequency transit service (high capacity transit or bus rapid transit) with major transit centers. The vision, goals and objectives of the plan comply with the 5Ds (design, density, diversity, destination accessibility, and distance to transit) of the East Riverside Corridor Regulating Plan which focuses on sustainable land use and transportation planning and encourages shorter trips with a relatively higher proportion of walk, bicycle, and transit trips. The result of the 5Ds is to create a well-designed corridor that would provide several transportation options, be aesthetically pleasing and support economic and community vitality, transforming East Riverside Drive from a "through" place into a "to" place. The following sections describe planned roadway improvements, multimodal improvements, and development activities and the subsequent impacts on traffic volumes and traffic operations.

NEIGHBORHOOD PLANS

Neighborhood plans are an important element to consider when conducting a study to alter the shape or features of the corridor that primarily serve them. Neighborhood plans provide insight to the visions, goals, and objectives residents and business communities would like to accomplish. It is important to consult these plans in the corridor development program process to make sure they align with the visions, goals, and objectives of the corridor. The following provides an overview of the key plans and goals that are most relevant to the future mobility needs of the larger community of the East Riverside Corridor.

THE RIVERSIDE DRIVE CORRIDOR DEVELOPMENT PROGRAM ENVISIONS A COMPREHENSIVE TRANSPORTATION INFRASTRUCTURE THAT FACILITATES AND ENCOURAGES WALKING, BICYCLE AND TRANSIT USES, BOTH WITHIN AND OUTSIDE THE STUDY AREA.

EAST RIVERSIDE/OLTORF COMBINED NEIGHBORHOOD PLAN

The East Riverside/Oltorf Combined Neighborhood Planning Area is located in the southeast part of Austin's urban core and is comprised of the Parker Lane, Pleasant Valley, and East Riverside Planning Areas (**Figure 4-1**). This plan was adopted by City Council on November 11, 2006, and provided important policy direction for the preparation of the East Riverside Corridor Master Plan and the subsequent Regulating Plan.

Figure 4-1: East Riverside Drive /Oltorf Street Combined Neighborhood Planning Area

Key Goals from the Neighborhood Plan:

- Preserve and enhance the character of existing residential neighborhoods.
- Improve the appearance, vitality and safety of existing commercial corridors and community amenities and encourage quality urban design and form that ensures adequate transition between commercial properties and adjacent residential neighborhoods.
- Enhance the transportation network to allow residents and visitors to get around safely and efficiently by foot, bicycle, automobile and public transit.
- Preserve and enhance existing parks, the Riverside Golf Course and other open spaces and create opportunities for additional public open space.
- Create interesting, lively, inviting, attractive, safe and comfortable non-residential environments that will encourage walking, biking and transit use and be appealing to passing motorists.
- Create convenient and accessible parking areas that do not dominate the environment and provide safe interaction between vehicles and pedestrians.

MONTOPOLIS NEIGHBORHOOD PLAN

The Montopolis Planning Area is located in the southeast part of Austin's Urban Core. The boundaries for the planning area are Grove Boulevard on the north and west, Bastrop Highway on the east, and E. Ben White Boulevard on the south (**Figure 4-2**). The Austin City Council adopted the Montopolis Planning Area on September 23, 2001.

Key Goals from the Neighborhood Plan:

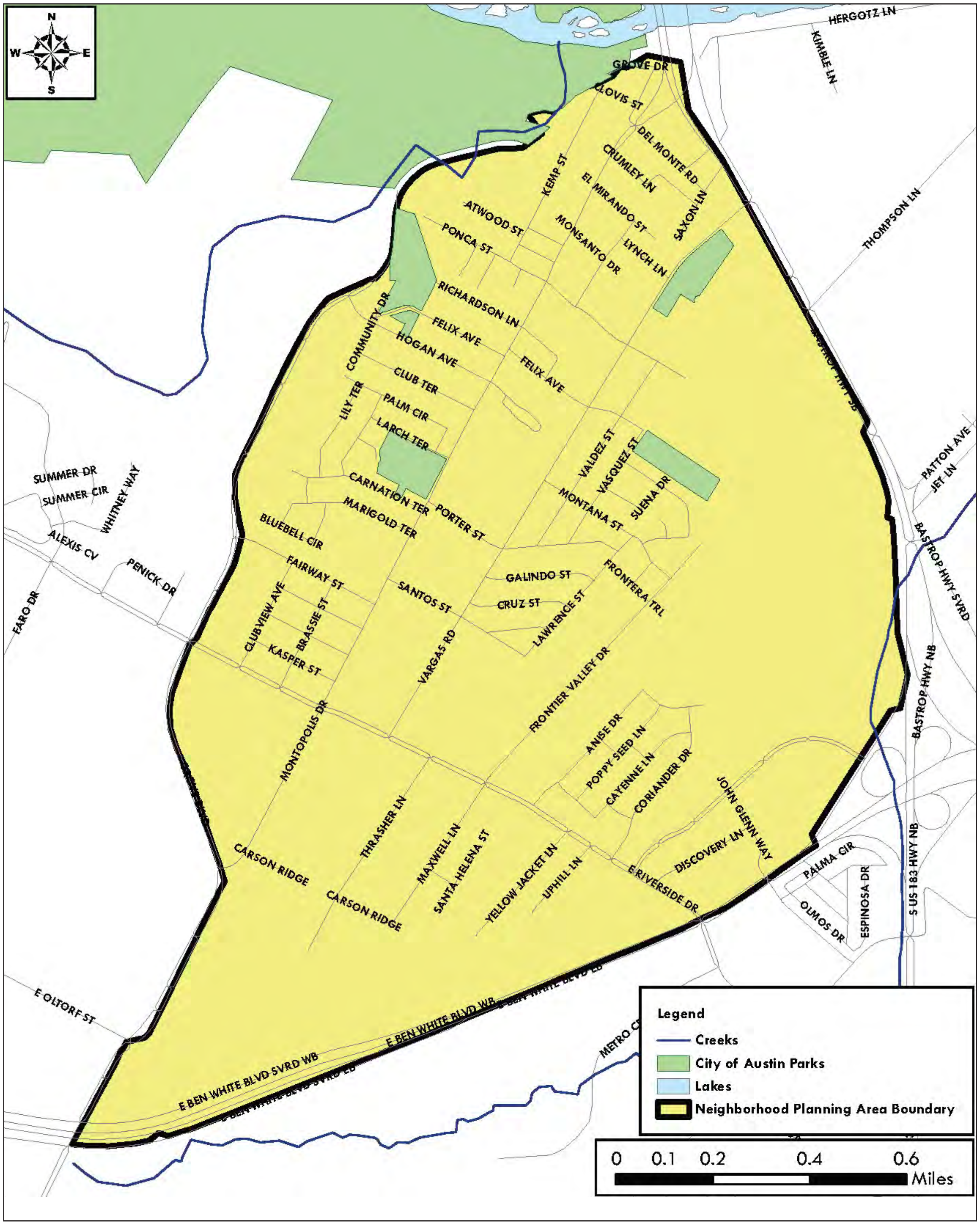
- Improve Transportation Safety in Montopolis.
- Improve Transportation Connections within Montopolis and to the rest of Austin.
- Enhance and Enliven the Streetscape.

PLANNED DEVELOPMENT

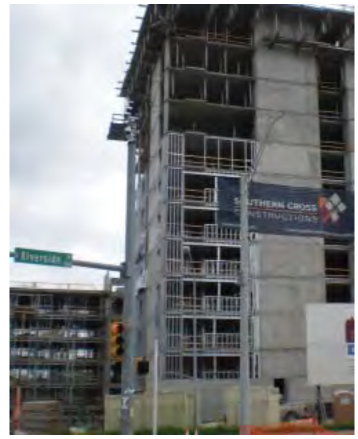
The vision for East Riverside Drive is to transform this single occupancy vehicle driven corridor to a people-oriented destination that has a high concentration of people living along the corridor. The redevelopment of East Riverside Drive can only be facilitated through a truly multimodal transportation system that allows trips to/from these diverse mixed-use developments via a mode other than autos. With the proposed planning of high capacity transit along Riverside Drive by the City and with the economic conditions improving, a lot of interest is being generated to redevelop the corridor. East Riverside Drive has seen new developments within the past few years. These developments include:

- AMLI South Shore mixed-use development
- Emo's East
- Reconstruction of H-E-B
- The Arbors at Riverside
- Best Western Plus Austin Airport Inn & Suites
- Staybridge Suites Austin Airport

Figure 4-2: Montopolis Neighborhood Planning Area



Mixed-used developments that contain a ground floor of retail space is beneficial to the East Riverside Corridor as business owners will have the assurance that they will always have customers living above and around them, while residents have the benefit of being able to walk short distances for services and goods thereby reducing their dependency on vehicles for simple day-to-day tasks.



New development on Riverside Drive.

In addition to these developments, planned developments are underway along the East Riverside Corridor. Currently most of these projects are multi-family in nature which paved the way for redevelopment of the retail sites. These developments include:

- City View – located on the northeast corner of IH 35 and Riverside Drive, it will include two five-story buildings closest to the lake, plus one 9-story and one 11-story building. Construction for the multifamily part (known as Star Riverside) is currently underway.
- South Shore District PUD – bounded by Lakeshore Boulevard, Riverside Drive and Tinnin Ford Road, this development will consist of multi-family apartments and supporting retail land uses.
- Lakeshore PUD – located along Lakeshore Boulevard and bounded by Pleasant Valley, Elmont Drive and Tinnin Ford Drive. This mixed use project will consist of residential and retail land uses.

In addition to these residential dominated mixed-use developments, smaller retail projects continue to be developed along the corridor. Austin Energy owns land south of the corridor adjacent to Grove Boulevard that will be developed in the future. The vacant property between East Riverside Drive, Grove Boulevard and Montopolis Drive has not been fully utilized and will likely be developed in the near future.

Although the ERC Master Plan and Regulating Plan do have provisions for roadway connections with future development, there are no viable locations to provide additional roadway connections in the area to relieve the existing traffic along Riverside Drive. Currently, there are three planned roadway improvements that will directly affect East Riverside Drive. Below is a brief discussion about these planned improvements and how they affect the corridor.

THE REDEVELOPMENT OF EAST RIVERSIDE DRIVE CAN ONLY BE FACILITATED THROUGH A MULTIMODAL TRANSPORTATION SYSTEM.

IH 35 AND EAST RIVERSIDE BRIDGE

The East Riverside Drive bridge over IH 35 is currently being evaluated for modifications related to the high capacity transit extension as well as improvements being planned along the IH 35 Corridor through Austin. As a result of these plans, the proposed bridge will likely accommodate three lanes in each direction (2 + 1 turn lane), a bike lane and sidewalk in each direction. Furthermore, it is anticipated that the proposed bridge will provide for median running rail to link with the proposed high capacity transit along the west portion of the East Riverside Corridor. The improvements along IH 35 are anticipated to include the addition of Managed Lanes and potential collector-distributor roads along IH 35. These improvements will result in an East Riverside Drive bridge that is longer and wider than the existing bridge.

SH 71 (BEN WHITE BOULEVARD)

The controlled access portion of SH 71 previously ended west of the Riverside Drive intersection, resulting in significant congestion. Currently, TxDOT is constructing a grade separation at the East Riverside Drive intersection to alleviate this congestion. The new construction over East Riverside Drive would reduce congestion along the freeway and reduce commuter delays around Austin as well as make SH 71 a more attractive facility to access the airport. This construction would help reduce the cut-through traffic along East Riverside Drive allowing it to be a more destination oriented roadway. Construction is anticipated to be complete April 2014.

LAKESHORE BOULEVARD

Private investment and redevelopment is beginning to occur along East Riverside Drive between IH 35 and Lakeshore Boulevard and also along Lakeshore Boulevard. The new South Shore mixed-use development has already been constructed at the corner of Lakeshore Boulevard. The proposed Lakeshore PUD and South Shore PUD will primarily be constructed along Lakeshore Boulevard and will consist mostly of residential development with some ground floor retail space.

PLANNED MULTIMODAL IMPROVEMENTS

The planned transportation improvements along the East Riverside Corridor study area will increase mobility options that can provide a sustainable way of travel along the corridor. These improvements will include facilities that will make riding a bike or using transit a more comfortable, convenient and safe experience.

PEDESTRIAN ENHANCEMENTS

Pedestrian enhancements along East Riverside Drive are focused on the pedestrian experience and environments. Recommendations made in the East Riverside Corridor Master Plan suggest enhancing transit stops, providing additional protection from vehicles, adding street trees to provide shade, minimizing driveway curb cuts and improving pedestrian roadway crossings.

BICYCLE FACILITIES

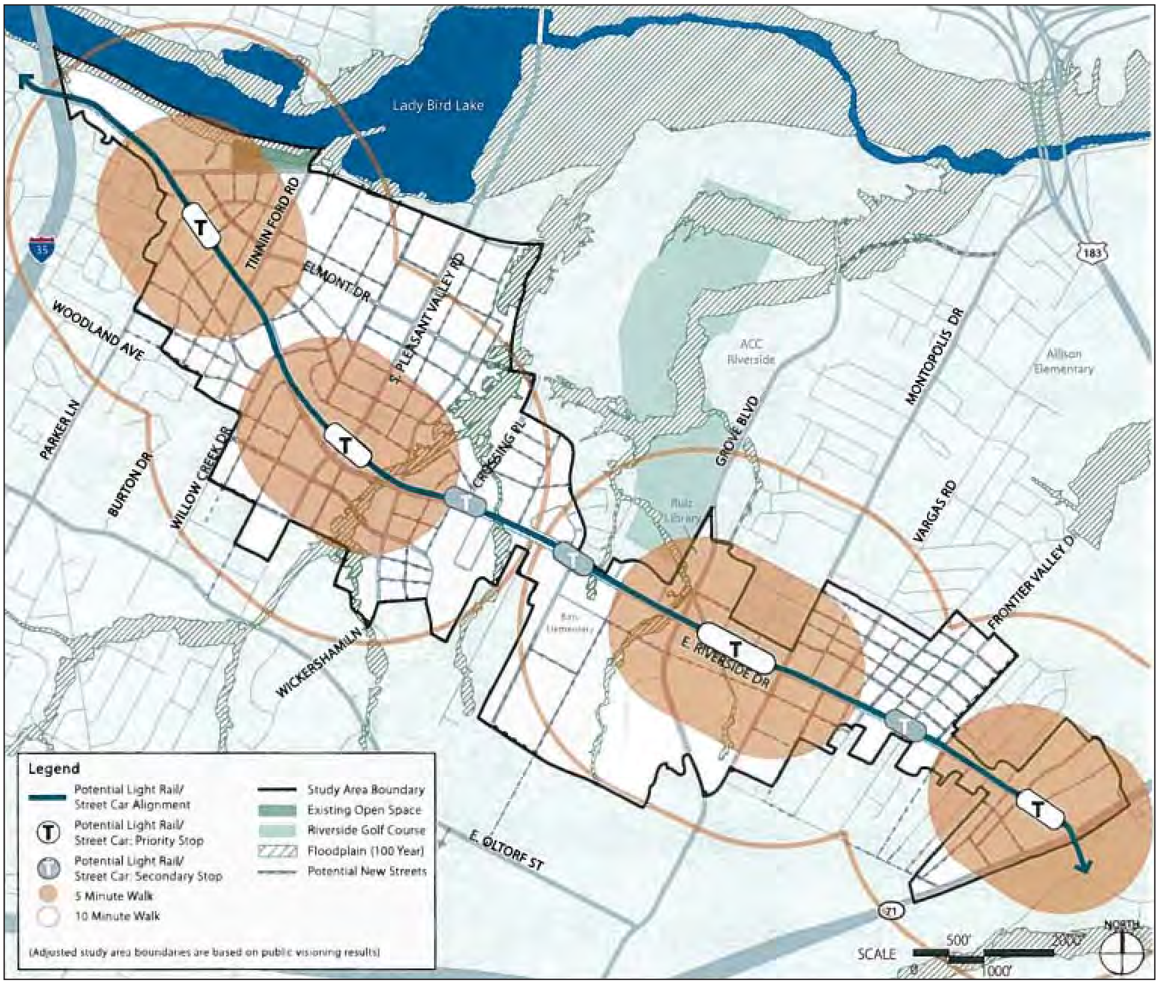
The City of Austin intends to remain consistent with its current bike program by planning to implement a mix of cycle tracks, striped bicycle lanes, and multi-use paths to serve the needs of bicyclists within and near the East Riverside Corridor. The improvements will complement and link to existing and proposed trails and parks within the area. Detailed information from the City of Austin regarding its bicycle program and 2009 Bicycle Master Plan can be viewed at http://www.sws.ci.austin.tx.us/department/bicycle-program-0.

HIGH CAPACITY TRANSIT

The East Riverside Corridor Master Plan recommends the implementation of a high capacity transit line that would serve the East Riverside Corridor area to provide an alternate mode of transportation between downtown Austin and SH 71. High capacity transit is a part of the City's Strategic Mobility Plan and could ultimately connect downtown Austin to Austin-Bergstrom International Airport via East Riverside Drive. This proposed high capacity transit line will help facilitate redevelopment and support density along the East Riverside Corridor. Transit hubs along East Riverside Drive are planned to be developed at higher density land uses to support existing and future transit and community amenities nearby. As per the East Riverside Corridor Master Plan, the hubs would provide distinct destinations where housing, shops, and offices would be easily accessible. Detailed information from the City of Austin regarding high capacity transit can be viewed at www.austinurbanrail.com.

As shown in **Figure 4-3**, four transit stations are currently envisioned in the East Riverside Corridor Master Plan: South Lakeshore Boulevard/Tinnin Ford Road, South Pleasant Valley Drive, Grove Boulevard/Montopolis Drive, and Airport Commerce Drive. High capacity transit is planned to run in the median and will utilize transit signal priority at signalized intersections.

Figure 4-3: Proposed East Riverside Drive High Capacity Transit Stations
Source: East Riverside Corridor Master Plan



FOUR TRANSIT STATIONS ARE CURRENTLY ENVISIONED IN THE EAST RIVERSIDE CORRIDOR MASTER PLAN: SOUTH LAKESHORE BOULEVARD/ TINNIN FORD ROAD, SOUTH PLEASANT VALLEY DRIVE, GROVE BOULEVARD/ MONTOPOLIS DRIVE, AND AIRPORT COMMERCE DRIVE.

TRANSPORTATION DEMAND MANAGEMENT

Transportation Demand Management (TDM) is defined as "various strategies that increase transportation system efficiency." These strategies support the use of alternative travel modes that reduce dependence on traditional modes such as the automobile.

TDM can play an important role in supporting the infrastructure improvement projects and land use changes envisioned in the East Riverside Corridor Master Plan as they are constructed and implemented.

The corridor's increased focus on livability and active transportation, as expressed through off-street parking and streetscape improvements will provide a more attractive and compelling environment in which to work, live, and play, with a reduced need to use an automobile for short trips and increased options for bicycling, walking or transit. Inclusion of a high capacity transit service along the East Riverside Corridor would also provide for longer trips, such as commuting to and from work or higher education, or for travel to the airport, downtown Austin, or the University of Texas.

While the investment in sidewalks, bicycle facilities, transit and land use will help encourage active transportation and transit use, increasing their relative mode share of trips made, TDM efforts can enhance their use even further.

The primary TDM programs suggested for use within the East Riverside Corridor study area include marketing, education and advocacy efforts to promote:

- Bicycling
- Walking
- Transit
- Ridesharing
- Telework

SUMMARY AND IMPACTS OF TDM

The evolution of the East Riverside Corridor from its current auto-oriented focus to a corridor in which multiple travel modes coexist will take place over time, and the introduction of new infrastructure projects will provide incentives for increased walking, bicycling, and transit because of their proximity, their convenience and their safety. TDM efforts such as those described in this section can provide an additional level of mode shift over and above that derived from the ease by which pedestrians, bicyclists and transit users can travel within the corridor. In addition, the construction of high-density, mixed-use development as planned for Riverside Drive will further support TDM efforts.

The degree to which additional movement toward transit and active transportation modes can be realized is dependent on the resources available and how well they can be integrated within the corridor and communicated to employers, employees, students, residents and visitors.

The regional travel model includes Austin-area TDM efforts as an input in its calculations. For our study purposes, there was no need to modify the No-Build Scenario modeling by increasing TDM's impact beyond the existing level. However, the introduction of mixed-use development and increased density along the corridor along with infrastructure improvement projects identified in the Build scenario will likely cause a decrease in persons traveling to and from the corridor via car and instead providing persons the opportunity to walk or bike for local amenities. TDM is estimated to have a localized mode shift within the corridor of approximately 3 percent. This assumption is based on a review of similar efforts elsewhere within the United States.

Turning movement volumes (TMV) for intersections along East Riverside Drive between IH 35 and SH 71 were developed for forecasted year 2035. **Figure 4-4** shows the study area intersections, boundaries and traffic analysis zones (TAZ). Prior to developing the turning movement forecasts, validation testing was performed on the Capitol Area Metropolitan Planning Organization's (CAMPO) travel demand model to document the strengths and weaknesses of the model with regard to travel forecasting for mixed use and infill development in a transit corridor. In addition, land use estimates were developed for the East Riverside Corridor redevelopment project. A summary of the steps followed to develop 2035 forecasted TMVs is described in detail in the 2035 Traffic Volume Forecast in **Appendix D**.

LAND USE ESTIMATES

In the absence of land use data for the East Riverside Corridor, an analysis to develop estimates of future land uses was performed. The estimates were reviewed and approved by City of Austin staff to be used by the CAMPO travel demand model for 2035 traffic forecast development. The steps involved in developing land use estimates are described below:

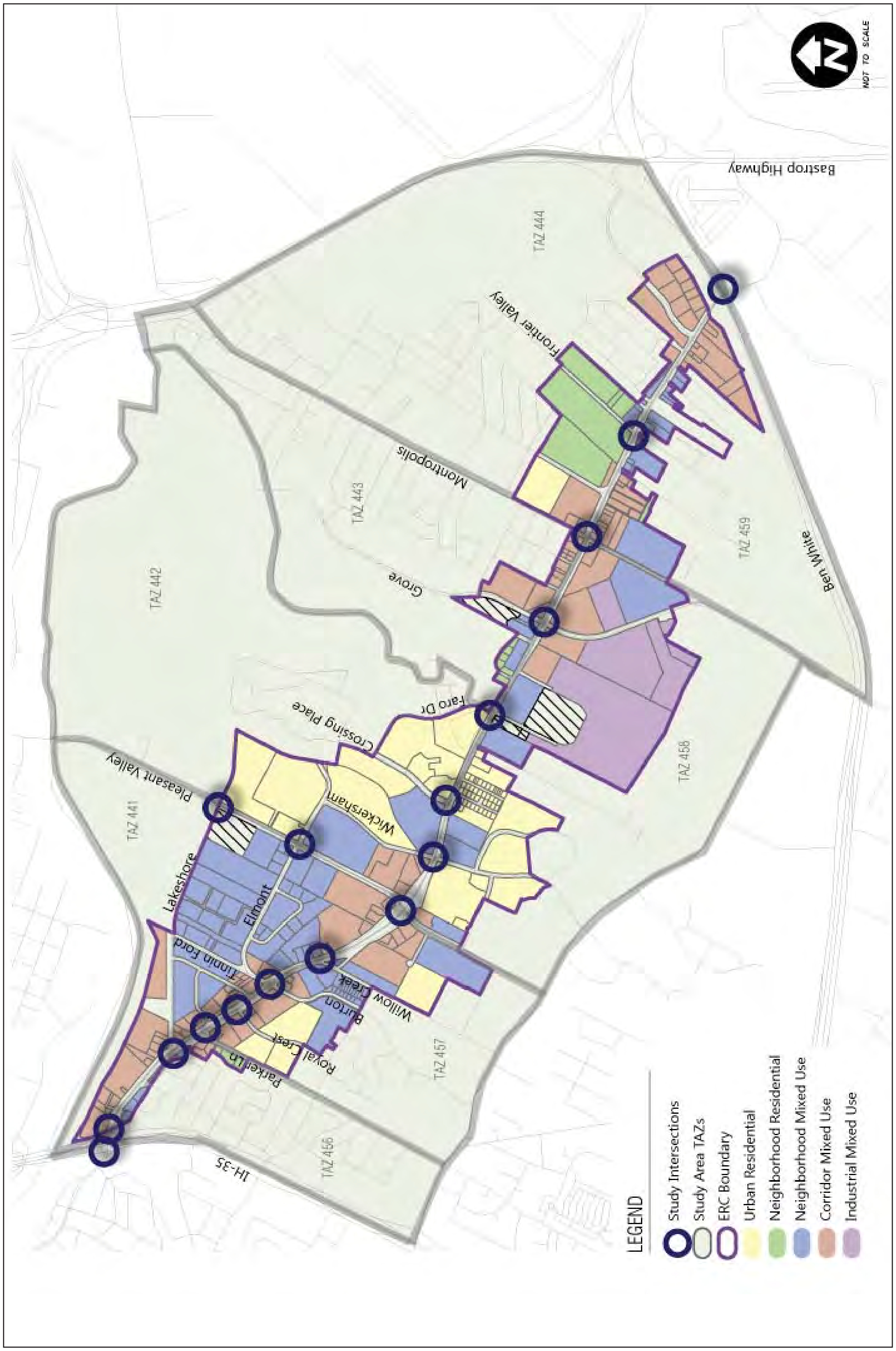
East Riverside Corridor Master Plan Review

To understand the context and vision behind the East Riverside Corridor Development Program, the East Riverside Corridor (ERC) Master Plan was reviewed as the first step in the future year land use estimation process. The ERC lays out a vision for the corridor that will require considerable redevelopment along East Riverside Drive to increase the density and accessibility of destinations. The ERC also envisions a comprehensive transportation infrastructure that facilitates and encourages walk, bicycle and transit trips, both within and outside the study area. In order to achieve this goal, the ERC proposes short walking blocks, mixed use development, bicycle facilities, and a high frequency transit service (high capacity transit or bus rapid transit) with major transit centers. Based on information contained in the ERC, the vision, goals and objectives of the plan comply with the 5Ds (design, density, diversity, destination accessibility, and distance to transit) of sustainable land use and transportation planning. Based on a preliminary review of the Master Plan, once implemented, the East Riverside Corridor is expected to experience shorter trips with a relatively higher proportion of walk, bicycle, and transit trips.

Land Use Assumptions

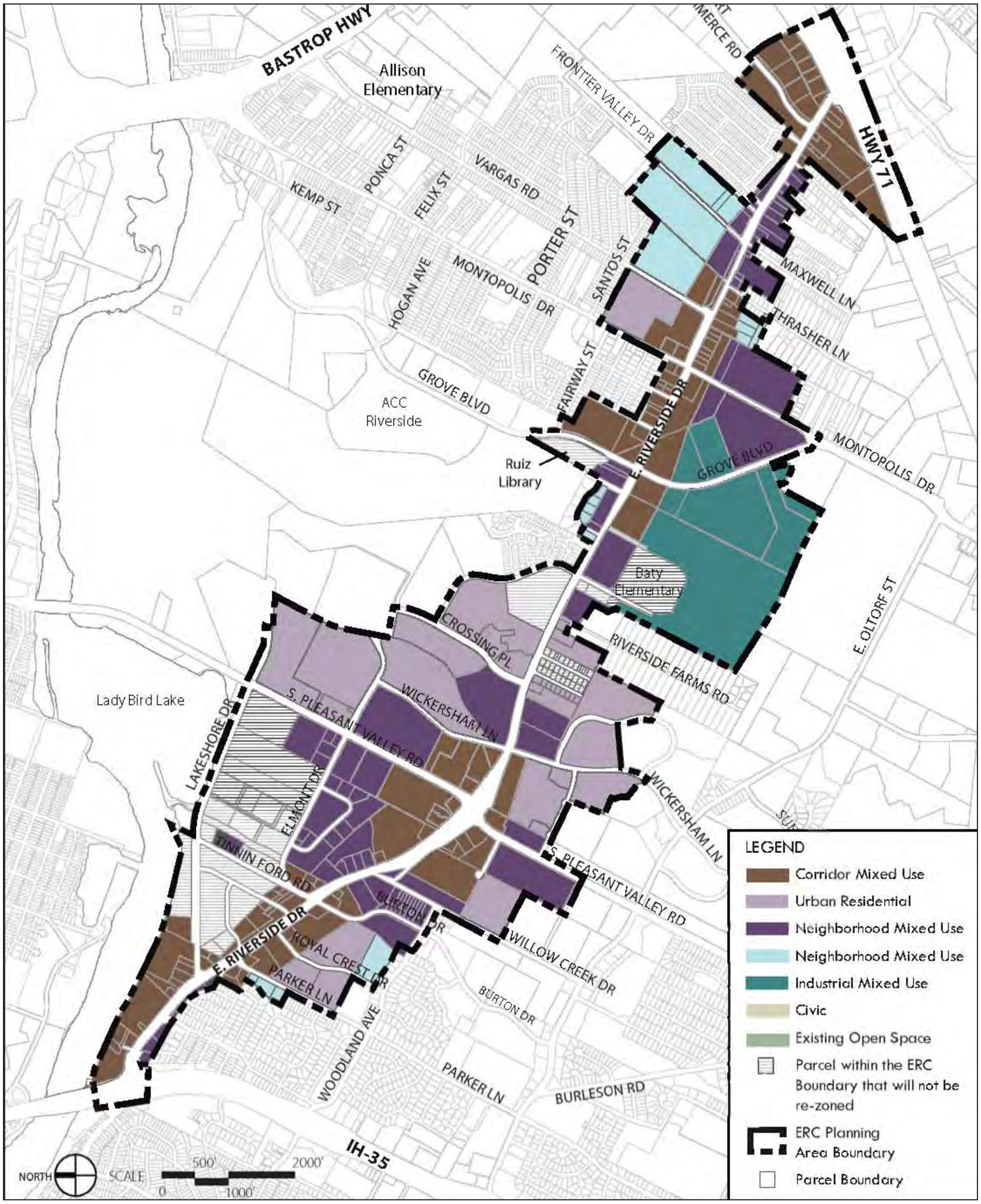
The Subdistrict map provided in the draft regulating plan breaks down the ERC to five (5) land use subdistricts: Corridor Mixed Use (CMU), Industrial Mixed Use (IMU), Neighborhood Mixed Use (NMU), Urban Residential (UR), and Neighborhood Residential (NR). A copy of the subdistrict map is shown in **Figure 4-5**. The East Riverside Corridor Regulating Plan classifies land uses by eight categories, namely, Residential Attached, Residential Detached, Small Scale Retail, General Retail, Office, Warehouse & Light Manufacturing, Education & Religion and Hospitality. The East Riverside Corridor Regulating Plan includes the Subdistrict Development Standard which contains information on permitted land uses and allowable FAR for each subdistrict. A copy of the Subdistrict Development Standard is included in **Appendix D** of the 2035 Traffic Volume Forecast Report.

Figure 4-4: East Riverside Drive Study Intersections and Traffic Analysis Zones



Source: East Riverside Drive Master Plan

Figure 4-5: Riverside Drive Subdistrict Map



Source: East Riverside Corridor Regulating Plan

Conversion Factors

The socio-economic inputs required for the CAMPO's travel demand model include population, households and employment. **Appendix D** of the 2035 Traffic Volume Forecast provides a summary of conversion factors used to estimate population and number of households from dwelling unit and employment from square footages. As shown in **Appendix D**, an occupancy rate of 95 percent was assumed to convert dwelling units to number of households.

Redevelopment of Existing Properties

An important part of estimating land uses was to identify dwelling units and square footages of existing residential and non-residential properties, respectively, that will be redeveloped to take advantage of the higher Floor-to-Area Ratio (FAR) recommended in the ERC Draft Regulating Plan. The identification of such properties was based on visual observations using online tools like Google Maps and Google Streetview. Exhibit 3 of the 2035 Traffic Volume Forecast provides a summary of the total residential (dwelling units) and non-residential (square footage) built up area that will be redeveloped as part of the ERC redevelopment. The socio-economic input parameters for such properties were estimated assuming a household size of 2.65, an overall employment ratio of 2 employees per thousand square feet of development, and a FAR of 0.7.

Land Use Scenarios

The CAMPO travel demand model is broken down into various TAZs and hence all land use estimates were aggregated at the TAZ level. TAZs 441 thru 444 and 456 thru 459 lie within the study area and are of primary importance for this project. Land use estimates were developed for three possible scenarios, optimistic, realistic and pessimistic. The optimistic scenario assumed aggressive redevelopment of existing properties. The realistic scenario assumed moderate to aggressive redevelopment of existing properties. The pessimistic scenario assumed minimal redevelopment of existing properties. It should be noted that full build out on all vacant parcels within the study area TAZ was assumed under all three scenarios to develop these land use estimates. This technical memorandum provides a summary of only the realistic scenario which was reviewed and approved by the City of Austin in December 2011 and was used in forecasting traffic volumes at study area intersections.

The vision, goals, and objectives of the East Riverside Corridor Master Plan comply with the 5Ds (design, density, diversity, destination accessibility, and distance to transit) of sustainable land use and transportation planning and are expected to encourage shorter trips with a relatively higher proportion of walk, bicycle, and transit trips. Planning the ERC redevelopment around the 5Ds is expected to result in approximately 17% to 30% reduction in daily trips associated with the study area TAZs. The adjusted and balanced 2035 AM and PM peak volumes for the "No-Build" (without redevelopment of the East Riverside Corridor) and "Build" (with redevelopment of the East Riverside Corridor) conditions are provided in **Figures 4-6** and **4-7**.

2035 FORECASTED VOLUMES

The 2035 alternatives demonstrate the future conditions and operations associated with increased traffic volumes and the improvements along East Riverside Drive in the future. The 2035 alternatives analyzed for this report are compared in this section. The previously planned and other short-term recommended improvements based on the existing models were incorporated in the 2035 alternatives. Each 2035 alternative is described in the following sections in detail.

Match to Figure 4-6 Part 2 of 2

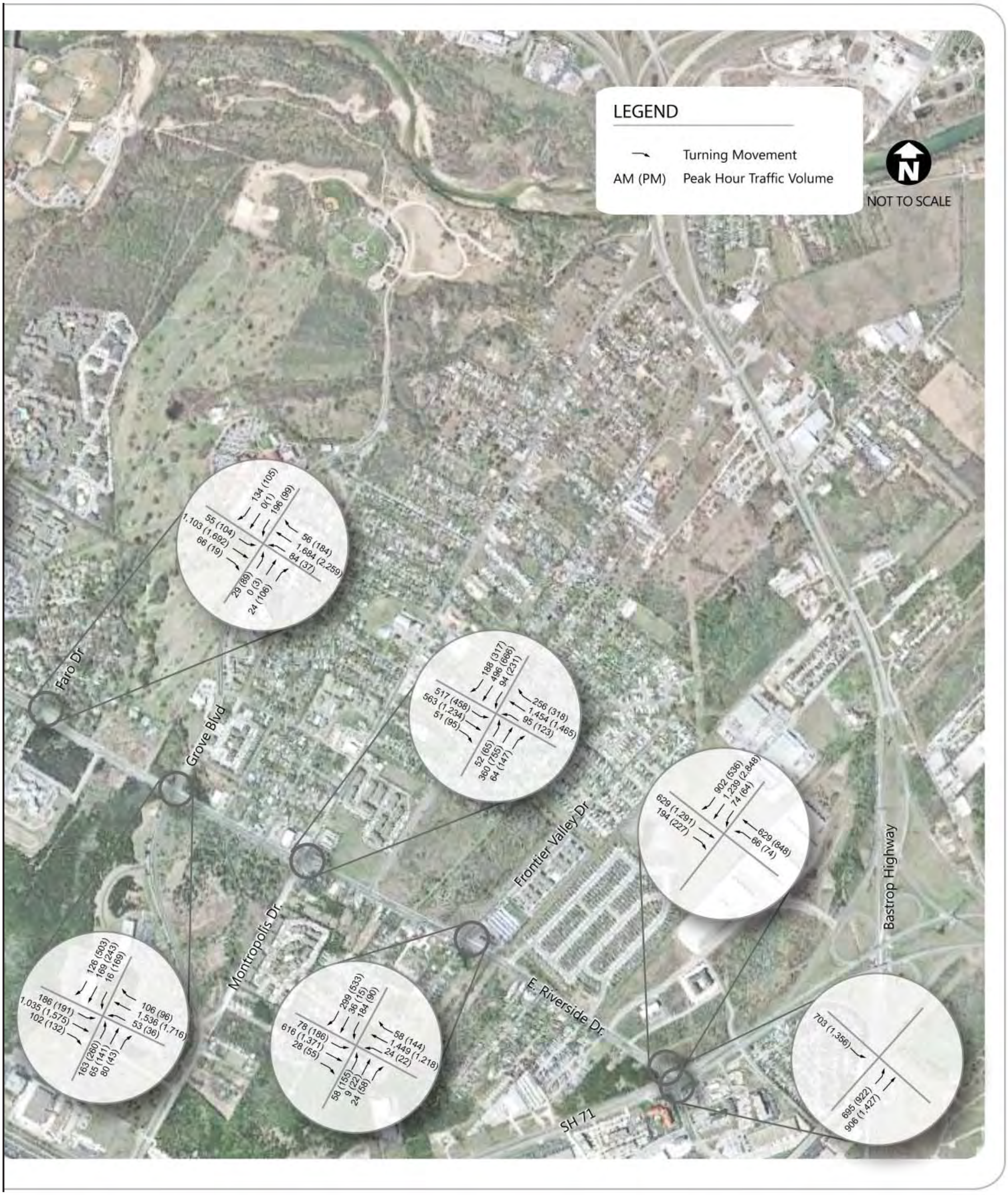
Figure 4-6: 2035 No-Build Traffic Volumes (Part 1 of 2)

Match to Figure 4-6 Part 1 of 2

Figure 4-6: 2035 No-Build Traffic Volumes (Part 2 of 2)

Match to Figure 4-7 Part 2 of 2

Figure 4-7: 2035 Build Traffic Volumes (Part 1 of 2)



Match to Figure 4-7 Part 1 of 2

Figure 4-7: 2035 Build Traffic Volumes (Part 2 of 2)

2035 ALTERNATIVES

Several alternatives were analyzed for the year 2035. After initial analyses, the following 2035 alternatives were identified for further evaluation.

- 2035 No Build scenario with 6-lanes on East Riverside Drive
- 2035 High Capacity Transit scenario with 4-lanes on East Riverside Drive

METHODOLOGY

Analysis of year 2035 traffic conditions required development of travel demand estimates. In order to develop 2035 travel demand estimates for the study area, travel demand models and historical traffic growth patterns were used as a base. The 2035 traffic forecasts were included in the modeling of the 2035 alternatives evaluation. Reasonable assumptions were developed regarding trip reductions due to high capacity transit, pedestrian, bicycle, and transportation demand management (TDM) which were applied to the 2035 High Capacity Transit Scenario. A more detailed description of the methodology used to the 2035 traffic forecasts can be found in **Appendix C**. A summary of the 2035 peak hour traffic volumes along the East Riverside Corridor are shown in **Figure 4-8**.

VISSIM 5.1 was utilized to model traffic operations for the future year scenarios. Using the calibrated existing conditions VISSIM models as a base, 2035 No-Build and Build models were developed for both the No Build and High Capacity Transit scenarios. The MOEs from each scenario were compared to each other and the existing conditions analysis results. The scenarios and results are described in further detail in the following sections.

2035 NO-BUILD SCENARIO

The 2035 No-Build scenario was analyzed with the existing roadway geometry along East Riverside Drive, which carries six lanes, along with short-term improvements identified in **Chapter 6**. Adjustments to signal operations were applied to all signalized intersections using SYNCHRO modeling software to accommodate the increased traffic volumes. The 2035 No-Build results are compared with the 2035 High Capacity Transit scenario results in **Tables 4-1, 4-2, 4-3** and **4-4** .

2035 HIGH CAPACITY TRANSIT SCENARIO

In the 2035 High Capacity Transit scenario, East Riverside Drive is assumed to have four lanes for vehicular traffic (two lanes in each direction) with high capacity transit in the median. Left turn pockets are proposed at all signalized intersections. The dedicated lanes for high capacity transit would reduce the conflict points and travel time as well as increase speed and ridership. Cycle tracks/ bike lanes are assumed on each side of East Riverside Drive and the sidewalks are assumed to be widened. Parking would be provided along sections where right-of-way is available. **Figure 4-9** shows a typical cross-section for the Center Running High Capacity Transit scenario. Short-term improvements to the corridor such as access management measures, bicycle lanes along cross streets, and intersection and pedestrian improvements will be included in this scenario. These improvements can be viewed in **Table 6-1** in **Chapter 6**.

DEDICATED LANES FOR HIGH CAPACITY TRANSIT WOULD REDUCE CONFLICT POINTS AND TRAVEL TIME. CYCLE TRACKS WERE ASSUMED ON BOTH SIDES OF RIVERSIDE DRIVE. WIDENED SIDEWALKS AND PARKING WILL BE PROVIDED ALONG SECTIONS WHERE RIGHT-OF-WAY IS AVAILABLE.

Figure 4-8: 2035 Peak Hour Traffic Volumes

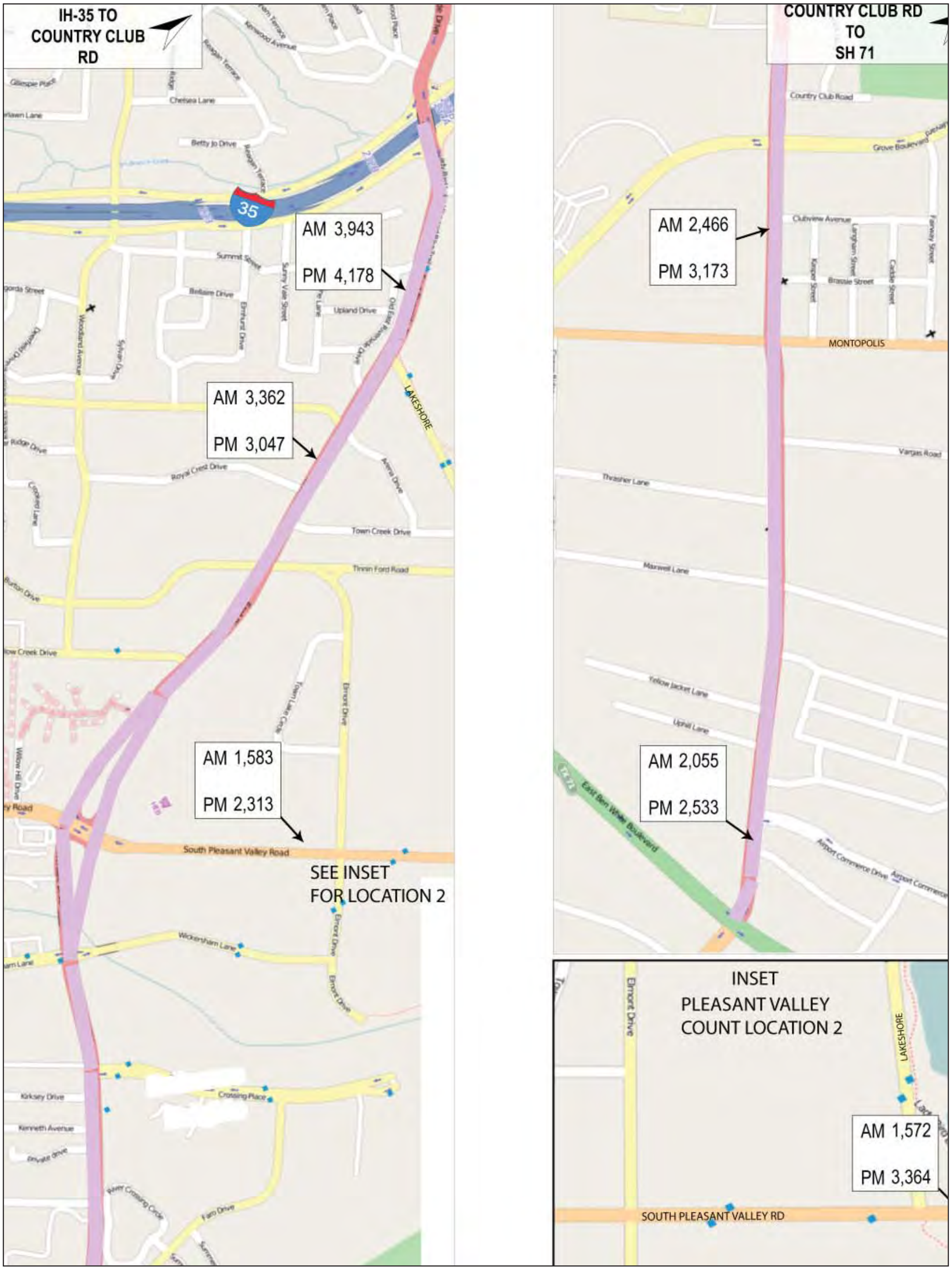
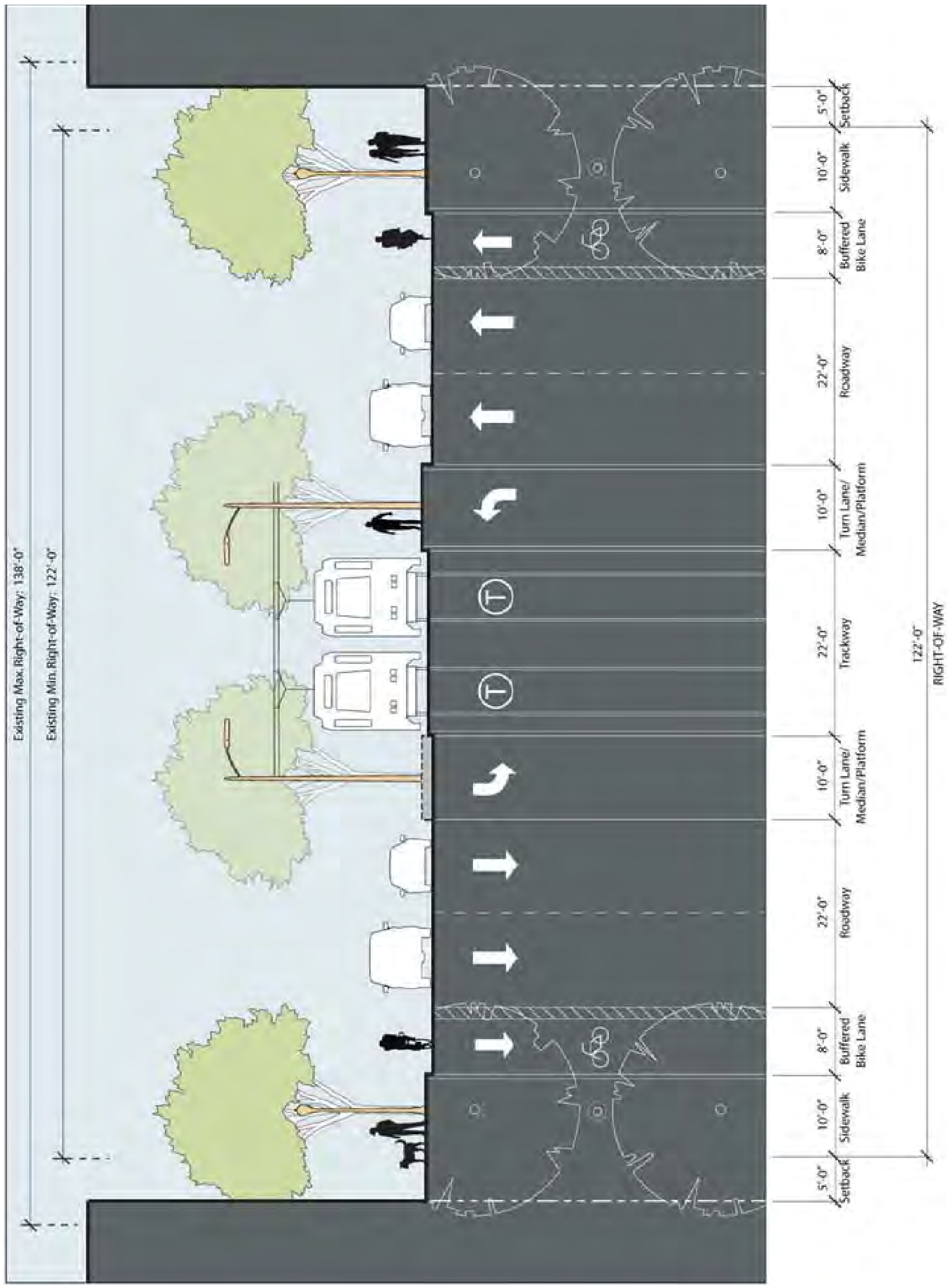


Figure 4-9: Typical Cross-Section for 2035 High Capacity Transit



2035 HIGH CAPACITY TRANSIT ASSUMPTIONS

In conjunction with the City of Austin, assumptions were developed relating to the characteristics of the high capacity transit vehicle and operations. Other characteristics that were assumed as part of the high capacity transit are level boarding platforms located in the median and the high capacity transit would yield to the posted speed limits and traffic signals of East Riverside Drive.

High capacity transit operations consist of a limited stop service in this corridor with the high capacity transit operating at 10 minute headways during the 2035 peak hours. The high capacity transit will have designated station locations between the IH 35 and SH 71 along East Riverside Drive. The following station locations were assumed as part of this study:

- East Riverside Drive and Parker Lane/Arena Drive
- East Riverside Drive and Pleasant Valley Road
- East Riverside Drive, between Grove Boulevard and Montopolis Drive
- East Riverside Drive and Discovery Lane

When high capacity transit was operational along the corridor, adjustments were made to local bus service dwelling time at selected hubs. The recommended improvements to the 2035 High Capacity Transit are listed in **Chapter 6**, which were also included in the analysis.

Table 4-1: Signalized Intersections Levels of Service – Year 2035

Intersections	2035 No Build		2035 with High Capacity Transit	
	AM Peak	PM Peak	AM Peak	PM Peak
East Riverside Dr. and IH 35 SB Frontage	**E**	**E**	D	**E**
East Riverside Dr. and IH 35 NB Frontage	**E**	D	C	C
East Riverside Dr. and Lakeshore Boulevard*	**E**	B	D	C
East Riverside Dr. and Arena/Parker Lane	**E**	B	C	B
East Riverside Dr. and Royal Crest Drive*	D	A	B	B
East Riverside Dr. and Burton/Tinnin Ford Rd.*	D	C	C	D
East Riverside Dr. and Willow Creek Dr. Dr.	D	D	C	D
East Riverside Dr. WB and Pleasant Valley Rd.	D	D	C	D
East Riverside Dr. EB and Pleasant Valley Rd.*	C	C	B	D
East Riverside Dr. and Wickersham Lane	D	D	C	D
East Riverside Dr. and Crossing Place	D	C	C	C
East Riverside Dr. and Faro Dr.*	C	B	B	C
East Riverside Dr. and Grove Boulevard	C	D	C	D
East Riverside Dr. and Montopolis Drive	**E**	**F**	D	D
East Riverside Dr. and Maxwell/Frontier Valley	**E**	**E**	C	D
East Riverside Dr. and SH 71 WB Frontage	D	D	D	D
East Riverside Dr. and SH 71 EB Frontage	D	**E**	D	D
Pleasant Valley Rd. and Elmont Dr.	C	B	A	B
Pleasant Valley Rd. and Lakeshore Boulevard*	C	D	B	**E**

*Asterisked intersections see an increase in delay during the PM peak with High Capacity Transit.

TRANSIT SIGNAL PRIORITY ASSUMPTIONS

Transit Signal Priority (TSP) is commonly used throughout the United States as a cost-effective method to enhance mobility of transit vehicles by improving travel time and reliability. TSP provides priority to the transit vehicle at signalized intersections by giving the vehicle additional green time or less red time to eliminate or lessen the delay experienced at signalized intersections. It should be noted that this priority is different than pre-emption, which always provides green time for the vehicle and is typically used for emergency vehicles. With pre-emption, there is a recovery period for the intersection. With TSP, the intersection always stays in coordination with the system. TSP also works within set parameters that are typically determined by the transit operator and the traffic signal operators, to balance the impact to vehicles also traveling on the roadway. The TSP parameters assumed in the evaluation of the 2035 High Capacity Transit alternatives are included in **Appendix C**. TSP was not assumed at the intersection of East Riverside Drive and Montopolis Drive because of the heavy congestion under the 2035 conditions, which is increased with the introduction of TSP at this location.

Figures 4-10 and **4-11** show graphically the number of intersections operating at each LOS (A – F) during the AM and PM peak hours, respectively. The majority of the intersections operate at an acceptable LOS D or better in the 2035 High Capacity Transit scenario during the AM peak hour. In the PM peak hour, there are two intersections operating at LOS E. Overall, the 2035 High Capacity Transit scenario has better intersection LOS results than the 2035 No-Build scenario.

Figure 4-10: Intersection LOS – 2035 AM Peak

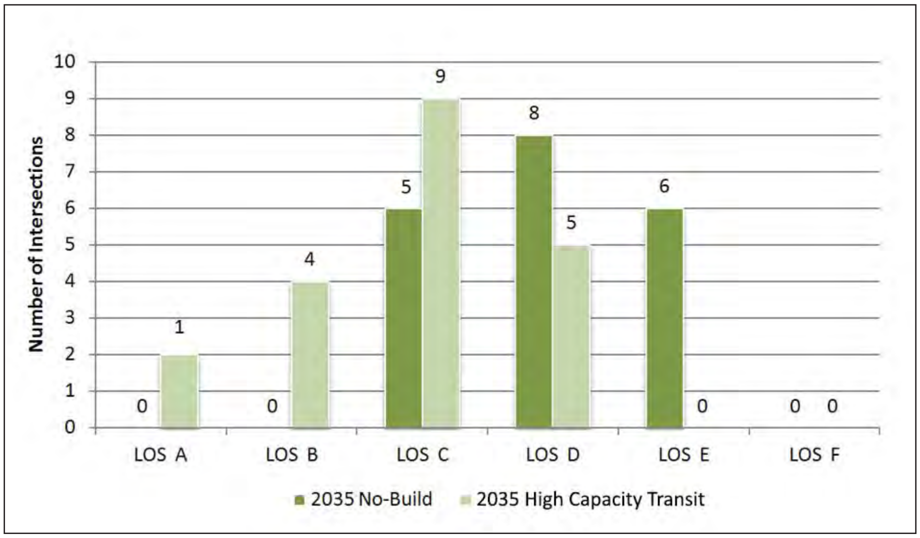
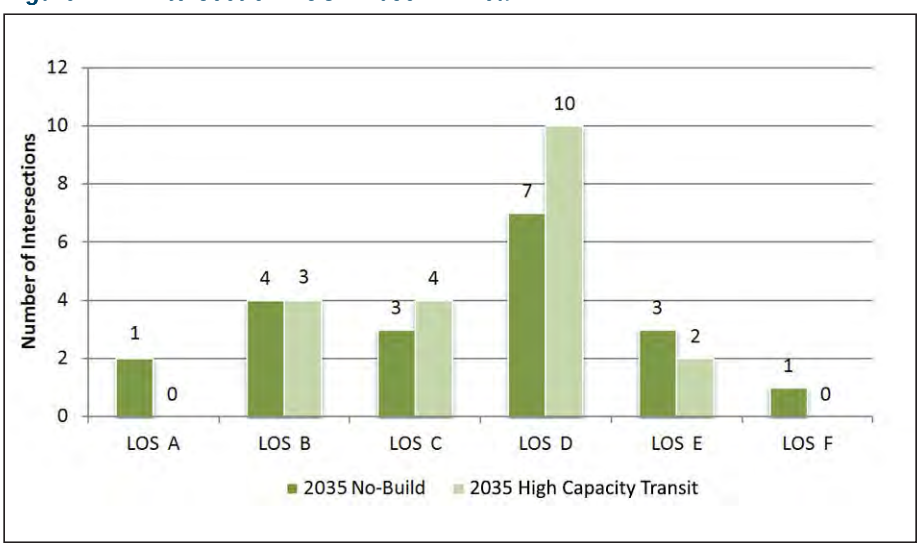


Figure 4-11: Intersection LOS – 2035 PM Peak



Tables 4-2 and **4-3** list the signalized intersections with the greatest delay in the 2035 AM and PM peak periods, respectively. The intersection of East Riverside Drive and IH 35 experiences the highest delay in all scenarios. The intersection of East Riverside Drive and Montopolis Drive is also among the intersections with the highest delay in both the AM and PM peaks in both scenarios.

Figure 4-12 shows the average travel time for auto traffic along East Riverside Drive under the 2035 No-Build conditions, and the 2035 High Capacity Transit scenario.

As shown in **Figure 4-12**, the 2035 High Capacity Transit scenario generally has lower average travel time in both the AM and PM peak hours than the 2035 No-Build scenario. A few key factors contribute to the travel time reduction – volumes reductions due to modal shift, TDM, etc., through traffic along Riverside Drive benefitting from TSP which provides more green time to Riverside Drive, and the reconfiguration of the Pleasant Valley Drive intersection. The only exception is the eastbound direction in the PM peak hour, which shows a slightly higher travel time (1.6 min) in the 2035 High Capacity Transit scenario. This higher travel time may be because all the left turn signals

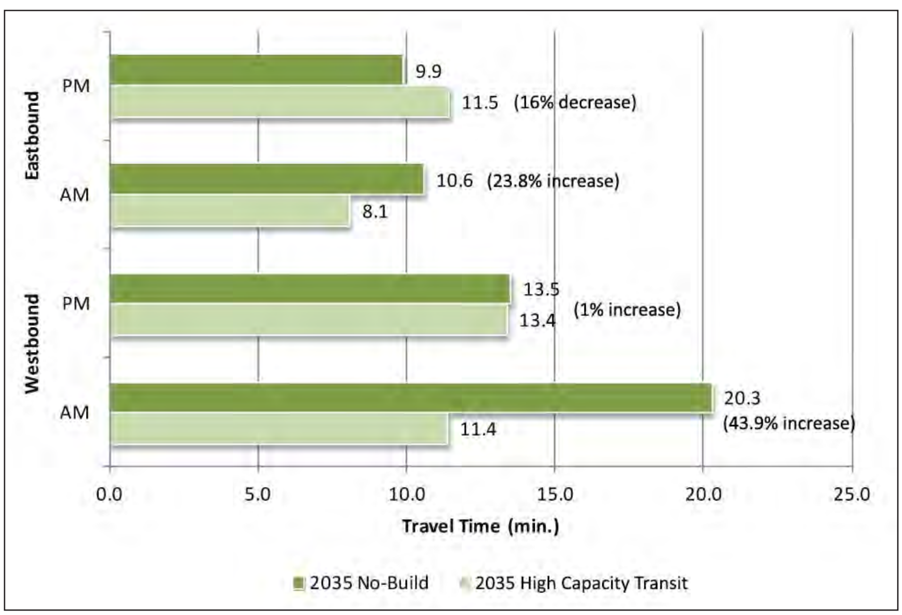
Table 4-2: Signalized Intersections With Highest Delay – 2035 AM Peak

Intersections	2035 No-Build	2035 High Capcity Transit
East Riverside Drive and IH 35	√	√
East Riverside Drive and Lakeshore Boulevard	√	√
East Riverside Drive and Pleasant Valley Road	√	
East Riverside Drive and Montopolis Drive	√	√

Table 4-3: Signalized Intersections With Highest Delay – 2035 PM Peak

Intersections	2035 No-Build	2035 High Capcity Transit
East Riverside Drive and IH 35	√	√
East Riverside Drive and Willow Creek Drive	√	√
East Riverside Drive and Wickersham Lane	√	
East Riverside Drive and Montopolis Drive	√	√

Figure 4-12: Auto Average Travel Time Along East Riverside Drive



along the East Riverside Drive were changed to protected-only to avoid conflicts between the high capacity transit and left-turning vehicles in the 2035 High Capacity Transit scenario. This may cause some of the left-turn queues to occasionally spill out of the bay and block the through vehicles on East Riverside Drive and increase the through movement travel time in some cases. To minimize the impact of the left-turn queues on the through traffic, additional recommendations were assumed such as left turn bay extension and the addition of dual left turn lanes where feasible.

Finally, area-wide statistics are critical to the evaluation of the overall efficiency of the transportation network. Results for network travel time, delay, number of vehicles, and average speed are shown in **Table 4-4**. The PM peak period is the critical peak that has the highest traffic volumes which results in the greatest travel time and delay within the network in both 2035 scenarios. When compared to the area-wide statistics under the 2035 No-Build conditions, total travel time, delay time and average speed improve in the 2035 High Capacity Transit scenario.

Table 4-4: Vissim Network-Wide Average Statistics – 2035

Peak-Hour	Network Vehicles (veh)	Total Travel Time (hr)	Total Delay Time (hr)	Average Speed (mph)
2035 No Build - Weekday				
AM Peak Hour	16,162	2,049	1,524	9.8
PM Peak Hour	19,987	2,216	1,625	10.2
2035 High Capacity Transit Scenario – Weekday				
AM Peak Hour	16,547	1,288	735	17.0
PM Peak Hour	19,519	2,025	1,421	11.8

Example Concept for High Capacity Transit

CHAPTER 5
IMPROVEMENT TOOLS

As discussed in previous chapters, East Riverside Drive experiences heavy congestion as well as safety issues in peak periods. Due to the high volumes and speeds currently present on the corridor, these conditions will only worsen in the future without mitigation. An Improvement Toolbox has been provided below to demonstrate various types of measures that can be implemented to reach the desired roadway conditions for East Riverside Drive.

IMPROVEMENT TOOLBOX

There are a number of potential tools that can be used to create a Complete Street and improve the user experience of the East Riverside Corridor. The following tools are nationally accepted standards that provide ways to achieve multi-modal accessibility, safety, operational efficiency, and policy guidance as it relates to the implementation of a Complete Street. This toolbox does not prescribe which tools must be used for a given situation but provides guidance on what elements are most acceptable for the East Riverside Corridor.

SIDEWALKS

Sidewalks should provide continuous connectivity along the corridor to provide safe access for pedestrians to businesses and bus and rail platforms. Sidewalks should also be wide enough to accommodate pedestrians passing each other and be built to ADA standards. When possible, sidewalks should be built with a buffer from roadway travel lanes. Opportunities to widen sidewalks should be considered whenever roads are reconstructed or new development occurs. **The recommended sidewalk width as stated in the East Riverside Corridor Regulating Plan is 12 to15 feet**.

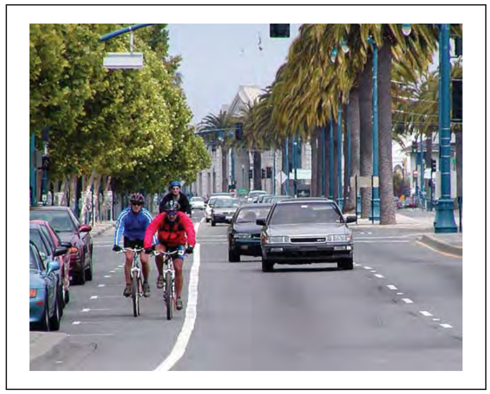
CROSSWALKS

Well-marked crosswalks are essential for a good walking environment and to alert motorists to pedestrian conflict areas, increase motorists yielding to pedestrians, enhance motorists' recognition of intersections, and attract pedestrians to the best crossing places with the most appropriate sight distances. Zebra or ladder style crosswalk markings are more visible to motorists and should be used in areas of high pedestrian activity or crossing of special emphasis such as a bicycle crossing. Additionally, **the distance between pedestrian crossing opportunities along East Riverside Drive should be minimized and preferably placed at a spacing of approximately 500 to 700 feet in order to reduce the number of mid-block pedestrian crossings**.

PEDESTRIAN HYBRID BEACONS (PHB)

A pedestrian beacon is a traffic signal used to stop roadway traffic and allow pedestrians to cross safely. Applied to the East Riverside Corridor, the PHB will allow a protected pedestrian crossing, stopping traffic along the corridor as needed and mitigate crossing issues due to intersection spacing **A PHB should be placed in areas where there is or expected to be a high volume of pedestrian crossings such as nearby transit stops, neighborhoods and major retail establishments**. PHB's should only be installed at locations where the criteria contained in the Texas MUTCD are satisfied.

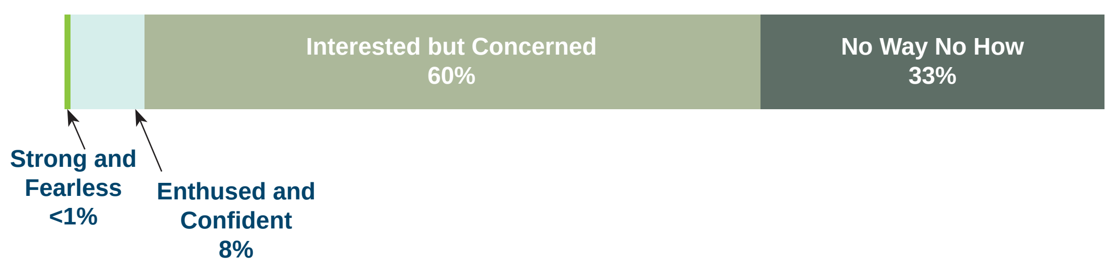
BICYCLE FACILITIES



There is limited modern national contextual guidance for the selection of bicycle facilities based on roadway characteristics that includes a state of the practice toolbox of bicycle lanes, buffered bicycle lanes, cycle tracks and off-street trails. One of the best guiding documents is a survey from the City of Portland that divides the population into groups based on how concerned about safety they are and what facilities they need to feel safe on the road. This survey quantifies the impact of facility selection on the portion of the population that will respond to it. Within this framework, on a street like East Riverside only 1% are "Strong and Fearless" without bicycle facilities. **With bicycle lanes along East Riverside Drive, approximately 8% of the population – the "Enthused and Confident" – could be captured. Unless bicycle facilities with physical separation are provided, East Riverside Drive will be missing an opportunity to attract the largest portion of the population (60%) who are "Interested but Concerned".**

Bicycle access along East Riverside Drive and its cross streets can be achieved through the implementation of bike lanes, signed shared roadways ("sharrow"), and/or a cycle track. The design and pavement markings for these types of facilities should follow the AASHTO Guide for the Planning, Design, and Operations of Bicycle Facilities as well as the Texas Manual on Uniform Traffic Control Devices (TMUTCD) and the NACTO Guidelines adopted by the City.

Four Types of Transportation Cyclists in Portland
By Proportion of Population



Signed Shared Roadway ("Sharrow")

A signed shared roadway also commonly known as a "sharrow" lane is a roadway that has been identified by signing as a preferred bike route. Wide curb lanes for bicycle use are usually preferred where there is not enough space to accommodate a bicycle lane, such as in restricted urban areas. It is recommended that a "sharrow" lane be implemented on roadways where the outside lane is wider than 12 feet.

Bicycle Lanes*

A Bike Lane is defined as a portion of the roadway that has been designated by striping, signage, and pavement markings for the preferential or exclusive use of bicyclists. Bike lanes enable bicyclists to ride at their preferred speed without interference from prevailing traffic conditions and facilitate predictable behavior and movements between bicyclists and motorists. A bike lane is distinguished from a cycle track in that it has no physical barrier (bollards, medians, raised curbs, etc.) that restricts the encroachment of motorized traffic. Conventional bike lanes run curbside when no parking is present, adjacent to parked cars on the right-hand side of the street or on the left-hand side of the street in specific situations. Bike lanes typically run in the same direction of traffic.

Cycle Tracks*

A cycle track is an exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane. A cycle track is physically separated from motor traffic and distinct from the sidewalk. Cycle tracks have different forms but all share common elements—they provide space that is intended to be exclusively or primarily used for bicycles, and are separated from motor vehicle travel lanes, parking lanes, and sidewalks. In situations where on-street parking is allowed cycle tracks are located to the curb-side of the parking (in contrast to bike lanes).

Cycle tracks are often separated from motor traffic by raised medians, on-street parking, or bollards. By separating cyclists from motor traffic, cycle tracks can offer a higher level of security than bike lanes and are attractive to a wider spectrum of the public, notably the "Interested but Concerned" who comprise roughly 60% of the population.

**Definitions for Bicycle Lanes and Cycle Tracks taken from the NACTO guide:*
http://nacto.org/cities-for-cycling/design-guide/bike-lanes/

In addition to these tools, considerations such as planning level improvements and policies that support operational efficiency along the corridor can be found in **Appendix F**.

CHAPTER 6
RECOMMENDATIONS

The recommendations discussed below are based on input from the public meetings and stakeholder focus groups, the results of land use and traffic analyses, and several related Transportation Demand Management (TDM) strategies. These recommendations will guide the City of Austin in making East Riverside Drive a multimodal corridor that supports pedestrians, bicycles, vehicles, high capacity transit and other transit vehicles. These recommendations will provide citizens who work and live around the corridor a safe and efficient way to conduct daily activities such as trips to school, work, or to access corridor amenities. In addition, the recommendations below are provided to alter the nature of the physical environment by improving mobility for residents and through traffic while maintaining the character and identity of the residents who live there and attracting people from other areas of Austin.

METHODOLOGY

In order to determine the feasibility of the recommendations, a variety of tools and software applications were used in conjunction with both the East Riverside Corridor Master Plan and Regulating Plan.

The roadway improvements to East Riverside Drive are meant to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders. The recommended improvements are different than traditional roadway improvements because the goal is not necessarily to move vehicles, but to move people. To improve the quality of life of the residents and users of the East Riverside Corridor is the focus of the Complete Streets concept and extends beyond safety, integrating sustainable living elements such as health, aesthetics, economic development, and connectivity. The following sections discuss the recommended short-, medium-, and long-term improvements. It should be noted that short- and long-term were analyzed, where applicable, using the traffic modeling software VISSIM 5.1. Medium-term improvements were developed based on engineering and planning judgment in order to reach the goals for the 2035 scenario

RECOMMENDED SHORT-AND MEDIUM-TERM IMPROVEMENTS

Short-and medium-term improvements are low cost improvements to immediately improve the safety, mobility, and access along the East Riverside Corridor and its surrounding roadway network. These improvements are scheduled to be implemented over a five to ten year period based on the funding timeframe of future City bond programs.

Access and Median Improvements

It is recommended that redundant or extraneous driveways along the corridor be closed or consolidated to improve corridor operations and safety. An access management plan is vital to minimize conflict points along the corridor and provide for the future land use that is consistent with the East Riverside Corridor Master Plan and Regulating Plan. A good access management plan should provide access to adjacent properties through the use of shared driveways and/or the restructuring of access, over time, to minimize vehicular and pedestrian conflict points while still providing adequate access to the adjacent businesses. Access management would also require motorists to utilize the connecting collector road system as outlined in the East Riverside Corridor Regulating Plan

Median modification and closures along the corridor are proposed in order to minimize conflict points with the proposed median-running high capacity transit and maximize safety and operational efficiency. Median modifications would alter the traffic pattern of the corridor by requiring motorists to connect to the East Riverside Corridor at designated signalized intersections, make u-turns at designated intersections or median openings or rely on the surrounding street network as an alternative route to their destination. Because the median closures are closely tied to the introduction of the high capacity transit into the East Riverside Drive median, **the median modifications and closures will not be implemented until the construction of the high capacity transit.** Detailed recommended improvements for short-and medium-term improvements are shown in **Table 6-1** and **Figure 6-1**.

Pedestrians

This plan recommends the addition of sidewalks and sidewalk gap closures along the corridor and surrounding street networks. Sidewalk improvements will reduce conflict points with vehicles and provide safe and continuous access to homes and businesses along the corridor. As stated in the East Riverside Corridor Regulating Plan, sidewalks along the East Riverside Drive (Core Transit Center) **should be built at a minimum of 15 feet while cross streets should be built at a minimum of 12 feet**.

Bicycles

The approach for developing the bicycle recommendations within the East Riverside Corridor was to focus on the short-and medium-term improvements which would focus on the connectivity of adjacent streets within the corridor, then address the remaining bicycle improvements along East Riverside Drive within the long-term recommendations.

The East Riverside Corridor Master Plan calls for the addition of on-street bicycle facilities for several roadways that intersect East Riverside Drive. **Bicycle lanes and shared-use ("sharrow") lane signage and markings are recommended as short-term improvements along several streets within the study area**. The bicycle improvements recommended as part of this study are intended to provide those vital links to adjacent and connecting roadways as well as links to other bicycle facilities in the area. **A bicycle track or buffered lane is recommended as a long-term improvement along East Riverside Drive**. It is not recommended to apply shared-use lanes for East Riverside Drive or other roadways that exceed 35 mph as stated by the Texas Manual on Uniform Traffic Control Devices. Recommended short-, medium-, and long-term bicycle improvements are in compliance with the City of Austin's Bicycle Master Plan and have been approved by the City of Austin.

Table 6-1: Short- and Medium-Term Improvements

Improvement Type	Project	Limits	Description
Access	Driveway Closure / Consolidation	Various locations along East Riverside Dr.	Close or consolidate various driveways to improve corridor operations and safety.
Pedestrian	Sidewalk Addition	Tinnin Ford Rd. from Riverside Dr. to Lakeshore Blvd.	Add 12' sidewalks along NB and SB Tinnin Ford Rd. from East Riverside Dr. to Lakeshore Blvd.
	Sidewalk Addition	Arena Dr. from Riverside Dr. to Town Creek Dr.	Add 12' sidewalks along EB Arena Dr. from East Riverside Dr. to Town Creek Dr.
	Sidewalk Addition	Pleasant Valley Rd. and Riverside Dr.	Add 15' sidewalk connection in front of strip mall at NE corner of Pleasant Valley Rd. and East Riverside Dr.
	Pedestrian Hybrid Beacon Addition	Pleasant Valley Rd. from Riverside Dr. to .10 miles north	Add PHB Signal and Crosswalk north of East Riverside Dr. on Pleasant Valley Rd.
	Sidewalk Addition	Pleasant Valley Rd. and Riverside Dr.	Add 15' sidewalk connection along NB Pleasant Valley Rd. between EB and WB East Riverside Dr.
	Sidewalk Replacement	Pleasant Valley Rd. and Riverside Dr.	Replace 4' sidewalk with 15' sidewalk connection along SB Pleasant Valley Rd. between EB and WB East Riverside Dr.
	Sidewalk Replacement	Intersection of Pleasant Valley Rd. and Riverside Dr.	Replace 4' sidewalk with 15' sidewalk connection along EB East Riverside Dr. just west of Pleasant Valley Rd.
	Sidewalk Addition	Grove Blvd. from Riverside Dr. to .25 miles south	Add 12' sidewalk connection along NB Grove Blvd. from East Riverside Dr. to .25 miles south.
	Sidewalk Addition	Montopolis Dr. from Riverside Dr. and Oltorf St.	Add 12' sidewalk connection along SB Montopolis Dr. between East Riverside Dr. and Oltorf St.
	Sidewalk Replacement	Montopolis Dr. from Riverside Dr. to .25 miles north	Replace 4' sidewalks with 12' sidewalk connection along SB Montopolis Dr. from East Riverside Dr. to .25 miles north.
Bicycle	Bicycle Lanes	Lakeshore Blvd. Dr. from Riverside Dr. to Pleasant Valley Rd.	Add striping, signing and on-street parking.
	Bicycle Lanes	Grove Blvd. from Roy G. Guerrero Park to Montopolis Dr.	Add striping, signing and on-street parking.
	Sharrows	Montopolis Dr. from Oltorf St. to SH 183	Add sharrow markings and signage along Montopolis Dr.
	Bicycle Lanes	Tinnin Ford Rd. from Riverside Dr. to Lakeshore Blvd.	Add striping and signage along Tinnin Ford Rd.
	Bicycle Lanes	Burton Dr. from Riverside Dr. to Oltorf St.	Add striping and signage along Burton Dr.
	Bicycle Lanes	Elmont Dr. from Tinnin Ford Rd. to Country Club Creek Trail	Add striping and signage along Elmont Dr.
	Bicycle Lanes	Arena Dr. from Town Creek Dr. to East Riverside Dr.	Add striping and signage along Arena Dr.
	Bicycle Lanes	Parker Ln. from East Riverside Dr. to Oltorf St.	Add striping and signage along Parker Ln.
	Bicycle Lanes	Town Creek Dr. from Lakeshore Blvd. to Arena Dr.	Add striping and signage along Town Creek Dr.

Table 6-1: Short- and Medium-Term Improvements (cont.)

Improvement Type	Project	Limits	Description
Intersection	Operational	East Riverside Dr. and IH 35	Restripe northbound IH 35 frontage road approach to left, left/through, and through; and Shift existing northbound right-turn lane to the east with 300 ft storage. Acquire ROW, and replace striping, signage, signals, ramps, and pavement.
	Operational	East Riverside Dr. and Lakeshore Blvd.	Add signal on eastbound approach of Riverside Drive; Convert northbound approach to Right-in/Right-out; and Provide pedestrian crosswalk Riverside Drive. Replace striping, signage, signals, ramps, and pavement.
	Operational	East Riverside Dr. and Willow Creek Dr.	Restripe south leg for longer NB left-turn lane; Remove split phasing on Willow Creek in the PM peak; and Implement protected-only left-turn phase on eastbound and westbound approaches of Riverside Drive. Replace signage, signals, ramps, and pavement.
	Operational	East Riverside Dr. and Pleasant Valley Rd.	Convert turnaround lane on Riverside Drive eastbound direction to left-turn lane; Provide side-by-side left-turn lanes on Pleasant Valley Road between eastbound and westbound Riverside Drive; Add raised pedestrian refuge in northwest corner at channelized right-turn, and tighten right-turn radius for safer pedestrian crossing; and Install mid-block pedestrian crossing with HAWK near HEB. Replace striping, signage, signals, ramps, and pavement.
	Operational	East Riverside Dr. at Montopolis Dr.	Add left-turn lane on northbound and southbound approaches of Montopolis Drive, and remove split phasing; and Extend EB left-turn bay on Riverside Drive. Replace striping, signage, signals, ramps, and pavement.
	Operational	East Riverside Dr. at SH 71	Grade separation.
	Operational	East Riverside Dr. at Arena Dr./Parker Ln.	Replace striping, signage, signals, ramps, and pavement.
	Operational	East Riverside Dr. at Tinnin Ford Rd./Burton Dr.	Replace striping, signage, signals, ramps, and pavement.
	Operational	East Riverside Drive at Willow Creek Dr.	
	Operational	East Riverside Dr. at Pleasant Valley Rd.	Replace striping, signage, signals, ramps, and pavement.
	Operational	East Riverside Dr. at Montopolis Dr.	Acquire ROW and replace striping, signage, signals, ramps, and pavement.

Intersections

Enhancements at designated intersections including the northbound IH 35 frontage road are recommended to reduce vehicular delay for through traffic and increase safety for pedestrians crossing the corridor by increasing their visibility. General recommended improvements for intersections include adding turn lanes and replacing striping, signage, signals, ramps, and pavement.

Figure 6-1: Short- and Medium-Term Improvements, 1 of 7

Figure 6-1: Short- and Medium-Term Improvements, 2 of 7

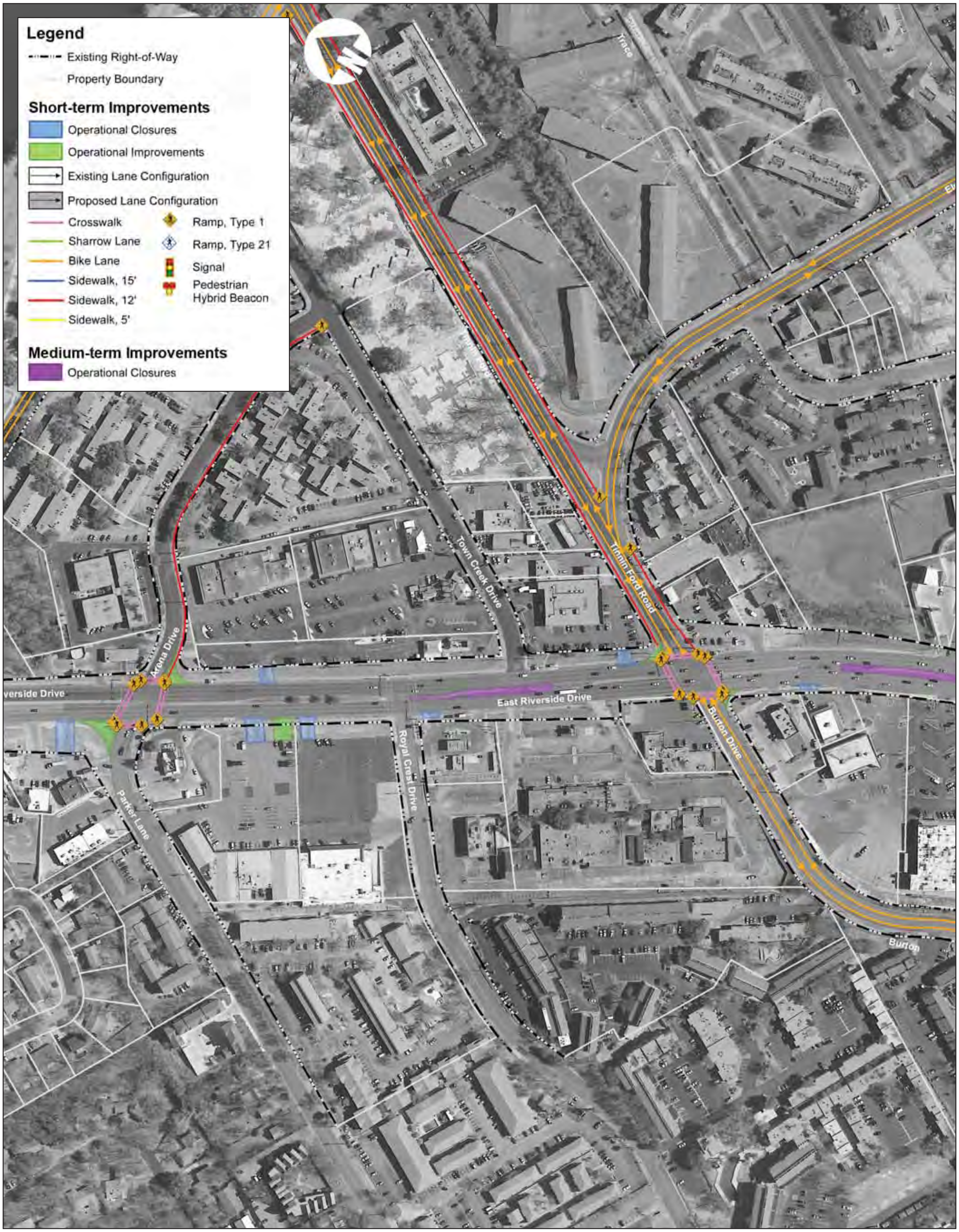


Figure 6-1: Short- and Medium-Term Improvements, 3 of 7

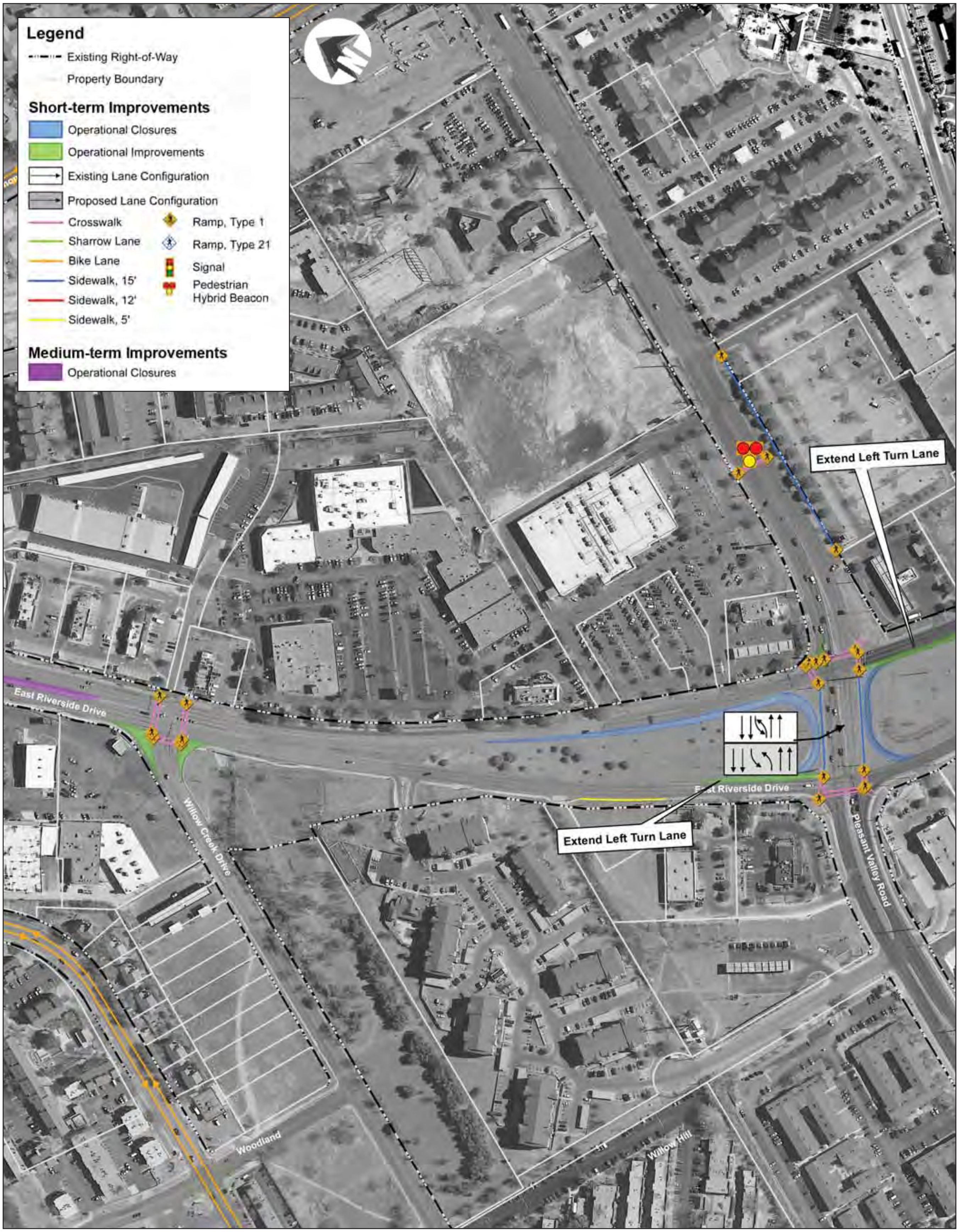


Figure 6-1: Short- and Medium-Term Improvements, 4 of 7

Figure 6-1: Short- and Medium-Term Improvements, 5 of 7

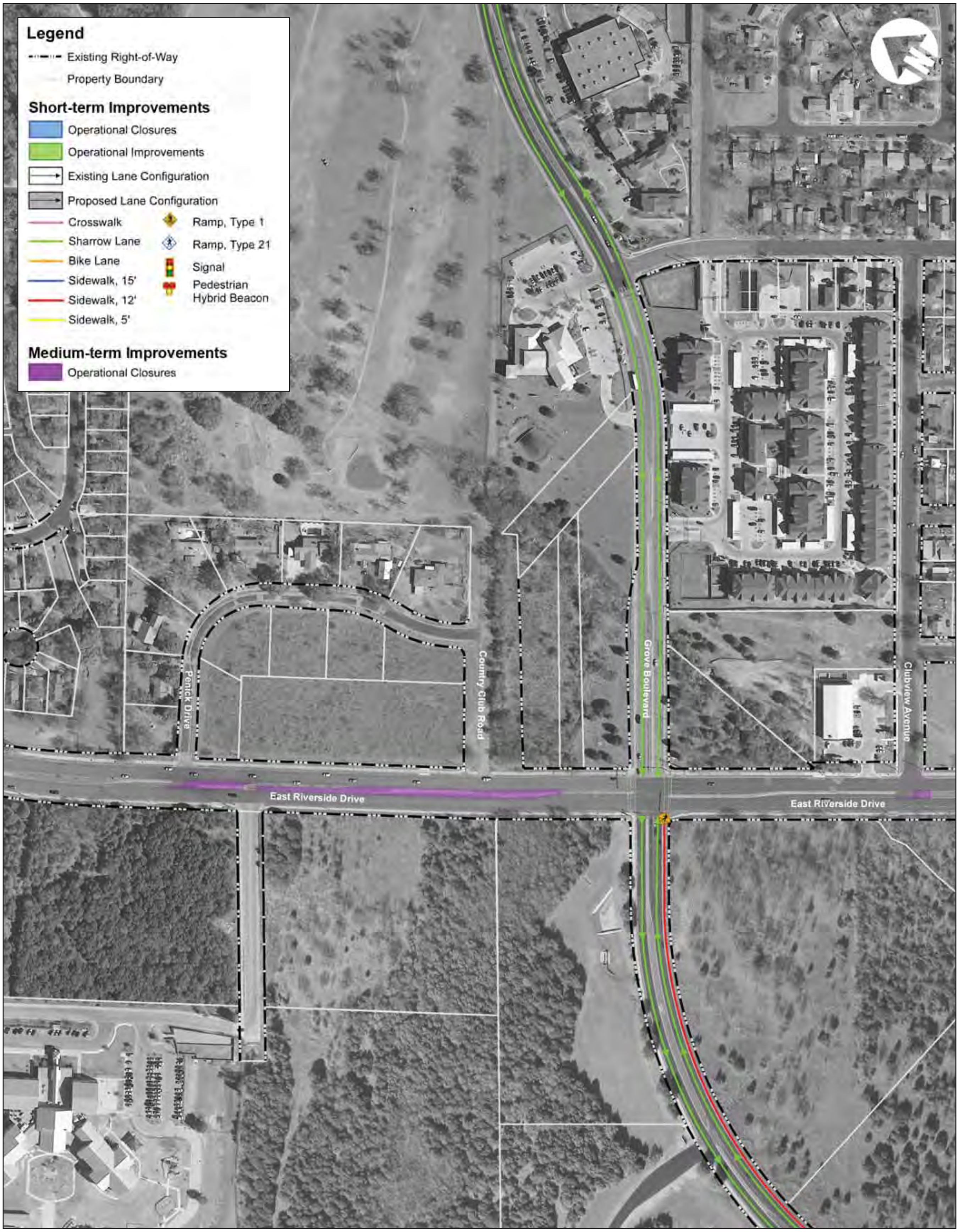


Figure 6-1: Short- and Medium-Term Improvements, 6 of 7

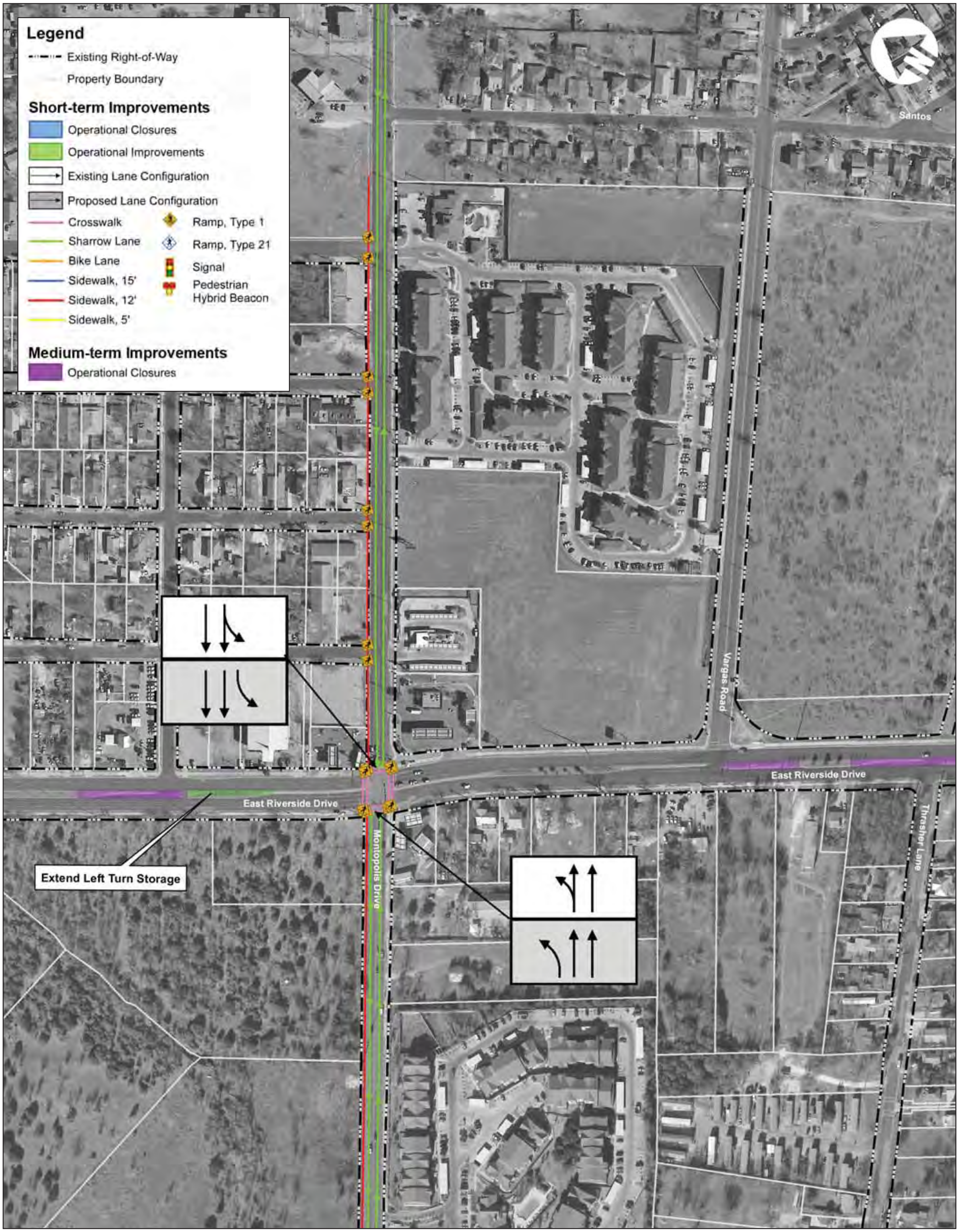


Figure 6-1: Short- and Medium-Term Improvements, 7 of 7

LONG-TERM IMPROVEMENTS

The following long-term recommendations would maximize mobility and improve the user experience and quality of life along the corridor for years to come. These improvements would fulfill the vision for the East Riverside Corridor and result in the Complete Streets solution that creates a new character of the corridor and attracts economic development. The long-term improvements are generally focused on East Riverside Drive itself and are discussed below.

LONG-TERM IMPROVEMENTS

In addition to the short-and medium-term improvements, the following long-term improvements are recommended for East Riverside Drive and are meant to be constructed with the high capacity transit near planning horizon year 2025. Based on the outcome of the travel demand modeling, these improvements assume that the high capacity transit will be included as part of the overall solution. The proposed improvements are highlighted below and **Table 6-2** lists the 2035 East Riverside Drive long-term improvements by intersection.

East Riverside Drive Improvements:

- The travel lanes along Riverside Drive are reduced from **three lanes in each direction to two lanes in each direction from IH 35 to SH 71**. The long-term improvements along Riverside Drive assume that the high capacity transit is running in the median of the proposed roadway. Additionally, the median running rail within the Riverside Corridor is assumed to extend across the IH 35 bridge.
- **Transit Signal Priority (TSP) is implemented at the signalized intersections** along Riverside Drive with the exception of Montopolis Drive.
- **All left-turn signal phases will be converted to protected-only** along Riverside Drive to facilitate high capacity transit operations.
- With the addition of high capacity transit, local bus average dwelling time at the selected bus stops is reduced from 40 to 25 seconds.
- **Construct a buffered 7 to 8-foot cycle track along east and westbound lanes** from the roadway and sidewalk.
- **Sidewalks along the corridor will be extended to meet the desired 15-foot width** as designated by the Riverside Corridor Regulating Plan. In order to achieve the desirable 15-foot design, it is anticipated that 10 feet would fit within the existing right-of-way **while the remaining five feet would be a requirement for future developments**.
- **Pedestrian hybrid beacons** are recommended between IH 35 and South Lakeshore Drive, Crossing Place and Faro Drive, Grove Boulevard and Montopolis Drive, Montopolis Drive and Vargas Road, and Airport Commerce Drive and SH 71 near the proposed priority rail stop. These pedestrian beacons would provide safe crossing across Riverside Drive while minimizing the impact to roadway traffic flow.
- Landscaping will be included along the corridor including street trees along the median and sidewalks.

THESE RECOMMENDATIONS WILL PROVIDE CITIZENS WHO WORK AND LIVE AROUND THE CORRIDOR A SAFE AND EFFICIENT WAY TO CONDUCT DAILY ACTIVITIES SUCH AS TRIPS TO SCHOOL, WORK, OR TO ACCESS CORRIDOR AMENITIES.

Table 6-2: 2035 East Riverside Long-term Improvements

Intersections	Recommended Long-term Improvements
Riverside Dr. and Lakeshore Blvd.	Convert single eastbound left-turn lane to dual left-turn lanes.
Riverside Dr. and Wickersham Lane	Convert single eastbound left-turn lane to dual left-turn lanes.
Riverside Dr. and Crossing Place	Consolidate the local bus stop located west of the East Riverside Drive/Crossing Lane intersection on the westbound direction with the upstream bus stop.
Riverside Dr. and Grove Boulevard	Convert single eastbound left-turn lane to dual left-turn lanes.
Riverside Dr. and Montopolis Drive	Model results indicate that congestion will be excessive in 2035 therefore 10-20 percent traffic volume on SB, NB and the EB left-turn of the Montopolis/Riverside Dr. intersection is relocated to the Grove/Riverside Dr. intersection as drivers will naturally find a quicker route; convert the single eastbound left-turn lane to dual left-turn lanes (**Figure 6-7**).
Riverside Dr./ Maxwell/Frontier Valley	Install signal when warranted.

Example Concept for Future Long-term Improvements

THESE IMPROVEMENTS WOULD FULFILL THE VISION FOR THE EAST RIVERSIDE DRIVE CORRIDOR AND RESULT IN THE COMPLETE STREETS SOLUTION THAT CREATES A NEW CHARACTER FOR THE CORRIDOR AND ATTRACTS ECONOMIC DEVELOPMENT.

Figure 6-2: Recommended Full East Riverside Typical Section

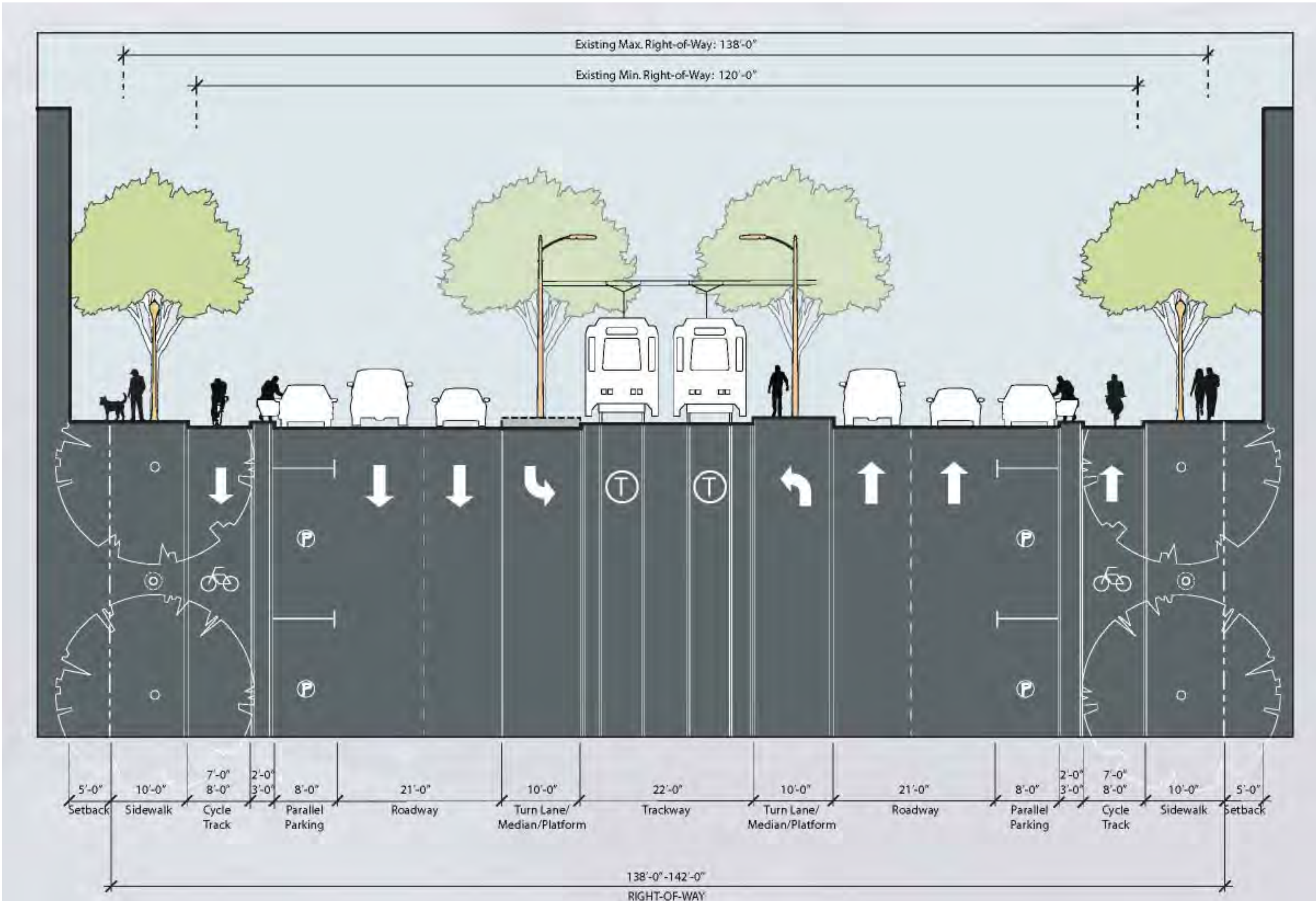


Figure 6-3: Recommended Constrained East Riverside Typical Section

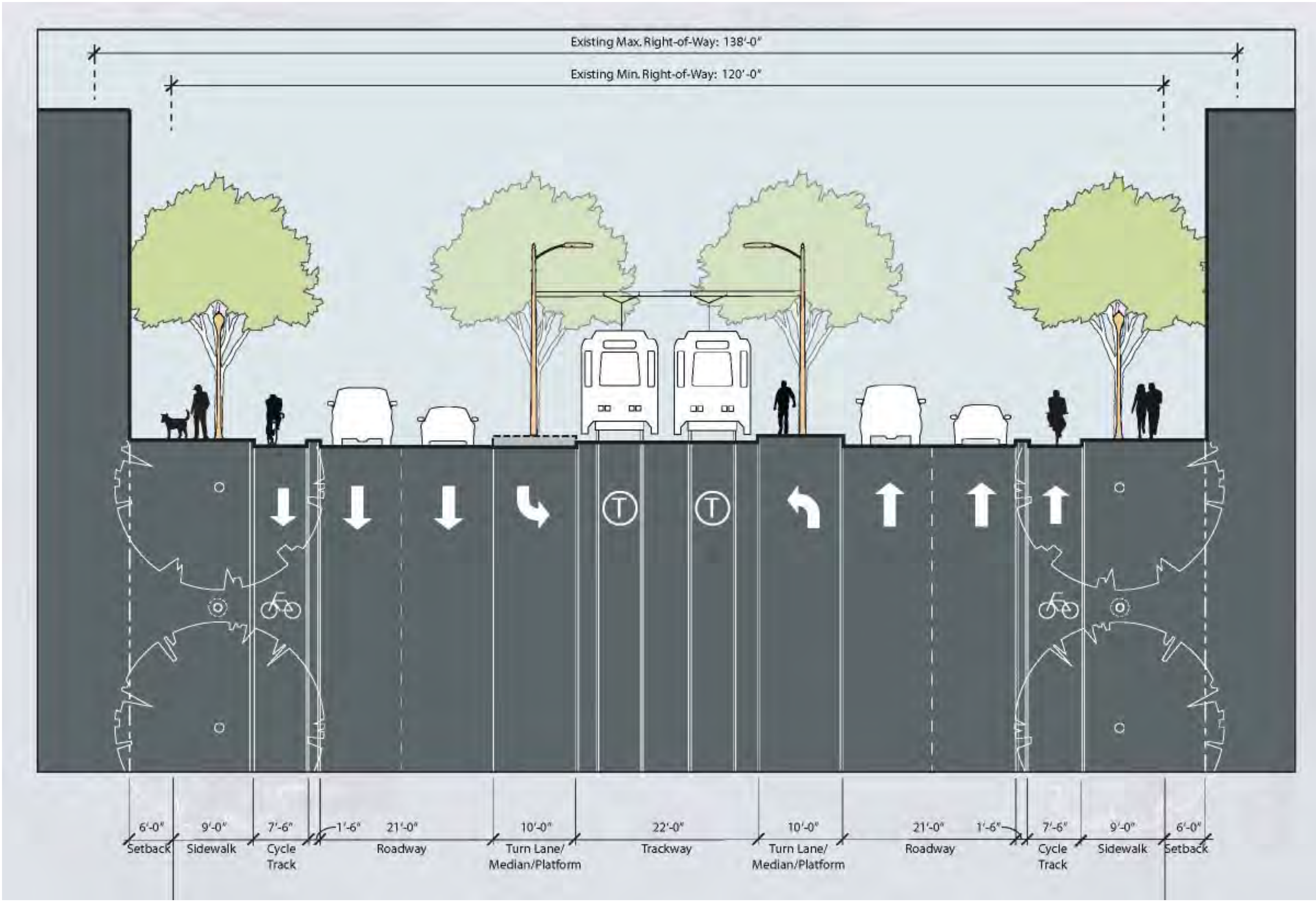
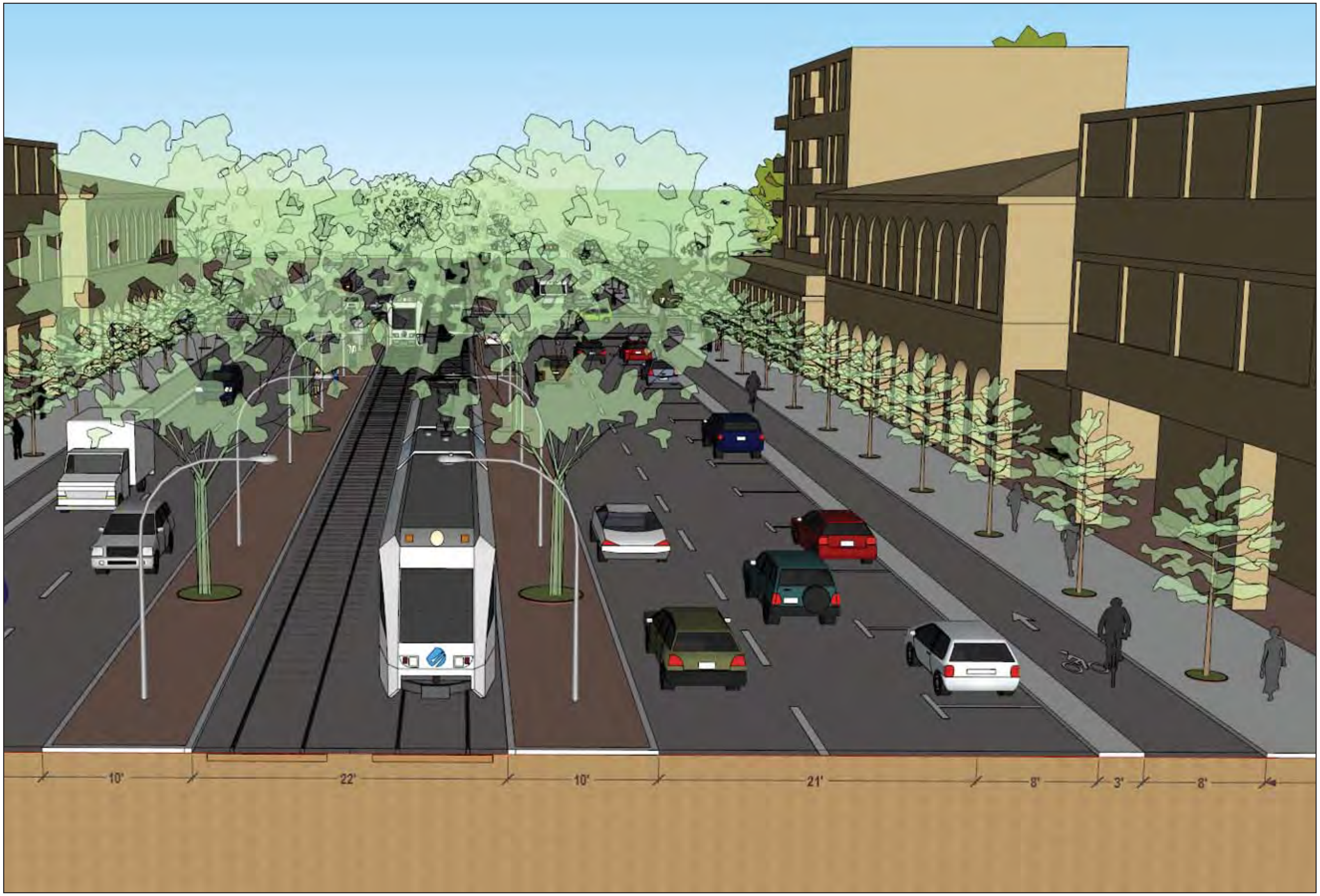


Figure 6-4: Conceptual Cross Section of East Riverside Drive with Redevelopment and High Capacity Transit



The typical sections shown in **Figures 6-2** and **Figure 6-3** display the two recommended roadway concepts along East Riverside Drive from IH 35 to SH 71 (Ben White Boulevard). In order to minimize/eliminate the need for additional right-of-way to develop the long-term improvements, these concepts were developed and can be applied to the appropriate sections of the corridor. **Figure 6-2** illustrates the full typical section along East Riverside Drive that accommodates parallel parking on both sides of the roadway while **Figure 6-3** depicts the constrained typical section that does not accommodate on-street parking.

SEGMENT 1 (IH 35 TO WILLOW CREEK DRIVE)

This roadway segment, shown in **Figure 6-5**, has a four-lane divided roadway with tree-lined medians and sidewalks. Trees provide a method of traffic calming without having to make changes to the roadway and are aesthetically pleasing. Crosswalk improvements have been made at the intersections as they are a part of the short-term improvements discussed above. High capacity transit platforms are located at the Arena Drive/Parker Lane intersection which is consistent with the East Riverside Corridor Master Plan. This segment of East Riverside Drive has sufficient right-of-way to provide on-street parking on one or both sides of the roadway.

Thumbnail of improvements IH 35 to Willow Creek Drive. See Figure 6-5 for full size rendering.

SEGMENT 2 (WILLOW CREEK DRIVE TO WICKERSHAM LANE)

Due to the complexity of traffic movements at this location it was recognized that sizable redesign would be needed to accommodate a new roadway configuration which includes high capacity transit and bicycle tracks, so that the corridor would maintain acceptable travel speeds and limit accidents. Over several meetings and workshops the City and its consultant developed a preliminary alternative for the Pleasant Valley Road intersections that would effectively move vehicles and accomplish the visions and goals established in the East Riverside Corridor Master Plan and Regulating Plan. This proposed plan for the Pleasant Valley Road area results in an intersection that addresses the forecasted increase in traffic, provides a multi-modal hub and creates a community focal point that is consistent with the vision of the East Riverside Corridor.

The design of the space around the Pleasant Valley Road intersection in **Figure 6-6** and **6-8** show the high capacity transit platform integrated with a plaza area and surrounding open space in the median of Riverside Drive. Because the large median will still be preserved, so will the split between the east and westbound lanes. Innovative traffic control and signal timing tools are used to reduce traffic speeds, increase pedestrian safety, and promote circulation within the area, much like the Embarcadero in San Francisco. The tree-filled corridor and median with ample open space will include

Pleasant Valley's geometry could allow for a tree filled, open space, much like San Francisco's Embarcadero Center., shown above.

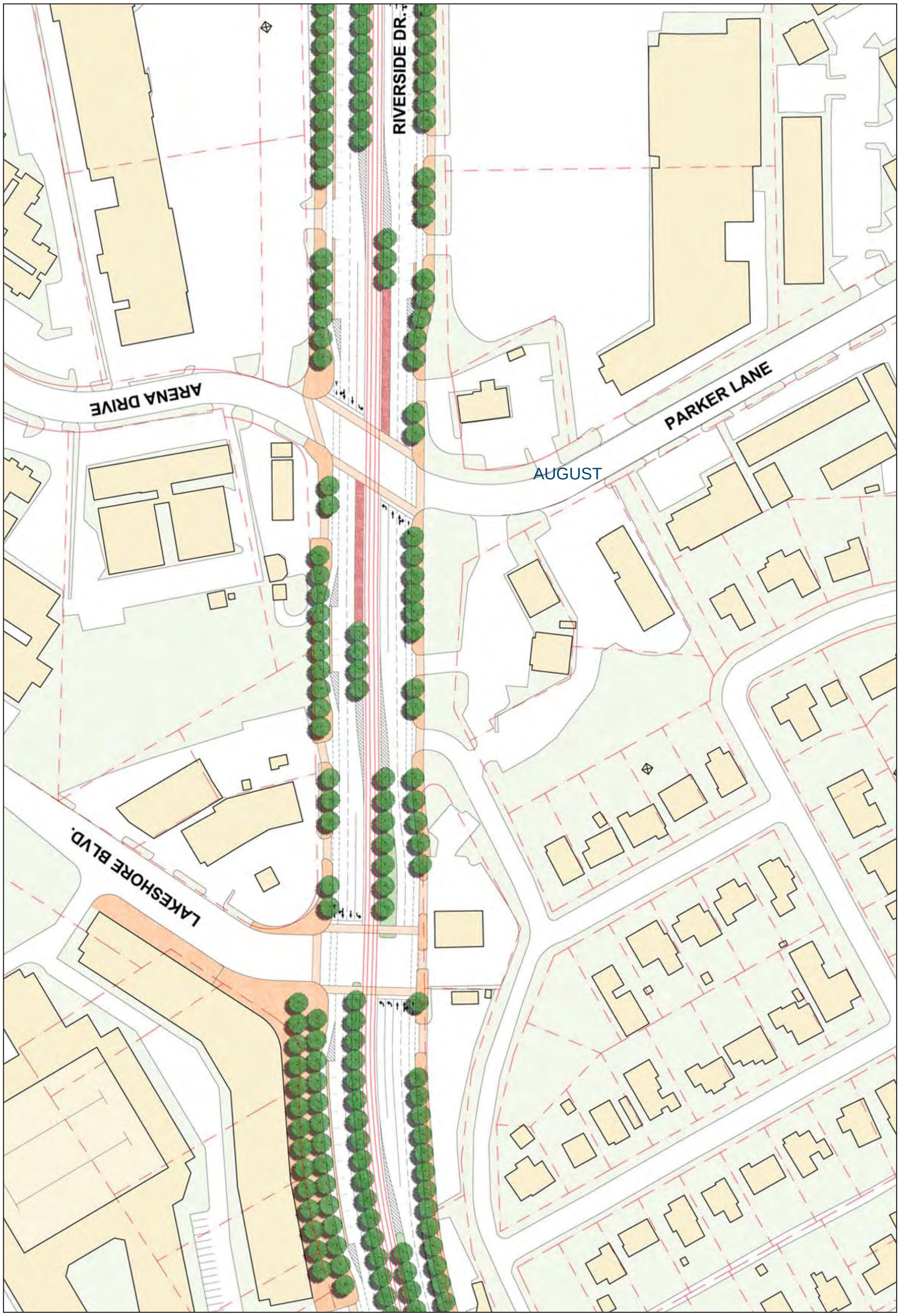


Figure 6-5: Recommended Lakeshore Boulevard

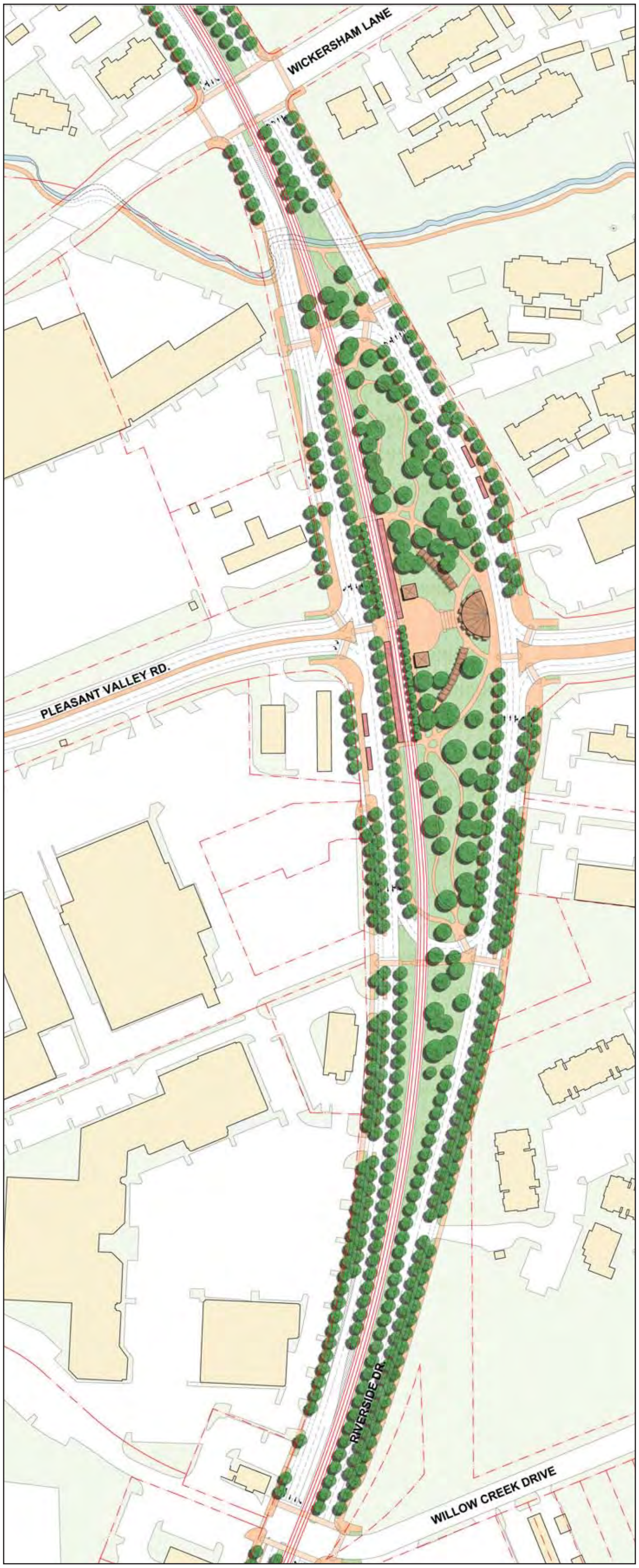


Figure 6-6: Recommended Pleasant Valley Road

Figure 6-7: Recommended Montopolis Drive

multi-use trails to promote social interaction and physical activity, contributing to the corridor's identity. The primary change in this section of the East Riverside Corridor is the modification of the flow along Pleasant Valley Road from the north side of East Riverside Drive to the south. The recommended improvement utilizes innovative median u-turn concepts on the east and west side of the interchange. The median u-turn concept prohibits left-turns from eastbound and westbound Riverside Drive and instead directs the driver to travel through the intersection and use the u-turn to head the opposite direction and make their desired movement on Pleasant Valley Road. This concept will improve operations at the intersection and travel time along the corridor by eliminated the time to serve the existing eastbound and westbound left-turn phases.

It also allows the preservation of the large median to accommodate the innovative use of this area for the Pleasant Valley Road transit stop and civic activity hub. Furthermore, because this segment has an extensive amount right-of-way, on street parking may be utilized as necessary in this segment.

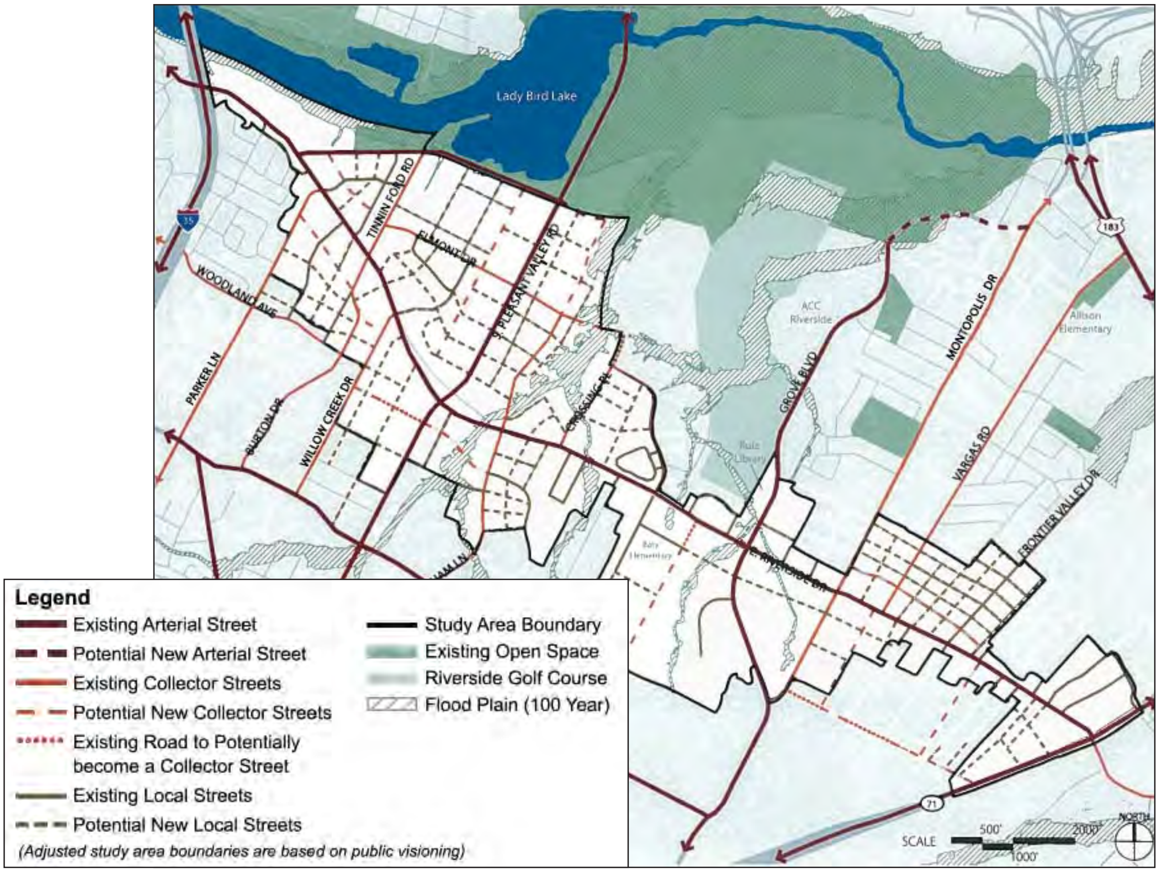
Figure 6-8: Vissim Model of Pleasant Valley Road

SEGMENT 3 (WICKERSHAM LANE TO SH 71)

Similar to the previous two segments, this design contains tree-lined medians and sidewalks (**Figure 6-7**). The area around Montopolis Drive is slightly more suburban than the areas surrounding Lakeshore Boulevard and Pleasant Valley Road and consists of a mix of undeveloped land and residential and commercial uses. The East Riverside Corridor Regulating Plan Sub District Map defines this area as future Corridor Mixed Use. Because this segment is constrained by right-of-way width, the constrained typical section is most applicable. The inclusion of on-street parking in this segment will likely be the responsibility of future developers.

Thumbnail of improvements at Montopolis Drive. See Figure 6-7 for full size rendering.

Figure 6-9: East Riverside Drive Roadway Network Map



Source: East Riverside Corridor Master Plan

STREET NETWORK IMPROVEMENTS

The surrounding street network of East Riverside Drive contributes in moving a relatively high volume of motorized and non-motorized traffic. As stated in the East Riverside Corridor Master Plan, the existing local, arterial, collector roadways should be improved to not only facilitate the efficient movement of automobiles, but to accommodate pedestrians and bicycle users and compliment the proposed land use development. The redevelopment of the East Riverside Corridor meets the roadway networks goals set forth in the East Riverside Corridor Master Plan. A street network map of the East Riverside Corridor Area is shown in **Figure 6-9**.

CONNECTION OF COLLECTORS

Collector streets serve to collect traffic from other streets, functioning as direct routes to arterials or other collector streets. Collector street connections to the surrounding East Riverside street network are important to the corridor's overall success. New collector streets proposed in the East Riverside Corridor Master Plan are designed to accommodate vehicular traffic, bicycles, and pedestrians. Any new potential collector for the area should be built to provide a continuous route connecting neighborhoods and destinations. The Riverside Corridor Master Plan suggests the City should consider developing a Collector Plan requiring the collectors be built as properties redevelop.

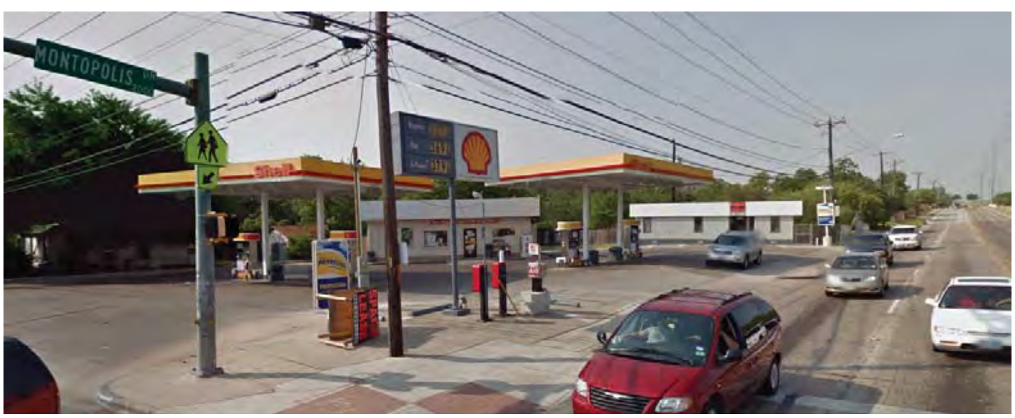
GROVE EXTENSION

In addition to the improvements focused directly on the East Riverside Drive roadway, one additional alternative should be considered in future infrastructure improvements. This improvement consists of the re-alignment of Grove Boulevard and Montopolis Drive as well as the modification of the connection to US 183. Currently, the Montopolis Drive area to the north of Riverside Drive is primarily residential in nature. In contrast, Grove Boulevard connects to the Austin Community College Campus as well as several park amenities and destinations. By re-aligning the connection to US 183 to primarily utilize Grove Boulevard instead of Montopolis Drive, access to these amenities is enhanced and the congested intersection at Montopolis and Riverside Drive is improved. **Figure 6-10** illustrates this potential connection. This re-alignment of Grove Boulevard could result in impacts to current land uses and change access and circulation patterns within the study area. These specific impacts will need to be evaluated in further detail in a subsequent study.

Figure 6-10: Grove Extension Alternative

SUMMARY

The short-, medium-, and long-term improvements are meant to provide safe access for all corridor users by including Complete Streets and TDM concepts. These concepts will effectively maximize the potential of the corridor by implementing elements such as wider sidewalks, cycle tracks, and high capacity transit to fulfill the ultimate vision for the East Riverside Corridor. Improvement costs and implementation strategies for these elements are discussed in the following chapter.



CHAPTER 7
PROJECT IMPLEMENTATION

This chapter describes the costs of the transportation improvements identified in **Chapter 6**.

COST ESTIMATES

The East Riverside Corridor improvement cost estimate was divided into the three character area segments mentioned in **Chapter 3** and **Chapter 6**. Each segment has been subdivided into five categories which capture the nature of improvements for the future project. The improvements have been categorized as drainage, streetscape, rail, roadway, and intersection improvements. Utility information such power, telephone and water and waste water lines, as-builts, signals, were gathered to develop the intersection improvement estimates.

A summary of the overall cost estimates for East Riverside Drive is presented in **Table 7-1**. For a detailed breakdown in quantities, please reference the East Riverside Drive Cost Estimates Report in **Appendix E**.

Table 7-1: East Riverside Drive Preliminary Project Cost Summary

Segment	Limits	Improvement Type			Ultimate Cost*
		Short-Term	Mid-Term	Long-Term	
Segment 1	IH 35 to Willow Creek Dr.	$844,700	$49,800	$106,400,000	$107,300,000
Segment 2	Willow Creek Dr. to Wickersham Ln.	$582,000	$99,600	$39,700,000	$40,400,000
Segment 3	Wickersham Ln. to SH 71	$727,200	$99,600	$212,300,000	$213,100,000
Project Cost Total		**$2,200,000**	**$249,000**	**$358,400,000**	**$360,800,000**

** Includes engineering, traffic control, utility, right-of-way and contingency costs. Costs are based on 2012 dollars.*

CHAPTER 8
FUTURE LAND USE MANAGEMENT STRATEGIES

Coordination is needed to preserve the character and operational integrity of the East Riverside Corridor and its future redevelopment including public and private construction projects. It is important to recognize that the built environment, such as transportation infrastructure and development, have had a direct impact on the safety, mobility, and quality of life of the users of the corridor. Strategies that include access management, maintenance and sustainable growth techniques will increase the life and structural longevity of East Riverside Drive. Several land use strategies may be applied to future redevelopment of the corridor.

DEVELOPMENT STRATEGIES

ACCOMMODATE NON-MOTORIZED CORRIDOR USERS

As stated in both the East Riverside Corridor Master Plan and Regulating Plan, connectivity for both bicycle and pedestrian users along the corridor is extremely important as it meets the needs of an alternate mode of transportation and fosters an environment of community and a sense of place. To improve the mobility and quality of life for bicycle and pedestrian users, it is important to continue to establish connectivity to sidewalks and multi-use paths, providing increased access to adjacent businesses.

Connectivity for both bicycle and pedestrian users along the corridor will help to provide an alternate mode of transportation.

ACCOMMODATE BUS AND HIGH CAPACITY TRANSIT USERS

Transit stops such as bus and rail stops require bicycle and pedestrian connectivity points and links at transit stops and surrounding destinations. Accommodations for pedestrians and bicycle users should be integrated with transit development within the East Riverside Corridor. Bus and rail transit stops should also meet the appropriate guidelines for providing adequate shelter and amenities which will promote safety and transit usage.

Transit stops provide shelter and amentities.

ACCESS MANAGEMENT

Currently East Riverside Drive has a plethora of driveways providing access to the retail establishments. The lack of an established access management strategy and joint access provisions result in multiple access points between the signalized intersections. In addition to the driveways, midblock median openings also impact the safety of operations along the corridor. These unsignalized midblock median openings encourage motorists to make unsafe maneuvers which impede corridor traffic flow. Between Lakeshore Boulevard and Willow Creek, most of the access points are provided to retail developments. The segment of Riverside Drive between Wickersham and SH 71 is currently undeveloped and provides access to small residential/collector streets via median openings. A combination of the access points and median openings have a significant impact on the capacity and safety of Riverside Drive despite it being a six-lane facility. It is recommended that property owners along the corridor should share driveway access where feasible and provide adequate traffic circulation within the properties as well.

THE IMPLEMENTATION OF SHORT AND LONG-TERM IMPROVEMENTS IS CONTINGENT ON THE RESULTS OF FUTURE BOND ELECTIONS AND THE ACQUISITION OF OTHER FUNDING MECHANISMS.

PRESERVE THE FUNCTIONAL AREA OF INTERSECTIONS

A safe and efficient operation of an intersection requires plenty of functional space for motorists. The functional area of an intersection is the space used by entering and exiting vehicles to complete their trip through an intersection. Sufficient functional space allows motorists to respond to the intersection by decelerating and making the appropriate movements to the appropriate lane to stop or complete a turn. Driveway access too close to intersections along East Riverside Drive can cause serious traffic conflicts that result in crashes and congestion.

CAPITAL IMPROVEMENTS AND MAINTENANCE

An adequate financial investment will be made to implement the short-, medium-, and long-term improvements for East Riverside Drive. To sustain these improvements and retain the integrity of the infrastructure of the corridor the proper maintenance plan has to be put in place. The City of Austin should include the maintenance of East Riverside Drive into their Transportation Fund to ensure the corridor remains in safe operational condition.

POLICY RECOMMENDATIONS

Below are policy recommendations that support the East Riverside Corridor Master Plan and Regulating Plan and will provide additional guidance to developers as the corridor continues to grow and change over time.

EAST RIVERSIDE CORRIDOR REGULATING PLAN

Use the East Riverside Corridor Regulating Plan as guidance for the appropriate development of properties as they relate to adjacent streets, neighborhoods, and the natural environment of the corridor.

BUILDING FACADE ALIGNMENT

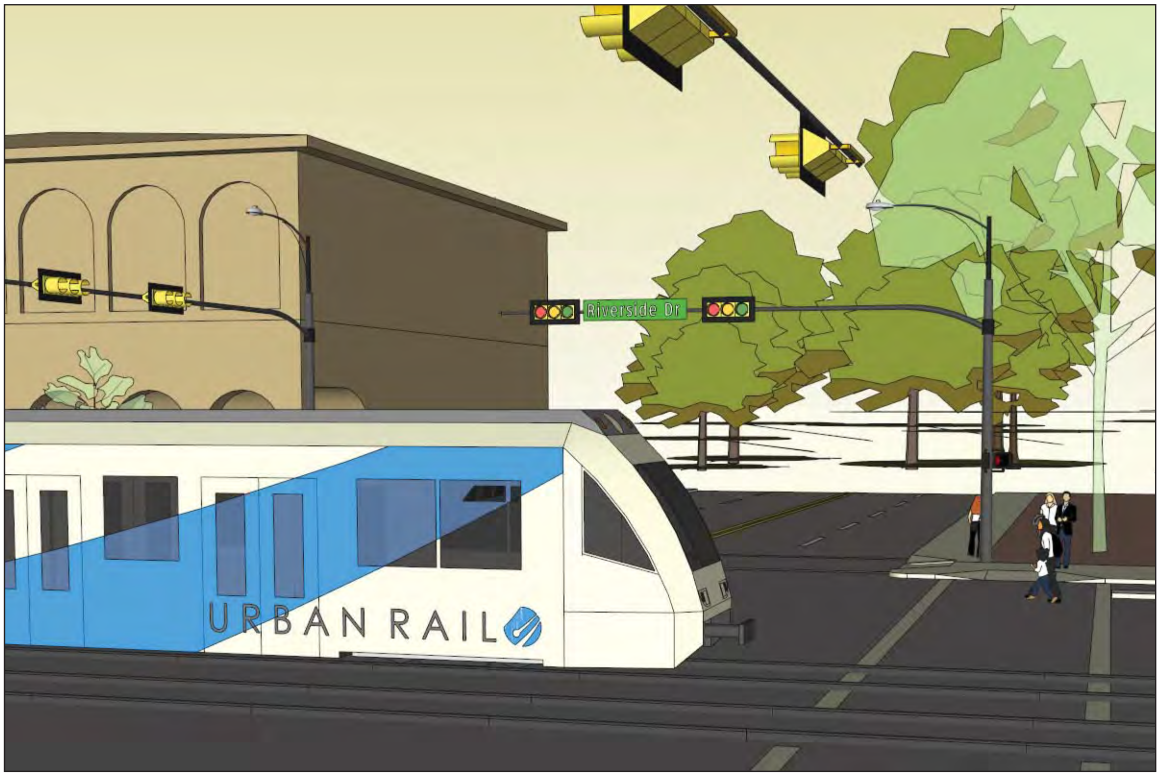
The required build-to line must be included into the development review process to encourage continuity in site plans and in the physical appearance of development along the corridor.

ON-STREET PARKING

Updating or revising the existing on-street parallel parking policy criteria should be considered to allow the on-street parking requirements to be determined by functional roadway class. On-street parallel parking should be considered to be allowed on low speed minor arterials, complete streets, and collector type roadways. The current parking policy should be maintained for higher speed arterial roadways.

IMPLEMENTATION AND STRATEGIES

The implementation of short-, medium-, and long-term improvements is contingent on the results of future bond election(s) and the acquisition of other funding mechanisms. Projected traffic for East Riverside Drive has been forecasted out to 2035. Improvements are not anticipated to be implemented beyond that planning year.



APPENDIX A
PUBLIC INVOLVEMENT PLAN

East Riverside Corridor Public Involvement Plan

East Riverside Transportation Corridor Study Project Description
East Riverside Drive between I-35 and US Highway 71 is a highly traveled roadway located a few minutes from downtown Austin. In addition to being a primary route to and from the Austin Bergstrom International Airport, it is an important commercial corridor to the diverse group of residents living in proximity to the roadway. Much of East Riverside Drive epitomizes the car-dominated environment that is typical of much of the modern American landscape. However, pedestrian activity along East Riverside Drive is much heavier than average. Many residents rely on public transportation and walk to and from local services, bus stops, and existing retail establishments.

The purpose of the East Riverside Transportation Corridor study is to:

- Identify short, medium, and long-term transportation improvements to improve safety;
- Increase vehicular, pedestrian and bicycle mobility and accessibility; and,
- Improve quality of life for the East Riverside corridor.

The Corridor Study Team will measure and evaluate a range of viable improvements/solutions. The study will address cost-benefit and cost-effectiveness of the various concepts/solutions. We will focus a portion of our work towards engaging businesses along the corridor and the analysis of transportation improvements that may impact them.

At the completion of the study, the City of Austin will have identified a list of recommended improvements, a time frame for implementation, and possible funding sources.

The East Riverside Transportation Corridor Study is one of four studies listed below that the City of Austin is undertaking:

Project	Limits	
	From	To
East Riverside Drive	IH-35	US-71
FM 969 Corridor	US-183	Town of Webberville
Airport Boulevard Corridor	North Lamar Blvd.	US-183
North Lamar Blvd. and North Burnet Road	US-183 Koenig Lane	IH-35Mopac

The boundary for the East Riverside Transportation Corridor study remains the same as the East Riverside Master Plan.
Previous Planning Efforts

For the past several years, residents, business owners and property owners have worked collectively and with City of Austin staff to develop a Master Plan for the East Riverside area. The East Riverside Corridor Master Plan is now beginning to shape positive change for this important part of town. The City Council-adopted plan envisions a bright future for the area corridor as an area characterized by:

- An appealing, safe place for people to live, work, eat, shop, and have fun;
- A diverse area with homes and neighborhood services convenient for all;
- An attractive place improved by high design standards for new development;
- A healthy, active place with trails, parks, and open space;
- A neighborhood where it is safe and easy to walk, bike, and use transit daily;
- A "green" place that contributes to Austin jobs and sustainable economic growth; and,
- A future high capacity transit corridor, with new neighborhood centers around rail stops

After more than a year of public input, the Austin City Council adopted the East Riverside Corridor Master Plan on February 25, 2010. The Master Plan encourages the transformation of the East Riverside Corridor area, emphasizing the importance of transit-oriented and pedestrian-friendly development. The plan also encourages sustainable practices while maintaining housing options for people with a range of incomes.

East Riverside Corridor Regulating Plan

The City is currently in the process of re-zoning properties within the East Riverside Corridor and creating new development regulations to help achieve the vision described in the adopted Master Plan. The Regulating Plan aims to translate the recommendations outlined in the Master Plan into a design-based code that ensures that any future development meets the vision established by the community.

Strategies and Tactics

The Strategies and Tactics, which are to be implemented by the East Riverside Transportation Corridor Study Public Involvement Team, are based on the City of Austin Transportation Department's "Austin Strategic Mobility Plan Transportation Corridor Studies Master Public Involvement Plan." They are designed to reflect the specific needs of the East Riverside Corridor while meeting the four public Involvement goals stated in the Master Public Involvement Plan:

1. **Stakeholder outreach.** This strategy includes all activities that are specifically targeted to *defined* individual stakeholders and groups of stakeholders, such as neighborhood groups, business groups, adjacent property owners, elected officials, EJ populations and the groups serving them, etc. This outreach will be a vital component of the overall engagement strategy for the Corridor Studies and is intended to complement and enhance engagement opportunities designed for broad public participation (see Strategy 2 below). Tactics to be deployed include:

    a. *Developing stakeholder databases and contact lists*. Initial lists of identified stakeholders for each corridor will be developed by the Corridor Study consultant teams with input from the City. These lists should include sufficient coding to identify particular stakeholder groups, allowing for multiple codes for individual records. All persons who would receive standard notification of a City land-use action (e.g., adjoining property owners, identified registered neighborhood groups) should be included and appropriately coded in stakeholder databases**.** Members of the public who sign up to participate online or in person should, where possible, be appropriately coded as stakeholders. Stakeholder lists and databases should be maintained using tools and systems that allow for interchange of data as necessary between Corridor Studies or with other City projects and initiatives.

i. *Database will include the following fields*

1. Last name, first name, street address, city, zip code, and codes below.

ii. *Database will include the following codes*

1. Property Owner
2. Business Owner *
3. Neighborhood Organization
4. Resident
5. Homeowner Group
6. Business Organization*
7. Civic Group
8. Religious Group

** The team will conduct targeted outreach to businesses along the corridor in the form of an information sheet and a business open house.*

b. *Individual and small-group meetings with identified stakeholders.* These include meetings hosted by the City and consultant teams to which identified stakeholders are invited, or those (e.g., neighborhood association meetings) held by stakeholders to which the Corridor Studies teams are invited. In either case, a presentation and discussion guide should be developed to allow for consistent, structured input by all participating stakeholders. Detailed notes from these meetings should be prepared as work product for internal use by the City and consultant teams; input received should be summarized for public use. These meetings can include efforts to reach traditionally underrepresented and hard-to-reach populations, as described in Goal 2 above.

c. *Small Community Focus Group Meetings (Focus Group)*

The City of Austin is managing the collaboration and input into the East Riverside Master Plan through an existing Stakeholder Group. This group continues to meet and is available to provide input into the East Riverside Transportation Corridor study. Because the stakeholder input group exists for the Master Plan, our process will utilize the existing meetings in the form of an additional agenda item called "Transportation Corridor Study Focus Groups." We will invite new stakeholders to the existing Master Plan stakeholder group to participate in four "Community Focus Groups" for the Transportation Corridor Study. The Community Focus

Groups will be used to gather input on the specific projects/concepts being presented as part of the transportation corridor study. The additional stakeholders will come from major employers, businesses and business groups within the corridor. Dates and times of these focus group meetings are detailed in the Anticipated Timelines Section.

1. *Focus Group #1 (before the Public Meeting (PM) #1): Introduce the project team, discuss the purpose of the Corridor Study, and identify values and issues.*
2. *Focus Group #2 (after PM#1): Review the input and begin discussing the Short-, Mid- and Long-Term Improvements.*
3. *Focus Group #3 (before PM#2): Review Draft Corridor Plan and Public Meeting Materials.*
4. *Focus Group #4 (after PM#2): Review input from public meeting and prioritize strategies.*

d. *Targeted information pieces*, both print and electronic, should be developed as needed to supplement general project communications and address issues of specific relevance to defined stakeholder groups. These pieces should be developed to be consistent in look, feel, and tone with general project communications.

- ***i.*** *Business Group Fact Sheet, which includes information on purpose of corridor study, and information that business owners may be interested in including: travel demand, impacts of concepts/solutions to businesses, etc.*

2. Public outreach. This strategy includes activities that are intended to be accessible to all interested citizens, even if those activities (e.g., the Business Open House) are programmed to emphasize the needs and interests of specific groups. Tactics include:

a. *Initial public meeting* to be held in each Corridor Study area. These meetings should use an open-house format to communicate the purpose and process of the Corridor Studies, allow participants to sign in and sign up to receive ongoing project updates, and collect feedback and input using standardized techniques (e.g., comment forms). Meeting notices (including print and electronic mailings, flyers, posters and push cards for distribution in the study area), letters to public officials; and media release announcements to publicize these meetings should be distributed with sufficient notice to maximize participation. All records of participation and comments received should be documented and made available for internal use and summarized for public use.

- *i. Public Meeting #1 – Introduction to the Study Workshop*
  1. *Summarize Previous Work in Corridor: East Riverside Master Plan*
     - *a. The Vision*
     - *b. Goals and Objectives*
     - *c. Proposed land uses and pattern of development*
     - *d. Proposed street, pedestrian, bicycle and transit improvements and*
     - *e. Short-and long-term transportation improvements*
  2. *Explain the Corridor Study*

3. *Describe the Public Input Process*
4. *Identify Specific Transportation Related Issues for Input - identify and categorize the needs and issues along the corridor including focus on multi-modal solutions*
    a. *Bus Stops*
    b. *High Capacity Transit/Rapid Transit*
    c. *Bicycle*
    d. *Etc.*
5. *Dialogue to focus on elements/improvements important to stakeholders*

b. *Business Open House and <u>other targeted public meetings</u>.* Each Corridor Study will also include an open-house meeting that is open to the public but which is held at a time and in a location that encourages participation from businesses served by the corridor. Publicity and outreach for Business Open House meetings will include targeted efforts to reach business stakeholders. As appropriate to the needs of each corridor, *similar open-house meetings can be conducted to reach other traditionally underrepresented and hard-to-reach populations, as described in Goal 2 above*. Participation and comments received should be documented for internal use and summarized for public use. *Only one Business Open House is planned for the E. Riverside Project.*
   i. *Business Open House – Introduction to the Study Open House*
   ii. *Business Open House – Input on Specified Projects*
      1. *Identify Specific Transportation Related Issues and Projects/Concepts for Input* - identify and categorize the needs and issues along the corridor including focus on multi-modal solutions with business owners.
         a. *Bus Stops*
         b. *Sidewalks*
         c. *High Capacity Transit/Rapid Transit*
         d. *Bicycle*
         e. *Etc.*

c. *Participation in other <u>public meetings. Opportunities</u> f*or outreach provided by other public meetings and events in the Corridor Study areas should be leveraged where appropriate. These could include meetings being held as part of other City or partner agency initiatives or other types of community events. Exhibits developed for open-house meetings, comment forms, and other such tools should be used; participation should *be documented and summarized as is feasible.*
   i. *The study team will identify potential outreach opportunities with specific groups in the area and coordinate with City of Austin staff to provide information to them on the study.*

d. *Final public meeting (Draft Plan presentation).* A final public meeting in the Corridor Study area will be held to present draft recommendations and allow for public feedback and comment. The format of this final public meeting, including the techniques used to collect feedback, should be determined as appropriate for each corridor study, as long as this feedback is adequately collected, documented, and summarized. Notification and outreach to encourage participation should be conducted as outlined above
    i. *Public Meeting #2 – Present* Draft Study presentation
        1. Overview of Process to Date
        2. Present Draft Presentation
        3. Discuss Proposed Improvements and Strategies
            a. Short-Term
            b. Mid-Term
            c. Long-Term

e. *Presentation to city boards, commissions, and City Council.* The City and consultant teams will conduct outreach as needed to support public awareness and participation opportunities; and provide City board/commission and Council briefings of each Corridor Study. The number of meetings will be limited in number and may include the opportunity to have members of City Boards/Commissions attend a single presentation to avoid numerous presentations to individual groups.

3. **Print and electronic communications materials.** The City and consultant teams will develop necessary print and electronic materials for ongoing communication and education about the Corridor Studies to both general and specific audiences. To the degree possible, these products should be standardized for use by all Corridor Study teams. Tactics include:
    a. *General interest list.* Interest lists to be used for distribution of print and electronic materials should be maintained in conjunction with stakeholder databases as described in Strategy 1. A standard process for signing up to receive further information will be developed for use by all four Corridor Studies.
    b. *Fact sheet.* A fact sheet template (for print or electronic distribution) is being developed for use by all four corridor study teams, with consistent branding and messaging but allowing for needed customization for each corridor.
    c. *Website.* Information for each of the Corridor Studies will be hosted, maintained and made available at the Austin Strategic Mobility Plan website at austinstrategicmobility.com.
        i. *Information that has been prepared for each meeting will be provided to City staff for posting.*
    d. *Press Release. We will work with the City's PIO to provide information about the East Riverside Corridor Transportation Study for distribution to the media.*

Roles and Responsibilities

Generally, responsibility for activities to implement this PIP will be allocated between the City and each corridor's consultant team as outlined below. More specifics are included in the scopes of work for each Corridor Study.

City of Austin staff	Consultant teams
• Stakeholder identification, including provision of customary City notification lists [hopefully in an Excel spreadsheet.] • Coordination of dates and locations for public meetings • Distribution of meeting notices, letters to public officials, media releases • Maintenance of corridor study Web presence at ASMP.com	• Public involvement plan • Stakeholder identification and database development based on City's databases/maintenance • Interest list (mailing list) development and maintenance • Exhibits for public and stakeholder meetings • Staffing and logistics for public and stakeholder meetings • Development of meeting notices, letters to public officials, media releases • Preparing questionnaires, discussion guides, sign-in-sheets, comment forms, etc. for use in public meetings • Documenting participation and input received at public meetings • Development of print and electronic communications materials and Web content

East Riverside Transportation Corridor Study
Anticipated timeline

August 2011	PIP development Initial stakeholder database and interest list development Planning/logistics for first public meeting	**EAST RIVERSIDE** PIP submitted to COA Monday September 2, 2011	**OTHER STUDIES**
September 2011	Initial stakeholder meetings Materials/Web development Community Working Group Meeting #1 Additional stakeholder meetings Distribution of print/electronic information materials Additional stakeholder database and interest list development	Community Focus Group #1 Wednesday September 14 6:30 p.m. – 8:00 p.m.	FM969 *Airport FBC Meeting* – Tuesday, September 13 *Lamar Blvd/Burnet Road* *PM#1*– Tuesday, September 20, 6:30-8:00 p.m. PM#2– Thursday, September 22,6:30-8:00 p.m.
October/November 2011	First public meeting Community Working Group #2, #3 Additional stakeholder/public meetings as needed (including Business Open House) Print/electronic project updates Web content	Public Meeting #1 Thursday October 27 6:00 p.m. – 8:00 p.m. Community Focus Group #2 Wednesday November 9 6:30 p.m. – 8:30 p.m. Community Focus Group #3 Wednesday January 11 6:30 p.m. – 8:30 p.m.	FM969 Airport FBC Meeting Charrette– Monday, October 3, 5 p.m. Lamar Blvd/Burnet Road Stakeholder Meeting – Friday, October 18, 1:30-3:30 p.m., 4-6p.m., 6:30-8 p.m. Lamar Blvd/Burnet Road Business Open House – Thursday, October 20– 10:30 a.m. -3:00 p.m. Lamar Blvd/Burnet Road Group C Stakeholder

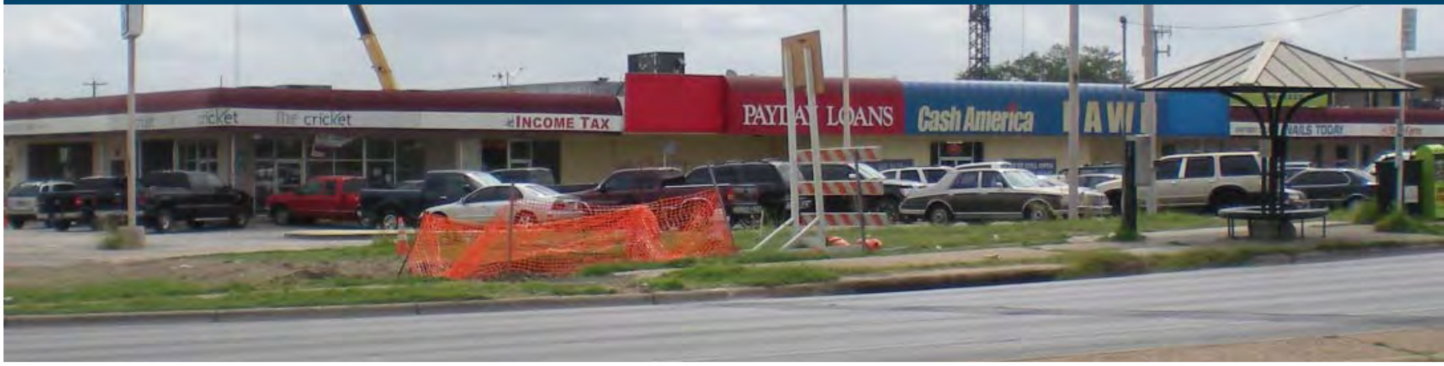
			Meeting – Friday, October 21, 1-3 p.m., 3:30-5:30 p.m.
December 2011 - January 2012	Public Meeting #2 Draft Study presentation Community Working Group #4 Print and electronic project updates	Public Meeting #2 Tuesday February 7 6:00 p.m. – 8:00 p.m.	FM969 Airport FBC Meeting, Final Public Meeting – Thursday, January 19, 6:30-8:30 p.m.
February 2012	Corridor Study presentation to City boards, commissions, City Council.	Community Focus Group #4 Wednesday February 8 6:30p.m. – 8:30 p.m.	

Focus Group Participants – East Riverside Corridor Study

(List comes from Master Plan process)

1. East Riverside Oltorf Combined (EROC) neighborhood representative: Jan Long
2. Montopolis neighborhood representative: Frank Monreal
3. Montopolis Community Business Leaders Assoc. representative: Delwin Goss
4. East Riverside Corridor renters: representative
5. East Riverside Corridor community organization leader: Fausto Rodriguez
6. Community Development Commission (affordable housing) representative: Ruby Roa
7. Planning Commission representative: Danette Chimenti
8. Design Commission representative: James Shieh
9. Urban Transportation Commission (transit) representative: Dana Lockler
10. Congress for New Urbanism (design professional) representative: Kit Johnson
11. East Riverside Corridor Commercial/Multifamily property owner: Ron Thrower
12. Developer representative: Marcy Phillips
13. Austin Community College
14. Employers in the corridor
15. Tokyo Electron
16. HEB
17. Retail and commercial businesses in the corridor
18. Others

APPENDIX B
DRAINAGE REPORT



State of Texas
Registered Firm
No. F-3572

CAS CONSULTING & SERVICES, INC.
Civil, Transportation, and Environmental Engineering
Austin • Dallas • Houston • San Antonio

East Riverside Drive Corridor Study

Drainage Report

Prepared for :
City of Austin and HDR, Inc.

Prepared by:
CAS Consulting and Services, Inc.

For Interim Review TX PE #107373 / 04-27-12
Ashley Hanson, P.E. Date

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Background

The East Riverside Corridor Study identifies short-, medium-, and long-term transportation projects to improve safety; increase vehicular, pedestrian and bicycle mobility and accessibility; and improve quality of life for the corridor. CAS Consulting and Services, Inc. (CAS), serving as a sub-consultant to HDR, Inc., was tasked with studying the existing drainage conditions and proposing solutions for areas that are out of compliance with the city requirements. These solutions coordinate with the overall East Riverside Dr. improvements developed with the Corridor Study. The focus of the drainage study is along East Riverside Dr. and its right of way, extending from IH-35 to US-71. CAS was also tasked with providing an order of magnitude opinion of probable construction cost for drainage related items.

Data Collection

Data collection included performing a site visit and obtaining GIS data, the hydraulic models accepted by the City of Austin (COA), and record drawings. A site visit was performed in August 2011 to identify the major drainage crossings, inlets, and flow patterns. COA GIS shapefiles were obtained, including the storm drain, zoning, land use, and watershed layers.

Current hydraulic models (US Army Corp of Engineers HEC-RAS models), made available by the COA, were received for the following watersheds: Carson Creek, Country Club East Creek, Country Club West Creek, Harper's Branch, and Town Lake (Lady Bird Lake). The Carson Creek watershed is currently being restudied and a new model is expected to become available in the Spring of 2012. All hydraulic models included future condition flows, except the Harper's Branch model, which only had existing flows. The Town Lake model provided maximum water surface elevations for the 10-yr, 50-yr, 100-yr, and 500-yr storm frequency events.

Record drawings for projects along East Riverside Dr. were obtained through the city. Several recent projects, old roadway, and site plans along the study corridor were identified for drainage information. A list of record drawings that served as sources of data for this study is provided in Appendix A.

As the city has grown over the years, the East Riverside Dr. roadway has been modified and widened, and properties along the roadway have been redeveloped. As a result, the drainage systems have been modified and extended over time. In several areas, record drawings conflicted with each other or recent aerial photography. Attempts were made to include near future development, such as the Texas Department of Transportation (TxDOT)'s East Riverside Dr. overpass and extension of the US-71 express lanes, a project that began construction in January 2012. Flow lines were estimated for structures when information was lacking.

Evaluation Criteria

The COA Drainage Criteria Manual (DCM) provides guidance for current city requirements for drainage systems and structures. This study will determine whether the following criteria are met:

- COA DCM section 1.2.2.B states that street curbs, gutters, inlets and storm sewers shall be designed to intercept, contain, and transport all runoff from the 25-year frequency storm
- COA DCM section 5.2.0 states that the 25-year hydraulic grade line (HGL) shall remain six inches below the theoretical gutter flow line of the storm drain inlets.

- And, COA DCM section 1.2.4 D states that for bridges and culverts in streets other than residential, runoff from the 100 year frequency storm shall not produce a headwater elevation at the roadway greater than six inches above the crown or six inches above any top of upstream curb elevation, whichever is lower.

Drainage System Identification

East Riverside Dr. between I-35 and US-71 is located within five watersheds and crosses several rivers and tributaries. The watersheds drain from south to north, outfalling in the Colorado River between IH-35 and US-71, except for the Carson Creek watershed, which outfalls in the Colorado River east of US-71.

Fourteen drainage systems, consisting of pipes, culverts, and/or bridges, were identified along East Riverside Dr., based on data from a site visit, the COA storm drain GIS shapefile, the COA-provided HEC-RAS model, and record drawings. Each system collects runoff south of and along East Riverside Dr., conveys flows under East Riverside Dr., and outfalls north of the roadway, with flows eventually outfalling into the Colorado River, east of IH-35. A map of the location of the drainage systems and major existing draining structures is provided in Appendix B.

Table 1 summarizes the locations of each system's major conveyance structure along East Riverside Dr., its watershed, and the type of data source used to identify its level of service or used to model and analyze the system.

Table 1. Identified Drainage Systems along East Riverside Dr.

Drainage System	Crossing Location under E Riverside Dr	Watershed	Data Source
1	At IH 35	Harper's Branch	HEC-RAS model
2	Near Summit St	Town Lake	Record Drawings
3	Near Parker Ln	Town Lake	Record Drawings
4	At Arena Dr	Town Lake	Record Drawings
5	At Burton Dr	Town Lake	Record Drawings
6	At Willow Creek Dr	Town Lake	Record Drawings
7	Near Wickersham Ln	Country Club West	HEC-RAS model and Record Drawings
8	Between Kenneth Ave and Riverside Farms Rd	Country Club West	HEC-RAS model and Record Drawings
9	Between Faro Dr and Penick Dr	Country Club East	HEC-RAS model and Record Drawings
10	Between Country Club Rd and Grove Blvd	Country Club East	HEC-RAS model and Record Drawings
11	Between Grove Blvd and Clubview Ave	Country Club East	HEC-RAS model and Record Drawings
12	At Vargas Rd	Country Club East	Record Drawings
13	Between Frontier Valley and Anise Dr	Carson Creek	Record Drawings
14	At Coriander Dr	Carson Creek	Record Drawings

A description of each of the fourteen drainage systems follows.

System 1

This network consists of two 7’x6’ box culverts, 700 ft in length, modeled in the Harper’s Branch HEC-RAS model (project *harper*, plan *PLAN 01*). The culvert begins west of IH-35 and crosses East Riverside Dr. in a northeast direction, outfalling adjacent to the northbound IH-35 frontage road and into Lady Bird Lake (formerly Town Lake). The COA storm drain shapefile does not show any substantial lateral lines along the East Riverside Dr. right of way for this drainage crossing.

System 2

The drainage area for System 2 is predominately single family residences south of East Riverside Dr. with some commercial businesses. The network consists of a 30” reinforced concrete pipe (RCP) trunk line crossing under East Riverside Dr. east of Summit Dr. The 30” RCP originates as a 24” RCP, just south of the Old Riverside Dr. in an open ditch. The 24” RCP collects flow from a 24” and a 6” RCP from the west and east of Old Riverside Drive, respectively. An 18” RCP picks up flow along south curb of East Riverside Dr. on the west side and 21” RCP picking up flow along the south curb on the east side of the 30” RCP. The 30” RCP turns east near the north curb of East Riverside Dr. and becomes a 36” RCP. Flow lines and rim elevations of the 18”, 24” and 30” were not identified in any record drawings and so limited parts of the system were modeled. The lateral lines tying into the 30" RCP within the right of way do not appear to be at manholes.

The storm system model created to analyze this system terminates just short of the north curb at East Riverside Dr., where the 30” RCP, which previously extended north, is connected to the east running 36” RCP. The 30" RCP was assumed to have a slope of 7.5% based on record drawings prepared by LAN, East Riverside Dr.. Improvements Drainage System Details, Sheet 2 (1-A-6788(D)). Capping the 30”RCP and taking the flow east in a 36” RCP is a recent system modification constructed with the multi-use development, AMLI Riverside, designed by Jacobs Carter Burgess. The 25-year storm event tailwater elevation, 465.50 ft, for the system is taken from the AMLI Riverside project’s hydraulic grade line at the junction of the 30” and new 36”.

System 3 and System 4

Systems 3 and 4 are situated between Lakeshore Blvd. and Arena Dr., begin more than 1,500 ft up-gradient of East Riverside Dr., and outfall into the same tributary of Town Lake. The networks have been modeled for analysis as shown on record drawings prepared by LAN, East Riverside Dr. Improvements Drainage System Details, Sheet 24 (1-A-6788(Z)), rather than the COA legacy storm drain GIS shapefile.

System 3 collects flow just west and east of Old Riverside Drive with a 42” RCP and 24” RCP, which cross under East Riverside Dr. and converge into a 60” RCP midway within the road. The drainage area consists predominately of single family residences in the upper basin and with a small area of multifamily home and commercial development in the lower basin.

System 4 collects flows between Parker Ln. and the area just east of Royal Crest Dr. The drainage basin is a mix of single family homes, multi-family homes, and commercial development. The drainage system appears to have been modified from the system presented in the record drawings prepared by LAN in 1980, East Riverside Dr.. Improvements (1-A-6788), to accommodate commercial development at the southeast intersection of Parker Ln and Riverside. The lengths, elevations, and locations of the 18” RCP and 24” RCP lateral lines in this area were estimated based on existing site conditions and the record drawings. The elevation of the 54” RCP outlet flow line was assumed as 448 ft based on contour data.

System 5

System 5 collects drainage in a 42”RCP trunk line from a highly impervious area, mostly commercial development and multi-family homes, between Royal Crest Dr. and Burton Dr., and outfalls into a tributary of Lady Bird Lake north of East Riverside Dr. This tributary drains parallel and east of Tinnin Ford Rd and converges with Lady Bird Lake approximately 2,500 ft downstream from E Riverside Dr. Record drawings identified with information on this system were prepared by LAN in 1980, East Riverside Dr. Improvements (1-A-6788). The system consists of several laterals within the right of way which pick up flow along the north and south curbs.

System 6

System 6 collects flows from an area between Burton Dr and Willow Hill Dr that is predominately multi-family residences. The conveyance structure is a 2-9’x5’ box culverts, approximately 715 ft long, that begins south of East Riverside Dr., crosses under the road, and runs parallel on the north side of the roadway under several businesses, outfalling approximately 350 feet upstream of the same channel as System 5. The network as shown in the 1980 record drawings East Riverside Dr. Improvements (1-A-6788) prepared by LAN is consistent with the COA GIS stormdrain shapefile network layout in this area. The plan set *Consolidated Administrative Site Plan for 2301 East Riverside Dr.* for the commercial development situated upstream of the culvert includes the design of the Willow Creek Regional Wet Pond, which document the culvert’s performance. Storm drain lines along Willow Creek Dr and at the intersection of Willow Creek Dr and East Riverside Dr tie into the culvert.

System 7

System 7 consists of the eastbound and westbound bridges east of South Pleasant Valley Dr. and the lateral lines that drain to the upstream and downstream faces of the bridges, outfalling into Country Club West Creek. Starting west of South Pleasant Valley Dr, lateral lines, along both eastbound and westbound East Riverside Dr., drain from west to east towards the bridges. Beginning near Kenneth Ave, lateral lines collect and bring flow from east to west towards the bridges. The drainage area is primarily multifamily residences. The bridges are modeled in the Country Club West Creek HEC-RAS model. The record drawings prepared by LAN in 1980, East Riverside Dr. Improvements (1-A-6788) provide details of this system. The HEC-RAS model for Country Club Creek West (project *Country Club Creek West*, plan *CCCW COA Future Conditions*), prepared by Halff Associates in Dec 2005, provides results of the hydraulic performance of the bridges. The lateral lines are modeled in the plans, East Riverside Dr. Improvements (1-A-6788) prepared by LAN in 1980.

System 8

The drainage area of System 8 is zoned for predominantly single and multifamily land use and is currently not fully developed. The system picks up flows between Kenneth Ave. and the eastern drainage divide, located between Riverside Farms Rd and Faro Drive. The HEC RAS model for Country Club Creek East Tributary 3 (project *CCW-1 COA Future Conditions*, plan *CCW-1 COA Future Conditions*) provides the hydraulic performance of the 2-8’x5’, 152’ long box culverts crossing East Riverside Dr. TxDOT record drawings M P043(2) provide pipe sizes and inverts on the show short lateral lines that convey flow along the north and south curbs to the culvert.

System 9

The drainage area of System 9 is zoned for commercial use and is currently not fully developed. The system picks up flows between the western drainage divide, which is between Riverside Farms Rd and Faro Dr., and the eastern drainage divide, which is between Penick Dr. and Country Club Rd. The HEC

RAS model for Country Club Creek East Tributary 3 (project *CCE-3 COA Future Conditions*, plan *CCE-3 COA Future Conditions*) provides the hydraulic performance of the 7'x5', 117' long box culvert. TxDOT record drawings M P043(2) provide pipe sizes and inverts on the lateral lines along the curbs between Faro Dr. and Penick Dr. that convey flow to the culvert and show the system was originally designed in 1983 for a 10-year level of service.

System 10

The drainage area of System 10 is zoned for commercial and industrial use and is currently not fully developed. The system picks up flows between western drainage divide, which is between Penick Dr. and Country Club Rd., and just east of Grove Blvd. The HEC RAS model for Country Club Creek East (project *CCCE COA Future Conditions*, plan *CCCE COA Future Conditions*) provides the hydraulic performance of the 4-4'x5', 114' long box culverts. TxDOT record drawings M P043(2) provide pipe sizes and inverts on the lateral lines along East Riverside Dr and show the system was originally designed in 1983 for a 10-year level of service.

System 11

The drainage area of System 11 is zoned for commercial use and is currently not fully developed. The system picks up flows between Grove Blvd and Montopolis Blvd. The HEC RAS model for Country Club Creek East Tributary 4 (project *CCE-4 COA Future Conditions*, plan *CCE-4 COA Future Conditions*) provides the hydraulic performance of the 2-6'x6', 156' long box culverts. TxDOT plans M P043(2) provide pipe sizes and inverts on the lateral lines along East Riverside Dr. and show the system was originally designed in 1983 for a 10-year level of service.

System 12

The drainage area of System 12 is zoned for residential and commercial land use and is currently not fully developed. This system collects from an area south of East Riverside Dr. between Montopolis Dr. and Thrasher Ln. The system is comprised of lateral lines along the north and south curbs of East Riverside Dr between Montopolis Dr. to Thrasher Ln. that drain to a 6'x3' box culvert. Flows collect from both the east and west directions into a junction box at the entrance of the culvert. TxDOT plans M P043(2) show the 6'x3' box culvert was originally 96' long and outfalling at the north right of way line. The culvert has been recently extended approximately 225 ft northeast of the right of way line and outfalls into a drainage channel just west of Vargas Rd. A site visit was performed to approximate the invert elevation of the outlet. Recent documentation of the system performance, particularly of the 6'x3' box culvert, was not available. TxDOT plans M P043(2) shows the system was originally designed in 1983 for a 10-year level of service.

System 13

System 13 collects from an area bounded between Thrasher Ln. and just east of Uphill Ln., an area that is zoned for residential and commercial land use and is not currently fully developed. TxDOT plans M P043(2) show that the system consists of lateral lines running along both sides of E Riverside Dr. and drains from both east and west directions. The trunk line crossing East Riverside Dr. is an open entrance 2-8' x 5' box culverts, 122' long. Lateral lines enter the culvert 39 ft downstream of the inlet face and 16 feet upstream of the outlet.

The 2008 record drawings for the Riverside Nursing Home development at 6801 Riverside Dr., which is situated at the western drainage boundary divide, altered the storm drain system. The modifications include a detention pond that ties into systems 12 and 13, splitting discharges from the site to the east and west flowing laterals, but the development does not appear to significantly change the pre-development flow patterns. Recent documentation of the system performance, particularly of the 2-8' x 5' box culverts, was not available. TxDOT plans M P043(2) shows the system was originally designed in 1983 for a 10-year level of service.

System 14

System 14 collects flows from an area south of East Riverside Dr from just west of Uphill Ln. to US-71. The drainage area is zoned for residential and commercial land use and is not currently fully developed. The drainage basin was delineated according to the proposed roadway modifications under the TxDOT plans for the East Riverside Dr. overpass and extension of the US-71 express lanes that has a construction start date of January 2012. TxDOT plans M P043(2) shows a lateral line brings drainage from east to west along the southern curb of E. Riverside Dr. to a 48" RCP that crosses E Riverside Dr. south to north. Along the north side, 48 feet of 18" RCP drains street flow into the 48" RCP. TxDOT plans M P043(2) show the 48" RCP to be 102 ft long and terminate at the north right of way line. Aerial photography and record drawings for the Riverside Drive Convenience Store at 7310 East Riverside Dr (SP-2009-0260C, Prossner and Associates, Inc, 2010) show the culvert extends past the north curb and then westerly approximately 283 ft with an outfall in a drainage easement east of Anise Rd. The culvert conveys flows into the same channel as System 13, approximately 180 ft downstream of the outfall of System 13. Documentation of the performance of the 48" RCP as it is currently configured was not found. TxDOT plans M P043(2) shows the system was originally designed in 1983 for a 10-year level of service.

Analysis Methodology

CAS is tasked to determine whether the drainage systems are in compliance. This evaluation is focused on:

- the capacity of major drainage structures to convey the 25-year storm event;
- the 25-year hydraulic grade line remaining six inches below the theoretical gutter flow line of the storm drain inlets;
- and, the water surface elevation at the bridge or culvert upstream face to be within the allowable 100-year event overtopping depth of six inches above the crown or any top of upstream curb elevation, whichever is lower.

Compliance with city code for the 14 systems was achieved by either identifying the level of service in the City-accepted FEMA floodplain study hydraulic model, reviewing recent record drawings, or if recent documentation was not found, modeling the system with storm drain analysis software. Systems 1, 7, 8, 9, 10, and 11 are modeled in HEC-RAS software as part of City-accepted FEMA floodplain studies. These hydraulic models are stream models and only model the structures crossing the river reaches. The capacity of these bridges and culverts were reviewed. The water surface elevation at the face of the structure, the road elevation, and 25-yr and 100-yr discharges were identified. The results are presented.

The evaluation of System 6 is documented in recent record drawings. The results are presented.

Systems 2, 3, 4, 5, 12, 13, and 14 were evaluated using Autodesk Storm and Sanitary Analysis 2012 software (Autodesk SSA). The major conveyance structure across East Riverside Dr., and if data was available, the immediate contributing lateral lines within the right of way were modeled and evaluated for pipe capacity and hydraulic grade line elevations. This analysis does not evaluate for the capacity of storm drain inlets and the resulting spread, nor the capacity and velocity within the lateral lines of the storm drain systems.

Model generation within Autodesk SSA requires determining the pipe invert elevations, pipe lengths, outfall information, and the network configuration. These parameters were based on record drawing information along with assumptions made as described in the previous section, **System Identification**. Tailwater depths were either determined by calculating normal depths within the outfall channel or identified from record drawings. Inlets were modeled as junctions to avoid identifying street and curb inlet details, which is beyond the scope of this study. The hydraulic grade line was calculated by disabling the software's overflow ponding at nodes option and setting the surcharge elevation higher than the expected hydraulic grade line elevation.

Discharges for the 25-year storm event were determined using the Rational Method. Calculation of discharge required several steps. Drainage areas for each system were delineated based on 2003 COA 2-ft contours. Time of concentration values were calculated using COA DCM guidelines for determination of sheet flow, shallow concentrated and channel flow. Manning's n values for sheet flow and overland flow calculations were determined using future conditions zoning maps and the land use described in the East Riverside Drive Corridor Master Plan. Rational method runoff coefficient C values were based on the maximum allowable impervious cover percentages as listed in the COA's zoning ordinance and maps and applied according to the land use conditions described in the East Riverside Drive Corridor Master Plan. Currently undeveloped land in drainage areas 12, 13, and 14 were assumed to be developed accordingly with the land use described in the East Riverside Drive Corridor Master Plan and assumptions were made for the flow route in time of concentration calculations.

Calculations and data for the existing conditions analysis, including discharges, time of concentration calculations, Rational Method parameters, and tailwater elevations can be found in Appendix C.

Existing Conditions Analysis

This section summarizes the evaluation of existing drainage systems along East Riverside Dr. Either water surface profiles for those structures modeled in HEC-RAS software or a plan view schematic of the Autodesk SSA results is provided. The Autodesk SSA program identifies pipes that are surcharged or junctions with hydraulic grade lines that exceed the rim or ground elevation with the color red. The program considers pipes surcharged if the ratio of maximum flow depth to total depth exceeds one. Pipe capacity is exceeded if the ratio of maximum flow to design flow exceeds one.

System 1

Results from the Harper's branch HEC RAS model (project *harper*, plan *PLAN 01*) shows that the 700 ft long 2- 7'x 6' box culverts, identified within the model as structure Interstate Highway 35 culverts, contains the 25-yr and 100-yr existing discharges, as shown in Figure 1 below. The elevation of the top of the upstream deck is 470 ft. The 25-yr and 100-yr existing conditions water surface elevations at the upstream face are 459.19 and 465.19 ft, respectively. The structure meets city drainage code.

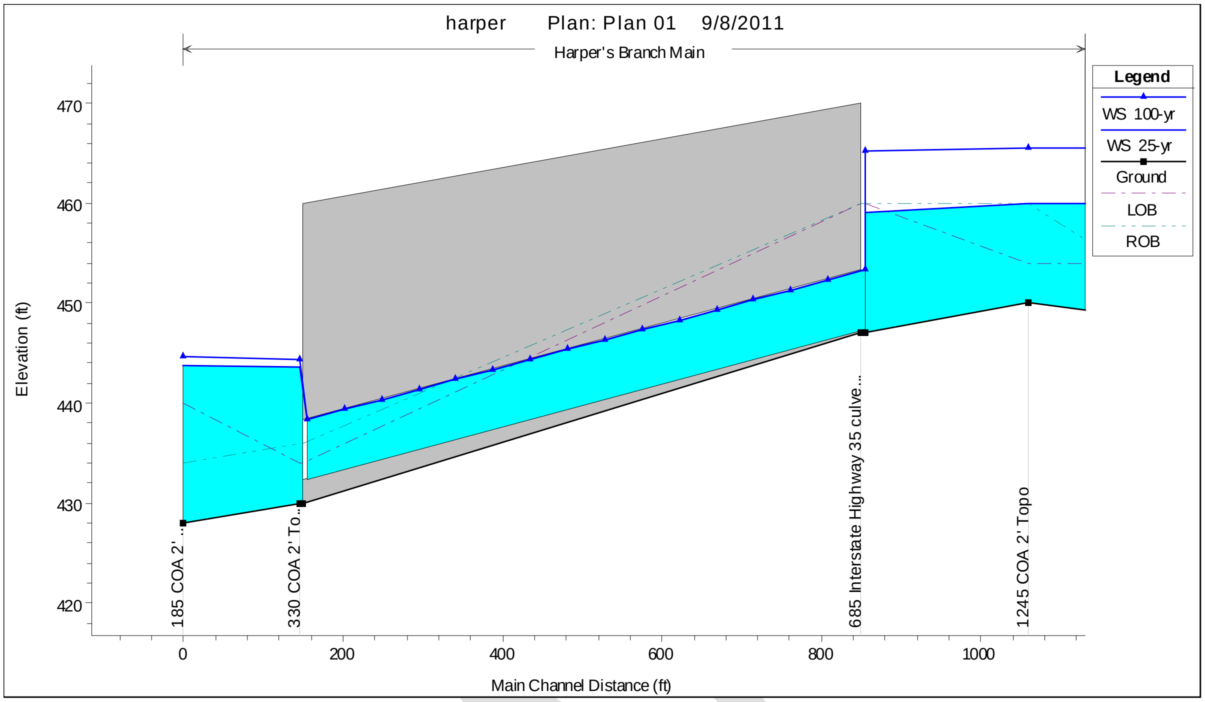

Figure 1. Profile of 25-yr and 100-yr water surface elevations at the East Riverside Dr culvert at Harper's Branch

System 2

Analysis by CAS with Autodesk SSA shows that this system does not meet criteria for a 25-yr level of service. As summarized below in Figure 2 and Table 3, the modeled system is surcharged (pipes are running full) during the 25-yr storm event, although the pipe capacity is not exceeded. The hydraulic grade line criteria is not met at the 21" RCP inlet. This system is controlled by tailwater, set by the 36" RCP downstream of the 30" RCP. Considering the assumptions made for the flow line elevations due to lack of data, as described in the previous section, further analysis is recommended.

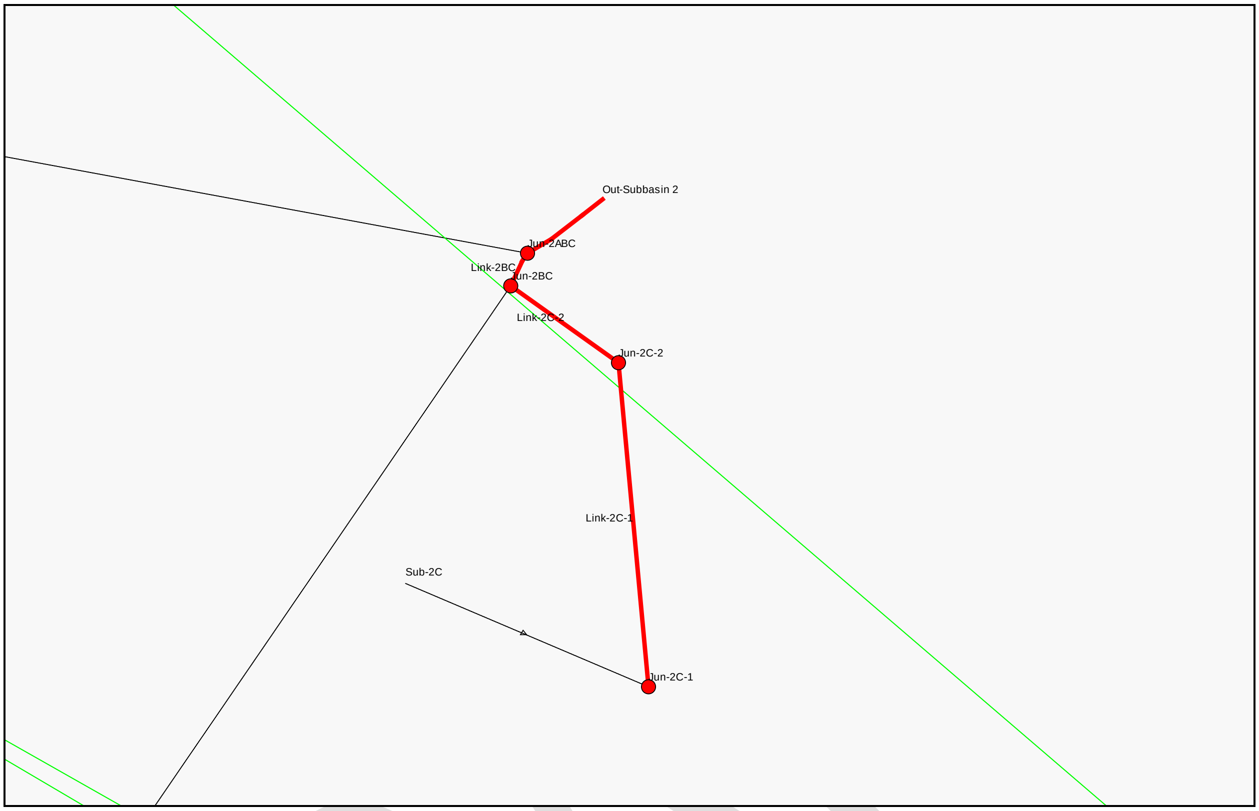

Figure 2. System 2 Existing Conditions Results Schematic

Table 2. System 2 Existing Conditions Results

Pipe	Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Maximum Flow / Design Flow Ratio	Maximum Flow Depth/ Total Depth Ratio	Reported Condition
Link-2ABC	CIRCULAR	30	30	0.61	1.00	SURCHARGED
Link-2BC	CIRCULAR	30	30	0.50	1.00	SURCHARGED
Link-2C-1	CIRCULAR	21	21	0.46	1.00	SURCHARGED
Link-2C-2	CIRCULAR	24	24	0.06	1.00	SURCHARGED

System 3

Analysis by CAS with Autodesk SSA shows that the entire system does not meet criteria for a 25-yr level of service. As summarized below in Figure 3 and Table 4, the modeled pipes are surcharged but have capacity for the 25-year storm event. The hydraulic grade line criteria is not met at the entrance of the 42" RCP (link-3B), which conveys 80% of the system's flow. The hydraulic grade line criteria is met for the 24" RCP.

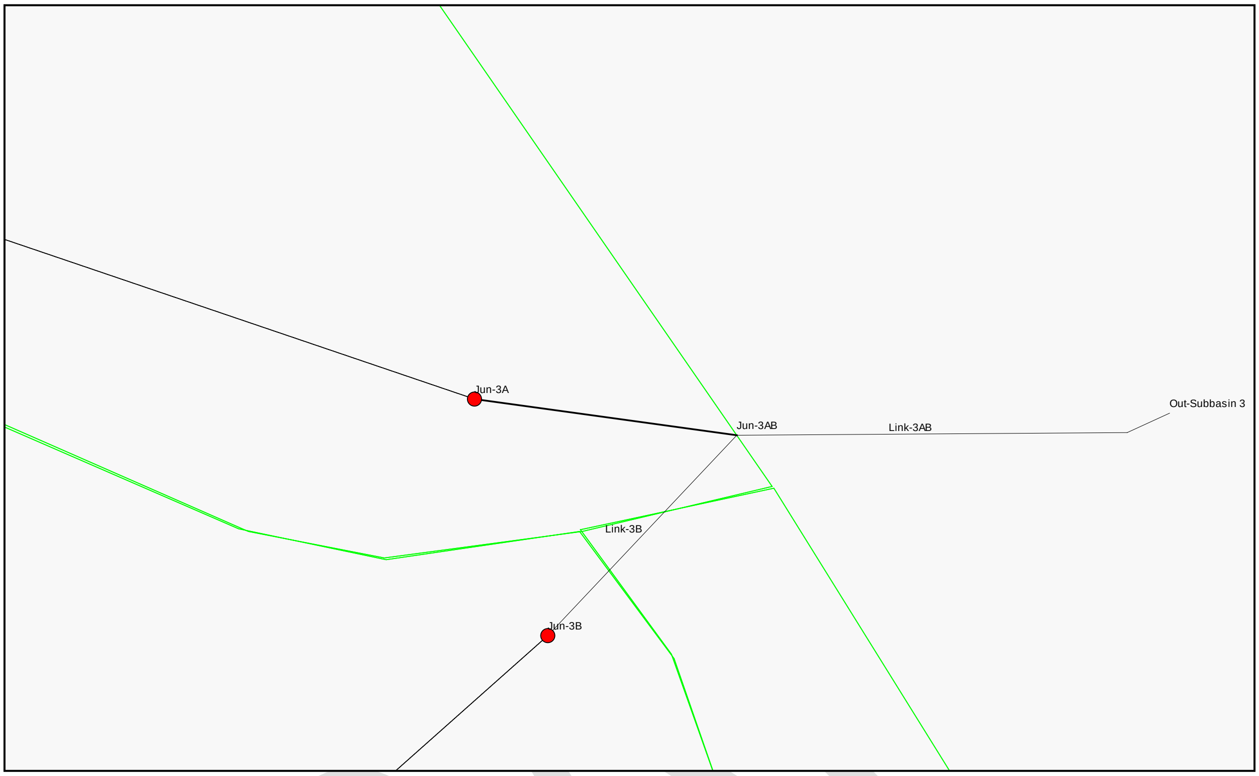

Figure 3. System 3 Existing Conditions Results Schematic

Table 3. System 3 Existing Conditions Results

Pipe	Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Maximum Flow / Design Flow Ratio	Maximum Flow Depth/ Total Depth Ratio	Reported Condition
Link-3A	CIRCULAR	24	24	0.69	0.81	Calculated
Link-3AB	CIRCULAR	60	60	0.60	0.66	Calculated
Link-3B	CIRCULAR	42	42	0.98	0.90	Calculated

System 4

Analysis by CAS with Autodesk SSA shows that the entire system does not meet criteria for a 25-yr level of service. As summarized below in Figure 4 and Table 4, the larger pipes have exceeded capacities, including the 54" trunk line. The hydraulic grade line elevations at the pipe entrances along the eastern side of the system do not meet COA criteria.

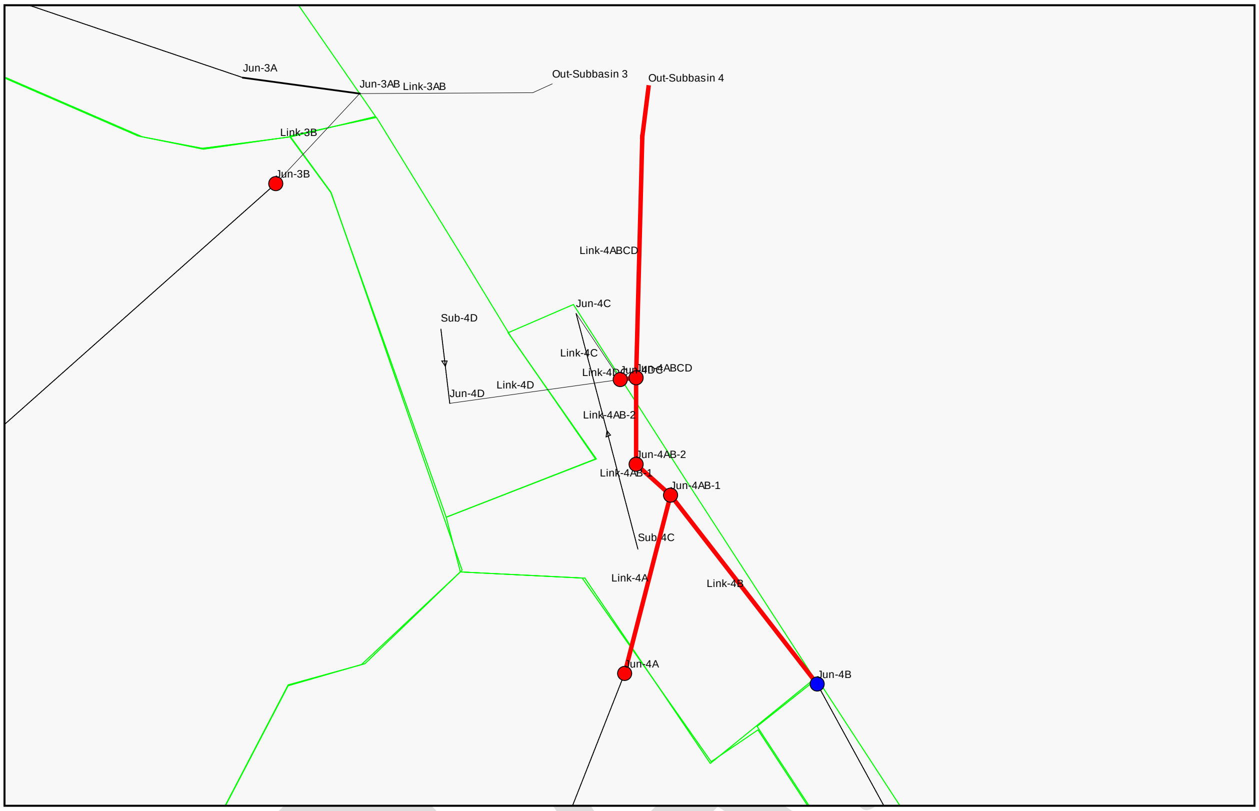

Figure 4. System 4 Existing Conditions Results Schematic

Table 4. System 4 Existing Conditions Results

Pipe	Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Maximum Flow / Design Flow Ratio	Maximum Flow Depth/ Total Depth Ratio	Reported Condition
Link-4A	CIRCULAR	24	24	5.47	1.00	SURCHARGED
Link-4AB-1	CIRCULAR	24	24	4.76	1.00	SURCHARGED
Link-4AB-2	CIRCULAR	54	54	0.74	1.00	SURCHARGED
Link-4ABCD	CIRCULAR	54	54	1.41	1.00	SURCHARGED
Link-4B	CIRCULAR	18	18	0.78	1.00	SURCHARGED
Link-4C	CIRCULAR	18	18	0.09	0.51	Calculated
Link-4D	CIRCULAR	21	21	0.07	0.51	Calculated
Link-4DC	CIRCULAR	21	21	0.19	1.00	SURCHARGED

System 5

Analysis by CAS with Autodesk SSA shows that the majority of the system meets criteria for a 25-yr level of service. Results, as summarized below in Figure 5 and Table 5, show that 25-yr storm event peak flows do not exceed pipe design flow capacity for the system, except at Link-5C-1, the 18" RCP along the north curb, which is exceeded by 2 cfs. The hydraulic grade line criteria is met for the system except at the entrance to the 18" RCP. The major drainage structures have capacity to convey the 25-yr storm event but not all modeled hydraulic grades lines meet COA criteria.

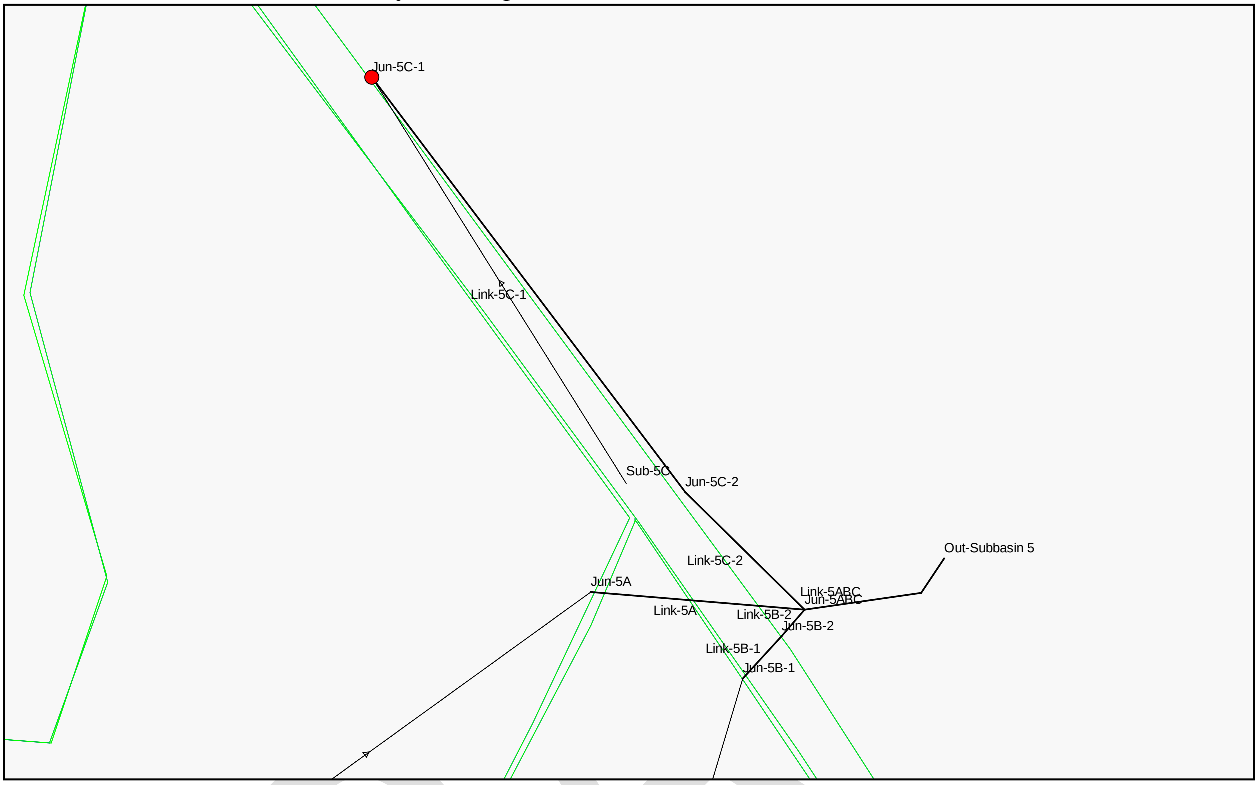

Figure 5. System 5 Existing Conditions Results Schematic

Table 5. System 5 Existing Conditions Results

Pipe	Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Maximum Flow / Design Flow Ratio	Maximum Flow Depth/ Total Depth Ratio	Reported Condition
Link-5A	CIRCULAR	42	42	0.83	0.75	Calculated
Link-5ABC	CIRCULAR	42	42	0.43	0.53	Calculated
Link-5B-1	CIRCULAR	36	36	0.31	0.67	Calculated
Link-5B-2	CIRCULAR	36	36	0.20	0.61	Calculated
Link-5C-1	CIRCULAR	18	18	1.26	0.85	> CAPACITY
Link-5C-2	CIRCULAR	18	18	0.61	0.63	Calculated

System 6

The 2-9'x5' box culverts near Willow Creek Drive conveys the 25-year and 100-yr existing conditions storm events without overtopping the roadway, as shown on Sheet 24 of 30 of the Willow Creek Regional Wet Pond 2301 Riverside Dr, Austin, TX plan set, SP-2008-0188C, prepared by Renaissance Engineering Group.

The inlet flow line is 478.1 ft and top of deck at the upstream face is model at an elevation of 487 ft. COA contours show the roadway to be at an elevation of 486 ft in this area. The 25-year and 100-year water surface elevation at the inlet face is 483.72 and 485.19 ft, respectively. The 25-year and 100-yr existing conditions storm event discharges are 606 cfs and 832 cfs, respectively. The lateral storm drain lines along Willow Creek Dr. and at the intersection of Willow Creek Dr. and E Riverside Dr. were not analyzed in this study. The East Riverside Dr. Improvements by LAN appear to be modeled for a 25-year event.

System 7

The bridges at East Riverside Dr and Country Club Creek West are modeled in HEC-RAS (project *Country Club Creek West*, plan *CCCW COA Future Conditions*) as structures CCCW-BR03 EB Riverside Drive and CCCW-BR04 WB Riverside Drive. At the upstream face of the eastbound bridge, the 25-yr and 100-yr water surface elevations are 475.04 and 474.59 ft, respectively with the lowest elevation of the bridge deck at 476.51 ft. At the upstream face of the west bound bridge, the 25-yr and 100-yr water surface elevations are 472.41, 473.77 ft, respectively with the lowest elevation of the bridge deck at 476.71 ft. Both bridges comply with COA storm drain policy. Trunk lines for this system not analyzed for compliance. A profile plot of the 25-yr and 100-yr water surface elevations at the bridges is presented as Figure 6.

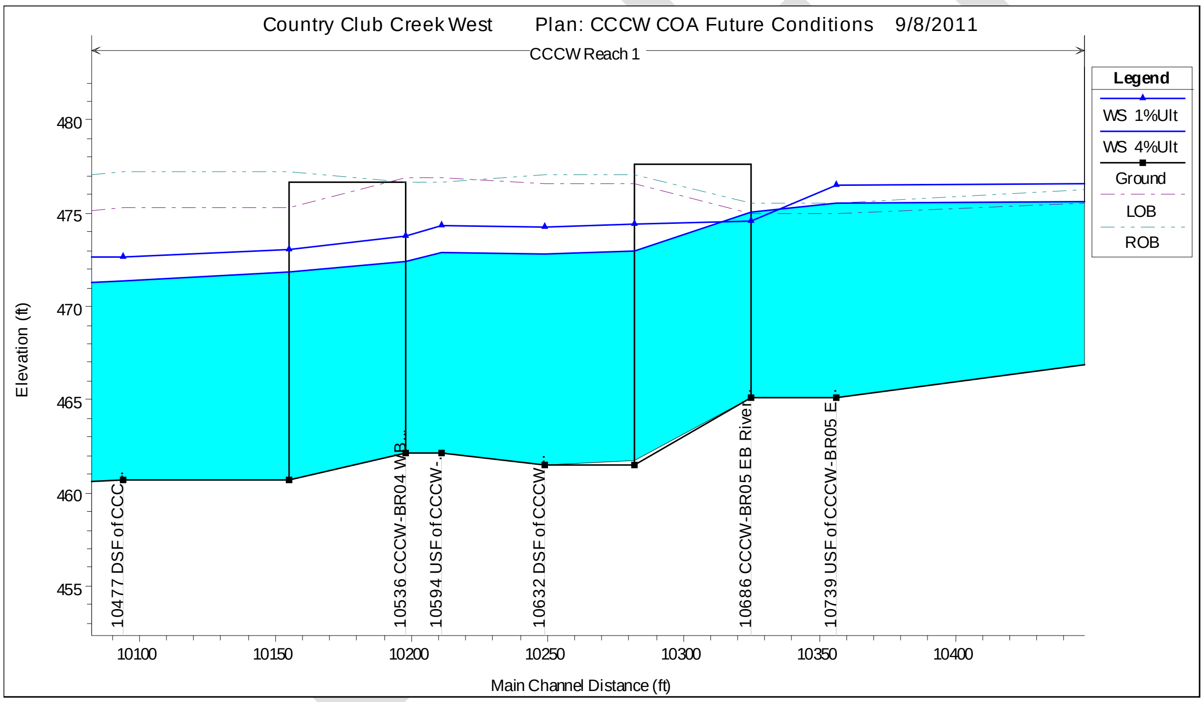

Figure 6. Profile of 25-yr and 100-yr water surface elevations at the East Riverside Dr bridges at Country Club West

System 8

The HEC-RAS model for Country Club Creek West Tributary 1 (project *CCW-1 COA Future Conditions*, plan *CCW-1 COA Future Conditions*) provides the hydraulic performance of the 2-8’x5’, 152’ long box culverts, identified within the model as structure BR02 Riverside Drive. The 25-yr and 100-yr ultimate conditions water surface elevation is 484.71 ft and 485.60 ft, respectively. The lowest elevation on the road at the upstream face is 485.59 ft. The culvert is overtopped in the 100-yr ultimate conditions storm event by only 0.01 ft, which is permissible by COA regulations. The culvert has a 100-year level of service. The lateral lines are shown in the TxDOT record drawings M P043(2) as designed for a 10-yr level of service. A profile plot of the 25-yr and 100-yr water surface elevations at the bridges is presented as Figure 7.

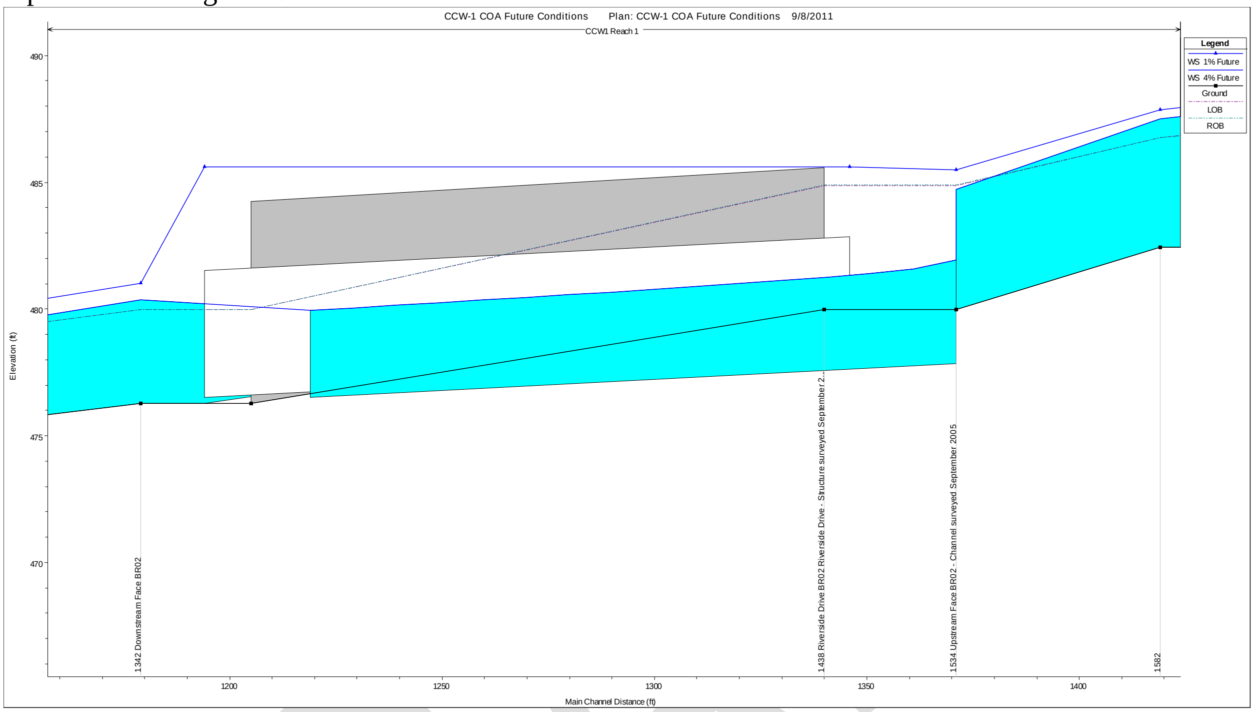

Figure 7. Profile of 25-yr and 100-yr water surface elevations at the East Riverside Dr culvert at Country Club Creek West Tributary 1

System 9

The HEC-RAS model for Country Club Creek East Tributary 3 (project *CCE-3 COA Future Conditions*, plan *CCE-3 COA Future Conditions*) provides the hydraulic performance of the 7’x5’, 117’ long box culverts, identified as structure CCE3-BR02 Riverside Drive. The 25-yr and 100-yr ultimate conditions water surface elevation is 495.76 ft and 497.75 ft, respectively. The lowest elevation on the road at the upstream face is 498 ft. The culvert has a 100-yr ultimate conditions capacity. A profile plot of the 25-yr and 100-yr water surface elevations at the bridges is presented as Figure 8.

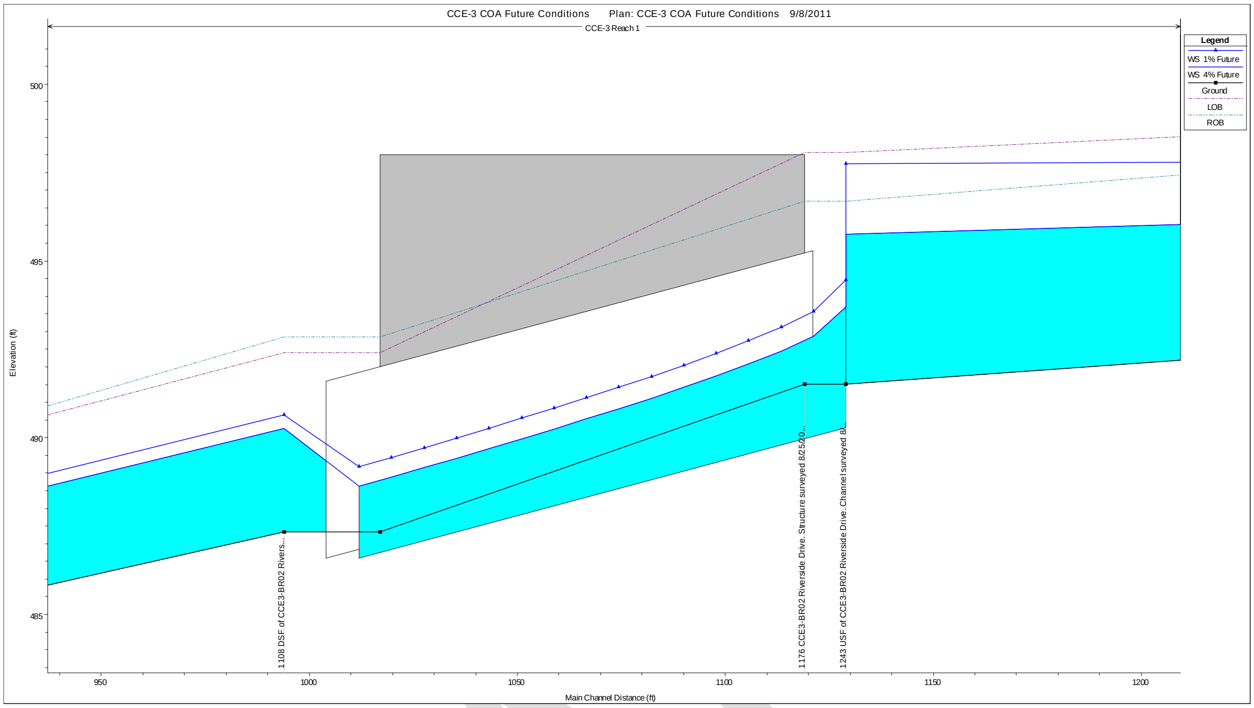

Figure 8. Profile of 25-yr and 100-yr water surface elevations at the East Riverside Dr culvert at Country Club Creek East Tributary 3

System 10

The HEC-RAS model for Country Club Creek East (project *CCCE COA Future Conditions*, plan *CCCE COA Future Conditions*), provides the hydraulic performance of the 4-4’x5’, 114’ long box culverts, identified as CCCE-BR10 Riverside Drive. The 25-yr and 100-yr ultimate conditions water surface elevation is 503.54 ft and 506.61 ft, respectively. The lowest elevation on the road at the upstream face is 506.34 ft. The culvert is overtopped by 0.27 ft at the upstream face. The culvert has a 100-yr level of service. A profile plot of the 25-yr and 100-yr water surface elevations at the bridges is presented as Figure 9.

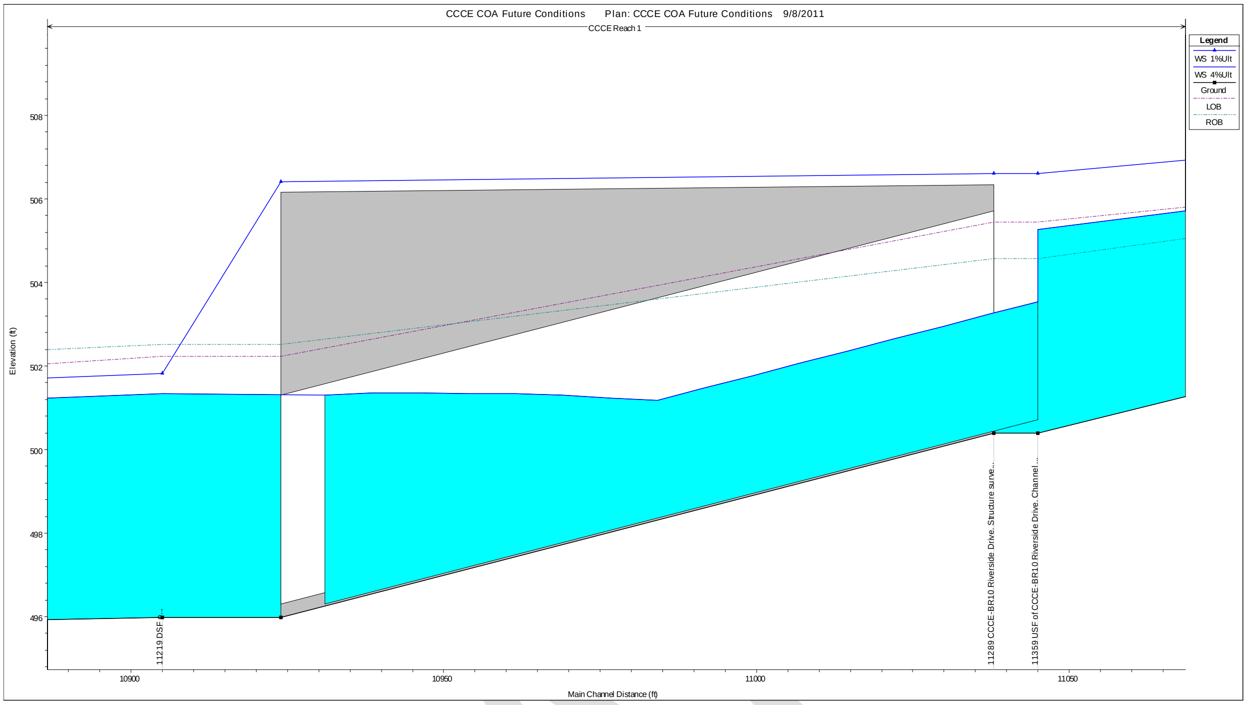

Figure 9. Profile of 25-yr and 100-yr water surface elevations at the East Riverside Dr culvert at Country Club Creek East

System 11

The HEC-RAS model for Country Club Creek East Tributary 4 (project *CCE-4 COA Future Conditions*, plan *CCE-4 COA Future Conditions*) provides the hydraulic performance of the 2-6'x6', 156' long culvert, identified as structure CCE4-BR02 Riverside Drive. The 25-yr and 100-yr ultimate conditions water surface elevation is 507.89 ft and 508.92 ft, respectively. The lowest elevation on the road at the upstream face is 508.30 ft. The culvert is overtopped in the 100-yr ultimate conditions storm event by 0.62 ft. The headwater elevation at the roadway is greater than six inches above any top of upstream curb elevation. The culvert has a 25-year level of service. A profile plot of the 25-yr and 100-yr water surface elevations at the bridges is presented as Figure 10.

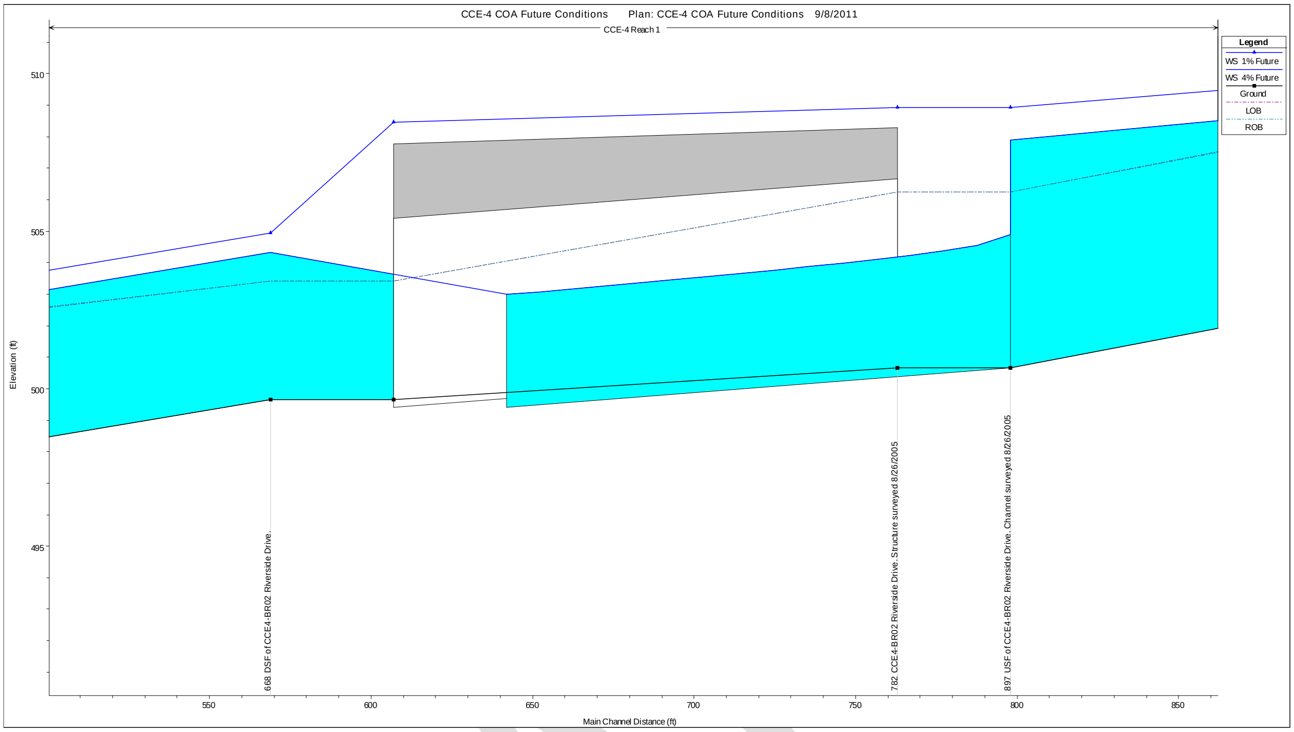

Figure 10. Profile of 25-yr and 100-yr water surface elevations at the East Riverside Dr culvert at Country Club Creek East

System 12

Analysis by CAS with Autodesk SSA shows that this system does not meet criteria for a 25-yr level of service. Results, as summarized below in Figure 11 and Table 6, show that the pipes, except Link-12ABCD-2, are surcharged and most pipe capacities are exceeded. The hydraulic grade line criteria is not met.

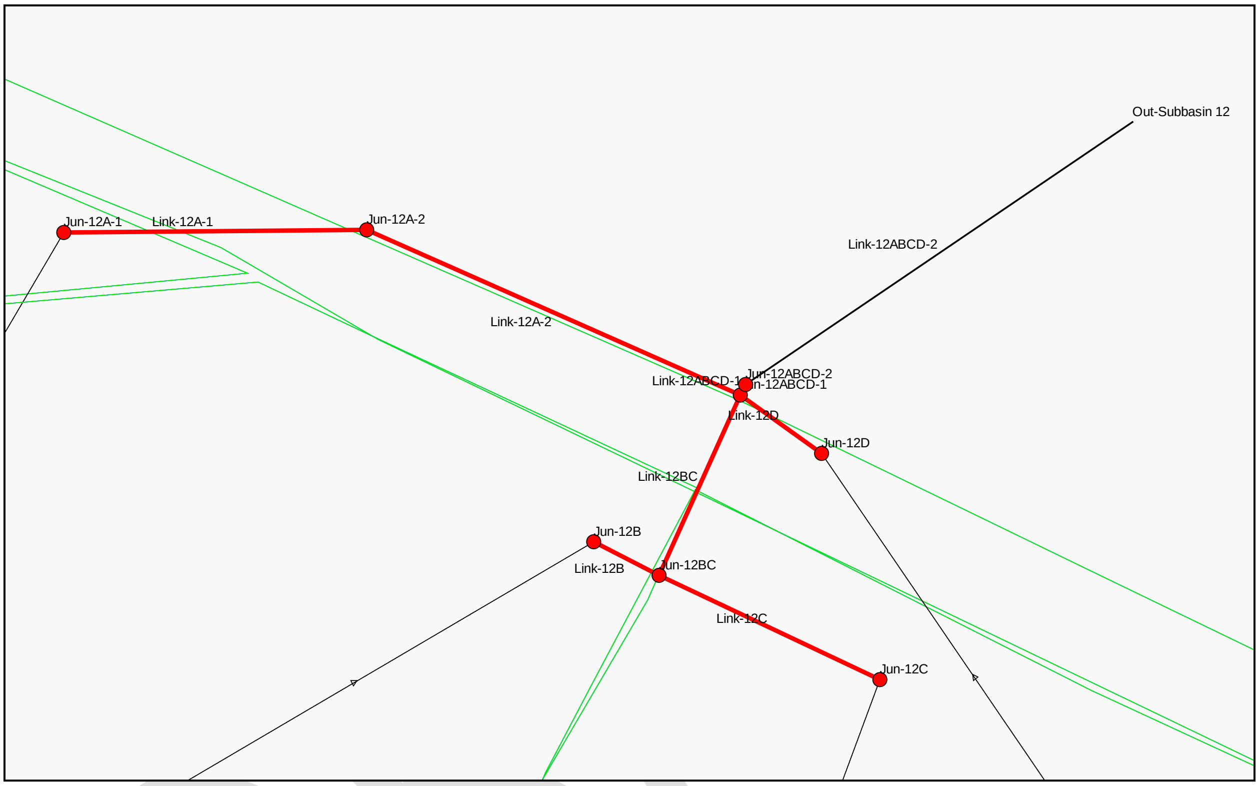

Figure 11. System 12 Results Schematic

Table 6. System 12 Existing Conditions Results

Pipe	Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Maximum Flow / Design Flow Ratio	Maximum Flow Depth/ Total Depth Ratio	Reported Condition
Link-12A-1	CIRCULAR	30	30	2.17	1.00	SURCHARGED
Link-12A-2	CIRCULAR	30	30	3.75	1.00	SURCHARGED
Link-12ABCD-1	Rectangular	36	72	2.68	1.00	SURCHARGED
Link-12ABCD-2	Rectangular	36	72	0.37	0.85	Calculated
Link-12B	CIRCULAR	30	30	1.71	1.00	SURCHARGED
Link-12BC	Rectangular	36	72	0.79	1.00	SURCHARGED
Link-12C	CIRCULAR	36	36	1.52	1.00	SURCHARGED
Link-12D	CIRCULAR	30	30	0.77	1.00	SURCHARGED

System 13

Analysis by CAS with Autodesk SSA shows that this system does not meet criteria for a 25-yr level of service. The capacity of the 2-8'x5' box culverts is exceeded by the 25-yr storm event peak flows. A majority of the modeled system has junctions at which the hydraulic grade line criteria limit is not met. Results are summarized below in Figure 12 and Table 7.

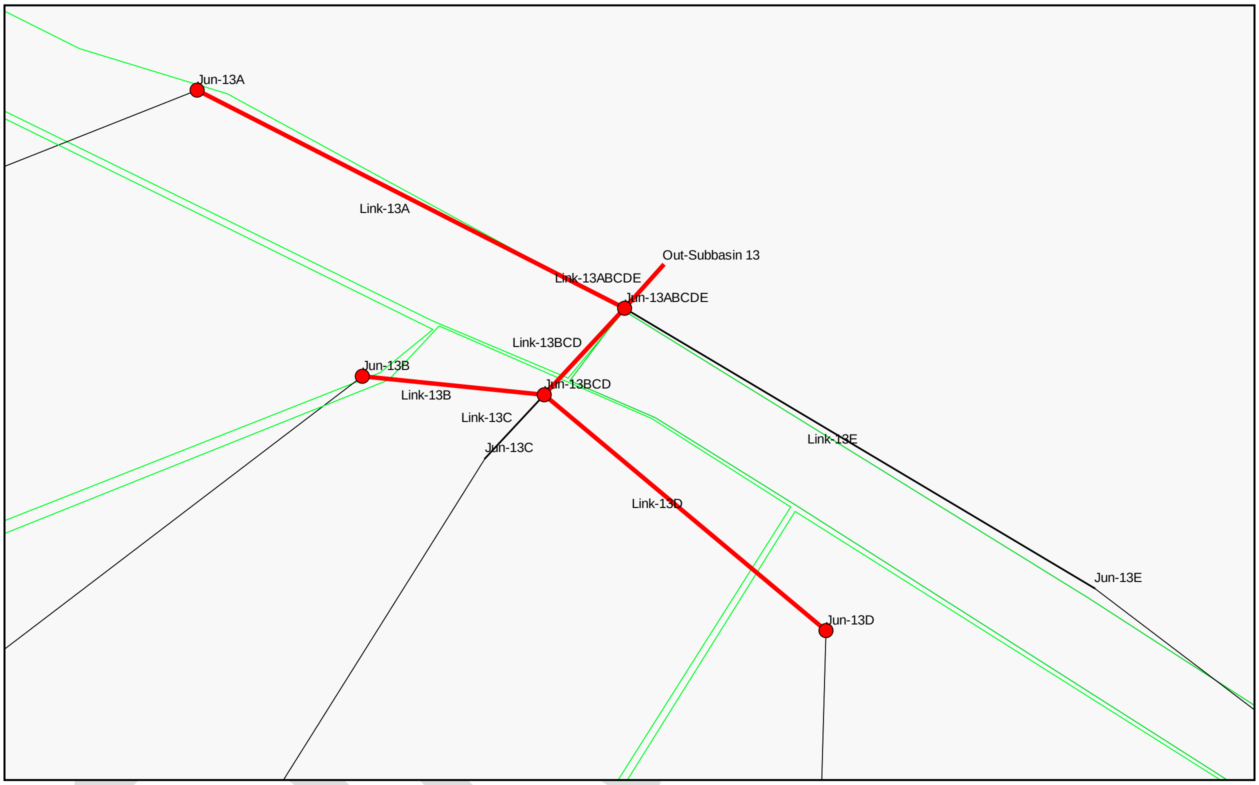

Figure 12. System 13 Existing Conditions Results Schematic

Table 7. System 13 Existing Conditions Results Summary

Pipe	Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Maximum Flow / Design Flow Ratio	Maximum Flow Depth/ Total Depth Ratio	Reported Condition
Link-13A	CIRCULAR	48	48	0.96	1.00	SURCHARGED
Link-13ABCDE	Rectangular	60	96	1.06	1.00	SURCHARGED
Link-13B	CIRCULAR	42	42	1.19	1.00	SURCHARGED
Link-13BCD	Rectangular	60	96	0.89	1.00	SURCHARGED
Link-13C	Rectangular	60	96	0.04	0.78	Calculated
Link-13D	CIRCULAR	36	36	1.71	1.00	SURCHARGED
Link-13E	CIRCULAR	18	18	0.58	0.79	Calculated

System 14

Analysis by CAS with Autodesk SSA shows that this system does not meet criteria for a 25-yr level of service. The capacity of the 48" RCP is exceeded by the 25-yr storm event peak flows. The hydraulic grade line criteria is not met at the junctions. Results are summarized below in Figure 13 and Table 8.

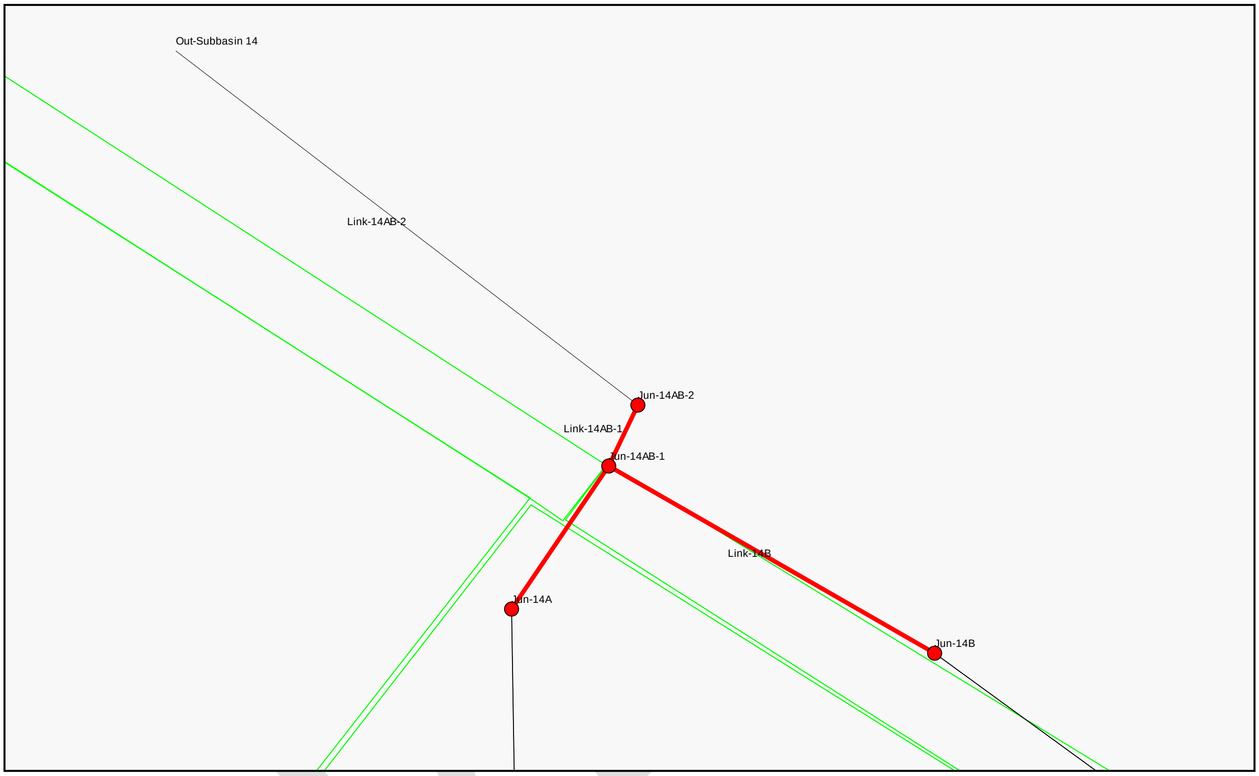

Figure 13. System 14 Existing Conditions Results Schematic

Table 8. System 14 Existing Conditions Results Summary

Pipe	Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Maximum Flow / Design Flow Ratio	Maximum Flow Depth/ Total Depth Ratio	Reported Condition
Link-14A	CIRCULAR	48	48	1.36	1.00	SURCHARGED
Link-14AB-1	CIRCULAR	48	48	1.58	1.00	SURCHARGED
Link-14AB-2	CIRCULAR	48	48	1.08	0.96	> CAPACITY
Link-14B	CIRCULAR	18	18	0.22	1.00	SURCHARGED

Table 9 summarizes the results of the existing conditions analysis. The systems modeled in hydraulic software HEC-RAS (Systems 1, 7, 8, 9, 10, and 11) appear to be in compliance with the City drainage code, except System 11. System 11 is out of compliance due to the overtopping depth exceeding six inches above the crown of the road. System 11 can be brought into compliance by raising the road elevation by 0.62 ft. The systems modeled and analyzed as a storm drain with Autodesk SSA (Systems 2, 3, 4, 5, 12, 13, 14, and 15) appear to be out of compliance. Documentation of System 6 shows that the culvert meets compliance.

Table 9. Summary of Existing Systems

Drainage System	Do the major drainage structure(s) have capacity to convey the 25-yr event?	Is the 25-year hydraulic grade line six inches or less below the theoretical gutter flow line of the storm drain inlets?	Is the water surface elevation at the bridge or culvert upstream face within the allowable 100-year event overtopping depth of six inches above the crown or any top of upstream curb elevation, whichever is lower?	Is the COA criteria met?
1	yes	----	yes	yes
2	yes	no	----	no
3	yes	no	----	no
4	no	no	----	no
5	yes	no	----	no
6	yes	----	yes	yes
7	yes	----	yes	yes
8	yes	----	yes	yes
9	yes	----	yes	yes
10	yes	----	yes	yes
11	yes	----	no	no
12	no	no	----	no
13	no	no	----	no
14	no	no	----	no

A copy of the existing conditions Autodesk SSA analysis output is found in Appendix D.

Proposed Improvements

The transportation configuration proposed for the East Riverside Corridor will require modification of existing major storm drain systems due to the roadway widening and the need to drain the train trackway. Existing inlets and lateral lines will likely be replaced. Assuming the proposed roadway drains outward toward the right of way line, the storm drain design includes the following:

- For segments with medians dividing the roadway and bicycle track, drainage inlets will be placed along those medians to simultaneously drain both. For roadway segments where the vehicle lanes and bicycle lanes are not separated, inlets will be placed at the curb.
- The roadway is super-elevated from approximately 1,000 ft east of the Willow Creek Dr. to 350 ft west of Wickersham Dr. This section of the road way is divided, requiring inlets along the north curbs of the both roadways.
- The proposed train trackway will require some type of drainage. Inlets will be placed between tracks for the purpose of this study.
- The inlets will drain toward the trunk line, which will run parallel with E. Riverside Dr.
- And, the trunk line will increase in pipe size as it reaches the system's major structure and outfalls along the north side of E. Riverside Dr.

For systems whose major structures do not meet capacity and/or whose existing configuration would not be easy to tie into with the proposed lateral network, analysis to size the major structure included:

- Calculating discharges using the rational method.
- Using the existing system's tailwater conditions for the 25-yr event.
- Maintaining the existing system's downstream invert elevation.
- Calculating an upstream invert elevation that provides three feet of cover. Contour data provided the existing ground elevation.
- Determining the pipe length based on the proposed roadway configuration.
- And, assuming the proposed structure was in the approximate location as the existing structure.

For systems whose major structures meet capacity and whose existing configuration would be easy to tie into with the proposed lateral configuration, the major structure was extended to the proposed roadway width. Summary of proposed modifications and replacement follow in the table below.

Table 10. Summary of Existing Major Drainage Structures and Proposed Improvements

Drainage System	Existing Conditions		Proposed Conditions
	Existing Major Structure	Evaluation Summary	Proposed Improvement
1	2-7'x 6' culvert	Meets code	---
2	30" rcp	Design capacity>peak flow tailwater controlled	Replace with 36" rcp, 138 ft long
3	42" rcp and 60" rcp	Design capacity>peak flow hgl exceeded for 42" rcp	Replace with 48" rcp, 178 ft long
4	54" rcp	Design capacity<peak flow	Replace with 8x6 mbc, 410 ft long
5	36" rcp and 42" rcp	Design capacity>peak flow hgl exceed for the 18" rcp	Replace with 42" rcp, 200 ft long
6	2-9'x5' culvert	Meets code	Extend 21 ft on the upstream side
7	2 bridge decks, 43 ft wide	Meets code	Widen south deck to 44 ft Widen north deck to 44.5 ft
8	2-8'x5' culvert	Meets code	Extend 60 ft
9	7'x5' culvert	Meets code	Extend 21 ft
10	4-5'x4' culvert	Meets code	Extend 24 ft
11	2-6'x6'	Culvert's curb/crown upstream is overtopped by 6" or more	Extend 36 ft
12	6'x3' culvert	Design capacity>peak flow	Replace with 6'x4' culvert, 287 ft long
13	2-8'x5' culvert	Design capacity<peak flow hgl exceeded	Replace with 2-8'x5', 153 ft and raise the upstream pipe invert elevation to at least 497 ft
14	48" rcp	Design capacity<peak flow hgl exceeded	Replace with 60" rcp, 420 ft long

Discharge calculations and parameters used for proposed analysis can be found in Appendix E. A map of the location of the proposed major structures is found in Appendix B.

Detention and Water Quality Treatment Requirements

The amount of paved area under the proposed design increases the amount of impervious cover from existing conditions by approximately nine acres. Storm water runoff peak flow rates will increase within the right of way due to the increase in impervious cover. The COA DCM states that peak flow rates under proposed development must be returned to existing peak flow rates as considered from a point of discharge. Controlling the peak flow rates can be done by either storage on-site or off-site (detention pond) or by participation in an approved Regional Stormwater Management Program (RSMP). To participate in the RSMP a fee is required based on the impervious acres and includes a cost for construction and land.

Water quality treatment is required as the proposed transportation design configuration will increase the impervious cover amount and redevelop the existing roadway. The percent increase in impervious cover between the existing and proposed roadway is approximately 25 percent.

Cost Estimate

Drainage-related items included in the cost estimate are box culverts, pipes, inlets, headwalls, manholes, detention ponds, and water quality ponds. The cost of bridge widening and guard railing across open drainage inlets and outlets were assumed to be covered under the roadway cost estimate. Sources of cost were City of Austin bid tabs, TxDOT bid information and RS Means CostWorks 2012.

Several design assumptions were made to determine the cost estimate for the drainage systems. The lateral lines draining from the inlet to the trunk line are assumed as 18" RCP. Lateral pipe sizes for the trunk will increase towards the system's major structure, starting at 300 ft from the system's drainage divide. Inlets were assumed to be spaced 300 ft apart along the trunk line. Lateral pipe lengths were determined based on the location of the inlet with respect to the proposed typical section. To determine the cost of the drainage system's trunk line a matrix was created to proportion the trunk line sizes according to the drainage length along the roadway to the major structure. Headwalls were required if replacement or extension of the major structure was required.

The order of magnitude opinion of probable construction cost is $4.9 million. A breakdown of costs are provided in Table 11.

Table 11. Cost Estimate for Drainage-Related Items

Item	Units	Quantity	Unit Cost	Cost
36" RCP	LF	138	$105	$14,490
42" RCP	LF	200	$120	$24,000
48" RCP	LF	178	$200	$35,600
60" RCP	LF	420	$215	$90,300
5'x4' box culvert	LF	96	$280	$26,880
6'x4' box culvert	LF	287	$375	$107,625
6'x6' box culvert	LF	72	$400	$28,800
7'x5' box culvert	LF	21	$350	$7,350
8'x5' box culvert	LF	426	$350	$149,100
8'x6' box culvert	LF	420	$415	$174,300
9'x5' box culvert	LF	42	$346	$14,532
Headwalls for box culverts	EA	14	$10,000	$140,000
Headwalls for RCP	EA	1	$4,000	$4,000
Inlets	EA	171	$4,000	$684,000
Manholes	EA	10	$4,000	$40,000
Trunk and lateral line pipes	LS	1	$1,855,158	$1,855,158
Detention and water quality ponds	LS	1	$1,500,000	$1,500,000
			Total Cost	$5,000,000

APPENDIX A

Data Sources

Record Drawings

- Cityview 1300 East Riverside Dr. Constellation Property Group, SP-06-0700C, 2007
- Consolidated Administrative Site Plan for AMLI Riverside 1620 East Riverside Dr. Austin, Travis County, Texas, 78741, SP2007-0710C, 2008
- East Riverside Dr. Improvements, 1-A-6788 (A) prepared by Lockwood, Andrews, and Newman, 1980
- Plans of Proposed TSM: Median Modification at the Intersection of East Riverside Dr. and Lakeshore Blvd., COA PW, SP-92-0429DS, 1993
- Riverside Place Subdivision Improvements Water, Wastewater, and Drainage Improvements, Longaro & Clark, Inc., SP-98-0341D, 1998
- Consolidated Administrative Site Plan for 2301 East Riverside Dr, SP-2008-0188C, Sheet 24 of 30, 2009
- Plans for Proposed State Highway Improvement Federal Project M P043(2) Travis County MH 101 In Austin on Riverside Drive From Pleasant Valley Road East to Ben White Boulevard, TxDOT, 1983 plans
- Town Vista Site Plan 2201 Montopolis Drive Austin, Texas, SP-02-0287C.SH, Urban Design Group, 2002
- Riverside Nursing Home 6801 Riverside Drive, Austin, Texas Vickery and Associates, Inc. SP- 2007-0655C
- San Pedro Subdivision, Raymond Chan and Associates, Inc.,C8-05-0138, 2006
- Riverside Meadows 1601 Montopolis Dr, SP-01-0478C.SH, 2001
- Site Development Permit and Construction Drawings for CAVCO-Austin Manufactured Home Sales Lot 7016 E. Ben White Blvd, SP-99-0204C, Conley Engineering, 1999
- Riverside Parking Lot 7305 Riverside Drive, Professional Strucivil Engineers, Inc., SP-05-1357C , 2005
- Don A. Stewart, Inc. Office Building and Warehouse Site Additions 7110 E Ben White Blvd, Griffin Engineering Group, SP-00-2359C, 2001
- ABI Park & Ride 7310 E Ben White Blvd, SP-00-2127C, 2000
- Plans of Proposed State Highway Improvements, Travis County, State Highway 71 For the Construction of Underpass, Frontage Roads and Main lanes, CSJ:0113-13-149, etc., TxDOT 2011
- Riverside Drive Convenience Store 7310 East Riverside Site Development Construction Plans, SP-2009-0260C, Prossner and Associates, Inc, 2010

HEC RAS models

- Harper's Branch (project *harper*, plan *PLAN 01*)
- Country Club Creek West (project *Country Club Creek West*, plan *CCCW COA Future Conditions*), prepared by Halff Associates in Dec 2005
- Country Club Creek East Tributary 3 (project *CCW-1 COA Future Conditions*, plan *CCW-1 COA Future Conditions*)
- Country Club Creek East Tributary 3 (project *CCE-3 COA Future Conditions*, plan *CCE-3 COA Future Conditions*)
- Country Club Creek East (project *CCCE COA Future Conditions*, plan *CCCE COA Future Conditions*)
- Country Club Creek East Tributary 4 (project *CCE-4 COA Future Conditions*, plan *CCE-4 COA Future Conditions*)

APPENDIX B

Exhibit 1 - Drainage Systems and Major Structures Map (1 of 3)

Exhibit 2 - Drainage Systems and Major Structures Map (2 of 3)

Exhibit 3 - Drainage Systems and Major Structures Map (3 of 3)

FILE: L:\!ACTIVE PROJECTS\COA TRANSPORTATION CORRIDOR STUDY\RIVERSIDE DR - HDR\3.0 WORK PRODUCTS\E RIVERSIDE DR STUDY WORKMAP_ED.DWG 4/27/2012 4:39 PM ED V

CITY OF AUSTIN

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STATE OF TEXAS
ASHLEY S. HANSON
107373
LICENSED PROFESSIONAL ENGINEER

EAST RIVERSIDE CORRIDOR STUDY

DRAINAGE SYSTEMS AND MAJOR STRUCTURES MAP (1 OF 3)

EXHIBIT 1

FILE: L:\!ACTIVE PROJECTS\COA TRANSPORTATION CORRIDOR STUDY\RIVERSIDE DR – HDR\3.0 WORK PRODUCTS\E RIVERSIDE DR STUDY WORKMAP_ED.DWG 4/27/2012 4:38 PM ED V

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EAST RIVERSIDE CORRIDOR STUDY

DRAINAGE SYSTEMS AND MAJOR STRUCTURES MAP (2 OF 3)

EXHIBIT 2

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DRAINAGE SYSTEMS AND MAJOR STRUCTURES MAP (3 OF 3)

EXHIBIT 3

Appendix C

Existing Conditions Calculations and Data

Table 12. Peak Flow Rates from Floodplain Study Models

Drainage System	Ultimate Conditions Peak Flow Rates (cfs)	
	25-yr	100-yr
1	1311*	1502*
2	---	---
3	---	---
4	---	---
5	---	---
6	606*	832*
7	4690	6550
8	750	1030
9	250	340
10	430	610
11	590	810
12	---	---
13	---	---
14	---	---

*Existing Conditions flows-based on present land use; Ultimate flows not provided with hydraulic model

Table 13. Peak Flow Rates Calculated for Storm Drain System Analysis

Drainage System	Basins	Area (ac)	Time of Concentration, tc (min)	25-Year Storm Event		
				Intensity, I (in/hr)	Runoff Coefficient, C	Ultimate Conditions Discharge, Q=CIA (cfs)
2	2-A	3.09	9.1	8.5	0.81	21.2
	2-B	10.94	12.5	7.5	0.73	59.9
	2-C	1.53	5.0	10.1	0.76	11.8
3	3-A	6.96	5.8	9.7	0.76	51.5
	3-B	41.53	16.3	6.7	0.74	205.3
4	4-A	61.2	19.2	6.2	0.78	295.4
	4-B	0.57	5.0	10.1	0.86	5.0
	4-C	0.52	5.0	10.1	0.86	4.5
	4-D	0.39	5.0	10.1	0.86	3.4
5	5-A	14.08	11.7	7.7	0.85	92.2
	5-B	5.79	5.0	10.1	0.91	53.3
	5-C	1.17	5.0	10.1	0.86	10.2
12	12-A	16.00	17.2	6.5	0.91	94.9
	12-B	6.30	5.8	9.7	0.91	55.9
	12-C	9.46	8.0	8.8	0.79	66.1
	12-D	2.72	7.8	8.9	0.85	20.6
13	13-A	26.56	17.5	6.5	0.80	137.4
	13-B	44.56	18.8	6.3	0.83	231.2
	13-C	38.29	13.5	7.3	0.81	225.9
	13-D	30.37	14.2	7.1	0.78	168.4
	13-E	1.01	5.0	10.1	0.86	8.8
14	14-A	16.71	5.0	10.1	0.94	158.8
	14-B	0.83	5.0	10.1	0.86	7.2

Table 14. Time of Concentration Calculations

Time of Concentration		2-A	2-B	2-C	3-A	3-B	4-A	4-B	4-C	4-D
Sheet Flow										
Manning's Roughness	n	0.3	0.3	0.3	0.3	0.3	0.3	0.02	0.02	0.02
Sheet Flow Distance (ft)	L	150	150	20	150	150	150	125	150	150
Land Slope (ft/ft)	S	0.080	0.033	0.600	0.067	0.073	0.020	0.016	0.027	0.013
Travel Time (min)	T	3.79	5.87	0.18	4.15	3.96	7.58	0.47	0.44	0.62
Shallow Concentrated Flow										
Length (ft)	L	232	165	66	430	400	500	415	132	96
Slope	S	0.129	0.061	0.030	0.116	0.110	0.076	0.034	0.015	0.021
Manning's n	n	0.30	0.30	0.02	0.02	0.30	0.02	0.02	0.02	0.02
Time (min)	T	3.2	3.4	0.1	0.4	6.0	0.6	0.8	0.4	0.2
Channel Flow										
Length (ft)	L	492	782	129	297	1527	2648	0	0	0
Velocity (fps)	V	4	4	4	4	4	4	4	4	4
Time (min)	T	2.1	3.3	0.5	1.2	6.4	11.0	0.0	0.0	0.0
Total Travel Time (min)	Tc	9.1	12.5	5.0	5.8	16.3	19.2	5.0	5.0	5.0

Time of Concentration		5-A	5-B	5-C	12-A	12-B	12-C	12-D
Sheet Flow								
Manning's Roughness	n	0.3	0.02	0.02	0.02	0.3	0.3	0.3
Sheet Flow Distance (ft)	L	150	150	150	150	150	150	150
Land Slope (ft/ft)	S	0.020	0.173	0.013	0.080	0.067	0.080	0.040
Travel Time (min)	T	7.58	0.17	0.62	0.25	4.15	3.79	5.36
Shallow Concentrated Flow								
Length (ft)	L	400	420	500	500	400	500	227
Slope	S	0.065	0.033	0.004	0.056	0.040	0.064	0.035
Manning's n	n	0.02	0.02	0.02	0.30	0.02	0.02	0.02
Time (min)	T	0.5	0.8	2.6	10.6	0.7	0.7	0.4
Channel Flow								
Length (ft)	L	874	126	195	1543	231	860	499
Velocity (fps)	V	4	4	4	4	4	4	4
Time (min)	T	3.6	0.5	0.8	6.4	1.0	3.6	2.1
Total Travel Time (min)	Tc	11.7	5.0	5.0	17.2	5.8	8.0	7.8

Time of Concentration		13-A	13-B	13-C	13-D	13-E	14-A	14-B
Sheet Flow								
Manning's Roughness	n	0.3	0.3	0.02	0.3	0.02	0.02	0.02
Sheet Flow Distance (ft)	L	150	150	150	150	150	150	150
Land Slope (ft/ft)	S	0.053	0.040	0.007	0.027	0.013	0.040	0.040
Travel Time (min)	T	4.64	5.36	0.87	6.56	0.62	0.36	0.36
Shallow Concentrated Flow								
Length (ft)	L	500	500	500	500	400	500	500
Slope	S	0.068	0.076	0.002	0.044	0.013	0.068	0.012
Manning's n	n	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Time (min)	T	0.6	0.6	3.7	0.8	1.2	0.6	1.5
Channel Flow								
Length (ft)	L	2939	3085	2125	1649	614	522	270
Velocity (fps)	V	4	4	4	4	4	4	4
Time (min)	T	12.2	12.9	8.9	6.9	2.6	2.2	1.1
Total Travel Time (min)	Tc	17.5	18.8	13.5	14.2	5.0	5.0	5.0

Table 15. Tailwater Calculations

Outfall Channel Parameters	Drainage System						
	2	3	4	5	12	13	14
Bottom Width (ft)	----	6.0	6.0	----	5.0	5.0	3.0
Side Slope (z:1)	----	2.0	2.0	----	4.5	2.5	3.0
Bed Slope (ft/ft)	----	0.005	0.005	----	0.014	0.012	0.006
Manning's n	----	0.035	0.035	----	0.035	0.035	0.018
Outfall Channel Invert Elevation (ft)	----	448.0	448.0	----	491.0	494.0	504.0
25-yr Event Outfall Discharge (cfs)	----	249.0	323.0	----	292.0	1080.0	227.0
25-yr Event Normal Depth (ft)	----	3.7	4.2	----	2.6	5.7	2.6
25-yr Event Tailwater (ft)	465.5*	451.7	452.2	466**	493.6	499.7	506.6

* Source: SP2007-0710C

**Source: SP 2008-0188C

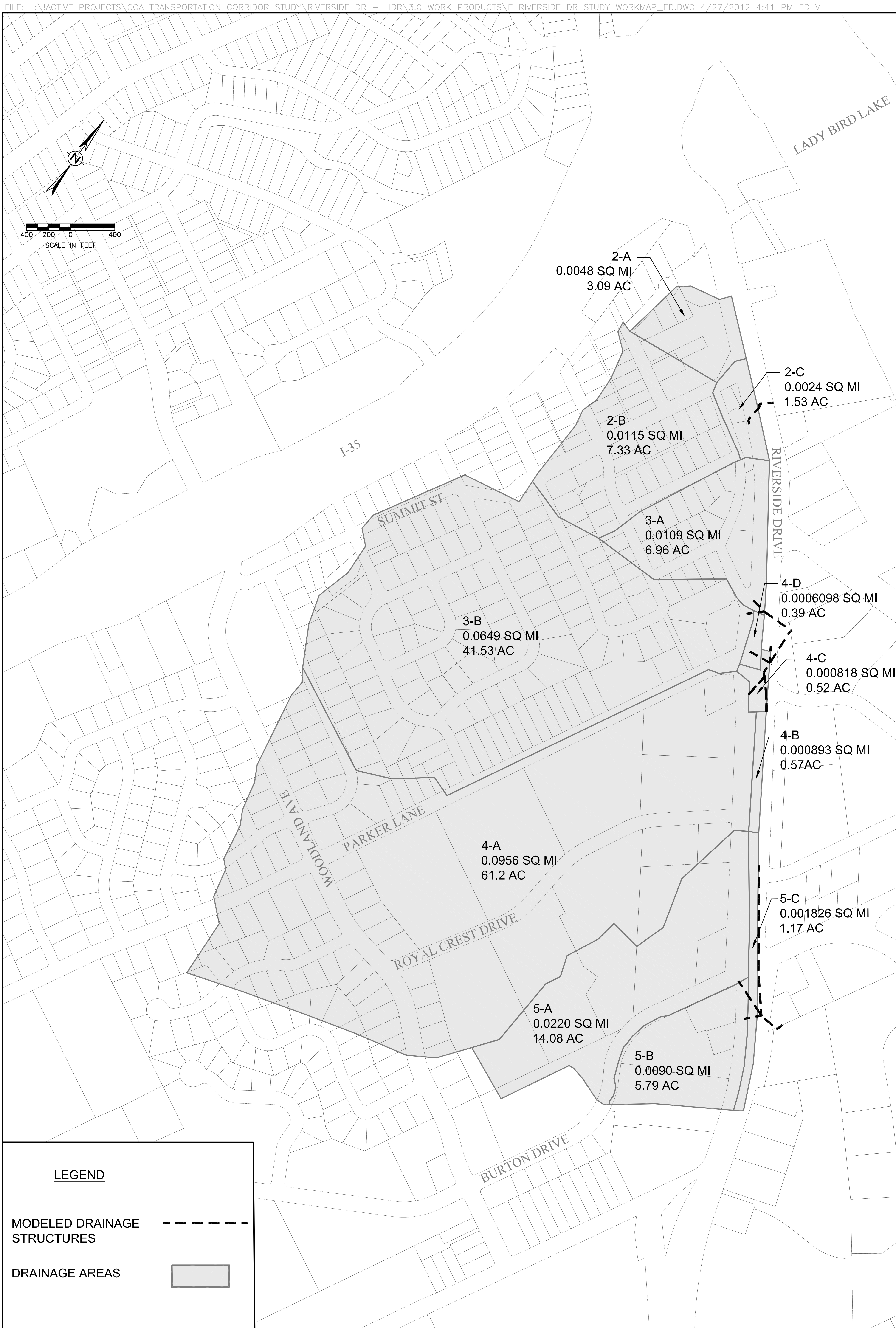
Appendix D

Existing Conditions Autodesk Storm and Sewer Analysis Output

Exhibit 4 - Existing Conditions Drainage Analysis Areas Map (1 of 2)

Exhibit 5 - Existing Conditions Drainage Analysis Areas Map (2 of 2)

FILE: L:\!ACTIVE PROJECTS\COA TRANSPORTATION CORRIDOR STUDY\RIVERSIDE DR - HDR\3.0 WORK PRODUCTS\E RIVERSIDE DR STUDY WORKMAP_ED.DWG 4/27/2012 4:41 PM ED V



CITY OF AUSTIN

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7908 CAMERON RD
AUSTIN, TEXAS 78754
REG. No. F-003572

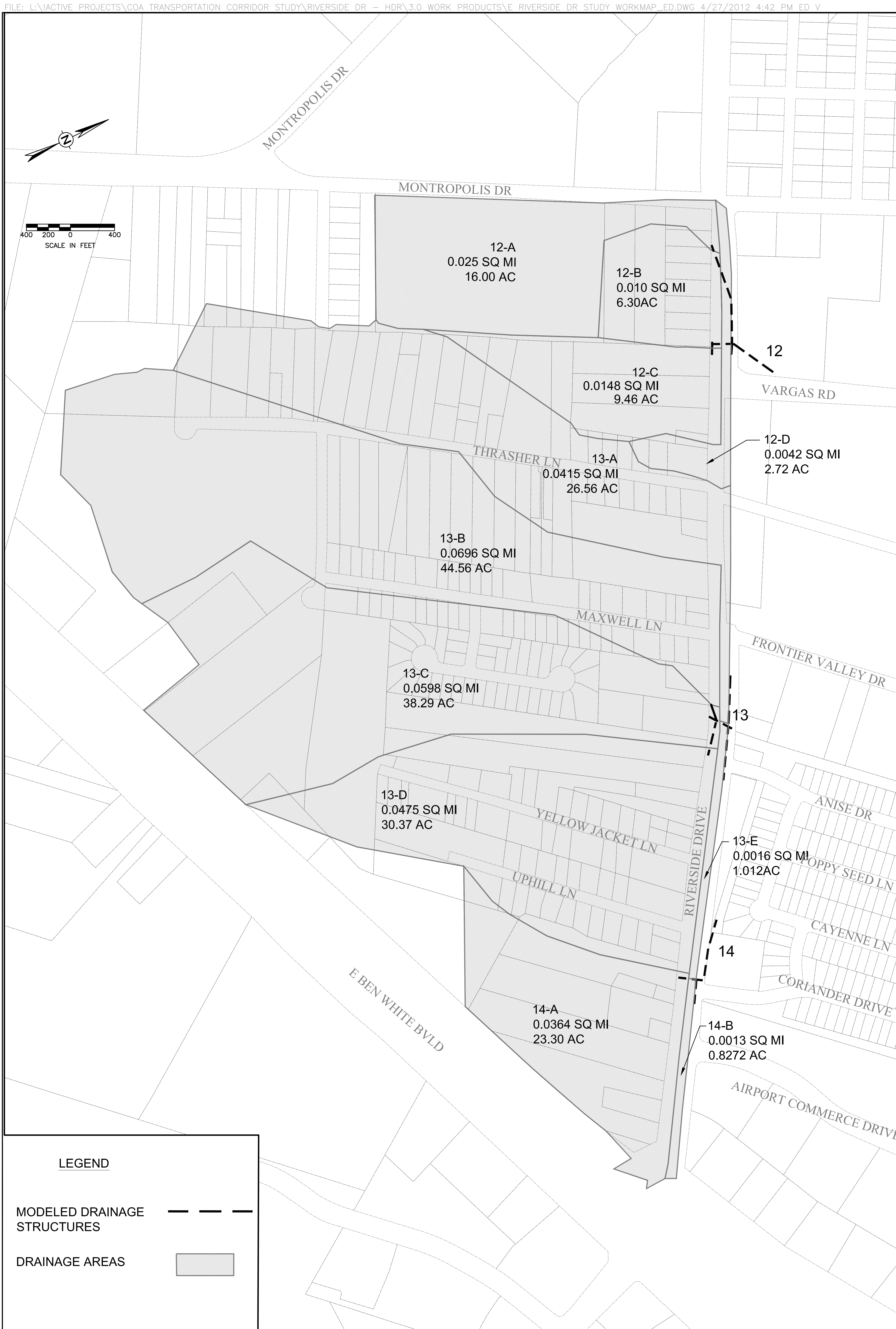
4/27/12
STATE OF TEXAS
ASHLEY S. HANSON
107373
LICENSED
PROFESSIONAL ENGINEER

EAST RIVERSIDE CORRIDOR STUDY

EXISTING CONDITIONS
DRAINAGE ANALYSIS MAP (1 OF 2)

EXHIBIT 4

FILE: L:\!ACTIVE PROJECTS\COA TRANSPORTATION CORRIDOR STUDY\RIVERSIDE DR – HDR\3.0 WORK PRODUCTS\E RIVERSIDE DR STUDY WORKMAP_ED.DWG 4/27/2012 4:42 PM ED V



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EXISTING CONDITIONS DRAINAGE ANALYSIS MAP (2 OF 2)

EXHIBIT 5

Existing Conditions Autodesk SSA Output

Autodesk® Storm and Sanitary Analysis 2012 - Version 6.4.29 (Build 6198)

```
  *******************
  Project Description
  *******************
  File Name ................. Existing Conditions Analysis East Riverside Corridor
Study.SPF


  ****************
  Analysis Options
  ****************
  Flow Units ................ cfs
  Subbasin Hydrograph Method. Rational
  Time of Concentration...... User-Defined
  Return Period.............. 25 years
  Link Routing Method ....... Hydrodynamic
  Storage Node Exfiltration.. None
  Starting Date ............. NOV-17-2011 00:00:00
  Ending Date ............... NOV-17-2011 03:00:00
  Report Time Step .......... 00:00:10


  *************
  Element Count
  *************
  Number of subbasins ....... 23
  Number of nodes ........... 47
  Number of links ........... 40


  ****************
  Subbasin Summary
  ****************
```

Subbasin ID	Total Area acres
Sub-12A	16.00
Sub-12B	6.30
Sub-12C	9.46
Sub-12D	2.72
Sub-13A	26.56
Sub-13B	44.56
Sub-13C	38.29
Sub-13D	30.37
Sub-13E	1.01
Sub-14A	16.71
Sub-14B	0.83
Sub-2A	3.09
Sub-2B	10.94
Sub-2C	1.53
Sub-3A	6.96
Sub-3B	41.53
Sub-4A	61.20
Sub-4B	0.57
Sub-4C	0.52
Sub-4D	0.39
Sub-5A	14.08

Sub-5B	5.79
Sub-5C	1.17

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft^2	External Inflow
Jun-12A-1	JUNCTION	501.95	507.06	0.00	
Jun-12A-2	JUNCTION	499.45	501.95	0.00	
Jun-12ABCD-1	JUNCTION	498.82	501.82	0.00	
Jun-12ABCD-2	JUNCTION	498.81	501.81	0.00	
Jun-12B	JUNCTION	499.19	503.07	0.00	
Jun-12BC	JUNCTION	499.11	502.11	0.00	
Jun-12C	JUNCTION	499.26	502.88	0.00	
Jun-12D	JUNCTION	498.97	502.88	0.00	
Jun-13A	JUNCTION	497.50	505.07	0.00	
Jun-13ABCDE	JUNCTION	494.66	499.66	0.00	
Jun-13B	JUNCTION	498.50	505.70	0.00	
Jun-13BCD	JUNCTION	494.80	499.80	0.00	
Jun-13C	JUNCTION	500.86	505.86	0.00	
Jun-13D	JUNCTION	499.65	505.69	0.00	
Jun-13E	JUNCTION	502.00	505.33	0.00	
Jun-14A	JUNCTION	506.60	513.79	0.00	
Jun-14AB-1	JUNCTION	506.14	510.14	0.00	
Jun-14AB-2	JUNCTION	506.05	510.05	0.00	
Jun-14B	JUNCTION	510.75	513.97	0.00	
Jun-2ABC	JUNCTION	456.38	458.88	0.00	
Jun-2BC	JUNCTION	457.00	459.50	0.00	
Jun-2C-1	JUNCTION	467.00	472.00	0.00	
Jun-2C-2	JUNCTION	465.00	467.00	0.00	
Jun-3A	JUNCTION	459.88	466.03	0.00	
Jun-3AB	JUNCTION	450.50	455.50	0.00	
Jun-3B	JUNCTION	454.60	464.00	0.00	
Jun-4A	JUNCTION	459.90	461.90	0.00	
Jun-4AB-1	JUNCTION	454.59	456.60	0.00	
Jun-4AB-2	JUNCTION	451.00	455.50	0.00	
Jun-4ABCD	JUNCTION	449.50	454.00	0.00	
Jun-4B	JUNCTION	464.00	468.00	0.00	
Jun-4C	JUNCTION	459.90	465.00	0.00	
Jun-4D	JUNCTION	459.80	463.85	0.00	
Jun-4DC	JUNCTION	452.92	454.67	0.00	
Jun-5A	JUNCTION	473.20	482.69	0.00	
Jun-5ABC	JUNCTION	471.20	474.70	0.00	
Jun-5B-1	JUNCTION	477.60	480.60	0.00	
Jun-5B-2	JUNCTION	474.20	477.20	0.00	
Jun-5C-1	JUNCTION	478.30	482.50	0.00	
Jun-5C-2	JUNCTION	475.80	477.30	0.00	
Out-Subbasin 12	OUTFALL	491.50	494.50	0.00	
Out-Subbasin 13	OUTFALL	494.60	499.60	0.00	
Out-Subbasin 14	OUTFALL	503.30	507.30	0.00	
Out-Subbasin 2	OUTFALL	454.04	456.54	0.00	
Out-Subbasin 3	OUTFALL	448.70	453.70	0.00	
Out-Subbasin 4	OUTFALL	448.00	452.50	0.00	
Out-Subbasin 5	OUTFALL	464.00	467.70	0.00	

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-12A-1	Jun-12A-1	Jun-12A-2	CONDUIT	260.0	0.9615	0.0120
Link-12A-2	Jun-12A-2	Jun-12ABCD-1	CONDUIT	195.0	0.3231	0.0120
Link-12ABCD-1	Jun-12ABCD-1	Jun-12ABCD-2	CONDUIT	13.0	0.0769	0.0120
Link-12ABCD-2	Jun-12ABCD-2	Out-Subbasin 12	CONDUIT	182.0	4.0165	0.0120
Link-12B	Jun-12B	Jun-12BC	CONDUIT	15.0	0.5333	0.0120
Link-12BC	Jun-12BC	Jun-12ABCD-1	CONDUIT	83.0	0.3494	0.0120
Link-12C	Jun-12C	Jun-12BC	CONDUIT	42.0	0.3571	0.0120
Link-12D	Jun-12D	Jun-12ABCD-1	CONDUIT	42.0	0.3571	0.0120
Link-13A	Jun-13A	Jun-13ABCDE	CONDUIT	217.0	0.8525	0.0120
Link-13ABCDE	Jun-13ABCDE	Out-Subbasin 13	CONDUIT	25.0	0.2400	0.0120
Link-13B	Jun-13B	Jun-13BCD	CONDUIT	69.0	3.1884	0.0120
Link-13BCD	Jun-13BCD	Jun-13ABCDE	CONDUIT	63.0	0.2222	0.0120
Link-13C	Jun-13C	Jun-13BCD	CONDUIT	34.0	17.8235	0.0120
Link-13D	Jun-13D	Jun-13BCD	CONDUIT	154.0	1.8506	0.0120
Link-13E	Jun-13E	Jun-13ABCDE	CONDUIT	237.0	1.6456	0.0120
Link-14A	Jun-14A	Jun-14AB-1	CONDUIT	82.0	0.5610	0.0120
Link-14AB-1	Jun-14AB-1	Jun-14AB-2	CONDUIT	20.0	0.4500	0.0120
Link-14AB-2	Jun-14AB-2	Out-Subbasin 14	CONDUIT	283.0	0.9717	0.0120
Link-14B	Jun-14B	Jun-14AB-1	CONDUIT	37.0	9.0541	0.0120
Link-2ABC	Jun-2ABC	Out-Subbasin 2	CONDUIT	32.0	7.3125	0.0120
Link-2BC	Jun-2BC	Jun-2ABC	CONDUIT	8.5	7.2941	0.0120
Link-2C-1	Jun-2C-1	Jun-2C-2	CONDUIT	91.5	2.1858	0.0120
Link-2C-2	Jun-2C-2	Jun-2BC	CONDUIT	13.0	61.5385	0.0120
Link-3A	Jun-3A	Jun-3AB	CONDUIT	70.0	9.2857	0.0120
Link-3AB	Jun-3AB	Out-Subbasin 3	CONDUIT	120.0	1.5000	0.0120
Link-3B	Jun-3B	Jun-3AB	CONDUIT	70.0	3.7143	0.0120
Link-4A	Jun-4A	Jun-4AB-1	CONDUIT	110.0	4.8273	0.0120
Link-4AB-1	Jun-4AB-1	Jun-4AB-2	CONDUIT	20.0	5.5000	0.0120

Link-4AB-2	Jun-4AB-2	Jun-4ABCD	CONDUIT	50.0	3.0000	0.0120
Link-4ABCD	Jun-4ABCD	Out-Subbasin 4	CONDUIT	182.0	0.8242	0.0120
Link-4B	Jun-4B	Jun-4AB-1	CONDUIT	160.0	5.5625	0.0120
Link-4C	Jun-4C	Jun-4DC	CONDUIT	38.0	18.1579	0.0120
Link-4D	Jun-4D	Jun-4DC	CONDUIT	95.0	7.2421	0.0120
Link-4DC	Jun-4DC	Jun-4ABCD	CONDUIT	10.0	7.2000	0.0120
Link-5A	Jun-5A	Jun-5ABC	CONDUIT	190.0	1.0526	0.0120
Link-5ABC	Jun-5ABC	Out-Subbasin 5	CONDUIT	125.0	5.6000	0.0120
Link-5B-1	Jun-5B-1	Jun-5B-2	CONDUIT	62.0	5.4839	0.0120
Link-5B-2	Jun-5B-2	Jun-5ABC	CONDUIT	18.0	14.0000	0.0120
Link-5C-1	Jun-5C-1	Jun-5C-2	CONDUIT	503.0	0.4970	0.0120
Link-5C-2	Jun-5C-2	Jun-5ABC	CONDUIT	175.0	1.4857	0.0120

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-12A-1	CIRCULAR	2.50	2.50	1	4.91	0.63	43.57
Link-12A-2	CIRCULAR	2.50	2.50	1	4.91	0.63	25.26
Link-12ABCD-1	RECT_CLOSED	3.00	6.00	1	18.00	1.00	61.82
Link-12ABCD-2	RECT_CLOSED	3.00	6.00	1	18.00	1.00	446.72
Link-12B	CIRCULAR	2.50	2.50	1	4.91	0.63	32.45
Link-12BC	RECT_CLOSED	3.00	6.00	1	18.00	1.00	131.76
Link-12C	CIRCULAR	3.00	3.00	1	7.07	0.75	43.18
Link-12D	CIRCULAR	2.50	2.50	1	4.91	0.63	26.56
Link-13A	CIRCULAR	4.00	4.00	1	12.57	1.00	143.68
Link-13ABCDE	RECT_CLOSED	5.00	8.00	2	40.00	1.54	323.39
Link-13B	CIRCULAR	3.50	3.50	1	9.62	0.88	194.62
Link-13BCD	RECT_CLOSED	5.00	8.00	2	40.00		

						1.54	311.18
Link-13C	RECT_CLOSED	5.00	8.00	2	40.00	1.54	2786.88
Link-13D	CIRCULAR	3.00	3.00	1	7.07	0.75	98.30
Link-13E	CIRCULAR	1.50	1.50	1	1.77	0.38	14.60
Link-14A	CIRCULAR	4.00	4.00	1	12.57	1.00	116.55
Link-14AB-1	CIRCULAR	4.00	4.00	1	12.57	1.00	104.39
Link-14AB-2	CIRCULAR	4.00	4.00	1	12.57	1.00	153.40
Link-14B	CIRCULAR	1.50	1.50	1	1.77	0.38	34.24
Link-2ABC	CIRCULAR	2.50	2.50	1	4.91	0.63	120.16
Link-2BC	CIRCULAR	2.50	2.50	1	4.91	0.63	120.01
Link-2C-1	CIRCULAR	1.75	1.75	1	2.41	0.44	25.38
Link-2C-2	CIRCULAR	2.00	2.00	1	3.14	0.50	192.25
Link-3A	CIRCULAR	2.00	2.00	1	3.14	0.50	74.68
Link-3AB	CIRCULAR	5.00	5.00	1	19.63	1.25	345.56
Link-3B	CIRCULAR	3.50	3.50	1	9.62	0.88	210.06
Link-4A	CIRCULAR	2.00	2.00	1	3.14	0.50	53.85
Link-4AB-1	CIRCULAR	2.00	2.00	1	3.14	0.50	57.48
Link-4AB-2	CIRCULAR	4.50	4.50	1	15.90	1.13	368.99
Link-4ABCD	CIRCULAR	4.50	4.50	1	15.90	1.13	193.40
Link-4B	CIRCULAR	1.50	1.50	1	1.77	0.38	26.84
Link-4C	CIRCULAR	1.50	1.50	1	1.77	0.38	48.49
Link-4D	CIRCULAR	1.75	1.75	1	2.41	0.44	46.19
Link-4DC	CIRCULAR	1.75	1.75	1	2.41	0.44	46.06
Link-5A	CIRCULAR	3.50	3.50	1	9.62	0.88	111.83
Link-5ABC	CIRCULAR	3.50	3.50	1	9.62	0.88	257.93
Link-5B-1	CIRCULAR	3.00	3.00	1	7.07	0.75	169.21
Link-5B-2	CIRCULAR	3.00	3.00	1	7.07	0.75	270.36
Link-5C-1	CIRCULAR	1.50	1.50	1	1.77	0.38	8.02
Link-5C-2	CIRCULAR	1.50	1.50	1	1.77	0.38	13.87

```
**************************        Volume         Depth
Runoff Quantity Continuity       acre-ft        inches
**************************     ---------       -------
Total Precipitation ......        47.583         1.677
```

```
  Continuity Error (%) .....         0.204


  **************************        Volume        Volume
  Flow Routing Continuity          acre-ft      Mgallons
  **************************     ---------     ---------
  External Inflow ..........         2.208         0.719
  External Outflow .........        38.434        12.524
  Initial Stored Volume ....         0.133         0.043
  Final Stored Volume ......         0.429         0.140
  Continuity Error (%) .....         0.029


  **************************************
  Runoff Coefficient Computations Report
  **************************************

  -------------------
  Subbasin Sub-12A
  -------------------
                                                                   Area          Soil
Runoff
  Soil/Surface Description                                       (acres)        Group
Coeff.

-------------------------------------------------------------------------------------
-----
  -                                                                16.00            -
  0.91
  Composite Area & Weighted Runoff Coeff.                          16.00
  0.91

  -------------------
  Subbasin Sub-12B
  -------------------
                                                                   Area          Soil
Runoff
  Soil/Surface Description                                       (acres)        Group
Coeff.

-------------------------------------------------------------------------------------
-----
  -                                                                 6.30            -
  0.91
  Composite Area & Weighted Runoff Coeff.                           6.30
  0.91

  -------------------
  Subbasin Sub-12C
  -------------------
                                                                   Area          Soil
Runoff
  Soil/Surface Description                                       (acres)        Group
Coeff.

-------------------------------------------------------------------------------------
-----
  -                                                                 9.46            -
  0.79
  Composite Area & Weighted Runoff Coeff.                           9.46
  0.79

  -------------------
```

Subbasin Sub-12D

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	2.72	-	0.85
Composite Area & Weighted Runoff Coeff.	2.72		0.85

Subbasin Sub-13A

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	26.56	-	0.80
Composite Area & Weighted Runoff Coeff.	26.56		0.80

Subbasin Sub-13B

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	44.56	-	0.83
Composite Area & Weighted Runoff Coeff.	44.56		0.83

Subbasin Sub-13C

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	38.29	-	0.81
Composite Area & Weighted Runoff Coeff.	38.29		0.81

Subbasin Sub-13D

Area Soil

Soil/Surface Description	(acres)	Group	Runoff Coeff.
-	30.37	-	0.78
Composite Area & Weighted Runoff Coeff.	30.37		0.78

Subbasin Sub-13E

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	1.01	-	0.86
Composite Area & Weighted Runoff Coeff.	1.01		0.86

Subbasin Sub-14A

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	16.71	-	0.94
Composite Area & Weighted Runoff Coeff.	16.71		0.94

Subbasin Sub-14B

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.83	-	0.86
Composite Area & Weighted Runoff Coeff.	0.83		0.86

Subbasin Sub-2A

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

```
-------------------------------------------------------------------------------------
  -                                                          3.09           -
  0.81
  Composite Area & Weighted Runoff Coeff.                    3.09
  0.81

  ------------------
  Subbasin Sub-2B
  ------------------
                                                            Area          Soil
Runoff
  Soil/Surface Description                                (acres)        Group
Coeff.

-------------------------------------------------------------------------------------
  -                                                         10.94           -
  0.73
  Composite Area & Weighted Runoff Coeff.                   10.94
  0.73

  ------------------
  Subbasin Sub-2C
  ------------------
                                                            Area          Soil
Runoff
  Soil/Surface Description                                (acres)        Group
Coeff.

-------------------------------------------------------------------------------------
  -                                                          1.53           -
  0.76
  Composite Area & Weighted Runoff Coeff.                    1.53
  0.76

  ------------------
  Subbasin Sub-3A
  ------------------
                                                            Area          Soil
Runoff
  Soil/Surface Description                                (acres)        Group
Coeff.

-------------------------------------------------------------------------------------
  -                                                          6.96           -
  0.76
  Composite Area & Weighted Runoff Coeff.                    6.96
  0.76

  ------------------
  Subbasin Sub-3B
  ------------------
                                                            Area          Soil
Runoff
  Soil/Surface Description                                (acres)        Group
Coeff.

-------------------------------------------------------------------------------------
```

```
  -                                                      41.53           -
  0.74
  Composite Area & Weighted Runoff Coeff.                41.53
  0.74

  ------------------
  Subbasin Sub-4A
  ------------------
                                                          Area           Soil
Runoff
  Soil/Surface Description                              (acres)         Group
Coeff.

-------------------------------------------------------------------------------------
-----
  -                                                      61.20           -
  0.78
  Composite Area & Weighted Runoff Coeff.                61.20
  0.78

  ------------------
  Subbasin Sub-4B
  ------------------
                                                          Area           Soil
Runoff
  Soil/Surface Description                              (acres)         Group
Coeff.

-------------------------------------------------------------------------------------
-----
  -                                                       0.57           -
  0.86
  Composite Area & Weighted Runoff Coeff.                 0.57
  0.86

  ------------------
  Subbasin Sub-4C
  ------------------
                                                          Area           Soil
Runoff
  Soil/Surface Description                              (acres)         Group
Coeff.

-------------------------------------------------------------------------------------
-----
  -                                                       0.52           -
  0.86
  Composite Area & Weighted Runoff Coeff.                 0.52
  0.86

  ------------------
  Subbasin Sub-4D
  ------------------
                                                          Area           Soil
Runoff
  Soil/Surface Description                              (acres)         Group
Coeff.

-------------------------------------------------------------------------------------
-----
  -                                                       0.39           -
  0.86
  Composite Area & Weighted Runoff Coeff.                 0.39
```

0.86

```
  ------------------
  Subbasin Sub-5A
  ------------------
                                                             Area          Soil
Runoff
  Soil/Surface Description                                 (acres)        Group
Coeff.

-------------------------------------------------------------------------------------
-----
  -                                                          14.08            -
  0.85
  Composite Area & Weighted Runoff Coeff.                    14.08
  0.85

  ------------------
  Subbasin Sub-5B
  ------------------
                                                             Area          Soil
Runoff
  Soil/Surface Description                                 (acres)        Group
Coeff.

-------------------------------------------------------------------------------------
-----
  -                                                           5.79            -
  0.91
  Composite Area & Weighted Runoff Coeff.                     5.79
  0.91

  ------------------
  Subbasin Sub-5C
  ------------------
                                                             Area          Soil
Runoff
  Soil/Surface Description                                 (acres)        Group
Coeff.

-------------------------------------------------------------------------------------
-----
  -                                                           0.85            -
  0.86
  Composite Area & Weighted Runoff Coeff.                     0.85
  0.86

  ***********************
  Subbasin Runoff Summary
  ***********************


-------------------------------------------------------------------------------------
---
  Subbasin       Accumulated     Rainfall     Total      Peak  Weighted
Time of
  ID                  Precip    Intensity    Runoff    Runoff    Runoff
Concentration
                          in        in/hr        in       cfs     Coeff    days
hh:mm:ss

-------------------------------------------------------------------------------------
---
```

Sub-12A	1.87	6.53	1.70	95.01	0.910	0	00:17:12
Sub-12B	0.95	9.74	0.86	55.82	0.910	0	00:05:48
Sub-12C	1.18	8.85	0.93	66.15	0.790	0	00:08:00
Sub-12D	1.17	8.92	0.99	20.63	0.850	0	00:07:48
Sub-13A	1.89	6.47	1.51	137.53	0.800	0	00:17:30
Sub-13B	1.96	6.25	1.63	231.31	0.830	0	00:18:48
Sub-13C	1.64	7.27	1.33	225.57	0.810	0	00:13:30
Sub-13D	1.68	7.12	1.31	168.58	0.780	0	00:14:12
Sub-13E	0.84	10.11	0.72	8.80	0.860	0	00:05:00
Sub-14A	0.84	10.11	0.79	158.83	0.940	0	00:05:00
Sub-14B	0.84	10.11	0.72	7.19	0.860	0	00:05:00
Sub-2A	1.29	8.47	1.05	21.21	0.810	0	00:09:06
Sub-2B	1.56	7.51	1.14	59.98	0.730	0	00:12:30
Sub-2C	0.84	10.11	0.64	11.76	0.760	0	00:05:00
Sub-3A	0.95	9.74	0.72	51.50	0.760	0	00:05:48
Sub-3B	1.82	6.69	1.35	205.62	0.740	0	00:16:18
Sub-4A	1.98	6.19	1.54	295.50	0.780	0	00:19:12
Sub-4B	0.84	10.11	0.72	4.96	0.860	0	00:05:00
Sub-4C	0.84	10.11	0.72	4.52	0.860	0	00:05:00
Sub-4D	0.84	10.11	0.72	3.39	0.860	0	00:05:00
Sub-5A	1.50	7.71	1.27	92.32	0.850	0	00:11:42
Sub-5B	0.84	10.11	0.77	53.28	0.910	0	00:05:00
Sub-5C	0.84	10.11	0.72	10.17	0.860	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained	Maximum Depth Attained	Maximum HGL Attained	Time of Max Occurrence	Total Flooded Volume	Total Time Flooded	Retention Time

	ft	ft	ft	days	hh:mm	acre-in	minutes	hh:mm:ss
Jun-12A-1	3.64	36.99	538.94	0	00:17	0	0	0:00:00
Jun-12A-2	2.51	21.13	520.58	0	00:17	0	0	0:00:00
Jun-12ABCD-1	1.01	7.50	506.32	0	00:08	0	0	0:00:00
Jun-12ABCD-2	0.87	5.97	504.78	0	00:08	0	0	0:00:00
Jun-12B	1.05	10.40	509.59	0	00:06	0	0	0:00:00
Jun-12BC	0.97	8.12	507.23	0	00:07	0	0	0:00:00
Jun-12C	1.02	10.29	509.55	0	00:08	0	0	0:00:00
Jun-12D	0.99	7.89	506.86	0	00:07	0	0	0:00:00
Jun-13A	2.69	8.41	505.91	0	00:01	0	0	0:00:00
Jun-13ABCDE	5.09	8.90	503.56	0	00:02	0	0	0:00:00
Jun-13B	3.10	19.33	517.83	0	00:18	0	0	0:00:00
Jun-13BCD	5.05	10.43	505.23	0	00:02	0	0	0:00:00
Jun-13C	0.39	2.76	503.62	0	00:14	0	0	0:00:00
Jun-13D	1.97	23.77	523.42	0	00:14	0	0	0:00:00
Jun-13E	0.05	0.87	502.87	0	00:05	0	0	0:00:00
Jun-14A	0.42	12.63	519.23	0	00:05	0	0	0:00:00
Jun-14AB-1	0.75	9.53	515.67	0	00:05	0	0	0:00:00
Jun-14AB-2	0.71	5.97	512.02	0	00:04	0	0	0:00:00
Jun-14B	0.09	7.36	518.11	0	00:04	0	0	0:00:00
Jun-2ABC	9.52	22.47	478.85	0	00:01	0	0	0:00:00
Jun-2BC	9.07	33.87	490.87	0	00:01	0	0	0:00:00
Jun-2C-1	0.46	12.69	479.69	0	00:03	0	0	0:00:00
Jun-2C-2	1.14	14.17	479.17	0	00:03	0	0	0:00:00
Jun-3A	0.27	6.40	466.28	0	00:05	0	0	0:00:00
Jun-3AB	1.56	3.62	454.12	0	00:16	0	0	0:00:00
Jun-3B	1.36	13.16	467.76	0	00:16	0	0	0:00:00
Jun-4A	48.59	412.12	872.02	0	00:19	0	0	0:00:00
Jun-4AB-1	18.98	154.31	608.90	0	00:19	0	0	0:00:00
Jun-4AB-2	2.70	13.72	464.72	0	00:19	0	0	

								0:00:00
Jun-4ABCD	3.33	8.35	457.85	0	00:19	0	0	0:00:00
Jun-4B	16.40	136.00	600.00	0	00:17	0.75	4	0:00:00
Jun-4C	0.02	0.31	460.21	0	00:05	0	0	0:00:00
Jun-4D	0.02	0.32	460.12	0	00:05	0	0	0:00:00
Jun-4DC	0.50	7.65	460.57	0	00:12	0	0	0:00:00
Jun-5A	0.44	5.18	478.38	0	00:11	0	0	0:00:00
Jun-5ABC	0.24	1.94	473.14	0	00:06	0	0	0:00:00
Jun-5B-1	0.08	1.79	479.39	0	00:05	0	0	0:00:00
Jun-5B-2	0.10	2.29	476.49	0	00:05	0	0	0:00:00
Jun-5C-1	0.10	6.24	484.54	0	00:05	0	0	0:00:00
Jun-5C-2	0.07	1.04	476.84	0	00:06	0	0	0:00:00
Out-Subbasin 12	2.10	2.10	493.60	0	00:00	0	0	0:00:00
Out-Subbasin 13	5.10	5.10	499.70	0	00:00	0	0	0:00:00
Out-Subbasin 14	3.30	3.69	506.99	0	00:05	0	0	0:00:00
Out-Subbasin 2	11.46	11.46	465.50	0	00:00	0	0	0:00:00
Out-Subbasin 3	3.00	3.00	451.70	0	00:00	0	0	0:00:00
Out-Subbasin 4	4.21	4.50	452.50	0	00:17	0	0	0:00:00
Out-Subbasin 5	2.00	2.00	466.00	0	00:00	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
Jun-12A-1	JUNCTION	94.83	94.83	0	00:17	0.00		
Jun-12A-2	JUNCTION	0.00	94.76	0	00:17	0.00		
Jun-12ABCD-1	JUNCTION	0.00	165.54	0	00:08	0.00		
Jun-12ABCD-2	JUNCTION	0.00	165.40	0	00:08	0.00		
Jun-12B	JUNCTION	55.80	55.80	0	00:06	0.00		
Jun-12BC	JUNCTION	0.00	103.81	0	00:06	0.00		
Jun-12C	JUNCTION	65.75	65.75	0	00:08	0.00		
Jun-12D	JUNCTION	20.61	20.61	0	00:07	0.00		

Jun-13A	JUNCTION	137.52	137.52	0	00:17	0.00		
Jun-13ABCDE	JUNCTION	0.00	688.09	0	00:00	0.00		
Jun-13B	JUNCTION	230.87	230.87	0	00:19	0.00		
Jun-13BCD	JUNCTION	0.00	555.83	0	00:14	0.00		
Jun-13C	JUNCTION	225.50	225.50	0	00:13	0.00		
Jun-13D	JUNCTION	168.53	168.53	0	00:14	0.00		
Jun-13E	JUNCTION	8.79	8.79	0	00:05	0.00		
Jun-14A	JUNCTION	158.63	158.63	0	00:05	0.00		
Jun-14AB-1	JUNCTION	0.00	165.10	0	00:05	0.00		
Jun-14AB-2	JUNCTION	0.00	164.71	0	00:05	0.00		
Jun-14B	JUNCTION	7.18	7.18	0	00:05	0.00		
Jun-2ABC	JUNCTION	21.16	73.38	0	00:12	0.00		
Jun-2BC	JUNCTION	59.98	59.98	0	00:12	0.00		
Jun-2C-1	JUNCTION	11.74	14.14	0	00:02	0.00		
Jun-2C-2	JUNCTION	0.00	17.93	0	00:02	0.00		
Jun-3A	JUNCTION	51.49	51.49	0	00:06	0.00		
Jun-3AB	JUNCTION	0.00	205.18	0	00:16	0.00		
Jun-3B	JUNCTION	205.15	205.15	0	00:16	0.00		
Jun-4A	JUNCTION	294.86	294.86	0	00:19	0.00		
Jun-4AB-1	JUNCTION	0.00	294.67	0	00:19	0.00		
Jun-4AB-2	JUNCTION	0.00	273.59	0	00:19	0.00		
Jun-4ABCD	JUNCTION	0.00	273.54	0	00:19	0.00		
Jun-4B	JUNCTION	4.95	20.92	0	00:19	20.91	0	00:19
Jun-4C	JUNCTION	4.52	4.52	0	00:05	0.00		
Jun-4D	JUNCTION	3.39	3.39	0	00:05	0.00		
Jun-4DC	JUNCTION	0.00	8.95	0	00:12	0.00		
Jun-5A	JUNCTION	92.31	92.31	0	00:11	0.00		
Jun-5ABC	JUNCTION	0.00	109.50	0	00:06	0.00		
Jun-5B-1	JUNCTION	53.21	53.21	0	00:05	0.00		
Jun-5B-2	JUNCTION	0.00	53.18	0	00:05	0.00		
Jun-5C-1	JUNCTION	10.16	10.16	0	00:05	0.00		
Jun-5C-2	JUNCTION	0.00	10.13	0	00:05	0.00		
Out-Subbasin 12	OUTFALL	0.00	165.52	0	00:08	0.00		
Out-Subbasin 13	OUTFALL	0.00	687.73	0	00:00	0.00		
Out-Subbasin 14	OUTFALL	0.00	165.34	0	00:05	0.00		
Out-Subbasin 2	OUTFALL	0.00	73.37	0	00:12	0.00		
Out-Subbasin 3	OUTFALL	0.00	205.78	0	00:16	0.00		
Out-Subbasin 4	OUTFALL	0.00	273.66	0	00:19	0.00		
Out-Subbasin 5	OUTFALL	0.00	110.44	0	00:06	0.00		

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Out-Subbasin 12	73.30	29.05	165.52
Out-Subbasin 13	100.00	109.22	687.73
Out-Subbasin 14	99.00	7.02	165.34
Out-Subbasin 2	100.00	8.90	73.37
Out-Subbasin 3	100.00	31.07	205.78
Out-Subbasin 4	99.92	48.27	273.66
Out-Subbasin 5	40.96	27.43	110.44
System	87.60	260.96	1320.62

****

Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
Link-12A-1	CONDUIT	0 00:17	19.31	1.00	94.76	43.57	2.17	1.00	24	SURCHARGED
Link-12A-2	CONDUIT	0 00:17	19.31	1.00	94.79	25.26	3.75	1.00	23	SURCHARGED
Link-12ABCD-1	CONDUIT	0 00:08	9.19	10.20	165.40	61.82	2.68	1.00	17	SURCHARGED
Link-12ABCD-2	CONDUIT	0 00:08	10.82	1.90	165.52	446.72	0.37	0.85	0	Calculated
Link-12B	CONDUIT	0 00:06	11.31	10.39	55.52	32.45	1.71	1.00	21	SURCHARGED
Link-12BC	CONDUIT	0 00:06	5.76	2.07	103.72	131.76	0.79	1.00	17	SURCHARGED
Link-12C	CONDUIT	0 00:08	9.31	3.79	65.84	43.18	1.52	1.00	16	SURCHARGED
Link-12D	CONDUIT	0 00:07	4.65	3.42	20.57	26.56	0.77	1.00	23	SURCHARGED
Link-13A	CONDUIT	0 00:17	10.94	1.05	137.47	143.68	0.96	1.00	15	SURCHARGED
Link-13ABCDE	CONDUIT	0 00:00	9.25	8.31	687.73	646.78	1.06	1.00	178	SURCHARGED
Link-13B	CONDUIT	0 00:19	24.00	4.47	230.92	194.62	1.19	1.00	21	SURCHARGED
Link-13BCD	CONDUIT	0 00:14	9.58	3.25	556.36	622.37	0.89	1.00	24	SURCHARGED
Link-13C	CONDUIT	0 00:14	3.43	24.22	213.15	5573.77	0.04	0.78	0	Calculated
Link-13D	CONDUIT	0 00:14	23.84	1.54	168.51	98.30	1.71	1.00	18	SURCHARGED
Link-13E	CONDUIT	0 00:05	5.69	1.00	8.50	14.60	0.58	0.79	0	Calculated
Link-14A	CONDUIT	0 00:05	12.57	2.52	158.00	116.55	1.36	1.00	5	SURCHARGED
Link-14AB-1	CONDUIT	0 00:05	13.11	9.83	164.71	104.39	1.58	1.00	1	SURCHARGED
Link-14AB-2	CONDUIT	0 00:05	13.32	1.00	165.34	153.40	1.08	0.96	0	> CAPACITY
Link-14B	CONDUIT	0 00:07	7.21	7.12	7.47	34.24	0.22	1.00	2	SURCHARGED
Link-2ABC	CONDUIT	0 00:12	14.95	10.45	73.37	120.16	0.61	1.00	179	SURCHARGED
Link-2BC	CONDUIT	0 00:12	12.20	39.32	59.88	120.01	0.50	1.00	179	SURCHARGED
Link-2C-1	CONDUIT	0 00:05	7.37	1.97	11.62	25.38	0.46	1.00	12	SURCHARGED
Link-2C-2	CONDUIT	0 00:05	6.08	53.25	11.86	192.25	0.06	1.00	16	SURCHARGED

Link-3A	CONDUIT	0	00:06	19.00	4.54	51.51	74.68	0.69	0.81	0	Calculated
Link-3AB	CONDUIT	0	00:16	15.05	2.52	205.78	345.56	0.60	0.66	0	Calculated
Link-3B	CONDUIT	0	00:16	22.49	4.64	205.18	210.06	0.98	0.90	0	Calculated
Link-4A	CONDUIT	0	00:19	>50.00	2.29	294.67	53.85	5.47	1.00	34	SURCHARGED
Link-4AB-1	CONDUIT	0	00:19	>50.00	13.16	273.59	57.48	4.76	1.00	31	SURCHARGED
Link-4AB-2	CONDUIT	0	00:19	17.20	7.05	273.50	368.99	0.74	1.00	17	SURCHARGED
Link-4ABCD	CONDUIT	0	00:19	17.21	1.33	273.66	193.40	1.41	1.00	4	SURCHARGED
Link-4B	CONDUIT	0	00:19	11.84	1.38	20.92	26.84	0.78	1.00	29	SURCHARGED
Link-4C	CONDUIT	0	00:05	10.29	9.05	4.49	48.49	0.09	0.51	0	Calculated
Link-4D	CONDUIT	0	00:05	7.13	2.81	3.33	46.19	0.07	0.51	0	Calculated
Link-4DC	CONDUIT	0	00:12	7.38	26.66	8.92	46.06	0.19	1.00	13	SURCHARGED
Link-5A	CONDUIT	0	00:11	12.01	1.17	92.27	111.83	0.83	0.75	0	Calculated
Link-5ABC	CONDUIT	0	00:06	21.25	2.99	110.44	257.93	0.43	0.53	0	Calculated
Link-5B-1	CONDUIT	0	00:05	12.12	5.45	53.18	169.21	0.31	0.67	0	Calculated
Link-5B-2	CONDUIT	0	00:06	12.45	26.71	53.65	270.36	0.20	0.61	0	Calculated
Link-5C-1	CONDUIT	0	00:05	6.70	1.00	10.13	8.02	1.26	0.85	0	> CAPACITY
Link-5C-2	CONDUIT	0	00:06	7.29	1.00	8.49	13.87	0.61	0.63	0	Calculated

Analysis began on: Fri Apr 27 11:03:49 2012
Analysis ended on: Fri Apr 27 11:03:49 2012
Total elapsed time: < 1 sec

APPENDIX E

Proposed Improvements Calculations and Data

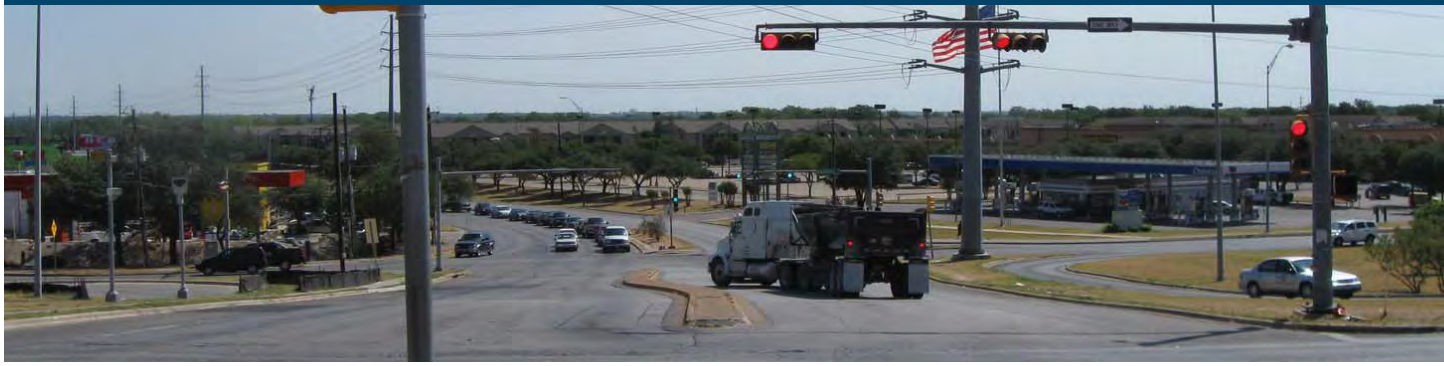
Table 15. Discharge Calculations for Sizing Major Structures

Drainage System	25-Year Storm Event Runoff Coefficient, C	Intensity, I (in/hr)	Area (ac)	Ultimate Conditions Discharge, Q=CIA (cfs)
1	---	---	---	---
2	0.75	7.5	15.66	88.1
3	0.74	6.2	48.49	222.9
4	0.78	10.1	61.77	487.6
5	0.87	10.1	21.04	184.5
6	---	---	---	---
7	---	---	---	---
8	---	---	---	---
9	---	---	---	---
10	---	---	---	---
11	---	---	---	---
12	0.87	6.5	34.48	194.6
13	0.81	6.3	140.79	711.5
14	0.94	10.1	17.53	166.1

Table 16. Modeling Parameters for Trunk Line Sizing

Drainage System	Proposed Improvement for Major Structure	Proposed Pipe Length (ft)	Downstream Invert Elev (ft)	Upstream Ground Elev (ft)	Prop Dia/Height (in)	Upstream Invert Elev (ft)	25-yr Tailwater Elev (ft)
1	---	---	---	---	---	---	---
2	replace with 36" rcp, 138 ft long	138	454.04	472	36	466	465.5
3	replace with 48" rcp, 178 ft long	178	448.7	467	48	460	451.7
4	replace with 8x6 mbc, 410 ft long	410	448	468	72	459	452.2
5	replace with 42" rcp, 200 ft long	200	464.2	484	42	477.5	466
6	extend 21 ft on the upstream side	---	---	---	---	---	---
7	widen south deck to 44 ft widen north deck to 44.5 ft	---	---	---	---	---	---
8	extend 60 ft	---	---	---	---	---	---
9	extend 21 ft	---	---	---	---	---	---
10	extend 24 ft	---	---	---	---	---	---
11	extend 36 ft	---	---	---	---	---	---
12	replace with 6'x4' culvert, 287 ft long	287	490.5	502.11	48	495.11	493.6
13	replace with 2-8'x5', 153 ft and raise the upstream pipe invert elevation to at least 497 ft	152.6	494.6	505	60	497	499.7
14	replace with 60" rcp, 420 ft long	420 total	503.3	516	60	508	506.6

APPENDIX C
2035 TRAVEL DEMAND ANALYSIS



CHAPTER 1 – INTRODUCTION

The E. Riverside Drive High Capacity Transit Corridor is approximately four miles long and provides an alternate connection to the airport from the downtown Austin. The developments along E. Riverside Drive consist of mixed-use, residential, and industrial land uses. The E. Riverside Drive Corridor is part of the Corridor Improvement projects, which was included in Proposition 1 on the 2010 General Obligation (GO) Bond Election. The proposition was passed by the City of Austin voters on November 2, 2010.

This report documents the study methodology and evaluation of existing traffic operations on E. Riverside Drive. **Chapter 1** describes the study background and purpose. **Chapter 2** describes the VISSIM model coding methodology. **Chapter 3** identifies existing traffic conditions and presents analysis results. **Chapter 4** discusses traffic volume forecast. **Chapter 5** presents the High Capacity Transit alternatives and analysis results, in addition to recommendations.

1.1 STUDY PURPOSE

The purpose of this traffic study is to use a high-level, microscopic simulation traffic model (VISSIM) to simulate existing, no-build, and High Capacity Transit alternative operational scenarios for the E. Riverside Drive corridor. The study included analyses of various High Capacity Transit strategies including transit signal priority and exclusive lanes to determine the impact of these strategies on system performance. The study also focuses on identifying short and long-term transportation improvements to improve safety, increase vehicular, pedestrian and bicycle mobility and accessibility and improve quality of life for the corridor.

1.2 STUDY AREA

The study area consists of approximately four miles of the E. Riverside Drive corridor from IH 35 to SH 71 and South Pleasant Valley Road from E. Riverside Drive to Lakeshore Boulevard as shown in **Figure 1-1**. The study area includes 15 signalized intersections, one unsignalized intersection along E. Riverside Drive and one pedestrian signal along South Pleasant Valley Road.

The Proposed High Capacity Transit along E. Riverside Drive is being planned to provide a transit connection between the downtown Austin to the airport. Currently, E. Riverside Drive is a six-lane roadway between IH 35 and SH 71. The microsimulation models were developed to assess feasibility and impact of the proposed High Capacity Transit on E. Riverside Drive and to prepare a mitigation plan for any traffic issues. The speed limit on E. Riverside Drive is 35 miles per hour (mph) between IH 35 and Crossing Place, 40 mph between Crossing Place and Montopolis Drive and 45 mph between Montopolis Drive and SH 71. The speed limit along South Pleasant Valley Road is 35 mph within the studyarea. The intersections of E. Riverside Drive with IH 35, South Pleasant Valley Road, Montopolis Drive and SH 71 experience significant delay during the peak hours. The E. Riverside Drive Corridor also serves transit buses within the study area. On-street parking is not currently allowed on E. Riverside Drive.

The proposed High Capacity Transit would travel on the curb-side on west side of IH 35 and transition to the center (median) at the IH 35 interchange and travel in median to the SH 71 interchange along E. Riverside Drive. Along the High Capacity Transit route, the proposed stations would be at Arena Lane/Parker Lane, Pleasant Valley Road, between Grove Boulevard and Montopolis Drive and Discovery Lane.

CHAPTER 2 – VISSIM MODEL CODING METHODOLOGY

2.1 COMPUTER SIMULATION

The E. Riverside Drive corridor was simulated using the microscopic simulation model VISSIM Version 5.40. VISSIM (a German acronym which translated means "traffic in towns – simulation") has main two components: a traffic simulator and a signal state generator. The traffic simulator is a microscopic traffic flow simulation model which includes car following and a lane change logic model. The signal state generator is signal control software that uses detector information from the traffic simulator and updates the status of the traffic signals on a discrete time step basis (as small as one tenth of a second). VISSIM is classified as a microscopic simulation model because it models vehicles and other components as individual units and updates them every second. After defining the street geometry, traffic control and vehicular volumes, VISSIM outputs many measures of effectiveness (MOEs) such as average delay, queue length, speed etc. that can then be used as a basis for comparison of alternatives. VISSIM also has the capability of modeling various modes of transit such as buses, trains, and rail. VISSIM has a user friendly 3D animation tool which can be used to show the existing and future transportation network in 3D animation form.

This chapter discusses the methodology for modifying VISSIM model parameters to account for roadway network changes in the study area.

2.2 ANALYSIS METHODOLOGY

The E. Riverside Drive corridor was simulated using VISSIM Version 5.40 to evaluate AM and PM peak hour traffic operations on weekdays. Signal timings for the future scenarios were optimized in SYNCHRO, a microcomputer traffic signal coordination software program developed by Trafficware. The future volume were developed using the Travel Demand Model. The optimized signal timings and future volume forecast were then imported in VISSIM software for simulation. VISSIM simulated the interaction of signals, the proposed High Capacity Transit, general traffic, buses and pedestrians.

2.3 VISSIM SIMULATION

One of the most important analytical tools of traffic engineering is microscopic simulation software. A transportation system simulation by means of a simulation model allows the prediction of the effects of modified lane configurations, traffic control and any changes made in the transportation system on the system's operational performance. Operational performance is measured in terms of MOEs, which include average vehicle speed, vehicle stops, delays, vehicle hours of travel, vehicle miles of travel, fuel consumption, and several other measures. The MOEs provide useful input in the selection of future alternative improvements to handle issues related to traffic such as traffic congestion, delay, queues, etc.

VISSIM is capable of simulating individual vehicle behavior in a roadway network and is capable of simulating the operation of signalized intersections. VISSIM applies interval-based simulation to describe traffic operations. Each vehicle is a distinct object whose characteristics are updated every second. Each variable control device (such as traffic signals) and each event are registered and updated every second. In addition, each vehicle is identified by category (auto, carpool, truck, or bus) and by type. Additionally, specific driver behavioral characteristics are assigned to specific vehicles. The major features of the VISSIM model are identified as follows:

- Link types and connectors;
- Fleet components (bus, truck, car);
- Load factor (number of passengers/vehicle);
- Automobile routing and turning movement;

- Bus operations (headways, dwell times, stations, and routes);
- Priority rules (right of way designations);
- Stop and yield signs; and
- Pretimed/actuated and transit signal priority signal control.

2.4 MODEL PARAMETERS

The traffic flow model used by VISSIM is a discreet, stochastic, time step based microscopic model, with driver-vehicle-units as single entities. The model contains a psycho-physical car following model for longitudinal vehicle movement and a rule-based algorithm for lateral movements (lane changing). The model is based on the continuous work of Wiedemann (1974, 1991).

Vehicles follow each other in an oscillating process. As a faster vehicle approaches a slower vehicle on a single lane, it has to decelerate. The action point of conscious reaction depends on the speed difference, distance, and driver-dependant behavior. On multi-lane links, vehicles check whether they can improve their position by changing lanes. If so, they check the possibility of finding acceptable gaps on neighboring lanes. Car following and lane-changing together form the traffic flow model, comprising the basis of VISSIM. The model parameters can be adjusted to reflect the field condition in the model.

More detailed information regarding VISSIM modeling parameters can be found in the VISSIM user's manual.

2.5 MODEL DEVELOPMENT

The HDR team developed the network for the E. Riverside Drive corridor. Field observations and aerial photographs were used to obtain accurate geometrics. Year 2011 traffic volume counts collected in the field during August were used for developing the existing condition models.

The major component inputs for the E. Riverside Drive corridor VISSIM model included the following:

Roadway Geometrics – The first step in defining a network is describing the network geometry. VISSIM uses the concept of links and connectors to define the roadway network. Links are one-directional segments of streets or freeways, and connectors are usually the intersection of two or more links. In the case of a two-way street, each roadway block would consist of two one-directional links as shown in **Figure 2-1.**

Volume Data – Year 2011 traffic volume counts collected in the field were used for calibrating the existing condition models. The year 2011 traffic volume counts were increased by a 10 percent adjustment factor to account for summer traffic conditions.

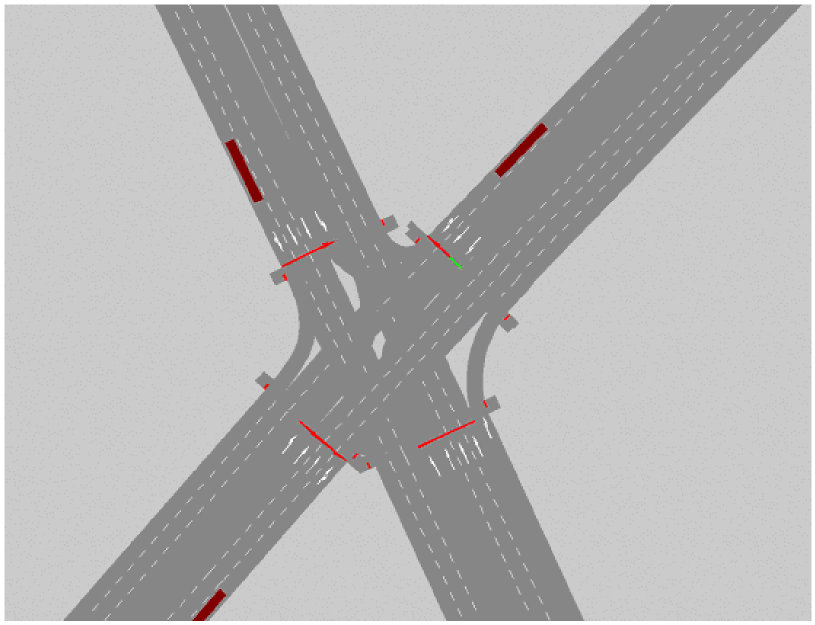
Entry and exit volumes at the periphery of the network were obtained from tube counts and intersection turning movement counts (TMCs), since entry volumes are coded as input when building the model, and exit volumes are used to calibrate the model to ensure appropriate distribution of traffic through the simulated network.

When coding the model, turning movement input describes how traffic is distributed to departure links. TMCs were used to determine existing routing decisions for each approach at an intersection. When a simulation is run, traffic volumes enter the network through entry links and are distributed through the network according to routing decisions assigned to each intersection approach.

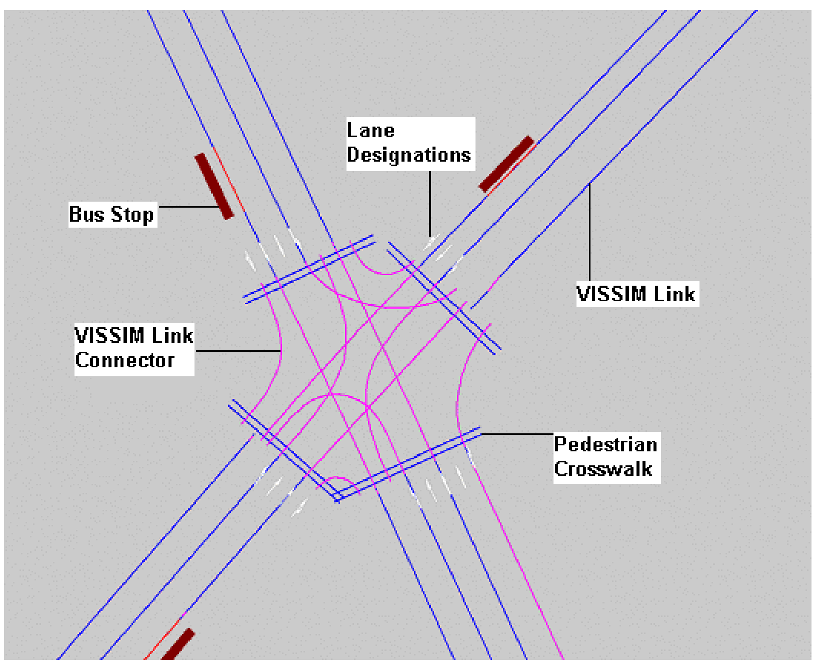
Traffic Control – Existing conditions analysis involved coding of traffic signal phasing, timing, and coordination in Synchro. This traffic signal information was then imported into the VISSIM model to simulate the operation of existing signalized intersections.

Transit Operations – Information on local bus routes, schedules, and bus stops was collected from the Capital Metropolitan Transportation Authority's (Cap Metro) website. Information on University of Texas (UT) shuttle routes, schedules, and stops was collected from UT at Austin's website. The collected information on transit routes and stops was included in the development of the VISSIM network. VISSIM requires that a transit route run from an entry link to an exit link and as a result some transit routes were split and coded separately, resulting in a total of 14 coded routes in the existing conditions model. In addition, there are approximately 34 bus stops within the study area.

FIGURE 2-1
INTERSECTION LINK TO CONNECTOR DIAGRAM
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS



(A) Typical VISSIM Intersection



(B) Typical Intersection Converted to VISSIM Link-Connector Diagram

2.6 MODEL CALIBRATION

The models were calibrated using field-counted traffic volume data. Turning movement counts at intersections within the corridor were used to verify that volumes shown on the corresponding links in the model were distributing in a manner consistent with real-world conditions. In case the volumes were not consistent, adjustments were made accordingly. In addition, field observations were conducted and the models were calibrated based on field observations of queue lengths, traffic signal operations, transit operations, and pedestrian operations. Finally, field gathered travel time data for E. Riverside Drive was compared to the travel time output from the simulation model.

In order to account for inherent variability in traffic flow and operations, 10 replicate runs were performed for each model scenario, and the average results were reported.

2.7 MEASURES OF EFFECTIVENESS

Operational performance is expressed in terms of MOEs, which include average vehicle speed, delay, vehicle miles of travel, travel time, fuel consumption, emissions and several other measures. While the VISSIM model provides a wide variety of MOEs, which are available to the City for other purposes, only a few MOEs that focus on the scope of this project were used to establish a baseline evaluation of existing traffic operations.

Vehicle Delay – Delay is a measure of lost travel time and is influenced by a number of factors including cycle length, signal coordination and degree of saturation or volume-capacity ratio. The Highway Capacity Manual (HCM) defines total delay as the total time elapsed from when a vehicle stops at the end of a queue until the vehicle departs from the stop line. It is measured in vehicle-hours and was measured for autos and buses.

Network Vehicles – Network Vehicles are measured in vehicles per hour and identifies the vehicles that have left the network or reached their destination. It was measured for autos and buses.

Network Travel Time – Network travel time is measured in hours. Travel time identifies the total amount of time, including moving time, delay time, and stop time, that it takes for all vehicles to travel through the study area network.

Travel Time Per Trip – Travel time per trip is measured in minutes. It is measured between two predefined points in a model. These predefined points are the start and end points of travel times collected in the field. This travel time is used to calibrate the model. Travel time is a useful MOE that most people can understand and is a very important measure along the E. Riverside Drive corridor.

Average Speed – Average speed is measured in miles per hour and identifies the average speed of a vehicle in the network. It is calculated by taking the average of all link speeds. Average speed is a useful measure of effectiveness to assess the impact of network changes for alternative models.

Intersection Level-of-Service - LOS is a qualitative measure of operating conditions at a location and is directly related to vehicle delay at intersections, as shown in **Table 2-1.** LOS is given a letter designation ranging from A to F (free flow to heavily congested), with LOS D generally considered as the limit of satisfactory operation. For example, LOS can be related to the grading scale of a report card: A = excellent, B = good, C = average, D = below average, E = needs improvement, and F = failing.

Utilizing procedures in the HCM and the MOEs reported by VISSIM, LOS was determined for intersections within the study area network.

TABLE 2-1
LEVEL-OF-SERVICE DEFINITIONS FOR INTERSECTIONS
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Level-of-Service (LOS)	Control Delay (sec/veh)		Description
	Signalized Intersections	Unsignalized Intersections	
A	≤ 10.0	≤ 10.0	Very low vehicle delays, free traffic flow, signal progression extremely favorable, most vehicles arrive during given signal phase.
B	10.1 to 20.0	10.1 to 15.0	Good signal progression, more vehicles stop and experience higher delays than for LOS A.
C	20.1 to 35.0	15.1 to 25.0	Stable traffic flow, fair signal progression, significant number of vehicles stop at signals.
D	35.1 to 55.0	25.1 to 35.0	Noticeable traffic congestion, longer delays and unfavorable signal progression, many vehicles stop at signals.
E	55.1 to 80.0	35.1 to 50.0	Limit of acceptable vehicle delay, unstable traffic flow, poor signal progression, traffic near roadway capacity, frequent cycle failures.
F	> 80.0	> 50.0	Unacceptable delay, extremely unstable flow, heavy congestion, traffic exceeds roadway capacity, stop-and-go conditions.

Source: Highway Capacity Manual, *Transportation Research Board*, 2000.

CHAPTER 3 – EXISTING CONDITIONS

The analysis of existing conditions forms the basis for VISSIM traffic simulation development and for evaluation of alternative scenarios. E. Riverside Drive This chapter describes how this information was used to develop the VISSIM model for the subsequent analyses.

3.1 COMPUTER SIMULATION

The E. Riverside Drive corridor was simulated using VISSIM Version 5.40. VISSIM is classified as a microscopic simulation model because it models vehicles and other modes as individual units, updating their properties (such as location) every second. After defining the street geometry, traffic control and vehicular volumes, VISSIM outputs several MOEs that can be used as a basis for comparison. A more detailed description of the model parameters, model development and model calibration can be found in **Chapter 2.**

3.2 INTERSECTION SIGNAL TIMING

There are currently 15 signalized intersections along the E. Riverside Drive corridor, including two diamond interchanges at IH 35 and Pleasant Valley Road. The traffic signals are maintained and operated by the City of Austin. The HDR team coordinated with the City to obtain existing intersection signal timing and phasing data. The existing signal timing and phasing were coded into VISSIM to ensure the model results reflect actual operations in the field.

3.3 EXISTING TRAFFIC DATA

Extensive data collection was performed to obtain information on existing conditions along the E. Riverside Drive corridor.

The following data were collected in the field as part of this study:

- 24-hour bi-directional tube counts
- AM (7-9) and PM (4-6) peak hour turning movements including pedestrians
- AM and PM peak hour travel time runs

The 24-hour bi-directional tube counts were collected at six locations along the corridor to identify the volume of traffic flowing through the corridor at various locations. AM and PM turning movement counts (TMCs) were collected at all signalized and one unsignalized intersection along the corridor. The peak hour TMCs also included pedestrian volumes which are summarized in **Table 3-2**. The tube counts, TMCs and travel time were collected in the summer while school was not in session. Therefore, the summer counts were adjusted by 10 percent to reflect normal weekday traffic volumes along the corridor when schools are in session. A summary of the peak hour traffic volumes along the E. Riverside Drive corridor are identified in **Table 3-1** and shown in **Figure 3-1.**

TABLE 3-1
EXISTING PEAK HOUR TRAFFIC VOLUMES
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Locations	AM Peak (vph)	PM Peak (vph)
E. Riverside Drive, east of IH 35 (near Summit Street)	2,805	3,032
E. Riverside Drive, between Arena Drive/Parker Lane and Royal Crest Drive	2,146	2,415
E. Riverside Drive, between Grove Boulevard and Montopolis Drive	1,371	2,069
E. Riverside Drive, west of SH 71	1,245	1,664
Pleasant Valley Road, north of E. Riverside Drive (near HEB)	936	1,683
Pleasant Valley Road, north of Lakeshore Boulevard	1,431	2,646

3.4 PEDESTRIAN VOLUMES

Pedestrian volumes were collected at all signalized intersections within the study area to identify current pedestrian activity along the E. Riverside Drive corridor. Intersections with the highest concentrations of pedestrian activity during the peak periods are summarized in **Table 3-2**.

TABLE 3-2
EXISTING PEAK HOUR PEDESTRIAN VOLUMES
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Intersections	AM Peak (ped/hr)	PM Peak (ped/hr)
E. Riverside Drive and Montopolis Drive	13	30
E. Riverside Drive and Grove Boulevard	12	22
E. Riverside Drive and Burton/Tinnin Ford Road	8	22
E. Riverside Drive and Crossing Place	11	19
E. Riverside Drive and Willow Creek Drive	9	20
E. Riverside Drive and Royal Crest Drive	8	19

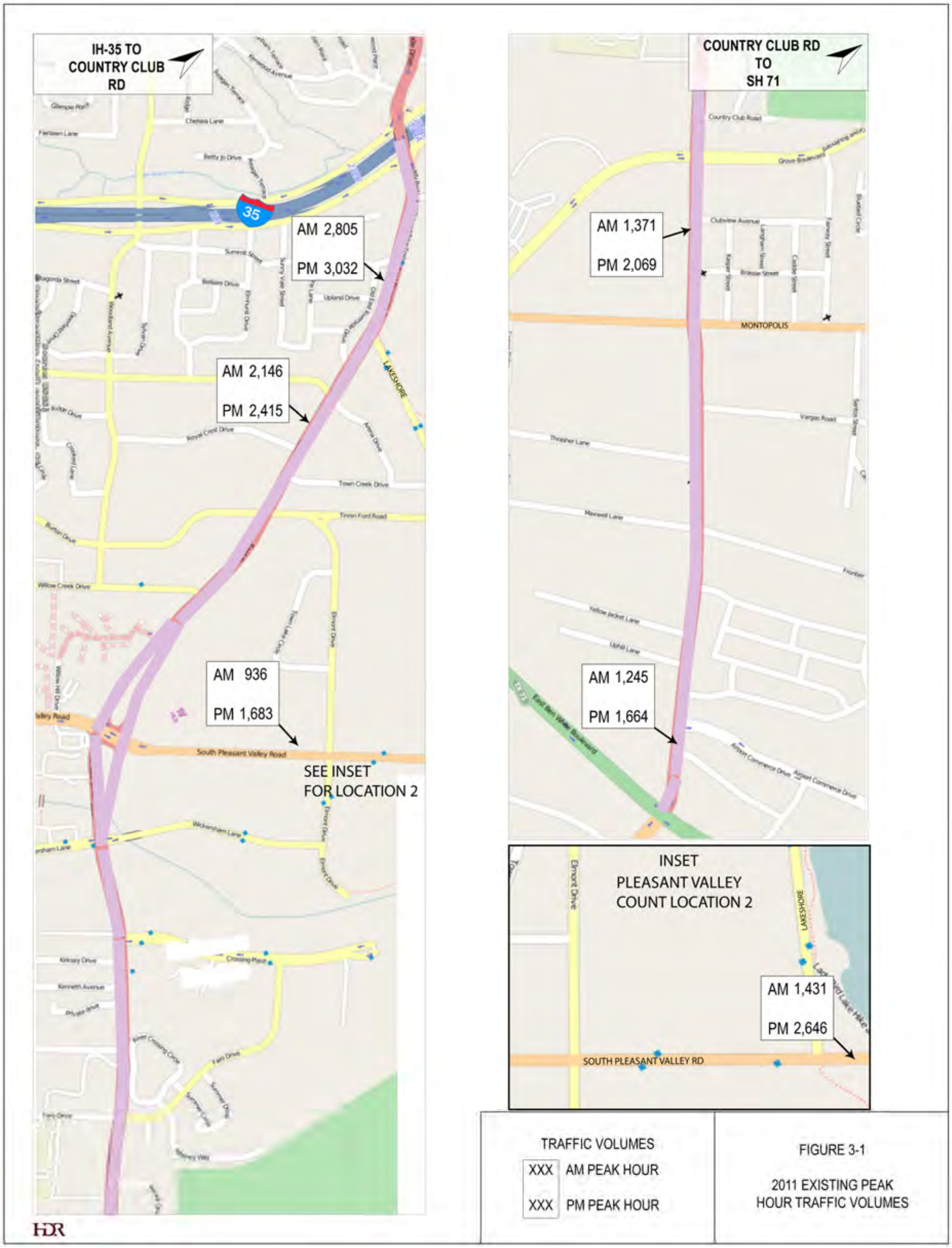


FIGURE 3-1

2011 EXISTING PEAK HOUR TRAFFIC VOLUMES

3.5 TRANSIT FACILITIES

The E. Riverside Drive corridor is well-traveled by Capital Metro buses and UT shuttle service. The Cap Metro buses have curbside stops either near-side and far-side of the intersections, and it was noticed that the local buses often block the through traffic behind it at the stop. Most bus stops provide benches and/or shelters..

Detailed information on city bus routes, schedules, and bus stops were collected from the Cap Metro's website. Information on UT Shuttle bus routes, schedules, and bus stops was gathered from the UT at Austin website. A total of 14 bus routes (actual 7 routes) and 34 bus stops were included in the VISSIM models for the study area. The average bus dwell time was estimated based on field observations.

3.6 PEDESTRIAN/BICYCLE FACILITIES

There are continuous sidewalks on both sides of E. Riverside Drive. The sidewalks are either directly adjacent to the curb lane or separated by a narrow buffer. All signalized intersections are equipped with pedestrian signals, push buttons, curb ramps, and crosswalks. Raised medians exist many places along the E. Riverside Drivecorridor and are used as pedestrian refuge for midblock crossings.

There is currently not a dedicated bicycle lane or paved shoulder along E. Riverside Drive. Continuous street lighting is generally available along the corridor in the study area.

3.7 CRASH ANAYLSIS

Reported traffic crash data for E. Riverside Drive between IH 35 and SH 71 were provided by the Austin Police Department for January of 2009 through July of 2011. The crash data were reported for the following crash severity:

- Property Damage Only (PDO)
- Injury
- Fatal

The total crashes by severity for E. Riverside Drive are shown in **Table 3-3**. E. Riverside Drive experienced the highest total crashes in 2009. Although the 2011 crash data was incomplete, the overall trend was showing a decreasing total number of crashes over the three-year period.

TABLE 3-3
TOTAL CRASHES JANUARY 2009 TO JULY 2011
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Month/Year	PDO	Injury	Fatal	Total
Jan – Dec 2009	116	125	0	241
Jan – Dec 2010	119	106	1	226
Jan – Jul 2011	63	50	2	115
Total	298	281	3	582

Crash rates are calculated to allow comparisons of different facilities and to determine if facilities are experiencing an above-average frequency of crashes. Crash rates for E. Riverside Drive were calculated for the selected intersections and segments.

Crash Rate by Intersection

Crash rate by intersection normalizes the reported crashes at an intersection to the exposure in terms of million entering vehicles (MEV). The MEV is calculated using the following equation:

$$MEV = \frac{TEV}{1{,}000{,}000} \times 365$$

Where: TEV = total daily entering vehicles at an intersection.

The crash rate for a given year is the reported crashes divided by the MEV. **Table 3-4** provides a summary of the crash rates in 2009 and 2010 for the top five intersections with the highest crash rates. Crash rates for 2011 were not calculated because the crash data was only reported from January to July.

TABLE 3-4
TOP FIVE INTERSECTIONS WITH THE HIGHEST CRASH RATES
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Year	Intersection	TEV	MEV	Reported Crashes	Crashes per MEV
2009	Riverside Drive and Pleasant Valley Road	54,505	19.8943	29	1.46
	Riverside Drive and Wickersham Lane	39,292	14.3416	20	1.39
	Riverside Drive and Willow Creek Drive	34,636	12.6421	14	1.11
	Riverside Drive and Burton/Tinnin Ford Road	35,827	13.0769	10	0.76
	Riverside Drive and IH 35	77,102	28.1422	20	0.71
2010	Riverside Drive and Burton/Tinnin Ford Road	36,626	13.3685	19	1.42
	Riverside Drive and Willow Creek Drive	35,409	12.9243	18	1.39
	Riverside Drive and Pleasant Valley Road	55,721	20.3382	22	1.08
	Riverside Drive and Crossing Place	36,096	13.1750	14	1.06
	Riverside Drive and Grove Boulevard	32,197	11.7519	9	0.77

The three intersections that made the top five lists for both 2009 and 2010 are E. Riverside Drive at Pleasant Valley Road, Willow Creek Drive, and Burton/Tinnin Ford Road. These intersections are discussed in detail below.

Pleasant Valley

Approximately 70 percent of the reported crashes were angle crashes, and the remaining were rear-end or sideswipe or fixed object crashes. Possible contributing factors for angle crashes include poor visibility of signals, inadequate signal timing, inadequate sight distance, high approach speed, and drivers running red lights. The proposed short-term improvements include providing side-by-side left-turn lanes on Pleasant Valley between eastbound and westbound E. Riverside Drive, and convert the turnaround lanes on E. Riverside Drive to left-turn lanes. Those improvements are expected to increase overall intersection capacity and reduce angle and rear-end crashes. Signal timing should be examined to ensure appropriate clearance intervals for all vehicular phases. Other countermeasures for consideration include improving intersection lighting, signal visibility, signing, and pavement markings.

Willow Creek

Approximately 75 percent of the reported crashes were angle crashes, and a significant portion of the angle crashes involved left-turning vehicles colliding with the opposing through vehicles on E. Riverside Drive. The most likely contributing factor for the left-turn crashes is the high volume of left-turns and opposing through traffic, the left-turn drivers chose to make the turn at inadequate gaps. The proposed short-term improvements include implementing protected-only left-turn phases on E. Riverside Drive. The protected-only left-turn phase will eliminate the permissive turn, thereby reducing the left-turn crashes. Signal timing should be examined to provide sufficient green time for the protected left-turn, especially in the westbound direction during PM peak period. The proposed short-term improvements also include removing split-phasing on Willow Creek in the PM peak period, which should improve the volume-to-capacity ratio for the cross street, thereby reducing angle crashes involving crossing vehicles on Willow Creek.

Burton/Tinnin Ford

Approximately 70 percent of the reported crashes were angle crashes involving either left-turn vehicles on E. Riverside Drive or crossing vehicles on Burton/Tinnin Ford. The likely contributing factor for the left-turn crashes is drivers making permissive turn at inadequate gaps. Potential countermeasures to reduce the left-turn crashes include eliminating left-turn yellow trap by converting the 5-section signal heads to flashing yellow arrows or protected-only heads, and examining signal timing to ensure appropriate clearance intervals for all vehicular phases. Possible contributing factors for crashes involving crossing vehicles include inadequate signal timing, high approach speed, and drivers running red lights. Potential countermeasures to reduce the crossing crashes include increasing green time for the cross street and improving visibility.

Crash Rate by Segment

Crash rate by segment is the reported crashes per 100 million vehicle miles of travel (100MVM) along the roadway segment. The 100MVM is calculated using the following equation:

$$100MVM = \frac{AADT \times L}{100{,}000{,}000} \times 365$$

Where: AADT = annual average daily traffic on the highway segment; L = segment length in miles measured between intersections.

The crash rate for a given year is the reported crashes on a roadway segment divided by the 100MVM. A summary of the crash rates in 2009-2011 for the four segments along E. Riverside Drive, where ADT data was collected in the field, is summarized in **Table 3-5**.

TABLE 3-5
CRASH RATE BY SEGMENTS
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Year	Segment	AADT	Length (miles)	100MVM	Reported Crashes	Crashes per 100MVM
2009	IH 35 to Lakeshore	44,060	0.32	0.0515	14	272.04
	Arena/Parker to Royal Crest	34,688	0.10	0.0127	6	473.89
	Grove to Montopolis	22,166	0.30	0.0243	2	82.40
	Montopolis to SH 71	18,548	0.87	0.0589	11	186.76
2010	IH 35 to Lakeshore	45,043	0.32	0.0526	13	247.10
	Arena/Parker to Royal Crest	35,462	0.10	0.0129	3	231.77
	Grove to Montopolis	22,661	0.30	0.0248	3	120.90
	Montopolis to SH 71	18,961	0.87	0.0602	19	315.56
2011*	IH 35 to Lakeshore	46,047	0.32	0.0314	7	223.12
	Arena/Parker to Royal Crest	36,253	0.10	0.0077	1	129.55
	Grove to Montopolis	23,166	0.30	0.0148	0	0.00
	Montopolis to SH 71	19,384	0.87	0.0359	4	111.40

*Available crash data for 2011 is provided from January to July

The Texas Department of Transportation (TxDOT) maintains a statewide automated database for all reported motor vehicle traffic crashes since 2003, and the statistics are available through TxDOT's website. The Texas statewide crash rates in 2009 – 2011 are listed in **Table 3-6**. For a comparable facility, the statewide crash rate is approximately 117 and 118 crashes per 100MVM in 2009 and 2010, respectively. The E. Riverside Drive crash rates in 2009 and 2010 were generally higher than the statewide rates.

TABLE 3-6
TEXAS STATEWIDE CRASH RATES
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Road Type	Traffic Crashes per 100 million vehicle miles of travel in Urban Area		
	2009	2010	2011*
4 or more lanes, divided	117.01	118.53	106.93

* Available crash data for 2011 is provided from January to July

3.7 TRAFFIC OPERATIONS ANALYSIS

Operational performance is expressed in terms of MOEs, which include average vehicle speed, delay, vehicle miles of travel, travel time, fuel consumption, emissions and several other measures. While the VISSIM model provides a wide variety of MOEs, only a few MOEs that focus on the scope of this project were used to establish existing traffic operations.

The MOEs that were evaluated for the existing conditions analysis include travel time, network delay, network vehicles, average speed and intersection LOS. The definitions of these MOEs can be found in **Chapter 2.**

Network-wide statistics are critical to the evaluation of the overall efficiency of the transportation network. VISSIM simulated statistics for network travel time, network delay, network vehicles, and average speed in the AM and PM peak hours are summarized in **Table 3-7**.

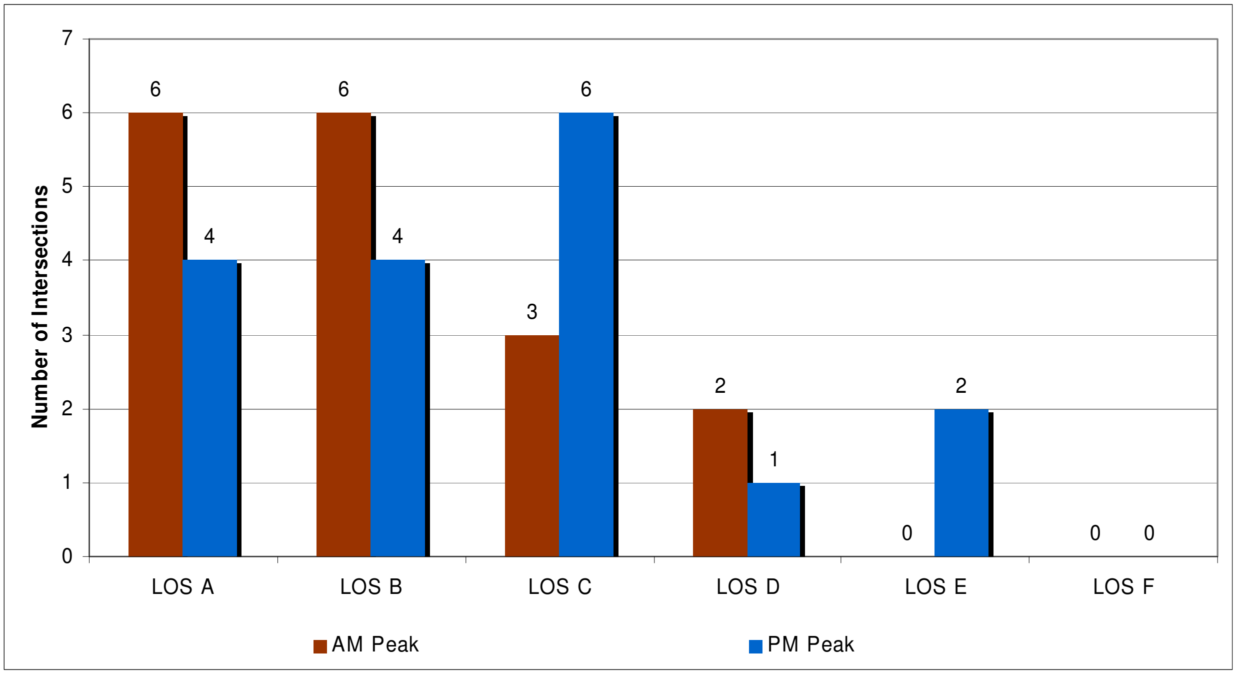
TABLE 3-7
VISSIM NETWORK-WIDE AVERAGE STATISTICS
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Peak-Hour	Network Vehicles (veh)	Total Travel Time (hr)	Total Delay Time (hr)	Average Speed (mph)
2011 Existing Conditions – Weekday				
AM Peak Hour	14,024	658	286	22.5
PM Peak Hour	17,922	1,132	653	16.8

As shown in **Table 3-7**, the PM peak period has the highest total traffic volumes and the greatest travel time and delay within the network, along with lower average speed. Total travel time and total delay time are 1,132 veh-hours and 653 vehicle-hours during the PM peak hour, respectively.

Intersection LOS is an important MOE for evaluating the existing conditions at the intersections along the E. Riverside Drive corridor. As shown in **Figure 3-2**, the majority of the intersections along the corridor operate at an acceptable LOS of A, B, C, or D during the AM and PM peak hours. The E. Riverside Drive intersection with IH 35 and SH 71 operate at LOS E in the PM peak hour. There are currently no intersections operating at LOS F during the peak periods.

FIGURE 3-2
EXISTING (2011) INTERSECTION LOS
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS



**Graph shows LOS for signalized intersections only*

An evaluation of existing conditions (Year 2011) served as the basis for evaluating future year conditions. Based on the existing traffic model MOEs, the PM peak period has the worst congestion along the E. Riverside Drive corridor. Levels of service for all signalized intersections are summarized in **Table 3-8**.

TABLE 3-8
SIGNALIZED INTERSECTIONS LEVELS OF SERVICE – EXISTING (2011)
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Intersections	AM Peak Hour	PM Peak Hour
E. Riverside Drive and IH 35 SB	C	**E**
E. Riverside Drive and IH 35 NB	C	C
E. Riverside Drive and Lakeshore Boulevard	B	A
E. Riverside Drive and Arena/Parker Lane	B	B
E. Riverside Drive and Royal Crest Drive	A	A
E. Riverside Drive and Burton/Tinnin Ford Road	B	B
E. Riverside Drive and Willow Creek Drive	A	C
E. Riverside Drive WB and Pleasant Valley Road	B	C
E. Riverside Drive EB and Pleasant Valley Road	C	C
E. Riverside Drive and Wickersham Lane	B	C
E. Riverside Drive and Crossing Place	A	A
E. Riverside Drive and Faro Drive	A	A
E. Riverside Drive and Grove Boulevard	A	B
E. Riverside Drive and Montopolis Drive	D	D
E. Riverside Drive and Maxwell/Frontier Valley	A	A
E. Riverside Drive and SH 71	D	**E**
Pleasant Valley and Elmont Drive	A	B
Pleasant Valley and Lakeshore Boulevard	B	C

3.8 MULTIMODAL LOS

The multimodal LOS methodology was developed under National Cooperative Highway Research Project (NCHRP) 3-70. The methodology uses various equations to calculate numerical scores for transit, bicycle, and pedestrian modes. The scores are converted to LOS based on the threshold values shown in **Table 3-9**. The NCHRP 3-70 methodology was documented in *NCHRP Report 616: Multimodal Level of Service for Urban Streets*.

TABLE 3-9
MULTIMODAL LEVEL-OF-SERVICE THRESHOLD VALUES
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

LOS Model Score	LOS Letter Grade
Model <= 2.00	A
2.00 < Model <= 2.75	B
2.75 < Model <= 3.50	C
3.50 < Model <= 4.25	D
4.25 < Model <= 5.00	E
Model > 5.00	F

Source: NCHRP Report 616: Multimodal Level of Service for Urban Streets

Multimodal LOS was analyzed using the Complete Streets LOS (CSLOS) software, which implements the NCHRP 3-70 methodology. **Table 3-10** presents the overall facility multimodal LOS scores and LOS under existing conditions for the E. Riverside Drive corridor. The analysis was performed for the peak direction along E. Riverside Drive, which is westbound in the AM peak and eastbound in the PM peak.

TABLE 3-10
EXISTING FACILITY MULTIMODAL LOS
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Mode	AM Peak Westbound E. Riverside Drive		PM Peak Eastbound E. Riverside Drive	
	Score	LOS	Score	LOS
Transit	3.05	C	4.10	D
Bicycle	4.40	E	4.53	E
Pedestrian	3.51	D	3.69	D

The existing transit LOS on E. Riverside Drive is adequate due to the availability of many bus routes and relatively frequent bus arrivals. Transit LOS is also affected by auto speed along E. Riverside Drive. The westbound direction in the AM has better transit LOS than the eastbound direction in the PM, primarily because the westbound direction has more bus routes and stops.

The existing pedestrian LOS is D in both the AM and PM peak periods. The presence of continuous sidewalks along E. Riverside Drive is a positive factor for the pedestrian LOS, but the lack of buffer zone between the curb lane and the sidewalk degrades the pedestrian LOS.

The existing bicycle LOS is the worst among the three multimodal modes mainly because there is currently not a bike lane or paved shoulder along E. Riverside Drive. The poor bicycle LOS is also associated with the presence of right-hand side driveways along the corridor.

CHAPTER 4 – 2035 TRAFFIC FORECASTS & ANALYSIS

The year 2035 forecasted turning movement volumes (TMV) for intersections along the E. Riverside Drive between IH 35 and SH 71 were developed by Fehr & Peers. **Figure 4-1** shows the study area intersections, boundaries and traffic analysis zones (TAZ). Prior to developing the turning movement forecasts, validation testing on the CAMPO travel demand model was performed to document the strengths and weaknesses of the model with regard to travel forecasting for mixed use and infill development in a transit corridor. In addition, the land use estimates were prepared for the East Riverside Corridor (ERC) redevelopment project. A summary of the steps followed to develop 2035 forecasted TMVs is described below.

4.1 Data Collection

a. Existing land use data: GIS files were obtained corresponding to the proposed land use subdistrict map provided in the ERC Draft Regulating Plan. The GIS files contained ERC project boundary, parcel sizes, land use zoning along with limited information on existing land uses. In order to collect the missing information, a detail survey was conducted using Google Maps and realtor/apartment locator websites to obtain information on existing land uses on parcels within the ERC study boundary. Parcel sizes for non-residential properties were estimated using data contained in the GIS file provided by the City.

b. Future land use maps: The East Riverside Drive Corridor Draft Regulating Plan and East Riverside Drive Corridor Masterplan were reviewed to obtain information on proposed developments along East Riverside Drive as part of the ERC redevelopment project. The ERC Draft Regulating Plan provides zoning information for the study corridor while the ERC Master plan provides limited information on proposed projects based on information collected in year 2008.

c. Traffic Counts: The traffic count data included 24-hour approach counts and AM and PM peak hour turning movement counts were collected in the field as described in **Chapter 2**.

d. CAMPO Travel Demand Model: The latest CAMPO travel demand model containing data corresponding to year 2010 and 2035 were obtained.

4.2 Traffic Forecasts

The CAMPO travel demand model was used to develop 2035 No Build and Build condition volume forecasts. The process followed to develop these forecasts is described below.

a. Model Update – As the first step, study area TAZs in the CAMPO model were updated with the estimates of socio-economic factor described in the previous section to create a model run scenario (Build Condition) to represent the ERC corridor redevelopment project.

b. CAMPO Model Run – The second step consisted of performing CAMPO travel demand model runs with the updated socio-economic data using the "*feedback loop*" option provided in the CAMPO model interface. The "*feedback loop*" option runs the trip distribution, mode choice, and trip assignment processes multiple times with the objective of achieving speed and delay equilibrium in the entire system. It should be noted that the CAMPO model does not accurately estimate the impact of mixed use development and/or transit oriented developments. The ERC is proposed to

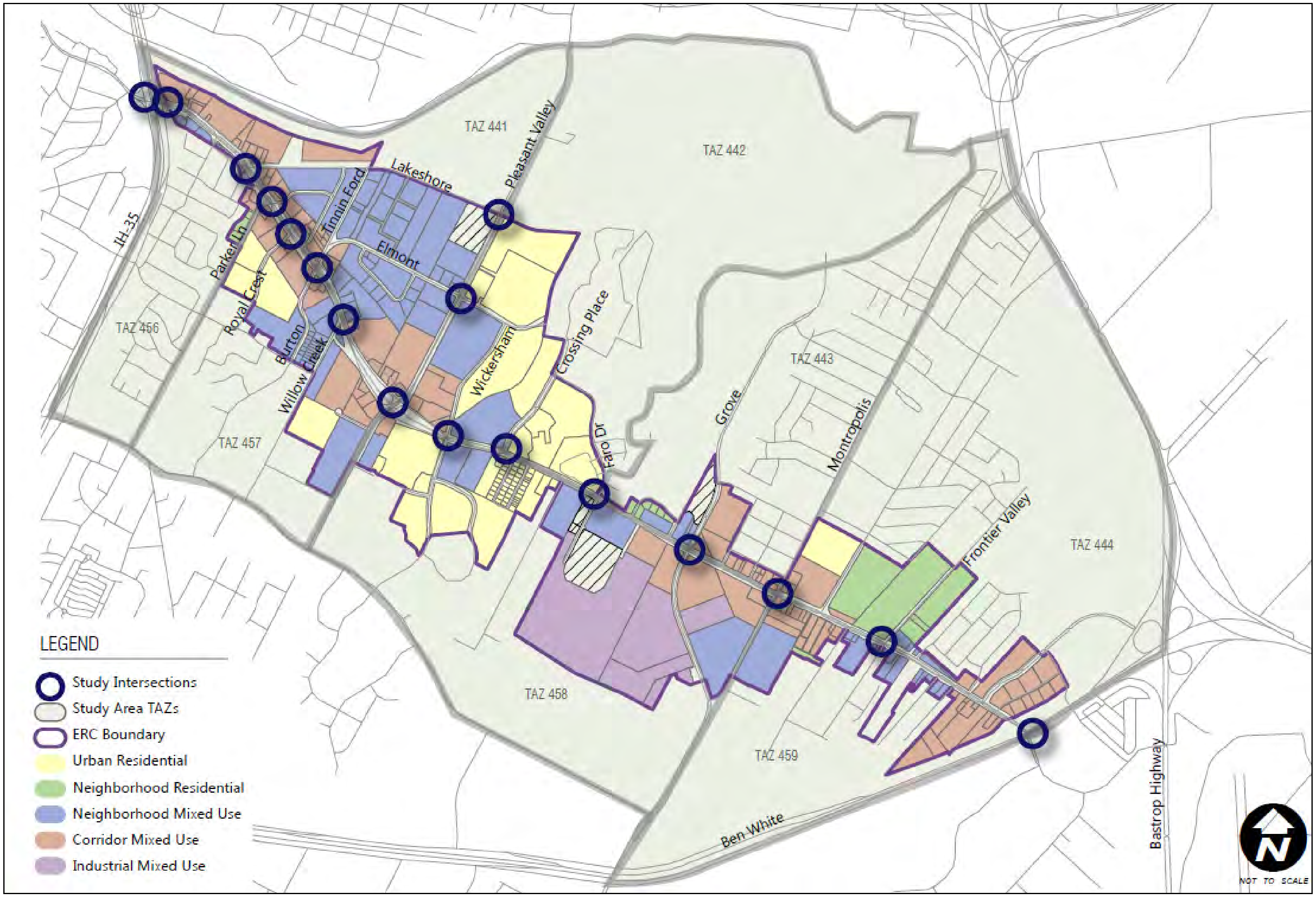


Figure 4-1 E. Riverside Drive Corridor TAZ Map

be developed based on the *5Ds* (design, density, diversity, destination accessibility, and distance to transit) of sustainable land use and transportation planning in order to encourage shorter and non-motorized trips. Therefore, the mixed-use developments (MXD) model, developed by Fehr & Peers, was utilized to estimate these reductions.

c. Estimating "5D" reductions – The 5Ds reduction factors were calculated using the MXD model. The MXD model uses various inputs to develop estimates of trip generation adjustment factors. Followings are the inputs of the MXD model:

1. Developed area within the study corridor.
2. Number of Intersections in the corridor.
3. Proportion of households within 1/4th mile of a transit stop.
4. Employment within one mile of the MXD.
5. Employment within a 30-minute door-to-door transit trip.
6. Total Regional Employment.
7. Site Population.
8. Average Household Size.
9. Average Vehicles per Household.

The input values for each study area TAZ (shown in **Figure 4-1**) were processed through the MXD model to obtain the trip generation adjustment factors.

TABLE 4-1
MXD TRIP GENERATION ADJUSTMENT FACTORS
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

TAZ ID	24-Hour	AM Peak	PM Peak
441	30%	30%	30%
442	24%	25%	24%
443	18%	21%	19%
444	20%	22%	20%
456	20%	22%	20%
457	19%	21%	20%
458	21%	22%	21%
459	17%	19%	18%

d. Model Adjustment – The reduction factors provided in **Table 4-1** were applied to the 24-Hour, AM peak, and PM Peak Origin-Destination (O-D) matrices obtained by running the CAMPO model. The updated O-D matrices were then processed through the CAMPO model "*Assignment"* step to obtain link and turning movement volumes for the study corridor.

e. Post-Processing – The post processing of the models consists of the following three steps.

1. Development of Adjustment Factors: The 2010 base year model volumes were compared with year 2011 AM and PM peak traffic counts. A comparison between 2010 model volumes and 2011 traffic counts indicates that the CAMPO model overestimates AM and PM peak hour volumes considerably. Adjustment factors were estimated by calculating the ratio of base year model volumes to base year traffic counts.
2. Adjusted Link and Turning Movement Volumes: This step consisted of applying adjustment factors to the appropriate link volumes and distributing the adjusted link volumes based on the turning movement splits obtained directly from the CAMPO model run.
3. Volume Balancing: As mentioned previously, the CAMPO model does not include minor arterials, collectors and residential streets. For example, the CAMPO model does not include the intersections of East Riverside Drive with Crossing Place, Faro Drive, and Frontier Valley Road. In addition, Parker Road and Willow Creek Road are coded as T-intersections in the model. To develop volume estimates for these roadways, a growth factor was calculated based on link volumes, immediately east and west of these intersections. These growth factors were then applied to the 2011 existing counts to estimate the future year northbound and southbound volumes at these intersections. The final step consisted of balancing link volumes such that traffic leaving an upstream intersection was equal to traffic arriving at a downstream intersection.

The *2035 Traffic Volume Forecast report* prepared by Fehr & Peers as part of this study describes methodology, land use assumptions, input and output of the forecasting models in detail.

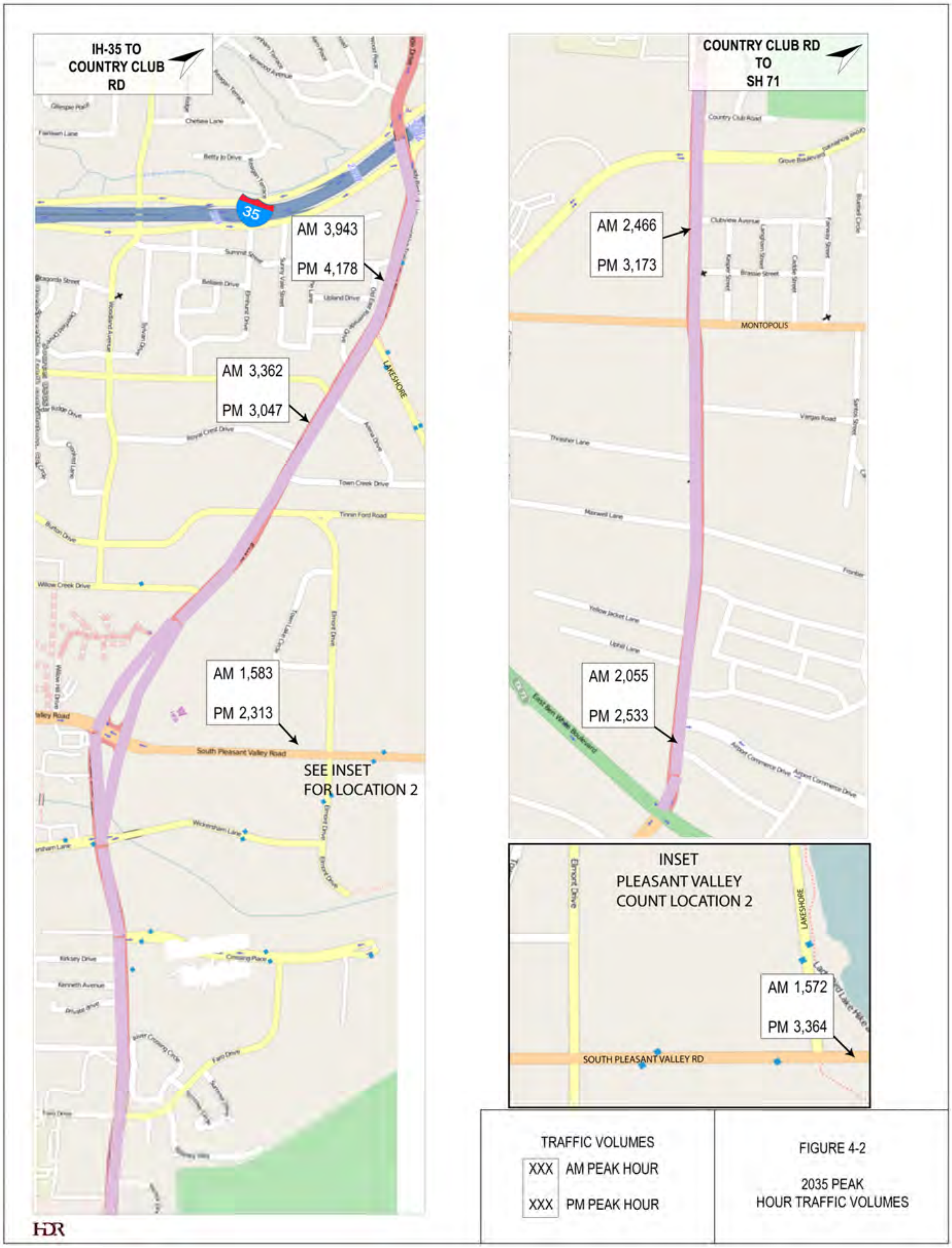


FIGURE 4-2
2035 PEAK
HOUR TRAFFIC VOLUMES

4.3 ROADWAY IMPROVEMENTS

To accommodate the increase in traffic volumes from 2011 existing conditions to the future years of 2035, roadway improvements will be necessary. The following sections summarize the recommended short-term improvements and long-term improvements for the 2035 scenarios.

4.3.1 SHORT-TERM IMPROVEMENTS

Short-term improvements were identified for the E. Riverside Drive corridor based on the existing condition traffic analysis. **Table 4-2** lists the short-term improvements by intersection.

TABLE 4-2
SHORT-TERM IMPROVEMENTS
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Intersections	Short-Term Improvements
E. Riverside Drive and IH 35	Restripe northbound IH 35 frontage road approach to left, left/through, and through; and Shift existing northbound right-turn lane to the east with 300 ft storage.
E. Riverside Drive and Lakeshore Boulevard	Add signal on eastbound approach of Riverside Drive; Convert northbound approach to Right-in/Right-out; and Provide pedestrian crosswalk Riverside Drive.
E. Riverside Drive and Willow Creek Drive	Restripe south leg for longer NB left-turn lane; Remove split phasing on Willow Creek in the PM peak; and Implement protected-only left-turn phase on eastbound and westbound approaches of Riverside Drive.
E. Riverside Drive and Pleasant Valley Road	Convert turnaround lane on Riverside Drive eastbound direction to left-turn lane; Provide side-by-side left-turn lanes on Pleasant Valley Road between eastbound and westbound Riverside Drive; Add raised pedestrian refuge in northwest corner at channelized right-turn, and tighten right-turn radius for safer pedestrian crossing; and Install mid-block pedestrian crossing with HAWK near HEB.
E. Riverside Drive and Montopolis Drive	Add left-turn lane on northbound and southbound approaches of Montopolis Drive, and remove split phasing; and Extend EB left-turn bay on Riverside Drive.
E. Riverside Drive and SH 71	Grade separation.

4.3.2 LONG TERM IMPROVEMENTS (2035 HIGH CAPACITY TRANSIT IMPROVEMENTS)

In addition to the short-term improvements, the following overall improvements along the E. Riverside Drive Corridor are recommended for the High Capacity Transit scenario and were included as part of the 2035 High Capacity Transit models.

- 4-lanes are maintained along E. Riverside Drive for vehicular traffic.
- High Capacity Transit runs in median on a dedicated lane along E. Riverside Drive.
- Curb running to median running transition and vice versa occurs at the IH 35 interchange.
- Transit Signal Priority (TSP) is implemented at the signalized intersections along E. Riverside Drive.
- Convert all left-turn signal phases to protected-only along E. Riverside Drive.
- Install two-stage pedestrian crossings at the signalized intersections along E. Riverside Drive.
- With the addition of High Capacity Transit, local bus average dwelling time at the selected bus stops is reduced from 40 seconds to 25 seconds.

2035 High Capacity Transit improvements were identified for the E. Riverside Drive corridor based on the 2035 condition traffic analysis. **Table 4-3** lists the 2035 High Capacity Transit improvements by intersection.

TABLE 4-3
2035 HIGH CAPACITY TRANSIT IMPROVEMENTS
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Intersections	2035 High Capacity Transit Improvements
E. Riverside Drive and IH 35	Provide a pocket on eastbound (curbside) and westbound (in median) to accommodate the train for TSP queue jump.
E. Riverside Drive and Lakeshore Boulevard	Convert single eastbound left-turn lane to dual left-turn lanes.
E. Riverside Drive and Pleasant Valley Road	Reconfigure to Median U-Turn (MUT) configuration; and Remove current U-turn lanes.
E. Riverside Drive and Wickersham Lane	Convert the single eastbound left-turn lane to dual left-turn lanes.
E. Riverside Drive and Crossing Place	Consolidate the local bus stop located west of the E. Riverside Drive/Crossing Lane intersection on the westbound direction with the upstream bus stop.
E. Riverside Drive and Grove Boulevard	Convert the single eastbound left-turn lane to dual left-turn lanes.
E. Riverside Drive and Montopolis Drive	10 to 20 percent of traffic volume on SB, NB and the EB left-turn of the Montopolis/Riverside Drive intersection is relocated to the Grove/Riverside Drive intersection because of excessive congestion at the Montopolis/Riverside Drive intersection; and Convert the single eastbound left-turn lane to dual left-turn lanes.
E. Riverside Drive and Maxwell/Frontier Valley	Install signal.

CHAPTER 5 – ANALYSIS OF 2035 ALTERNATIVES

The 2035 Alternatives demonstrate the future conditions and operations associated with increased traffic volumes and the improvements along E. Riverside Drive in the future. The 2035 Alternatives were analyzed and the results are compared in this chapter. The approved and other short-term recommended improvements based on the Existing models were incorporated in the 2035 Alternatives. Each 2035 Alternative is described in the following sections in detail.

5.1 2035 TRAFFIC VOLUME ASSUMPTIONS

Analysis of year 2035 traffic conditions required development of travel demand estimates. In order to develop 2035 travel demand estimates for the study area, travel demand models prepared by Fehr and Peers and historical traffic growth pattern were used as a base. The methodology for developing the traffic forecasts is summarized in **Chapter 4** and described in detail in the *2035 Traffic Volume Forecast Report* prepared by Fehr & Peers. The 2035 traffic forecasts were included in the modeling of the 2035 Alternatives Analysis. Further reductions were applied to the 2035 traffic volumes to account for the High Capacity Transit, Transportation Demand Management (TDM) and volume threshold to maintain the intersection LOS, D or better, in the 2035 High Capacity Transit Scenario which is discussed in Section 5.2.2.

5.2 2035 ALTERNATIVES

Several alternatives were analyzed for the year 2035. After initial analyses, the following 2035 alternatives were identified for further analysis.

1. 2035 No Build scenario with 6-lane on E. Riverside Drive
2. 2035 High Capacity Transit scenario with 4-lane on E. Riverside Drive

Each of the above alternatives and their underlying assumptions are further defined in the following sections.

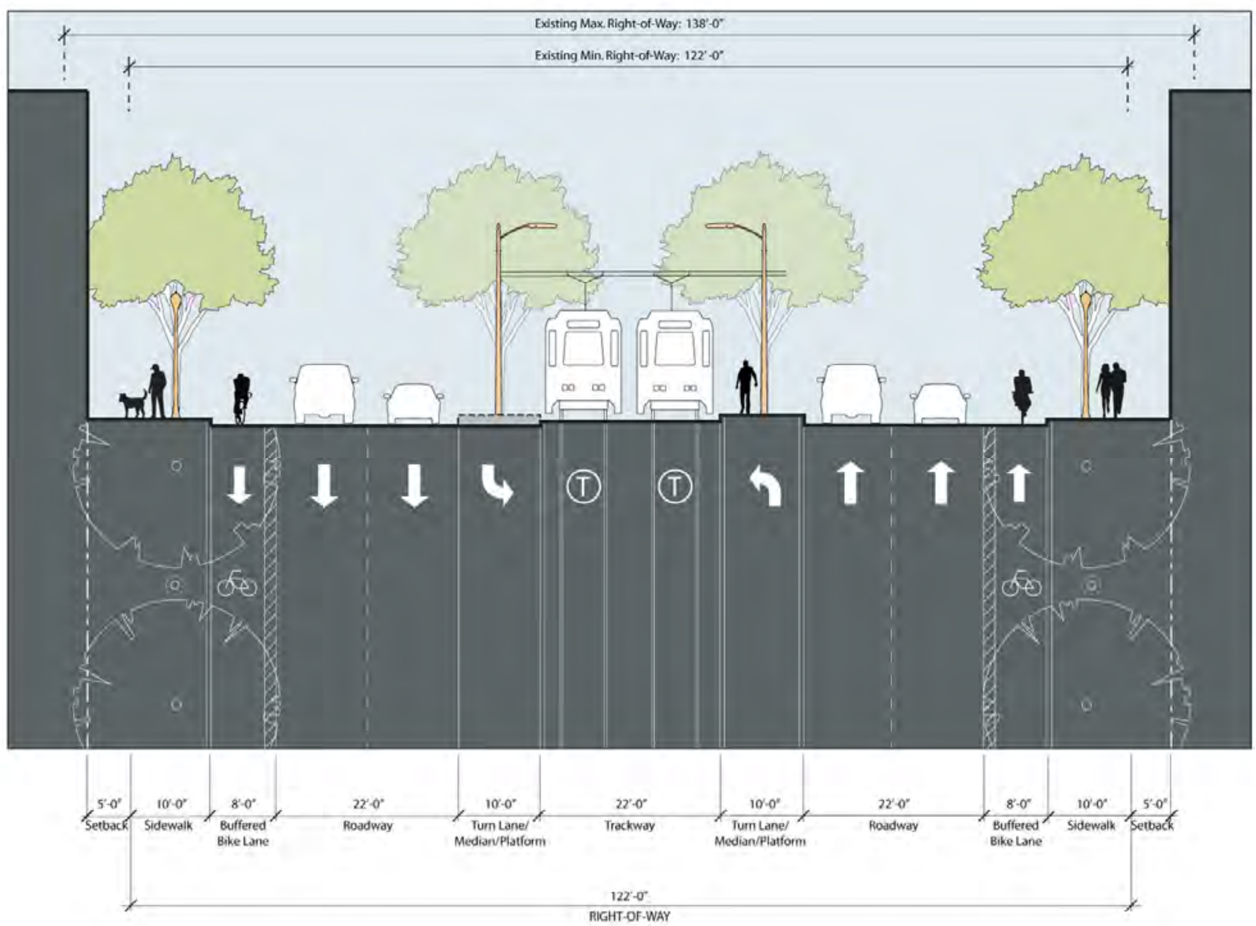
5.2.1 2035 No Build Scenario

The 2035 No-Build scenario was analyzed with the existing roadway geometry along E. Riverside Drive, which carries 6-lanes, and the short-term improvements as listed in **Chapter 4.**. Adjustments to signal operations were applied to all signalized intersections using SYNCHRO to accommodate the increased traffic volumes.
The 2035 No Build results are compared with the 2035 High Capacity Transit scenario results in **Tables 5-2, 5-3, 5-4**, and **5-5**.

5.2.2 2035 High Capacity Transit Scenario

In the 2035 High Capacity Transit scenarios, E. Riverside Drive is assumed to have two lanes next to the median dedicated to High Capacity Transit, one lane in each direction, and remaining four lanes for vehicular traffic, two lanes in each direction. The dedicated lanes for High Capacity Transit would reduce the conflict points and travel time as well an increase speed and ridership. Bike lanes are assumed on each side E. Riverside Drive, and the sidewalk is assumed to be widened. **Figure 5-1** shows the typical cross section for E. Riverside Drive for the Median Running High Capacity Transit scenario. In this scenario, the 2035 No-Build traffic forecasts were reduced by applying a 5% High Capacity Transit reduction as a result of a mode shift, and a 3% Transportation Demand Management (TDM) reduction. In addition, a 10% overall volume reduction was applied to the corridor to account for land use changes. It was assumed that some of the Pleasant Valley Road traffic would reroute to US 183 due to the grade separation of the E. Riverside Drive and SH 71 interchange. Therefore, an additional 30 percent through traffic of Pleasant Valley Road was rerouted to US 183.

FIGURE 5-1
TYPICAL CROSS-SECTION FOR 2035 HIGH CAPACITY TRANSIT SCENARIO
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS



5.2.2.1 2035 HIGH CAPACITY TRANSIT ASSUMPTIONS

In conjunction with the City of Austin, assumptions were developed relating to the characteristics of the High Capacity Transit vehicle and operations. It was assumed that the total length of the High Capacity Transit is 165 foot (two 81 foot cars). Other characteristics that were assumed as part of the High Capacity Transit are level boarding with platforms located in the median and the High Capacity Transit would follow the posted speed limits of E. Riverside Drive.

The High Capacity Transit operations consist of a limited stop service with the High Capacity Transit operating at 10 minute headways during the 2035 peak hours. The High Capacity Transit will have designated station locations between the IH 35 and SH 71 along E. Riverside Drive. The following station locations were assumed as part of this study:

1. Riverside Drive and Arena Lane/Parker Lane
2. Riverside Drive and Pleasant Valley Road
3. Riverside Drive, between Grove Boulevard and Montopolis Drive
4. Riverside Drive and Discovery Lane.

When the High Capacity Transit is operational along the corridor, adjustments were made to local bus service dwelling time at selected stations as described in **Section 4.3**. The recommended Improvements to the 2035 High Capacity Transit are listed in **Chapter 4,** which were also included in the analysis.

5.2.2.2 TRANSIT SIGNAL PRIORITY ASSUMPTIONS

Transit Signal Priority (TSP) is commonly used throughout the United States as a cost-effective method to enhance mobility of transit vehicles by improving travel time and reliability. TSP provides priority to the transit vehicle at signalized intersections by giving the vehicle additional green time or less red time to eliminate or lessen the delay experienced at signalized intersections. It should be noted that this priority is different than pre-emption, which always provides green time for the vehicle and is typically used for emergency vehicles. With pre-emption, there is a recovery period for the intersection. With TSP, the intersection always stays in coordination with the system. TSP also works within set parameters that are typically determined by the transit agency and the traffic signal operators, to balance the impact to vehicles also traveling on the roadway. **Table 5-1** shows the TSP parameters assumed in the analysis of the 2035 High Capacity Transit alternatives. TSP was not assumed at the intersection of E. Riverside Drive and Montopolis Drive because of the heavy congestion under the 2035 conditions.

TABLE 5-1
TSP PARAMETERS
E. RIVERSIDE DRIVE HIGH CAPACITY TRANSIT CORRIDOR
AUSTIN, TEXAS

TSP Strategies	Early Green, Green Extension
Signal Specification	
Maximum Green Time Reduction (%)	
Concurrent LT	20% w/o reducing past min green
Cross-Street Through	20% w/o reducing past min green
Cross-Street LT	20% w/o reducing past min green
Maximum Green Extension Time	Maximum truncation of all conflicting phases
Transit Arrival Prediction	Yes – set independently for each intersection
Re-Arm Timer Setting	Maximum of 1 TSP every 2 cycles
Method to Return to Coordination	Never leaves coordination
Pedestrian Clearance Phase Truncation	No ☒ Yes ☐
Phase Rotation	No ☒ Yes ☐
Phase Suppression/Skipping	No ☒ Yes ☐
Conditional Priority	Unconditional priority
Transit Specification	
Transit Routes Eligible for TSP	High Capacity Transit only
Approaches Capable of Granting TSP	Along Riverside Drive Only

5.3 SUMMARY OF RESULTS

Operational performance is expressed in terms of MOEs, which include average vehicle speed, delay, vehicle miles of travel, travel time, fuel consumption, emissions and several other measures. While the VISSIM model provides a wide variety of MOEs, which are available for other purposes, only a few MOEs that focus on the scope of this project were used to establish existing traffic operations.

The MOEs that were evaluated for the 2035 alternatives analysis include travel time, network delay, network vehicles, average speed and intersection LOS. Detailed descriptions of the MOE terminology can be found in **Chapter 2.**

In order to validate results, ten (10) replicate runs using different random seed numbers were performed for each model scenario. Results were calibrated with forecasted traffic volumes to ensure that appropriate volumes were being fed into each model. Outliers found with the model result validation process were investigated, and an iterative process was followed to resolve any issues that may have existed between replicate runs.

To reflect realistic traffic conditions in each model, minor changes were made to the vehicle diffusion time parameter at selected locations. Simulations of models were observed multiple times for the entire seeding and analysis duration, to alleviate any unrealistic vehicle behavior and weaving between closely spaced intersections. Routing decisions, lane change distances and link distances were modified as needed.

Intersection LOS is an important MOE for evaluating the future conditions along the E. Riverside Drive corridor. The comparisons of intersection levels of service for all intersections in the study area between the 2035 No Build and 2035 High Capacity Transit scenarios are shown in **Table 5-2**. The intersections of E. Riverside Drive with IH 35, Lakeshore Boulevard, Arena Drive, Montopolis Drive, Maxwell/Frontier Valley and SH 71 Eastbound Frontage Road are failing in either AM peak or PM peak hours in the 2035 No Build scenario. The intersections of E. Riverside Drive with IH 35 and SH 71 are already failing in the Existing condition during the PM peak hour. The reduction in volumes due to the High Capacity Transit, TDM and additional volume reduction improve the intersection LOS in the 2035 High Capacity Transit scenario. Besides the volume reductions, the improvements shown in Section 4.3.2, where were included in the analysis, also improve intersection delay in the 2035 High Capacity Transit scenario.

TABLE 5-2
SIGNALIZED INTERSECTIONS LEVELS OF SERVICE – YEAR 2035
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Intersections	2035 No Build		2035 with High Capacity Transit*	
	AM Peak	PM Peak	AM Peak	PM Peak
E. Riverside Drive and IH 35 SB Frontage	**E**	**E**	D	**E**
E. Riverside Drive and IH 35 NB Frontage	**E**	D	C	C
E. Riverside Drive and Lakeshore Boulevard	**E**	B	D	C
E. Riverside Drive and Arena/Parker Lane	**E**	B	C	B
E. Riverside Drive and Royal Crest Drive	D	A	B	B
E. Riverside Drive and Burton/Tinnin Ford Road	D	C	C	D
E. Riverside Drive and Willow Creek Drive	D	D	C	D
E. Riverside Drive WB and Pleasant Valley Road	D	D	C	D
E. Riverside Drive EB and Pleasant Valley Road	C	C	B	D
E. Riverside Drive and Wickersham Lane	D	D	C	D
E. Riverside Drive and Crossing Place	D	C	C	C
E. Riverside Drive and Faro Drive	C	B	B	C
E. Riverside Drive and Grove Boulevard	C	D	C	D
E. Riverside Drive and Montopolis Drive	**E**	**F**	D	D
E. Riverside Drive and Maxwell/Frontier Valley	**E**	**E**	C	D
E. Riverside Drive and SH 71 WB Frontage	D	D	D	D
E. Riverside Drive and SH 71 EB Frontage	D	**E**	D	D
Pleasant Valley Road and Elmont Drive	C	B	A	B
Pleasant Valley Road and Lakeshore Boulevard	C	D	B	**E**

*includes volume reductions and additional improvements.

Figure 5-2 and **5-3** show graphically the number of intersections operating at each LOS (A – F) during the AM and PM peak hours, respectively. As shown in **Figure 5-2** and **5-3**, the majority of the intersections operate at an acceptable LOS D or better in the 2035 High Capacity Transit scenario during the AM peak hour. In the PM peak hour, there are two intersections operating at LOS E. Overall, the 2035 High Capacity Transit scenario has better intersection LOS results than the 2035 No-Build scenario.

Figure 5-2
INTERSECTION LOS – 2035 AM PEAK
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

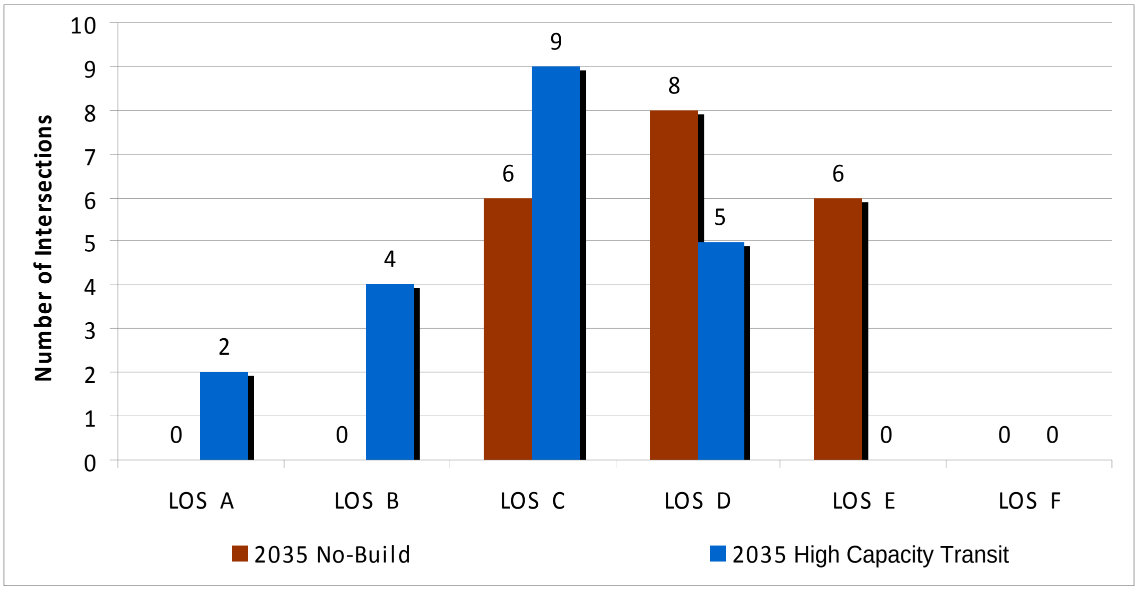
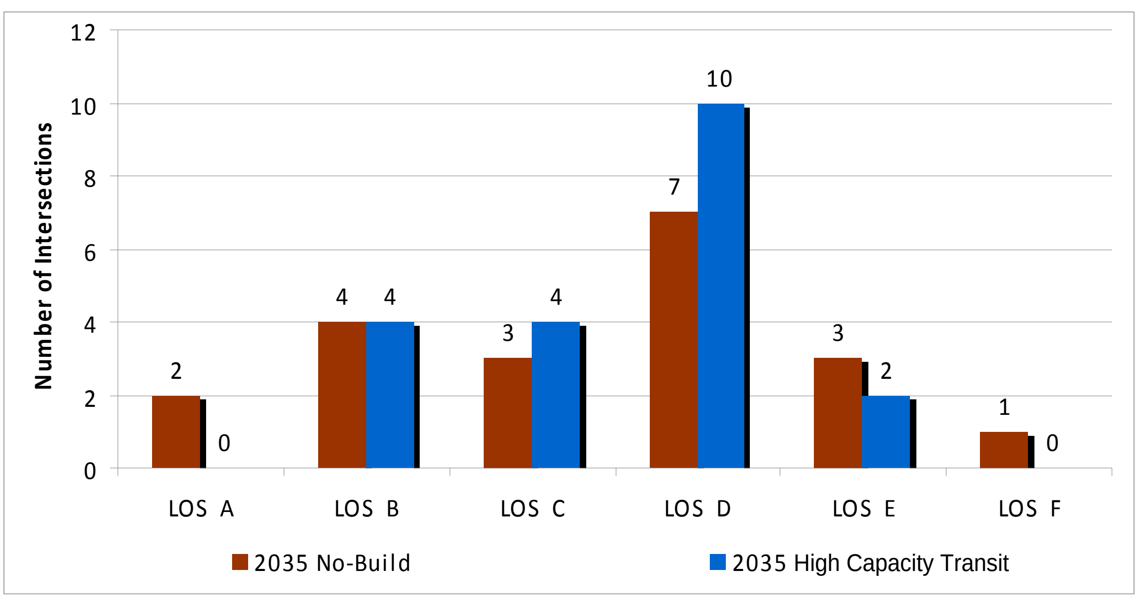


FIGURE 5-3
INTERSECTION LOS – 2035 PM PEAK
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS



Tables 5-3 and **5-4** list the signalized intersections with highest delay in the 2035 AM and PM peak periods, respectively. The intersection of Riverside Drive and IH 35 experiences the highest delay in all scenarios. The intersection of Riverside Drive and Montopolis Drive also experiences delays in both peak periods and both 2035 scenarios.

TABLE 5-3
SIGNALIZED INTERSECTIONS WITH HIGHEST DELAY – 2035 AM PEAK
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

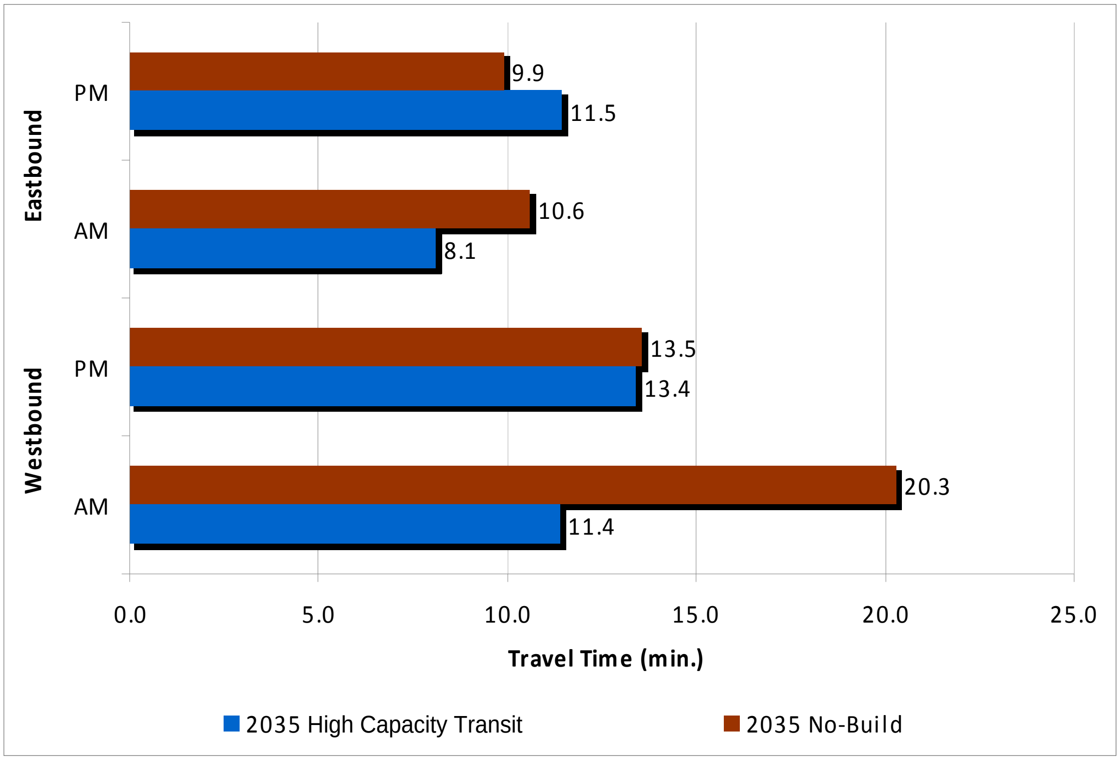
Intersections	2035 No-Build	2035 High Capacity Transit
E. Riverside Drive and IH 35	√	√
E. Riverside Drive and Lakeshore Boulevard	√	√
E. Riverside Drive and Pleasant Valley Road	√	
E. Riverside Drive and Montopolis Drive	√	√

TABLE 5-4
SIGNALIZED INTERSECTIONS WITH HIGHEST DELAY – 2035 PM PEAK
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Intersections	2035 No-Build	2035 High Capacity Transit
E. Riverside Drive and IH 35	√	√
E. Riverside Drive and Willow Creek Drive	√	√
E. Riverside Drive and Wickersham Lane	√	
E. Riverside Drive and Montopolis Drive	√	√

Figure 5-4 shows the average travel time for auto traffic along E. Riverside Drive under the 2035 No-Build conditions, and the 2035 High Capacity Transit scenario.

FIGURE 5-4
AUTO AVERAGE TRAVEL TIME ALONG E. RIVERSIDE DRIVE
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS



As shown in **Figure 5-4**, the 2035 High Capacity Transit scenario generally has lower average travel time in both the AM and PM peak hours than the 2035 No Build scenario. The only exception is the eastbound direction in the PM peak hour, which shows a slightly higher travel time (1.6 min) in the 2035 High Capacity Transit scenario. That may be because all the lefts turn signals along the E. Riverside Drive were changed to protected-only to avoid conflicts between the High Capacity Transit and left-turning vehicles in the 2035 High Capacity Transit scenario. This that may cause some of the left-turn queue to occasionally spill out of the bay and block the through vehicles on E. Riverside Drive and increase the through movement travel time in some cases. To minimize the impact of the left-turn queue on the through traffic, additional recommended improvements were assumed such as left turn bay extension and the addition of dual left turn lanes where feasible.

Finally, the network wide MOEs are summarized in **Table 5-5.** Area-wide statistics are critical to the evaluation of the overall efficiency of the transportation network. Results for network travel time, delay, number of vehicles, and average speed are shown in **Table 5-5**. The PM peak period is the critical peak that has the highest traffic volumes which results in the greatest travel time and delay within the network in both 2035 scenarios. When compared to the area-wide statistics under the 2035 No-Build conditions, total travel time, delay time and average speed improve in the 2035 High Capacity Transit scenario.

TABLE 5-5
VISSIM NETWORK-WIDE AVERAGE STATISTICS – 2035
E. RIVERSIDE DRIVE CORRIDOR
AUSTIN, TEXAS

Peak-Hour	Network Vehicles (veh)	Total Travel Time (hr)	Total Delay Time (hr)	Average Speed (mph)
2035 No Build – Weekday				
AM Peak Hour	16,162	2,049	1,524	9.8
PM Peak Hour	19,987	2,216	1,625	10.2
2035 High Capacity Transit Scenario – Weekday				
AM Peak Hour	16,547	1,288	735	17.0
PM Peak Hour	19,519	2,025	1,421	11.8

APPENDIX D
2035 TRAFFIC VOLUME FORECAST

2035 TRAFFIC VOLUME FORECASTS

City of Austin Transportation Corridor Study
East Riverside Drive Corridor

FEHR PEERS

HDR

Fehr & Peers, as part of the HDR team, was retained by the City of Austin to develop year 2035 forecasted turning movement volumes (TMV) for intersections along East Riverside Drive between IH 35 and SH 71. **Figure 1** shows the study area intersections, boundaries and traffic analysis zones (TAZ). Prior to developing the turning movement forecasts, Fehr & Peers performed validation testing on the CAMPO travel demand model to document the strengths and weaknesses of the model with regard to travel forecasting for mixed use and infill development in a transit corridor. In addition, Fehr & Peers also developed land use estimates for the East Riverside Corridor (ERC) redevelopment project. A summary of the steps followed to develop 2035 forecasted TMVs is described below.

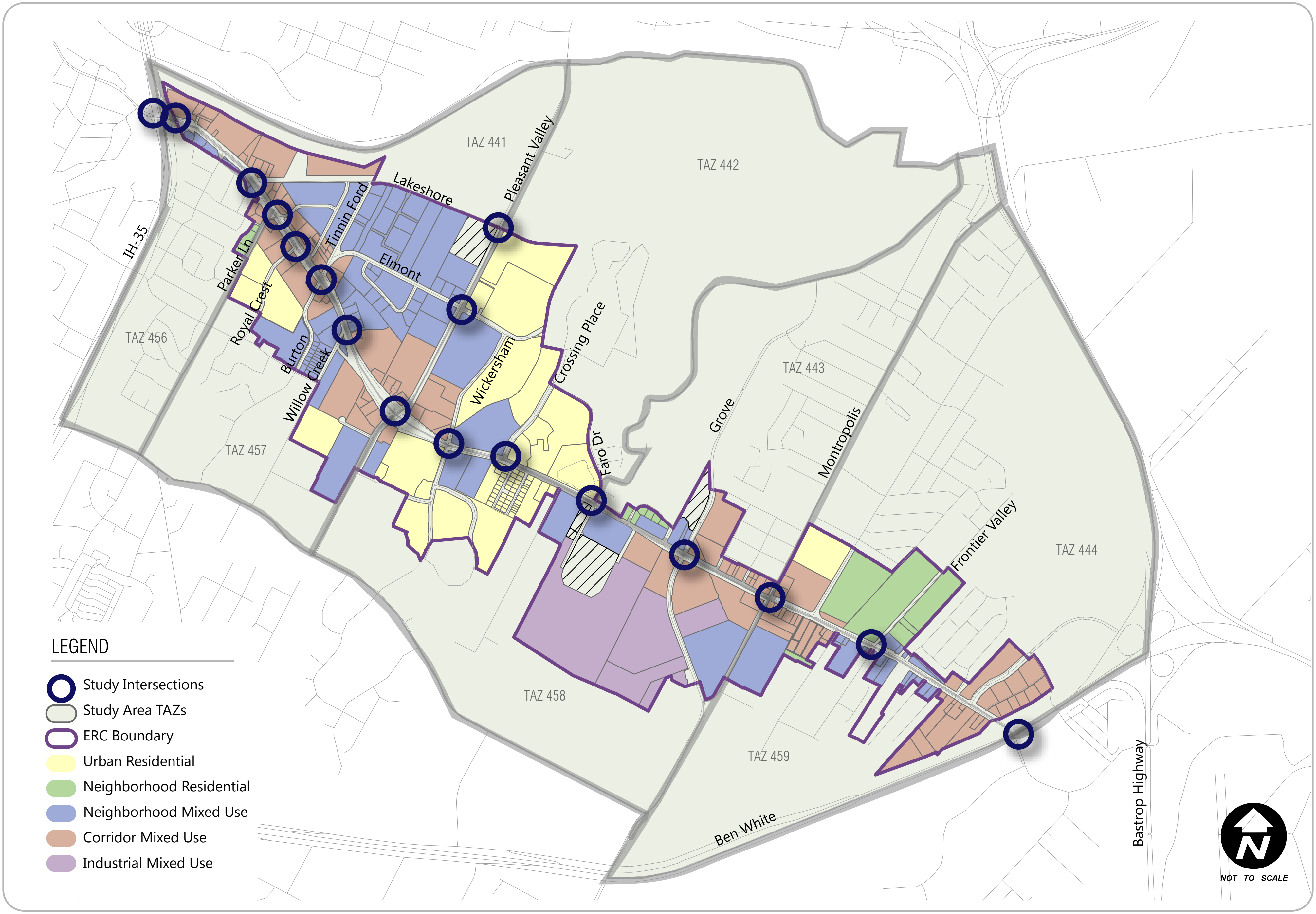
1.1. Data Collection

a. Existing land use data: Fehr & Peers obtained GIS files corresponding to the proposed land use subdistrict map provided in the ERC Draft Regulating Plan. The GIS files contained ERC project boundary, parcel sizes, land use zoning along with limited information on existing land uses. In order to collect the missing information, Fehr & Peers performed a detailed survey using Google Maps and realtor/apartment locator websites to obtain information on existing land uses on parcels within the ERC study boundary. Parcel sizes for non-residential properties were estimated using data contained in the GIS file provided by the City.

b. Future land use maps: Fehr & Peers reviewed the East Riverside Drive Corridor Draft Regulating Plan (**Ref. 1**) and East Riverside Drive Corridor Masterplan (**Ref. 2**) to obtain information on proposed developments along East Riverside Drive as part of the ERC redevelopment project. The ERC Draft Regulating Plan provides zoning information for the study corridor while the ERC Master plan provides limited information on proposed projects based on information collected in year 2008.

c. Traffic Counts: Fehr & Peers obtained traffic count data from HDR which included 24-hour approach counts and AM & PM peak hour turning movement counts. Based on the directions received from HDR, the traffic counts were increased by 10% to account for school closure during the data collection period.

d. CAMPO Travel Demand Model: Fehr & Peers obtained the most recent CAMPO travel demand model containing data corresponding to year 2010 and 2035.



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March 2012

1.2. Validation Testing

Fehr & Peers' standard model validation procedure involves two types of tests, static validation and dynamic validation. According to Federal Highway Administration's (FHWA) *Travel Model Validation and Reasonableness Checking Manual* (**Ref 3**), model validation is an important process that is performed prior to using a travel demand model to understand its sensitivity to changes in demographic and roadway network characteristics. This knowledge on the model's sensitivity helps analysts to understand the usefulness and applicability of the model for the proposed analysis scenario. Static validation is the most common type of validation test and measures the ability of a travel demand model to replicate observed traffic conditions. Dynamic validation, while less common, was also applied since travel demand models are not developed to replicate existing data, but rather to test how changes in land use or the transportation network influence travel patterns. Description of the Static and Dynamic Validation process is provided below:

1.2.1. Static Validation

The objective of the static validation tests was to evaluate the model's ability to accurately replicate observed traffic conditions in the study area. For the purpose of this study, the model output for analysis year 2010 were compared with traffic counts collected by HDR Engineering Inc., in August 2011. The guidelines established by Caltrans for travel demand model performance were used for static validation (**Ref 4**): The CAMPO model was statically validated to 2011 daily, AM peak hour, and PM peak hour conditions. Model volumes were compared to existing traffic counts at 6 individual count location for the daily, AM and PM peak hour periods.

<u>Validation Criteria</u>

The following criteria were used to validate the CAMPO model:

- The maximum deviation is the difference between the model volume and the actual count divided by the actual count.
- The correlation coefficient estimates the correlation between the actual traffic counts and the estimated traffic volumes from the model.
- The percent root mean square error (RMSE) is the square root of the model volume minus the actual count squared divided by the number of counts. It is a measure similar to standard deviation in that it assesses the accuracy of the model.

Model-Wide Validation Guidelines

For a travel demand model to be considered accurate and appropriate for use in traffic forecasting, it must replicate actual conditions with a certain level of accuracy. The *Travel Forecasting Guidelines* (**Ref. 4**) developed by Caltrans contains several validation standards for travel demand models. The following criteria were selected for this study:

- At least 75 percent of the roadway links for which counts are available should be within the maximum desirable deviation, which ranges from approximately 15 to 60 percent depending on total volume (the larger the volume, the less deviation is permitted).

- The correlation coefficient between the actual ground counts and the estimated traffic volumes should be greater than 88 percent.

- The percent RMSE should not exceed 40 percent.

The static validation results are presented in **Table 1**.

TABLE 1
RESULTS OF STATIC MODEL VALIDATION FOR EAST RIVERSIDE DR. CORRIDOR
CAMPO 2010 MODEL

Validation Statistic	Criterion for Acceptance	Model Results: Daily (24-Hour)	Model Results: AM (2-Hour)	Model Results: PM (2-Hour)
Count Locations	NA	10	6	6
Percent of roadway links within maximum allowable deviation of 15%	> 75%	**33%**	**0%**	**0%**
Correlation Coefficient	Greater than 88%	0.95	0.81	0.95
Percent RMSE	30% or less	21%	**189%**	**124%**

As shown in the table above, the CAMPO travel demand model does not meet Caltrans static validation standards especially under the AM peak hour, and PM peak hour conditions for the Riverside Drive corridor. This indicates that considerably post-processing is required prior to using the peak period model volumes.

1.2.2. Dynamic Validation

The objective of dynamic validation was to evaluate the model's sensitivity to changes in socio-economic, transit, and roadway network characteristics. The model was tested by changing the socio-economic parameters, transit headways and roadway network for analysis year 2010. A description of these three dynamic validation scenarios is presented below:

1. Socio-economic Changes
   Land use modifications were made to a single TAZ (442) while keeping all else the same in the validated base year (2010) model's Master TAZ database and a full model run was performed. The first dynamic test consisted of varying the population (and household) and service employment (and total employment) to compare the magnitude and direction of change from the original forecast. The following metrics were evaluated as part of the first set of dynamic validation tests:
   - Change in model-wide vehicle trips (VT) per unit change in population/employment.
   - Change in TAZ level vehicle trips (VT) per unit change in population/employment.
   - Change in TAZ level trips rates per unit change in population/employment.

Scenarios 1 and 2: The impact of change in population on trip generation was examined at the model-wide and TAZ levels by examining the change in trips associated with the change in population. **Figures 2** and **3** show the model-wide and TAZ level (TAZ 442) trip generation, respectively, before and after adding one (1), and 5,000 persons to TAZ 442.

Under Scenario 1, model-wide vehicle trips decreased by 24, 9, and 9 trips during the 24-hour, 2-hour AM Peak and 2-Hour PM peak periods, respectively. At the TAZ level, the number of trips decreased by 26, 10 and 4 vehicle trips during the 24-hour, 2-hour AM Peak and 2-Hour PM Peak periods, respectively, under Scenario 1. An increase in population by one (1) person is expected to result in no change or marginal increase in trips. However, vehicle trips' forecasts show a decrease in trips and hence are not consistent with prior expectations of direction of change in vehicle trips.

Under Scenario 2, model-wide vehicle trips increased by 6,897, 1,906, and 2,047 trips during the 24-hour, 2-hour AM Peak and 2-Hour PM peak periods, respectively. At the TAZ level, the number of trips increased by 6,988, 2,005 and 2,162 vehicle trips during the 24-hour, 2-hour AM Peak and 2-Hour PM Peak periods, respectively, under Scenario 2. The results indicate that vehicle trips' forecasts are consistent with prior expectations of direction of change in vehicle trips.

Figure 2
Change in Model-Wide Vehicle Trips Vs. Change in Population

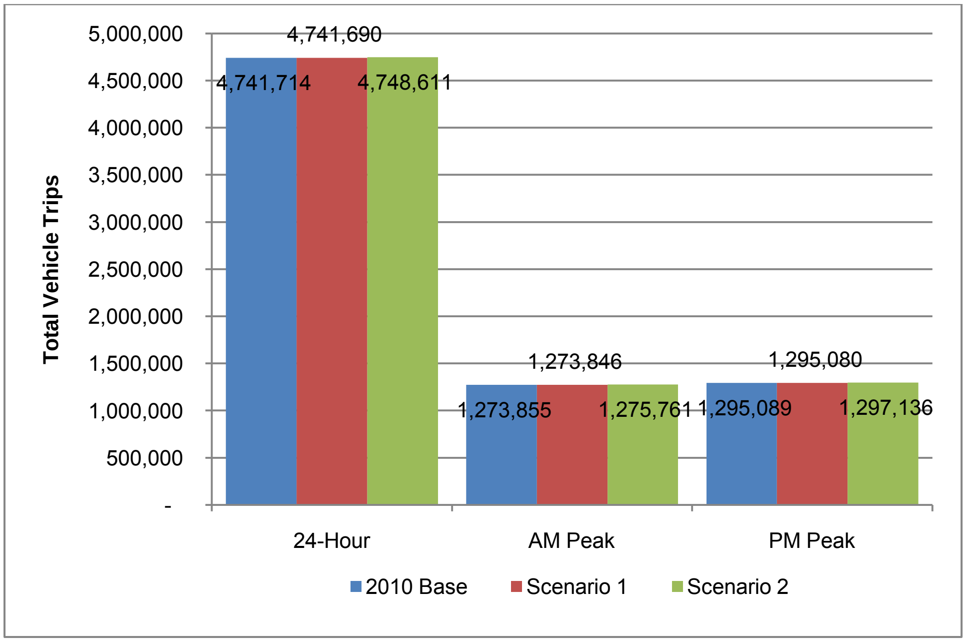
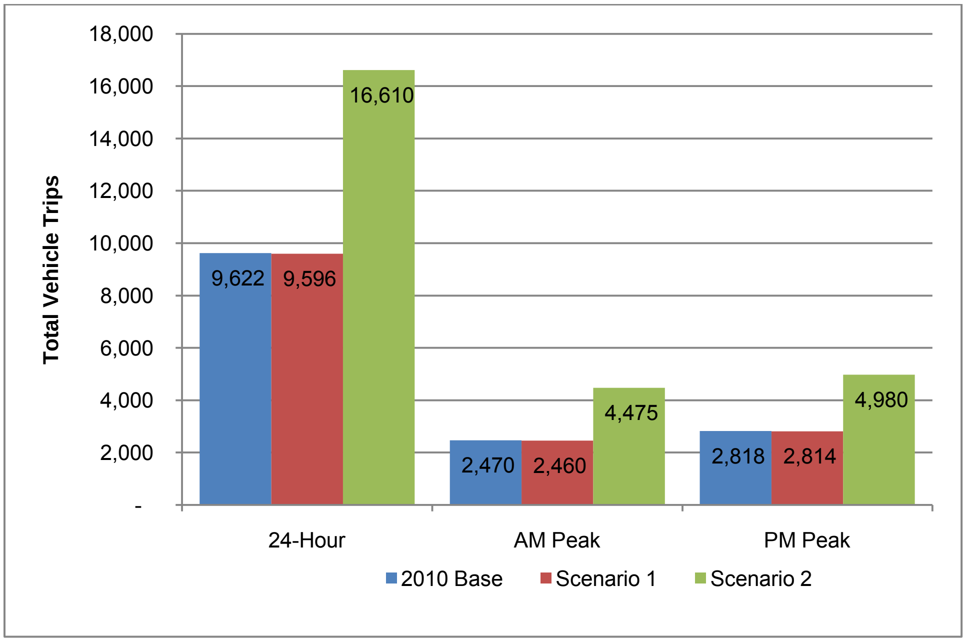


Figure 3
Change in Vehicle Trips (TAZ 442 Only) Vs. Change in Population



In addition to change in direction of the c hange in vehicle trips, average and incremental TAZ level trip rates were estimated to examine the change in magnitude for the three test scenarios. As shown in **Table 2**, under Scenario 1, the average daily trip rate for the entire TAZ population decreases from 1.80 trips per person to 1.79 trips per person. This implies an incremental trip rate of -26 daily trips for every one person in addition to population (5,359) assigned by CAMPO for TAZ 442 in year 2010. The corresponding incremental trip rates for AM and PM peak periods are -10 and -4 trips per additional person. As stated earlier, this pattern is not consistent with prior expectations.

Under Scenario 2, the average daily trip rate for the entire TAZ population decreases from 1.80 trips per person to 1.60 trips per person. This implies an incremental trip rate of 1.4 daily trips for every one person in addition to population (5,359) assigned by CAMPO for TAZ 442 in year 2010. The corresponding incremental trip rates for AM and PM peak periods are 0.43 and 0.40 trips per additional person. The decrease in trip rates for the additional 5,000 persons added under Scenario 2 indicates that the model factors in the impact of population density in estimating vehicle trips.

TABLE 2
TAZ 442 TRIP RATE ESTIMATES
CHANGE IN POPULATION

Analysis Period	Scenario	Population	TAZ 442 Trips	Average Trip Rate	Incremental Trip Rate
Daily	2010 CAMPO Base Model	5359	9,622	1.80	NA
	2010 Scenario 1	5360	9,596	1.79	-26
	2010 Scenario 2	10359	16,610	1.60	1.40
AM Peak	2010 CAMPO Base Model	5359	2,470	0.46	NA
	2010 Scenario 1	5360	2,460	0.46	-10
	2010 Scenario 2	10359	4,475	0.43	0.40
PM Peak	2010 CAMPO Base Model	5359	2,818	0.53	NA
	2010 Scenario 1	5360	2,814	0.53	-4
	2010 Scenario 2	10359	4,980	0.48	0.43

Scenarios 3 and 4: The impact of change in population on trip generation was examined at the model-wide and TAZ levels by examining the change in trips associated with the change in employment. **Figures 4** and **5** show the model-wide and TAZ level (TAZ 442) trip generation, respectively, before and after increasing service employment by one (1), and 5,000 in TAZ 442.

Under Scenario 3, model-wide vehicle trips decreased by 89, 36, and 29 trips during the 24-hour, 2-hour AM Peak and 2-Hour PM peak periods, respectively. At the TAZ level, the number of trips increased by 34, 6 and 11 during the 24-hour, 2-hour AM Peak and 2-Hour PM Peak periods, respectively, under Scenario 3. An increase in employment by one (1) is expected to result in a marginal increase in trips at both the model-wide and

TAZ levels. However, as shown in **Figures 4** and **5**, the total model-wide trips decrease while the total TAZ level trips increase.

Under Scenario 4, model-wide vehicle trips decreased by 343, 183, and 150 trips during the 24-hour, 2-hour AM Peak and 2-Hour PM peak periods, respectively. At the TAZ level, the number of trips increased by 22,572, 5,574 and 5,825 during the 24-hour, 2-hour AM Peak and 2-Hour PM Peak periods, respectively, under Scenario 4. An increase in employment by 5,000 jobs is expected to result in a considerable increase in trips at both the model-wide and TAZ levels. However, as shown in **Figures 4** and **5**, the total model-wide trips decrease while the total TAZ level trips increase.

Although the results for Scenarios 3 and 4 appear contrary to prior expectations, a closer examination of TAZ 442 indicates that the population of this TAZ is 5359. As a result,

adding employment to the TAZ 442 results in reassignment of internal-external trips relative to TAZ 442 (from TAZ 442 to other model TAZs). This results in a reduction in model-wide trips as some of the internal-external trips (from TAZ 442 to other TAZs) are reassigned as internal-internal (TAZ 442 to TAZ 442) trips.

Figure 4
Change in Model-Wide Vehicle Trips Vs. Change in Service Employment

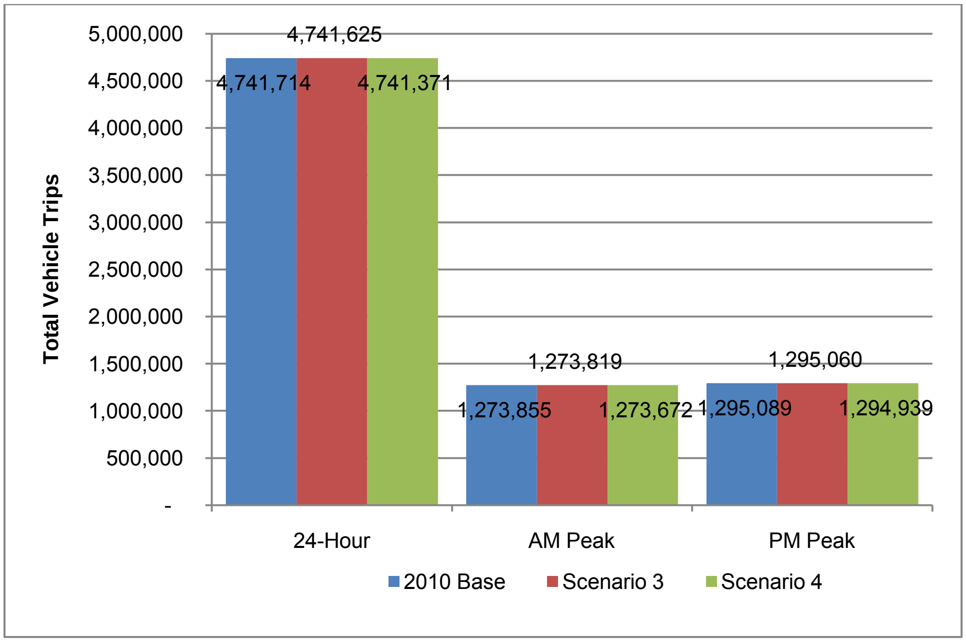
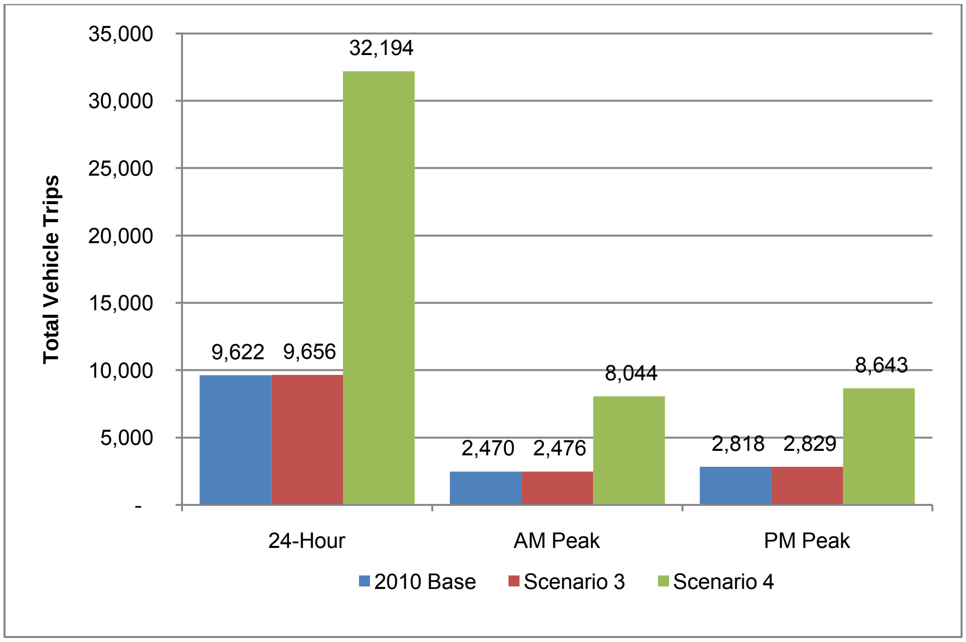


Figure 5
Change in Vehicle Trips (TAZ 442 Only) Vs. Change in Service Employment



In addition to change in direction of the change in vehicle trips, average and incremental TAZ level trip rates were estimated to examine the change in magnitude for the three test scenarios. As shown in **Table 3**, under Scenario 3, the average daily trip rate for the entire TAZ population decreases from 110.6 trips per job to 109.73 trips per job. This implies an incremental trip rate of 34 daily trips for every additional service job. The corresponding incremental trip rates for AM and PM peak periods are 6 and 11 trips per additional job, respectively.

Under Scenario 4, the average daily trip rate for the entire TAZ population decreases drastically from 110.6 trips per job to 6.33 trips per job. This implies an incremental trip rate of 4.51 daily trips for every one service job in addition to service jobs (87) assigned by CAMPO for TAZ 442 in year 2010. The corresponding incremental trip rates for AM and PM peak periods are 1.11 and 1.17 trips per additional job. The drastic decrease in trip rates for the additional 5,000 jobs added under Scenario 4 indicates that the model factors in the impact of internal trip capture due to presence of both households and employment in the same zone.

TABLE 3
TAZ 442 TRIP RATE ESTIMATES
CHANGE IN EMPLOYMENT

Analysis Period	Scenario	Employment	TAZ 442 Trips	Average Trip Rate	Incremental Trip Rate
Daily	2010 CAMPO Base Model	87	9,622	110.60	NA
	2010 Scenario 3	88	9,656	109.73	34
	2010 Scenario 4	5087	32,194	6.33	4.51
AM Peak	2010 CAMPO Base Model	87	2,470	28.39	NA
	2010 Scenario 3	88	2,476	28.14	6
	2010 Scenario 4	5087	8,044	1.58	1.11
PM Peak	2010 CAMPO Base Model	87	2,818	32.39	NA
	2010 Scenario 3	88	2,829	32.15	11
	2010 Scenario 4	5087	8,643	1.70	1.17

Transit Headway Changes

A second test was performed to evaluate the model's sensitivity to changes in transit headways. Capital Metro Route 20 was selected for testing the model since it serves East Riverside Drive and provides transit access to Austin Community College's (ACC) East Riverside Campus. The reasonableness of the results are judged in terms of direction and magnitude of change. As part of this test, the following changes were made to the headways for Route 20 of Capital Metro:

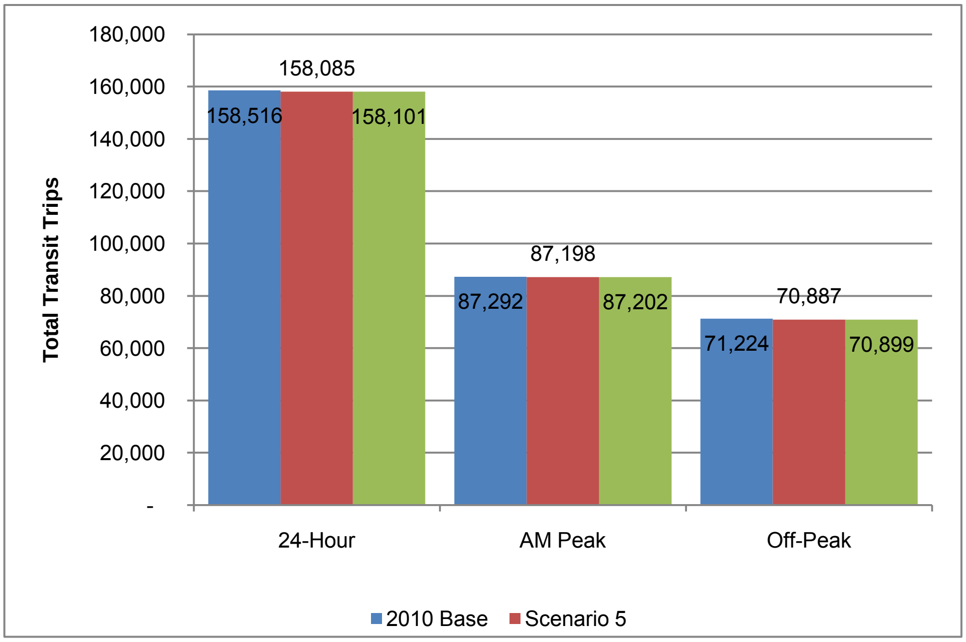
1. Scenario 5: Changed AM/PM and Off-Peak headways from 12 and 20 minutes to 6 and 10 minutes, respectively.
2. Scenario 6: Changed AM/PM and Off-Peak headways from 12 and 20 minutes to 11 and 19 minutes, respectively.

The following metrics were evaluated as part of the second set of dynamic validation tests:

- Change in 24-hour and 4-hour (AM and PM) peak period transit trips.
- Change in personal automobile trips along East Riverside Drive.

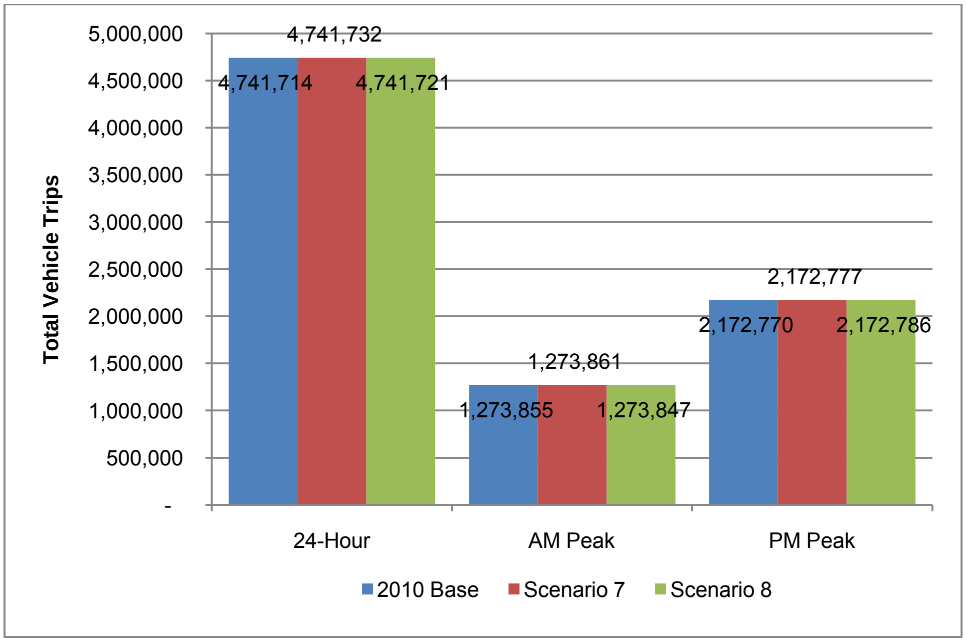
As shown in **Figure 6**, model-wide 24-hour, Peak, and Off-Peak transit trips reduced by 431, 94, and 337 trips, respectively, under Scenario 5. The corresponding reductions in model-wide 24-hour, Peak, and Off-Peak transit trips under Scenario 6 are 415, 90, and 325 trips. A decrease in transit headway is expected to result in an increase in transit trips. However, transit trip forecasts show a decrease in trips and hence are not consistent with prior expectations of direction of change in vehicle trips.

Figure 6
Change in Model-Wide Transit Trips Vs. Change in Route 20 Headway



As shown in **Figure 7**, model-wide 24-hour, AM peak, and PM peak vehicle trips increased by 18, 6, and 5 trips, respectively, under Scenario 5. However, under Scenario 6, the model-wide 24-hour vehicle trips increase by 7 trips while the AM peak and PM peak vehicle trips decreased by 8 and 1 trips, respectively. A decrease in transit headway is expected to result in a decrease in vehicle trips. However, vehicle trip forecasts show a trend that is not consistent with prior expectations except under Scenario 6 during the AM and PM peak periods

Figure 7
Change in Model-Wide Vehicle Trips Vs. Change in Route 20 Headway



<u>Roadway Network Changes</u>
The third dynamic test performed was to evaluate the model's sensitivity to changes in the roadway network. The reasonableness of the results are judged in terms of direction and magnitude of change. As part of this test, the section of Montopolis Drive between East Riverside Drive and Grove Boulevard was deleted. As shown in **Table 4**, traffic volumes on Grove Boulevard, between East Riverside Drive and Montopolis Drive, and East Riverside Drive between Grove Boulevard and Montopolis Drive increased by approximately 40% and 46%, respectively, while the overall traffic volumes along East Riverside Drive decreased by approximately 10% to 22%.

TABLE 4
EAST RIVERSIDE DRIVE
CHANGE IN 24-HOUR TRAFFIC VOLUMES

Roadway	Section	24-Hour Volume		Percent Difference
		2010 CAMPO Base	Scenario 7	
E Riverside Dr	IH 35 to Lakeshore	54,154	46,066	-14.9%
E Riverside Dr	Lakeshore to Parker	38,081	30,403	-20.2%
E Riverside Dr	Parker to Royal Crest	40,709	31,983	-21.4%
E Riverside Dr	Royal Crest to Burton	42,605	33,372	-21.7%
E Riverside Dr	Burton to Willow Creek	31,806	25,054	-21.2%
E Riverside Dr	Willow Creek to Pleasant Valley	34,470	27,936	-19%
E Riverside Dr	Pleasant Valley to Wickersham	35,173	31,794	-9.6%
E Riverside Dr	Wickersham to Crossing Place	24,950	21,953	-12%
E Riverside Dr	Crossing Place to Faro	26,803	23,513	-12.3%
E Riverside Dr	Faro to Grove	21,081	22,821	8.3%
E Riverside Dr	Grove to Montopolis	15,576	22,746	46%
E Riverside Dr	Montopolis to Frontier Valley	17,683	14,550	-17.7%
E Riverside Dr	Frontier Valley to SH 71	13,608	11,107	-18.4%
Montopolis Dr	Montopolis, S of E Riverside Dr	13,981	0	-100%
Montopolis Dr	Montopolis, N of E Riverside Dr	16,177	10,278	-36.5%
Grove Blvd	Grove, S of E Riverside Dr	13,671	19,221	40.6%
Grove Blvd	Grove, N of E Riverside Dr	5,268	5,657	7.4%

In order to examine the reasonableness of this decrease in traffic volumes, total vehicle trips at the model-wide and TAZ level were examined. Deleting a link is not expected to have any impact on vehicle trips at both the model-wide and TAZ levels. However, as shown in **Table 5**, the total model-wide trips decrease at both the model-wide and TAZ levels. This indicates undesirable sensitivity to small network changes in the model.

TABLE 5
CHANGE IN 24-HOUR VEHICLE TRIPS

Scenario	Vehicle Trips		Change in Vehicle Trips		Percent Change in Vehicle Trips	
	Model-Wide	TAZ Level	Model-Wide	TAZ Level	Model-Wide	TAZ Level
2010 Base Scenario	4,741,714	9,622	-	-	-	-
2010 Scenario 7	4,685,792	9,318	(55,922)	(304)	-1.18%	-3.16%

The static and dynamic validation process completed as part of this project established that the model significantly overestimates volumes for the AM and PM peak periods. In addition, the model significantly underestimates the impact of high frequency transit service. This indicates that the volumes obtained directly from the CAMPO model require considerable post-processing.

1.3. Land Use Estimates

In the absence of land use data for the ERC, Fehr & Peers performed analysis to develop estimates of future land uses. The estimates were reviewed and approved by the City for use in traffic forecast development. The steps involved in developing land use estimates are described below:

1.3.1. East Riverside Drive Corridor Masterplan Review

To understand the context and vision behind the ERC redevelopment project, Fehr & Peers reviewed the ERC Masterplan as the first step in the future year land use estimation process. The ERC Masterplan lays out a vision for the corridor that will require considerable redevelopment along the East Riverside to increase the density and accessibility of destinations. The ERC Masterplan also envisions a comprehensive transportation infrastructure that facilitates and encourages walk, bicycle and transit trips, both within and outside the study area. In order to achieve this goal, the ERC Masterplan proposes short walking blocks, mixed use development, bicycle facilities, and a high frequency transit service (light rail or bus rapid transit) with major transit centers. Based on information contained in the ERC Masterplan, the vision, goals and objectives of the plan comply with the *5Ds* (design, density, diversity, destination accessibility, and distance to transit) of sustainable land use and transportation planning. Based on a preliminary review of the Masterplan, once implemented, the East Riverside Drive Corridor is expected to experience shorter trips with a relatively higher proportion of walk, bicycle, and transit trips.

1.3.2. Land Use Assumptions**:** The Subdistrict map provided in the draft regulating plan breaks down the ERC to five (5) land use subdistricts, Corridor Mixed Use (CMU), Industrial Mixed Use (IMU), Neighborhood Mixed Use (NMU), Urban Residential (UR), and Neighborhood Residential (NR). A copy of the subdistrict map is included in **Appendix A**. The ERC regulating plan classifies land uses by eight categories, namely, Residential Attached, Residential Detached, Small Scale Retail, General Retail, Office, Warehouse & Light Manufacturing, Education & Religion and Hospitality. The ERC Draft Regulating Plan includes the Subdistrict Development Standard which contains information on permitted land uses and allowable FAR for each subdistrict. A copy of the Subdistrict

Development Standard is included in **Appendix B**. In addition to the subdistrict map, information provided in Exhibit A.25 of the ERC Masterplan was also used in the land use estimation process. A copy of Exhibit A.25 is included in **Appendix C**. **Exhibits 1** through **11** in **Appendix D** provide summary of tables for the land use estimation process.

In the absence of further information on the breakdown for each zone, Fehr & Peers developed distribution assumptions based on the ERC Masterplan vision statement. *Exhibit 1* (**Appendix D)** provides a summary of these distribution assumptions for each of the five (5) land use subdistricts.

1.3.3. Conversion Factors: The socio-economic inputs required for the CAMPO's travel demand model include population, households and employment. *Exhibit 2* (**Appendix D**) provides a summary of conversion factors used to estimate population and number of households from dwelling unit and employment from square footages. As shown in *Exhibit 2*, an occupancy rate of 95 percent was assumed to convert dwelling units to number of households.

1.3.4. Redevelopment of Existing Properties: An important part of estimating land uses was to identify dwelling units and square footages of existing residential and non-residential properties, respectively, that will be redeveloped to take advantage of the higher Floor-to-Area Ratio (FAR) permitted by the ERC Draft Regulating Plan. The identification of such properties was based on visual observations using online tools like Google Maps and Google Streetview. *Exhibit 3* (**Appendix D**) provides a summary of the total residential (dwelling units) and non-residential (square footage) built up area that will be redeveloped as part of the ERC redevelopment. **The socio-economic input parameters for such properties were estimated assuming a household size of 2.65, an overall employment ratio of 2 employees per thousand square feet of development, and a FAR of 0.7 as shown in Table 7.**

1.3.5. Land Use Scenarios: The CAMPO travel demand model is broken down into various TAZs and hence all land use estimates were aggregated at the TAZ level. TAZs 441 thru 444 and 456 thru 459 lie within the study area and are of primary importance for this project. **Figure 1** shows boundaries of the study area TAZs. Land use estimates were developed for three possible scenarios, optimistic, realistic and pessimistic. The optimistic scenario assumed aggressive redevelopment of existing properties. The realistic scenario assumed moderate to aggressive redevelopment of existing properties. The pessimistic scenario assumed minimal redevelopment of existing properties. **It should be noted that full build out on all vacant parcels within the study area TAZ was assumed under all three scenarios to develop these land use estimates.** This technical memorandum provides a summary of only the realistic scenario which was reviewed and approved by the City of Austin in December 2011 and was used in forecasting traffic volumes at study area intersections.

It should be noted that these land use estimates are not based on a market study of the East Riverside Drive Corridor and have been calculated for the sole purpose of developing traffic forecasts for study intersections along East Riverside Drive.

1.3.6. Land Use Analysis Summary

Moderate redevelopment on existing properties and full build out on vacant parcels was assumed to develop estimates of land use for the ERC redevelopment project. *Exhibit 4* (**Appendix D**) provides a summary of total built up area (in square feet) in each TAZ and accounts for FAR recommended in the Subdistrict Development Standards. This table is based on information provided in the East Riverside Corridor Subdistrict Map and distribution assumptions shown in *Exhibit 1*. The square footage for residential uses were then converted to households as shown in *Exhibit 5* (**Appendix D**) assuming a rate of **1,000 square feet per dwelling unit**. *Exhibit 6* (**Appendix D**) provides a summary of proposed developments listed in the ERC Masterplan (**Appendix C**). *Exhibit 7* (**Appendix D**) shows total households and non-residential land use square footage for the year 2035. Conversion factors summarized in *Exhibit 2* were used to convert the total dwelling units and non-residential land use square footage to socio-economic parameters (population, households and employment). The estimates of socio-economic parameters were then compared with the base 2035 socio-economic parameters in CAMPO's travel demand model. Estimates of population and employment (inputs for the CAMPO's travel demand model) are shown in *Exhibits 8* and *9* (**Appendix D**). *Exhibit 10* (**Appendix D**) provides total estimates of population and employment for each TAZ along the East Riverside Drive corridor. The totals presented in *Exhibit 10* represent the growth in population & employment between 2010 and 2035 and **do not** include the existing developments that will be replaced as part of the redevelopment process. *Exhibit 11* (**Appendix D**) shows future population, household and employment projections and a growth rate comparison between the base 2035 CAMPO model inputs and those developed as part of this analysis. It should be noted that the socio-economic estimates shown in *Exhibit 11* account for the redevelopment of existing properties.

1.4. Traffic Forecasts

The CAMPO travel demand model was used to develop 2035 "No Build" and "Build" condition volume forecasts. The process followed to develop these forecasts is described below.

1.4.1. Model Update – As the first step, study area TAZs in the CAMPO model were updated with the estimates of socio-economic factor described in the previous section to create a model run scenario ("Build Condition) to represent the ERC corridor redevelopment project.

1.4.2. CAMPO Model Run – The second step consisted of performing CAMPO travel demand model runs with the updated socio-economic data using the "*feedback loop*" option provided in the CAMPO model interface. The "*feedback loop*" option runs the trip distribution, mode choice, and trip assignment processes multiple times with the objective of achieving speed and delay equilibrium in the entire system. It should be noted that the CAMPO model does not accurately estimate the impact of mixed use development and/or transit oriented developments. The ERC is proposed to be developed based on the *5Ds* (design, density, diversity, destination accessibility, and distance to transit) of sustainable land use and transportation planning in order to encourage shorter and non-motorized trips. Therefore, the MXD model developed by Fehr & Peers was utilized to estimate these reductions.

1.4.3. Estimating "5D" reductions – Current methods of trip generation adjustments understate the benefits of mixed-use developments (MXDs) leading to exaggerated roadway impacts and higher impact fees while discouraging development of otherwise desirable smart growth projects. Fehr & Peers led a national study for the US EPA to develop a new methodology to more accurately predict the traffic impacts of MXDs. The study evaluated household travel surveys from 239 mixed-use developments in Seattle, Portland, Sacramento, Houston, Atlanta and Boston, and found statistical relationships between site characteristics and the amount of vehicle travel generated in and out of the site. MXDs were found to reduce traffic impacts relative to single-use suburban development, due to key factors such as diverse on-site activities that capture a large share of trips internally, placement within walkable areas with good transit access that generate high shares of walk and transit trips (i.e., TODs), and central locations (i.e., infill) that reduce trip lengths. The MXD model developed by Fehr & Peers uses various inputs to develop estimates of trip generation adjustment factors. A brief description of the MXD model inputs and method used to estimate them follows:

1. *Developed Area*: This was estimated from TAZ data provided in the CAMPO model.
2. *Number of Intersections*: This was estimated using Google Earth aerial photographs of the study area.

3. *Proportion of households within 1/4th mile of a transit stop*: Based on a review of the East Riverside Drive Master Plan, it was assumed that all households (100%) within the study area will be within 1/4th mile of a transit stop.
4. *Employment within one mile of the MXD*: This was estimated by calculating the total employment within a one mile radius of each study area TAZ in the CAMPO model. It should be noted that estimate of employment around a study area TAZ was pro-rated on the basis of area covered in the one mile radius.
5. *Employment within a 30-minute door-to-door transit trip*: A 30-minute transit trip consists of walk time to the stop, and wait time at the stop and in-vehicle transit time. The average walk time and wait time was assumed to be 12.5 minutes based on recommendations provided in the *Planning for Transit-Friendly Land Use A Handbook for New Jersey Communities* (**Ref. 5**). A review of Capital Metro schedules indicates that a distance of approximately 2.5 miles can be covered in five (5) minutes. This was used as a basis to assume that a 30-minute door-to-door transit trip translates into an approximately 2.5 mile transit trip. The TAZ file in the CAMPO model was analyzed to estimate employment within a 2.5 mile radius (30 minute door-to-door trip).
6. *Total Regional Employment*: This was obtained directly from the CAMPO model employment estimates.
7. *Site Population*: This was obtained from the land use estimates developed by Fehr & Peers.
8. *Average Household Size*: An average household size of 2 was assumed and approved by the City of Austin. Average household size for the neighboring TAZs was obtained directly from the CAMPO model.
9. *Average Vehicles per Household*: This was obtained from the CAMPO model auto ownership estimates. Average household vehicle ownership for the neighboring TAZs were obtained directly from the CAMPO model.

The input values for each study area TAZ (shown in **Figure 1**) were processed through the MXD model to obtain the trip generation adjustment factors. The MXD input values are included in **Appendix E** and MXD adjustment factors are summarized in **Table 6**.

TABLE 6
MXD TRIP GENERATION ADJUSTMENT FACTORS

TAZ ID	24-Hour	AM Peak	PM Peak
441	30%	30%	30%
442	24%	25%	24%
443	18%	21%	19%
444	20%	22%	20%
456	20%	22%	20%
457	19%	21%	20%
458	21%	22%	21%
459	17%	19%	18%

1.4.4. Model Adjustment – The reduction factors provided in **Table 6** were applied to the 24-Hour, AM peak, and PM Peak Origin-Destination matrices obtained by running the CAMPO model as described previously. The updated O-D matrices were then processed through the CAMP model "*Assignment"* step to obtain link and turning movement volumes for the study corridor.

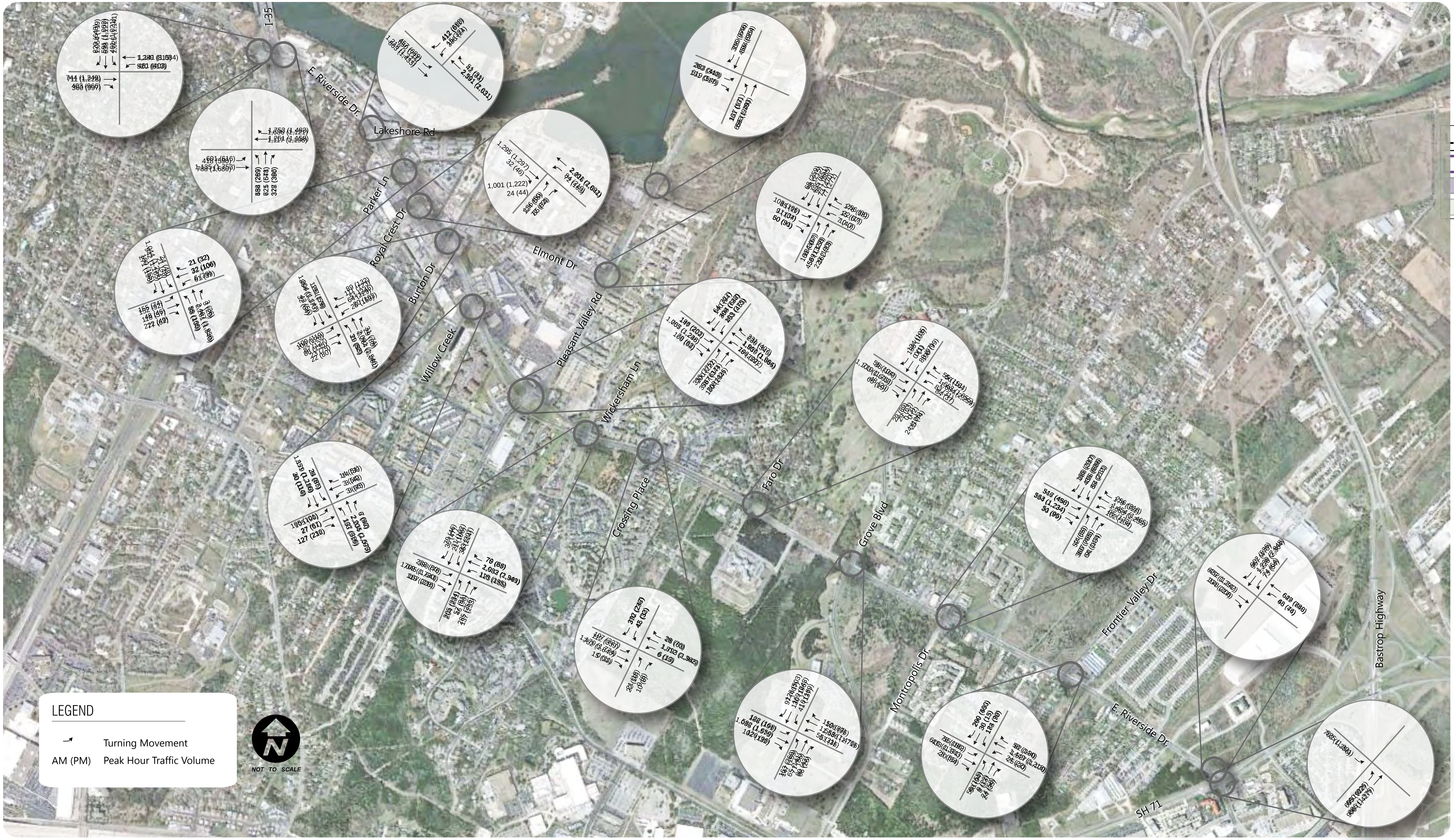
1.4.5. Post-Processing – One of CAMPO travel demand model's main objective is to assist public officials in making long range and large scale planning decisions. To efficiently serve this objective, the model excludes minor roadways like residential streets, collector streets, and/or driveways. As a result, link and turning movement volumes estimated by the model may not accurately represent actual traffic counts. In addition, based on the validation process, the CAMPO travel demand model significantly overestimates AM and PM peak period volumes. It was therefore necessary to adjust the model outputs based on the base year model volume to counts ratio. Fehr & Peers employed a three step process to develop 2035 forecasted TMVs.

1. Development of Adjustment Factors: The 2010 base year model volumes were compared with year 2011 AM and PM peak traffic counts provided by HDR. A comparison between 2010 model volumes and 2011 traffic counts indicates that the CAMPO model overestimates AM and PM peak hour volumes considerably. Fehr & Peers estimated adjustment factors by calculating the ratio of base year model volumes to base year traffic counts.

2. Adjusted Link and Turning Movement Volumes: This step consisted of applying adjustment factors to the appropriate link volumes and distributing the adjusted link volumes based on the turning movement splits obtained directly from the CAMPO model run.
3. Volume Balancing: As mentioned previously, the CAMPO model does not include minor arterials, collectors and residential streets. For example, the CAMPO model does not include the intersections of East Riverside Drive with Crossing Place, Faro Drive, and Frontier Valley Road. In addition, Parker Road and Willow Creek Road are coded as T-intersections in the model. To develop volume estimates for these roadways, a growth factor was calculated based on link volumes, immediately east and west of these intersections. These growth factors were then applied to the 2011 existing counts provided by HDR to estimate the future year northbound and southbound volumes at these intersections. The final step consisted of balancing link volumes such that traffic leaving an upstream intersectionwas equal to traffic arriving at a downstream intersection.

The adjusted and balanced 2035 AM and PM peak volumes for the “No Build” (without ERC redevelopment) and “Build” (with ERC) conditions are provided in **Figures 8** and **9**.

Figure 8: 2035 Build Traffic Volumes



FEHR PEERS

March 2012

Figure 9: 2035 Build Traffic Volumes

1.5. Summary

The ERC Masterplan envisions a comprehensive transportation infrastructure that facilitates and encourages walk, bicycle and transit trips, both within and outside the study area. In order to achieve this goal, the ERC Masterplan proposes short walking blocks, mixed use development, bicycle facilities, and a high frequency transit service (light rail or bus rapid transit) with major transit centers. The vision, goals and objectives of the plan comply with the *5Ds* (design, density, diversity, destination accessibility, and distance to transit) of sustainable land use and transportation planning and are expected to encourage shorter trips with a relatively higher proportion of walk, bicycle, and transit trips. MXD model developed by Fehr & Peers was employed to estimate the impact of the 5Ds. Based on the results obtained from the MXD model, planning the ERC redevelopment around the 5Ds is expected to result in approximately 17% to 30% reduction in daily trips associated with the study area TAZs.

Fehr & Peers also performed static & dynamic validation testing on the CAMPO travel demand model to evaluate its sensitivity to changes in socio-economic factors, transit headways, and roadway network. The results of the validation tests indicate that the CAMPO model significantly overestimates traffic volumes especially for the AM and PM peak period. In addition, the model does not accurately analyze impacts of high frequency transit services. This indicates that the model results should be post-processed prior to using them for subsequent analysis. The Fehr & Peers MXD model was also helpful in overcoming some of the limitations in the CAMPO travel demand model. The reduction factors developed using the MXD model were applied to the CAMPO model O-D matrix to obtain the adjusted volume forecasts for the East Riverside Drive corridor. As mentioned previously, the CAMPO model significantly overestimates traffic volumes in the project study area. To account for this limitation, the volumes were post-processed based on the base year model volume to traffic count ratio along with volume balancing between study intersections. A review of the “Build” condition link volume forecasts indicates that the average annual growth rates along various segments of East Riverside Drive are expected to range between approximately 1% and 6%.

It should be noted that these traffic volume forecasts are based on land use estimates developed by Fehr & Peers and approved by city staff depend upon various assumptions described in Section 1.3.2. These assumptions were made to overcome the absence of accurate land use forecasts for the study corridor. Any changes in the assumptions including modifications to the East Riverside Corridor Masterplan may impact the future traffic volumes.

REFERENCES

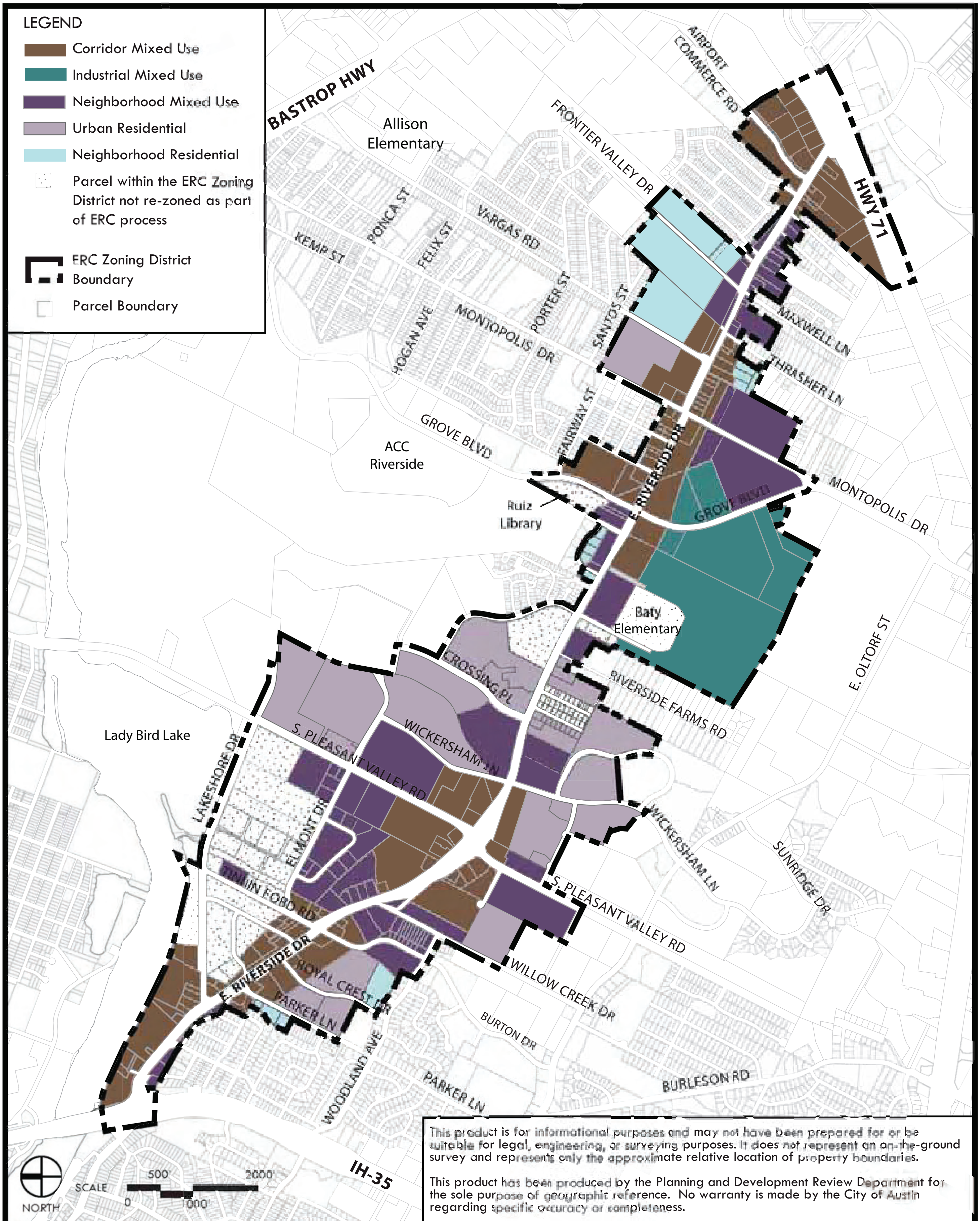
1. East Riverside Corridor Draft Regulating Plan. http://stevieray.ci.austin.tx.us/eastriverside. Accessed October 2011.
2. East Riverside Drive Master Plan. http://stevieray.ci.austin.tx.us/sites/default/files/files/Planning/erc_final.pdf. Accessed October 2011.
3. Travel Model Validation and Reasonableness Checking Manual- 2nd Edition. The Travel Model Improvement Program. FHWA. http://media.tmiponline.org/clearinghouse/FHWA-HEP-10-042/FHWA-HEP-10-042.pdf. Accessed November 2011
4. Travel Forecasting Guidelines, California Department of Transportation, November 1992. http://ntl.bts.gov/DOCS/TF.html. Accessed November 2011.
5. Planning for Transit-Friendly Land-Use. A Handbook for New Jersey Communities. New Jersey Department of Transportation. http://isddc.dot.gov/OLPFiles/FTA/007846.pdf. Accessed December 2011.

APPENDIX A

East Riverside Corridor Subdistrict Map

Figure 1-2: East Riverside Corridor Subdistrict Map

Identifies the subdistict for each property within the ERC boundary.



APPENDIX B

East Riverside Corridor Subdistrict Development Standards

Lot Size

Minimum Lot Size: 2,500 sf

Minimum Lot Width: 20'

Minimum Setbacks

Front and Street Side Yard*:
No ground-level front yard or side yard setbacks are required. Instead, development must meet the building placement standards in Section 4.3.

Interior Side Yard: 0'
Rear Yard: 0'

Upper-Story Building Facade Street-Side Stepbacks:
The building facade at the 3rd story and above must be stepped back 10 feet from the ground-level building facade line.

* If the street right-of-way is less than 60 feet in width, the minimum front yard setback for buildings three or more stories in height shall be 30 feet from the center line of the street to ensure fire access.

Building Placement

Building placement determined by Roadway type and Active Edge Designation.

*See Section 4.3

Maximum Impervious Cover

Impervious Cover:
90% or Maximum Allowed by Environmental Criteria Manual.*

*The Environmental Criteria Manual is one of 9 Technical Criteria Manuals used by the City of Austin.

Floor to Area Ratio (FAR)

Maximum Floor-to-Area Ratio (FAR) by Right: 2:1

Note: Additional building height may be granted in exchange for the provision of public benefits. Maximum FAR waived with a bonus. Development bonus criteria and standards are detailed in Article 6.

Building Height

Maximum Building Height:
60 feet maximum w/ a minumum of 2 stories.

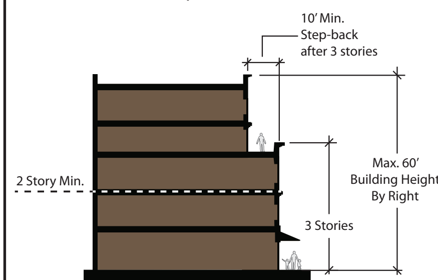
Maximum Building Height with Development Bonus:
Established on Figure 1-8.

Compatibility

See Section 4.2.4 for compatibility standards.

COMMERCIAL MIXED USE (CMU) SUBDISTRICT

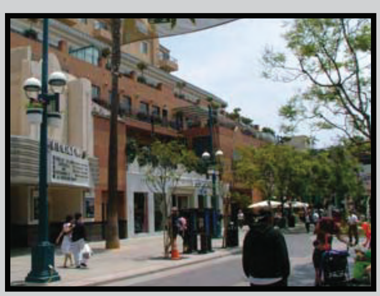
Corridor Mixed Use is the highest density district designation within the East Riverside Corridor and will typically be expressed as residential or office uses over commercial ground floor uses, such as retail or office. The ground floors of these buildings are envisioned to be primarily retail or office while upper floors may be office and/or residential. Mixed use development is key within this subdistrict because it will help to create a walkable environment with a variety of land uses located in a compact area.



ABOVE:
Typical minimum stories, height limit, and step back requirements for buildings within the Corridor Mixed Use (CMU) Subdistrict.*

*Max. Building Height with a Density Bonus is established on Figure 1-8.

ABOVE & BELOW:
Examples of development similar to that allowed in the Corridor Mixed Use Subdistrict.



Corridor Mixed Use (CMU) Land Use Summary*

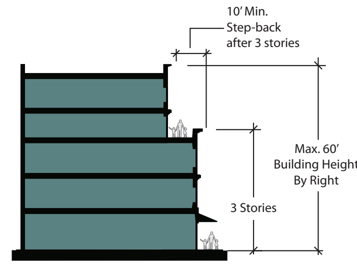
Land Use	
Residential, attached	Permitted
Residential, detached	Not Permitted
Smaller-scale Retail (less than 50,000 sq. ft.)	Permitted
General Retail	Permitted
Office	Permitted
Warehousing & Light Manufacturing	Not Permitted
Education / Religion	Permitted
Hospitality (hotels/motels)	Permitted
Civic Uses (public)	Permitted

*The table above provides a summary only of land uses permitted within the Corridor Mixed Use Subdistrict. See Section 2.3.3. for a complete list of permitted land uses.

Figure 1-10: Industrial Mixed Use (IMU)
Summary of IMU Subdistrict Development Standards

INDUSTRIAL MIXED USE (IMU) SUBDISTRICT

Industrial Mixed Use is a transition subdistrict used to accommodate existing industrial uses and enable future development to include residential and commercial uses.



ABOVE:
Typical height limit requirement for buildings within the Industrial Mixed Use (IMU) Subdistrict.

*Max. Building Height with a Density Bonus is established on Figure 1-8.

Lot Size

Minimum Lot Size: 2,500 sf

Minimum Lot Width: 20'

Minimum Setbacks

Front and Street Side Yard*:
No ground-level front yard or side yard setbacks are required. Instead, development must meet the building placement standards in Section 4.3.

Interior Side Yard: 0'
Rear Yard: 0'

Upper-Story Building Facade Street-Side Stepbacks:
The building facade at the 3rd story and above must be stepped back 10 feet from the ground-level building facade line.

* If the street right-of-way is less than 60 feet in width, the minimum front yard setback for buildings three or more stories in height shall be 30 feet from the center line of the street to ensure fire access.

Building Placement

Building placement determined by Roadway type and Active Edge Designation.

*See Sections 4.3

Maximum Impervious Cover

Impervious Cover: 90% or Maximum Allowed by Environmental Criteria Manual.*

*The Environmental Criteria Manual is one of 9 Technical Criteria Manuals used by the City of Austin.

Floor to Area Ratio (FAR)

Maximum Floor-to-Area Ratio (FAR) by Right: 2:1

Note: Additional building height may be granted in exchange for the provision of public benefits. Maximum FAR waived with a bonus. Development bonus criteria and standards are detailed in Article 6.

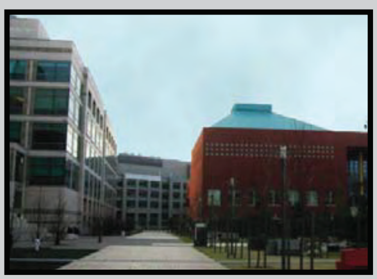
Building Height

Maximum Building Height:
60 feet.

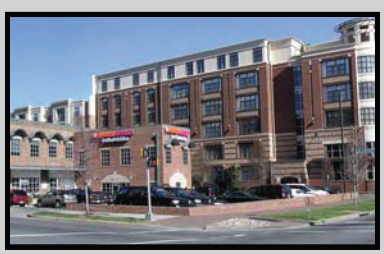
Maximum Building Height with Development Bonus:
Established on Figure 1-8.

Compatibility

See Section 4.2.4 for compatibility standards.



ABOVE & BELOW:
Examples of development similar to that allowed in the Industrial Mixed Use Subdistrict.



Industrial Mixed Use (IMU) Land Use Summary*

Land Use	
Residential, attached	Permitted
Residential, detached	Not Permitted
Smaller-scale Retail (less than 50,000 sq. ft.)	Permitted
General Retail	Permitted
Office	Permitted
Warehousing & Light Manufacturing	Permitted
Education / Religion	Permitted
Hospitality (hotels/motels)	Permitted
Civic Uses (public)	Permitted

*The table above provides a summary only of land uses permitted within the Industrial Mixed Use Subdistrict. See Section 2.3.3. for a complete list of permitted land uses.

Lot Size

Minimum Lot Size: 1,600 sf

Minimum Lot Width: 20'

Minimum Setbacks

Front and Street Side Yard*:
No ground-level front yard or side yard setbacks are required. Instead, development must meet the building placement standards in Section 4.3.

Interior Side Yard: 0'
Rear Yard: 0'

Upper-Story Building Facade Street-Side Stepbacks:
The building facade at the 4th story and above must be stepped back 10 feet from the ground-level building facade line.

* If the street right-of-way is less than 60 feet in width, the minimum front yard setback for buildings three or more stories in height shall be 30 feet from the center line of the street to ensure fire access.

Building Placement

Building placement determined by Roadway type and Active Edge Designation.

*See Sections 4.3

Maximum Impervious Cover

Impervious Cover:
80% or Maximum Allowed by Environmental Criteria Manual.*

*The Environmental Criteria Manual is one of 9 Technical Criteria Manuals used by the City of Austin.

Floor to Area Ratio (FAR)

Maximum Floor-to-Area Ratio (FAR) by Right: 1:1

Note: Additional building height may be granted in exchange for the provision of public benefits. Maximum FAR waived with a bonus. Development bonus criteria and standards are detailed in Article 6.

Building Height

Maximum Building Height:
50 feet

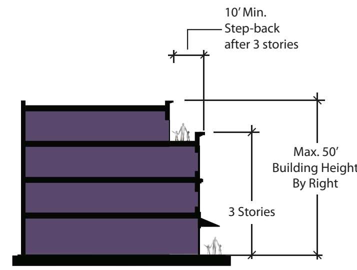
Maximum Building Height with Development Bonus:
Established on Figure 1-8.

Compatibility

See Section 4.2.4 for compatibility standards.

NEIGHBORHOOD MIXED USE (NMU) SUBDISTRICT

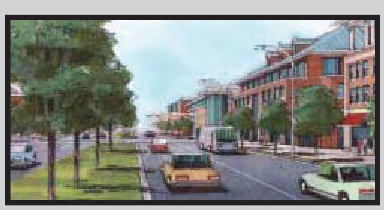
The Neighborhood Mixed Use Subdistrict provides for mid-rise residential with neighborhood-oriented retail and smaller employers. It is intended to have opportunities for attached residential and smaller-scale commercial uses.



ABOVE:
Typical height limit and step back requirements for buildings within the Neighborhood Mixed Use (NMU) Subdistrict.*

*Max. Building Height with a Density Bonus is established on Figure 1-8.

ABOVE & BELOW:
Examples of development similar to that allowed in the Neighborhood Mixed Use Subdistrict.



Neighborhood Mixed Use (NMU) Land Use Summary*

Land Use	
Residential, attached	Permitted
Residential, detached	Not Permitted
Smaller-scale Retail (less than 50,000 sq. ft.)	Permitted
General Retail	Not Permitted
Office	Permitted
Warehousing & Light Manufacturing	Not Permitted
Education / Religion	Permitted
Hospitality (hotels/motels)	Permitted
Civic Uses (public)	Permitted

*The table above provides a summary only of land uses permitted within the Neighborhood Mixed Use Subdistrict. See Section 2.3.3. for a complete list of permitted land uses.

Figure 1-12: Urban Residential (UR)
Summary of UR Subdistrict Development Standards

URBAN RESIDENTIAL (UR) SUBDISTRICT

Urban Residential is a residential zone that allows for a range of housing types, including townhouses, rowhouses, condos, or multifamily dwellings.

CMU
IMU
NMU
UR
NR

Lot Size

Minimum Lot Size: 1,200 sf

Minimum Lot Width: 16'

Minimum Setbacks

Front and Street Side Yard*:
No ground-level front yard or side yard setbacks are required. Instead, development must meet the building placement standards in Section 4.3.

Interior Side Yard: 0'
Rear Yard: 0'

Upper-Story Building Facade Street-Side Stepbacks:
The building facade at the 3rd story and above must be stepped back 10 feet from the ground-level building facade line.

* If the street right-of-way is less than 60 feet in width, the minimum front yard setback for buildings three or more stories in height shall be 30 feet from the center line of the street to ensure fire access.

Building Placement

Building placement determined by Roadway type and Active Edge Designation.

*See Sections 4.3

Maximum Impervious Cover

Impervious Cover:
65% or Maximum Allowed by Environmental Criteria Manual.*

*The Environmental Criteria Manual is one of 9 Technical Criteria Manuals used by the City of Austin.

Floor to Area Ratio (FAR)

Maximum Floor-to-Area Ratio (FAR) by Right: .75 :1

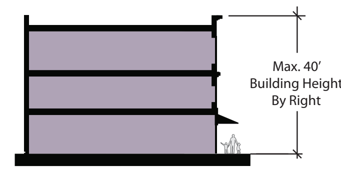
Building Height

Maximum Building Height:
40 feet

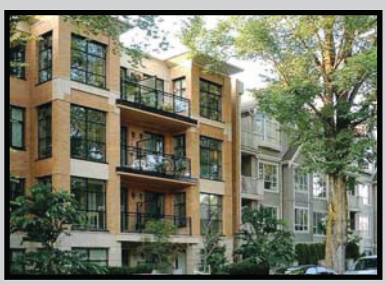
Not eligible for Development Bonus

Compatibility

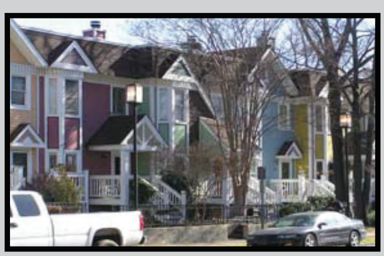
See Section 4.2.4 for compatibility standards.



ABOVE:
Typical height limit requirements for buildings within the Urban Residential (UR) Subdistrict.



ABOVE & BELOW:
Examples of development similar to that allowed in the Urban Residential



Urban Residential (UR) Land Use Summary*

Land Use	
Residential, attached	Permitted
Residential, detached	Not Permitted
Smaller-scale Retail (less than 50,000 sq. ft.)	Not Permitted
General Retail	Not Permitted
Office	Not Permitted
Warehousing & Light Manufacturing	Not Permitted
Education / Religion	Permitted
Hospitality (hotels/motels)	Not Permitted
Civic Uses (public)	Permitted

*The table above provides a summary only of land uses permitted within the Urban Residential Subdistrict. See Section 2.3.3. for a complete list of permitted land uses.

Lot Size

Minimum Lot Size: 1,600sf

Minimum Lot Width: 18'

Minimum Setbacks

Front and Street Side Yard*: No ground-level front yard or side yard setbacks are required. Instead, development must meet the building placement standards in Section 4.3.

Interior Side Yard: 0'
Rear Yard: 0'

* If the street right-of-way is less than 60 feet in width, the minimum front yard setback for buildings three or more stories in height shall be 30 feet from the center line of the street to ensure fire access.

Building Placement

Building placement determined by Roadway type and Active Edge Designation.

*See Sections 4.3

Maximum Impervious Cover

Impervious Cover: 55% or Maximum Allowed by Environmental Criteria Manual.*

*The Environmental Criteria Manual is one of 9 Technical Criteria Manuals used by the City of Austin.

Floor to Area Ratio (FAR)

Maximum Floor-to-Area Ratio (FAR) by Right: .5 :1

Building Height

Maximum Building Height: 35 feet

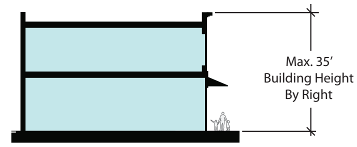
Not eligible for Development Bonus.

Compatibility

See Section 4.2.4 for compatibility standards.

NEIGHBORHOOD RESIDENTIAL (NR) SUBDISTRICT

Neighborhood Residential is the residential transition zone located between the higher density, more active urban Subdistricts and existing single-family neighborhoods. It provides for a height transition to the existing neighborhoods outside of the ERC Zoning District. The Neighborhood Residential Subdistrict allows for single family homes, duplexes, townhouses, rowhouses, and smaller scale mutli-family buildings.



ABOVE:
Typical height limit requirements for buildings within the Neighborhood Residential (NR) Subdistrict.

CMU
IMU
NMU
UR
NR

ABOVE & BELOW:
Examples of development similar to that allowed in the Neighborhood Residential Subdistrict.

Neighborhood Residential (NR) Land Use Summary*

Land Use	
Residential, attached	Permitted
Residential, detached	Permitted
Smaller-scale Retail (less than 50,000 sq. ft.)	Not Permitted
General Retail	Not Permitted
Office	Not Permitted
Warehousing & Light Manufacturing	Not Permitted
Education / Religion	Permitted
Hospitality (hotels/motels)	Not Permitted
Civic Uses (public)	Permitted

*The table above provides a summary only of land uses permitted within the Neighborhood Residential Subdistrict. See Section 2.3.3. for a complete list of permitted land uses.

APPENDIX C

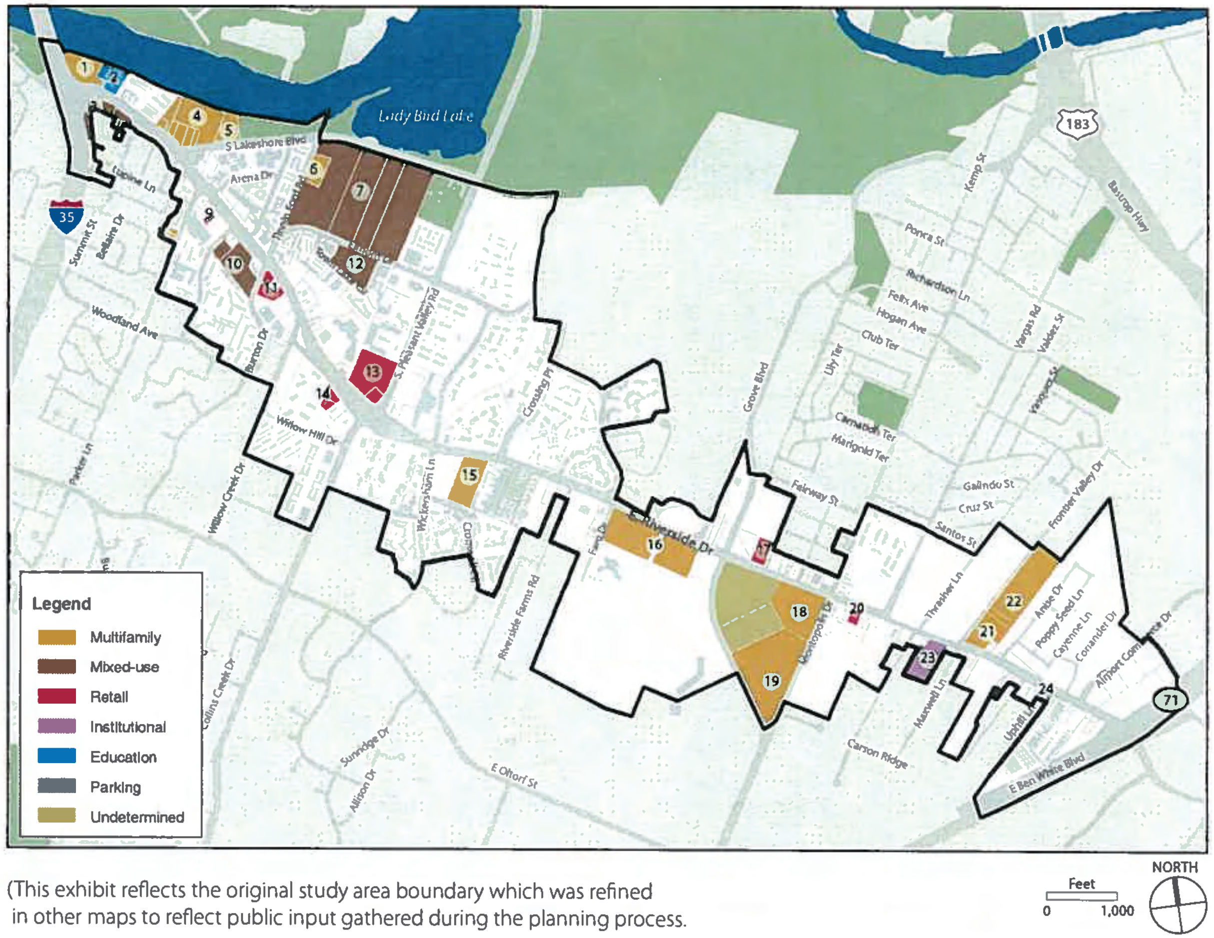
Exhibit A.25 East Riverside Corridor Masterplan

Area Development/ Proposed Development

Numerous new developments are underway in the East Riverside Corridor Study Area (as can be seen in Exhibit A.25). Most of these projects are close to the IH 35 intersection of Riverside Drive, near Lady Bird Lake. These projects range from retail and educational facilities to mixed use development, condos, and apartments. Some of these projects are in the construction process while others are still in the design and permitting stage. The following information is based on information available at the time of plan research in 2008 and is subject to change.

1. Star Riverside - 251 condos, retail first floor of one building
2. Acton School of Business – 10,000 sq. ft. school for MBA program
3. Schuler Family Trust - Mixed Use Development, 60 condos, 45,000 sq. ft. of commercial/retail, 30,000 sq. ft. of office and multi level parking garage
4. AMLI -375 apartments and condos
5. Mac Pike and Wally Scott of the Sutton Co. - Convert 48 apartments to condos and add additional 40-50 condos
6. Town Lake Village-Apartments - Converted to 74 condos
7. Cypress Plan 1 - Demolish Lakeview Apartments and Chelsea on Town Lake Apartments Homes and build a mixed use development with up to 2,500 apartments, condos, and townhomes
8. Parker Lane Condos
9. Libertad Bank
10. Rivertown Mall - Mixed use building to include 300 apartments plus condos or townhomes
11. Long John Silvers and Autozone
12. Cypress Plan 2 – demolish London Square Apartments and redevelop property
13. HEB – Demolish existing store and build a new 100,000 sq. ft. store
14. La Hacienda
15. Mirada Condos
16. Riverside East and West - Multi-Family development with 22 townhouses and 105 apartments
17. Dollar General
18. Rivermont Place – Mixed use development to include 142 rental units and 2,000 sq. ft of retail and 20,000 neighborhood retail
19. Grand Tract Loft Apartments
20. Restaurant and Storefront
21. Arbors at Riverside - Four 2-story buildings with 32 units, mostly 1 bedroom
22. Santora Apartments - Multi-Family development with 192 apartments
23. Riverside Nursing Home
24. Riverside Parking Lot

Exhibit A.25:
Development Projects & Proposals Map



(This exhibit reflects the original study area boundary which was refined in other maps to reflect public input gathered during the planning process. These projects were current at time of plan research in 2008 and are subject to change)

APPENDIX D

Land Use Analysis Exhibits

EAST RIVERSIDE DRIVE CORRIDOR

LAND USE ESTIMATES

FEHR & PEERS

Exhibit 1
Land Use Distribution Assumptions

Land Use Zone	Land Use Distribution								
	Residential Attached	Residential Detached	Small Scale Retail	General Retail	Office	Warehouse & Light Manufacturing	Education & Religion	Hospitality	Total
Corridor Mixed Use	60%	0%	10%	10%	10%	0%	5%	5%	100%
Industrial Mixed Use	25%	0%	15%	20%	15%	15%	5%	5%	100%
Neighborhood Mixed Use	70%	0%	10%	0%	10%	0%	5%	5%	100%
Urban Residential	95%	0%	0%	0%	0%	0%	5%	0%	100%
Neighborhood Residential	30%	65%	0%	0%	0%	0%	5%	0%	100%

EAST RIVERSIDE DRIVE CORRIDOR

FEHR PEERS

LAND USE ESTIMATES

Exhibit 2
Conversion Factor Assumptions

Description	Conversion Factor	Unit
Average Household Size (2010 Existing)	2.65	Residents per Household
Existing Floor-to-Area Ratio (2010 Existing)	0.70	Built up area per square feet of parcel
2010 Employment	2	Employees per thousand square feet of development
Average Dwelling Unit Size (2010 Existing)	1500	Square Feet
Average Household Size (2035 Existing)	2.00	Residents per Household
Average Dwelling Unit Size (2035 Existing)	1000	Square Feet
Dwelling Units to Households (2035 Forecasted Dwelling Unit Occupancy)	95%	Percentage
Small Scale Retail (2035 Forecasted)	1.5	Employees per thousand square feet of development
General Retail (2035 Forecasted)	2	Employees per thousand square feet of development
Office (2035 Forecasted)	3.5	Employees per thousand square feet of development
Warehouse & Light Manufacturing (2035 Forecasted)	3	Employees per thousand square feet of development
Education/Religion (2035 Forecasted)	1.5	Employees per thousand square feet of development
Hospitality (2035 Forecasted)	0.6	Employees per thousand square feet of development

EAST RIVERSIDE DRIVE CORRIDOR

FEHR PEERS

LAND USE ESTIMATES

Exhibit 3
Summary of Existing Properties to be Redeveloped

TAZ	REALISTIC	
	Residential units to be redeveloped (DU)	Non-residential properties to be redeveloped (Sq Ft)
441	653	1,420,819
442	0	113,674
443	184	76,760
444	0	28,023
456	43	76,025
457	274	764,649
458	0	99,364
459	59	352,689
Total	**1213**	**2,932,004**

Assumptions

1. Information on existing dwelling units was obtained from property locator websites. If a property was not listed on such websites, number of apartments were counted using google maps.
2. Gross square footage for parcels was estimated from the GIS file provided by the City.
3. Built up square footage for existing non-residential properties is based on a FAR of 0.7.

EAST RIVERSIDE DRIVE CORRIDOR

LAND USE ESTIMATES

Exhibit 4
Realistic Land Use Estimates (Based on ERC Subdistrict Map)

TAZ	Residential Attached	Residential Detached	Small Scale Retail	General Retail	Office	Warehouse & Light Manufacturing	Education/Religion	Hospitality
	(Sq Ft)	(Sq Ft)	(Sq Ft)	(Sq Ft)	(Sq Ft)	(Sq Ft)	(Sq Ft)	(Sq Ft)
441	2,620,700	-	416,100	220,800	416,100	-	208,000	208,000
442	393,400	-	48,700	48,700	48,700	-	29,700	24,300
443	922,300	6,900	149,100	124,700	149,100	-	75,100	74,600
444	1,888,800	559,200	270,600	263,600	270,600	-	178,300	135,300
456	102,500	-	16,200	10,600	16,200	-	8,100	8,100
457	1,545,800	-	194,300	130,400	194,300	-	113,800	97,200
458	1,703,800	-	426,000	440,700	426,000	222,855	178,700	175,900
459	1,806,500	55,300	348,600	259,600	291,500	-	150,000	145,800
Total	**10,983,800**	**621,400**	**1,869,600**	**1,499,100**	**1,812,500**	**222,855**	**941,700**	**869,200**

EAST RIVERSIDE DRIVE CORRIDOR
LAND USE ESTIMATES

FEHR PEERS

Exhibit 5
Realistic Land Use Estimates (Based on ERC Subdistrict Map)

TAZ	Residential Attached (Households)	Residential Detached (Households)	Small Scale Retail (Sq Ft)	General Retail (Sq Ft)	Office (Sq Ft)	Warehouse & Light Manufacturing (Sq Ft)	Education/Religion (Sq Ft)	Hospitality (Sq Ft)
441	2,490	-	416,100	220,800	416,100	-	208,000	208,000
442	374	-	48,700	48,700	48,700	-	29,700	24,300
443	876	7	149,100	124,700	149,100	-	75,100	74,600
444	1,794	531	270,600	263,600	270,600	-	178,300	135,300
456	97	-	16,200	10,600	16,200	-	8,100	8,100
457	1,469	-	194,300	130,400	194,300	-	113,800	97,200
458	1,619	-	426,000	440,700	426,000	222,855	178,700	175,900
459	1,716	53	348,600	259,600	291,500	-	150,000	145,800
Total	**10,435**	**590**	**1,869,600**	**1,499,100**	**1,812,500**	**222,855**	**941,700**	**869,200**

Exhibit 6
Proposed Projects (Based on Exhibit A.25 Proposed Developments in ERC Master Plan)

TAZ	Residential Attached (Households)	Residential Detached (Households)	Small Scale Retail (Sq Ft)	General Retail (Sq Ft)	Office (Sq Ft)	Warehouse & Light Manufacturing (Sq Ft)	Education/Religion (Sq Ft)	Hospitality (Sq Ft)
441	413	0	35,100	-	-	-	-	-
442	-	0	-	-	-	-	-	-
443	-	0	0	-	-	-	-	-
444	87	0	0	-	-	-	-	-
456	95	0	45,000	-	30,000	-	-	-
457	390	-	0	-	-	-	-	-
458	1,006	0	22,000	-	-	-	-	-
459	-	0	0	-	-	-	-	-
Total	**1,991**	**-**	**102,100**	**-**	**30,000**	**-**	**-**	**-**

Exhibit 7
Realistic Land Use Estimate Totals (Exhibits 5 + 6)

TAZ	Residential Attached (Households)	Residential Detached (Households)	Small Scale Retail (Sq Ft)	General Retail (Sq Ft)	Office (Sq Ft)	Warehouse & Light Manufacturing (Sq Ft)	Education/Religion (Sq Ft)	Hospitality (Sq Ft)
441	2,903	-	451,200	220,800	416,100	-	208,000	208,000
442	374	-	48,700	48,700	48,700	-	29,700	24,300
443	876	7	149,100	124,700	149,100	-	75,100	74,600
444	1,882	531	270,600	263,600	270,600	-	178,300	135,300
456	192	-	61,200	10,600	46,200	-	8,100	8,100
457	1,858	-	194,300	130,400	194,300	-	113,800	97,200
458	2,625	-	448,000	440,700	426,000	222,855	178,700	175,900
459	1,716	53	348,600	259,600	291,500	-	150,000	145,800
Total	**12,426**	**590**	**1,971,700**	**1,499,100**	**1,842,500**	**222,855**	**941,700**	**869,200**

EAST RIVERSIDE DRIVE CORRIDOR
LAND USE ESTIMATES

FEHR PEERS

Exhibit 8
Realistic Population and Employment Estimate (For ERC Subdistrict Map)

TAZ	Residential Attached	Residential Detached	Small Scale Retail	General Retail	Office	Warehouse & Light Manufacturing	Education/Religion	Hospitality
	Population	Population	Employment	Employment	Employment	Employment	Employment	Employment
441	4,979	-	624	442	1,456	0	312	125
442	747	-	73	97	170	0	45	15
443	1,752	13	224	249	522	0	113	45
444	3,589	1,062	406	527	947	0	267	81
456	195	-	24	21	57	0	12	5
457	2,937	-	291	261	680	0	171	58
458	3,237	-	639	881	1,491	669	268	106
459	3,432	105	523	519	1,020	0	225	87
Total	**20,869**	**1,181**	**2,804**	**2,998**	**6,344**	**669**	**1,413**	**522**

Exhibit 9
Population and Employment Estimate (For ERC Proposed Projects)

TAZ	Residential Attached	Residential Detached	Small Scale Retail	General Retail	Office	Warehouse & Light Manufacturing	Education/Religion	Hospitality
	Population	Population	Employment	Employment	Employment	Employment	Employment	Employment
441	827	-	53	0	0	0	0	0
442	-	-	0	0	0	0	0	0
443	-	-	0	0	0	0	0	0
444	175	-	0	0	0	0	0	0
456	190	-	68	0	105	0	0	0
457	779	-	0	0	0	0	0	0
458	2,012	-	33	0	0	0	0	0
459	-	-	0	0	0	0	0	0
Total	**3,982**	**-**	**153**	**-**	**105**	**-**	**-**	**-**

Exhibit 10
Realistic Population and Employment Estimate Totals (Tables 16 + 17)

TAZ	Residential Attached	Residential Detached	Small Scale Retail	General Retail	Office	Warehouse & Light Manufacturing	Education/Religion	Hospitality
	Population	Population	Employment	Employment	Employment	Employment	Employment	Employment
441	5,806	-	677	442	1,456	-	312	125
442	747	-	73	97	170	-	45	15
443	1,752	13	224	249	522	-	113	45
444	3,764	1,062	406	527	947	-	267	81
456	385	-	92	21	162	-	12	5
457	3,716	-	291	261	680	-	171	58
458	5,249	-	672	881	1,491	669	268	106
459	3,432	105	523	519	1,020	-	225	87
Total	**24,852**	**1,181**	**2,958**	**2,998**	**6,449**	**669**	**1,413**	**522**

EAST RIVERSIDE DRIVE CORRIDOR
LAND USE ESTIMATES

Exhibit 11
Comparison of Demographic Projections (Realistic)

TAZ	Population					Households					Employment				
	CAMPO 2010	CAMPO 2035	2035 Realistic ERC Estimate	Percent Change (2010 - 2035 CAMPO)	Percent Change (2010 CAMPO - 2035 ERC)	CAMPO 2010	CAMPO 2035	2035 Realistic ERC Estimate	Percent Change (2010 - 2035 CAMPO)	Percent Change (2010 CAMPO - 2035 ERC)	CAMPO 2010	CAMPO 2035	2035 Realistic ERC Estimate	Percent Change (2010 - 2035 CAMPO)	Percent Change (2010 CAMPO - 2035 ERC)
441	7,241	7,767	11,316	7%	56%	2,987	3,107	5,237	4%	75%	859	2,008	1,029	134%	20%
442	5,359	10,886	6,106	103%	14%	2,060	4,815	2,434	134%	18%	223	913	623	309%	179%
443	3,466	3,535	4,744	2%	37%	1,016	1,016	1,715	0%	69%	620	1,705	1,619	175%	161%
444	6,128	7,621	10,954	24%	79%	1,944	2,500	4,357	29%	124%	888	4,172	3,061	370%	245%
456	1,589	1,618	1,860	2%	17%	823	823	972	0%	18%	1,081	1,964	1,221	82%	13%
457	7,705	7,882	10,695	2%	39%	3,600	3,600	5,184	0%	44%	930	969	862	4%	-7%
458	4,892	7,285	10,141	49%	107%	2,494	3,330	5,119	34%	105%	1,593	4,719	5,481	196%	244%
459	1,394	1,442	4,775	3%	243%	463	666	2,173	44%	369%	553	3,245	2,222	487%	302%
Total	**37,774**	**48,036**	**60,592**	**27%**	**60%**	**15,387**	**19,857**	**27,190**	**29%**	**77%**	**6,747**	**19,695**	**16,117**	**192%**	**139%**

APPENDIX E

MXD Model Inputs

MIXED USE TRIP GENERATION MODEL V6.1 - BATCH INPUT

This Tab allows you to specify inputs for multiple MXDs and generate results for each one by running a macro (with the button to the right).
The results are generated on the 'batch output' tab.
Inputs can still be set normally on the input tab as before.

NOTE: Section 2 information (variable modeling parameters) is not included on this tab - it is still set on the input tab and assumed to be the same for each MXD.
Future versions will allow varying the section 2 information by MXD if there is demand to do so.

ALSO NOTE: The ITE equation to use (linear vs. log vs. average rate) is also not included on this tab and should be set on the input tab. Whichever is chosen in each case will be used for all MXDs in the batch.

Section 1 - General Site Information

Site Name	TAZ 441	TAZ 442	TAZ 443	TAZ 444	TAZ 456	TAZ 457	TAZ 458	TAZ 459
Geographic								
Developed Area (in acres)	370	806	428	777	193	287	610	330
Number of Intersections	15	6	7	6	7	7	3	1
Is Transit (bus or rail) present within the site or across the street?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Proportion of households within 1/4 mile of a transit stop	100%	100%	100%	100%	100%	100%	100%	100%
Land Use - Surrounding Area								
Is the site in a Central Business District or TOD?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Employment within one mile of the MXD	46,407	32,692	25,237	23,310	34,597	28,858	25,524	25,768
Employment within a 30 minute Transit Trip (Door-to-door)	272,184	232,529	118,848	92,314	256,035	232,412	153,348	89,605
Total Regional Employment	1,646,712	1,646,712	1,646,712	1,646,712	1,646,712	1,646,712	1,646,712	1,646,712
Site Demographics								
Enter Site Population Directly?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population	11316	6106	4744	10954	1860	10695	10141	4775
Average HH Size within MXD								
Single Family	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Multi-Family	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
High Rise Condo	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Townhouse	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Use Census Tract Level Data for Average HH Size?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Use Census Tract Level Data for Average Vehicle Ownership?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average Vehicles Owned per Dwelling Unit within MXD	1.12	1.00	1.11	1.28	1.19	1.10	1.06	1.24
Neighboring Site Demographics								
Average HH size near Site	2.06	2.44	2.47	2.68	2.32	2.30	2.51	2.72
Average Vehicles Owned per Dwelling Unit near Site	1.10	1.10	1.15	1.13	1.17	1.11	1.15	1.20

Section 3 - Trip Generation

Quantities (some can be in either jobs or ksf, and the units are specified in the next section)

Number of Dwelling Units								
Single Family	0	0	13	959	0	0	0	65
Multi-Family	5237	2434	1702	3398	972	5184	5119	2108
Townhouse								
High Rise Condo								
Retail (can be in either jobs or ksf)								
General Retail other than those listed below	347	306	499	999	222	316	1629	962
Supermarket								
Bank								
Health Club								
Restaurant (non-fast food)								
Fast-Food Restaurant								
Gas Station								
Auto Repair								
Home Improvement Superstore								
Free-Standing Discount								
Office (can be in either jobs or ksf)								
Non-Medical	246	257	629	1059	936	331	2544	997
Medical								
Industrial								
Light Industrial (jobs or ksf)							808	
Manufacturing (jobs or ksf)								
Warehousing / Self-Storage (ksf)								
Hotel Rooms (including restaurant, facilities, etc…)	125	15	46	684	50	44	935	38
Motel Rooms								
Movie Theater (with Matinee, screens)								
Movie Theater (Multiplex, screens)								
School (in student units)								
University	0	0	329	0	0	0	0	0
High School	312	45	116	320	12	171	373	225
Middle School								
Elementary								

Units (in cases where it can vary)

General Retail other than those listed below	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Supermarket	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Bank	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Health Club	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Restaurant (non-fast food)	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Fast-Food Restaurant	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Gas Station	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Auto Repair	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Home Improvement Superstore	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Free-Standing Discount	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Office								
Non-Medical	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Medical	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Industrial								
Light Industrial	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs
Manufacturing	jobs	jobs	jobs	jobs	jobs	jobs	jobs	jobs

Trips from Land uses not covered above ==>

Daily
AM Peak Hour
PM Peak Hour

MIXED USE TRIP GENERATION MODEL V6.1 - BATCH INPUT

Jobs in those Land Uses

Trip Equation Method								
Daily								
Single Family	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation
Multi-Family	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation
Townhouse	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation
High Rise Condo	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation
Retail								
General Retail other than those listed below	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation
Supermarket	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Bank	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Health Club	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Restaurant (non-fast food)	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Fast-Food Restaurant	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Gas Station	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Auto Repair	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Home Improvement Superstore	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Free-Standing Discount	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Office								
Non-Medical	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation
Medical	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Industrial								
Light Industrial	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Manufacturing	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Warehousing / Self-Storage	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Hotel (including restaurant, facilities, etc…)	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Motel	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Movie Theater (with Matinee)	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Movie Theater (Multiplex)	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
School								
University	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation
High School	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Middle School	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Elementary	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
AM								
Single Family	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation
Multi-Family	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation
Townhouse	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation
High Rise Condo	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation
Retail								
General Retail other than those listed below	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation
Supermarket	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Bank	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Health Club	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Restaurant (non-fast food)	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Fast-Food Restaurant	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Gas Station	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Auto Repair	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Home Improvement Superstore	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Free-Standing Discount	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Office								
Non-Medical	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation
Medical	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Industrial								
Light Industrial	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Manufacturing	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Warehousing / Self-Storage	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Hotel (including restaurant, facilities, etc…)	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Motel	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Movie Theater (with Matinee)	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Movie Theater (Multiplex)	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
School								
University	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
High School	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Middle School	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Elementary	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
PM								
Single Family	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation
Multi-Family	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation
Townhouse	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation
High Rise Condo	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation
Retail								
General Retail other than those listed below	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation	Log Equation
Supermarket	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Bank	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Health Club	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Restaurant (non-fast food)	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Fast-Food Restaurant	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Gas Station	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Auto Repair	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Home Improvement Superstore	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Free-Standing Discount	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Office								
Non-Medical	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation	Linear Equation
Medical	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Industrial								
Light Industrial	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Manufacturing	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Warehousing / Self-Storage	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Hotel (including restaurant, facilities, etc…)	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Motel	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Movie Theater (with Matinee)	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Movie Theater (Multiplex)	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
School								
University	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
High School	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Middle School	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate
Elementary	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate	Average Rate

APPENDIX E
COST ESTIMATES REPORT

East Riverside Corridor

Proposed Short- and Mid-Term Improvements

Project Number	Project Description	Short/Mid Term Improv.	Improvement Type	ROW Requirement	Roadway Cost [1]	Right Turn Bay Cost $30,000/ea	Left Turn Bay Cost $18,000/ea	Structure Cost [2]	Removal Cost	Signing/ Striping	Sidewalk Cost [3]	Signal Cost [4]	Landscape Cost	Major Utility Cost	Drainage	Construction Cost	ROW Cost	Utility Cost 20% of ROW	Contingency 20% of Const. Cost	Engineering Cost 8%	Total Project Cost
Driveway Consolidation																					
1	Corridor-Wide	Short	Operational	None	$ 19,954				$ 12,688		$ 33,041					$ 65,682		$ -	$ 13,136	$ 6,305	$ 85,124
																$ -		$ -	$ -	$ -	$ -
Median Improvements																$ -		$ -	$ -	$ -	$ -
2	Corridor-Wide	Mid	Operational	None	$ 49,999				$ 135,497	$ 6,643						$ 192,139		$ -	$ 38,428	$ 18,445	$ 249,012
																$ -		$ -	$ -	$ -	$ -
Pedestrian Improvements																$ -		$ -	$ -	$ -	$ -
3	Corridor-Wide	Short	Safety	None					$ 8,898	$ 352	$ 462,661	$ 80,000	$ 106,500			$ 658,411		$ -	$ 131,682	$ 63,207	$ 853,301
																$ -		$ -	$ -	$ -	$ -
Bicycle Improvements																$ -		$ -	$ -	$ -	$ -
4	Lakeshore Sharrow Lanes	Short	Safety	None						$ 13,444						$ 13,444		$ -	$ 2,689	$ 1,291	$ 17,423
5	Grove Sharrow Lanes	Short	Safety	None						$ 26,901						$ 26,901		$ -	$ 5,380	$ 2,583	$ 34,864
6	Montopolis Sharrow Lanes	Short	Safety	None						$ 35,058						$ 35,058		$ -	$ 7,012	$ 3,366	$ 45,436
7	Tinnin Ford Bike Lanes	Short	Safety	None						$ 7,145						$ 7,145		$ -	$ 1,429	$ 686	$ 9,260
8	Burton Bike Lanes	Short	Safety	None						$ 13,482						$ 13,482		$ -	$ 2,696	$ 1,294	$ 17,473
9	Elmot Bike Lanes	Short	Safety	None						$ 12,464						$ 12,464		$ -	$ 2,493	$ 1,197	$ 16,154
10	Arena Bike Lanes	Short	Safety	None						$ 4,366						$ 4,366		$ -	$ 873	$ 419	$ 5,658
11	Parker Bike Lanes	Short	Safety	None						$ 14,990						$ 14,990		$ -	$ 2,998	$ 1,439	$ 19,428
12	Town Creek Bike Lanes	Short	Safety	None						$ 3,787						$ 3,787		$ -	$ 757	$ 364	$ 4,909
																$ -		$ -	$ -	$ -	$ -
Intersection Improvements																$ -		$ -	$ -	$ -	$ -
13	IH 35	Short	Operational	Minor	$ 3,220	$ 30,000			$ 10,535	$ 428	$ 2,817					$ 47,000	$ 10,000	$ 2,000	$ 9,400	$ 4,512	$ 72,912
14	Lakeshore	Short	Operational	None	$ 8,733	$ 30,000			$ 8,630		$ 10,961	$ 150,000				$ 208,324		$ -	$ 41,665	$ 19,999	$ 269,988
15	Arena/Parker	Short	Operational	None	$ 1,670				$ 4,672		$ 10,656					$ 16,999		$ -	$ 3,400	$ 1,632	$ 22,030
16	Tinnin Ford/Burton	Short	Operational	None	$ 1,075				$ 1,805		$ 10,656					$ 13,537		$ -	$ 2,707	$ 1,300	$ 17,544
17	Willow Creek	Short	Operational	None	$ 2,185				$ 3,323		$ 8,080					$ 13,588		$ -	$ 2,718	$ 1,304	$ 17,610
18	Pleasant Valley	Short	Operational	None	$ 34,463				$ 26,774	$ 182	$ 15,808					$ 77,227		$ -	$ 15,445	$ 7,414	$ 100,086
19	Montopolis	Short	Operational	Minor	$ 126,631				$ 3,284	$ 1,455	$ 10,524					$ 141,894	$ 102,000	$ 20,400	$ 28,379	$ 13,622	$ 306,294
																$ -		$ -	$ -	$ -	$ -
Total Cost of Improvements																					**$ 2,164,505**

[1] Includes pavement, subbase, curbs, earthwork

[2] Includes bridges and retainaing walls

[3] Includes ADA ramps, traffic refuge and sidewalk pavement

[4] Includes standard signals and HAWK pedestrian signals

Corridor-Wide Driveway Consolidation

	Unit	Cost/Unit	Quanitity	Total Cost
Pavement Removal	SY	$ 9.92	1,279.00	$ 12,687.68
Curb Placement	LF	$ 2.86	1,491.00	$ 4,264.26
Driveway Pavement	SF	$ 6.54	2,399.00	$ 15,689.46
Sidewalk	LF	$ 22.16	1,491.00	$ 33,040.56
				$ 65,681.96

Corridor-Wide Median Improvements				
	Unit	Cost/Unit	Quanitity	Total Cost
Pavement Removal	SY	$ 9.92	13,659	$ 135,497.28
Curb Placement	LF	$ 2.86	17,482	$ 49,998.52
Striping	LF	$ 0.38	17,482	$ 6,643.16
				$ 192,138.96

Corridor-Wide Pedestrian Improvements[1]

	Unit	Cost/Unit	Length (ft)	Quanitity	Total Cost
Add 12' sidewalks along NB and SB Tinnin Ford from Riverside to Lakeshore					
Sidewalks	SY	$ 35.00	1,800	2,400	$ 84,000.00
Ramp (TY 1)	EA	$ 1,200.00		6	$ 7,200.00
Street Trees (30 ft spacing)	EA	$ 500.00		60	$ 30,000.00
					$ 121,200.00
Add 12' sidewalks along EB Arena from Riverside to Town Creek					
Sidewalks	SY	$ 35.00	1,025	1,367	$ 47,833.33
Ramp (TY 1)	EA	$ 1,200.00		2	$ 2,400.00
Street Trees (30 ft spacing)	EA	$ 500.00		-	$ -
					$ 50,233.33
Add 15' sidewalk connection in front of strip mall at NE corner of Pleasant Valley and Riverside					
Sidewalks	SY	$ 35.00	560	933	$ 32,666.67
Ramp (TY 1)	EA	$ 1,200.00		2	$ 2,400.00
Street Trees (30 ft spacing)	EA	$ 500.00		19	$ 9,500.00
					$ 44,566.67
Add HAWK Signal and Crosswalk north of Riverside on Pleasant Valley					
HAWK Signal	EA	$ 80,000.00		1	$ 80,000.00
Crosswalk Striping (12")	LF	$ 2.20		160	$ 352.00
Ramp (TY 1)	EA	$ 1,200.00		2	$ 2,400.00
					$ 82,752.00
Add 15' sidewalk connection along NB Pleasant Valley between EB and WB Riverside					
Sidewalks	SY	$ 35.00	250	417	$ 14,583.33
Ramp (TY 1)	EA	$ 1,200.00		2	$ 2,400.00
Street Trees (30 ft spacing)	EA	$ 500.00		9	$ 4,500.00
					$ 21,483.33
Replace 4' sidewalk with 15' connection along SB Pleasant Valley between EB and WB Riverside					
Sidewalks	SY	$ 35.00	250	417	$ 14,583.33
Ramp (TY 1)	EA	$ 1,200.00		2	$ 2,400.00
Removal	SY	$ 9.92		111	$ 1,101.12
Street Trees (30 ft spacing)	EA	$ 500.00		9	$ 4,500.00
					$ 22,584.45
Replace 4' sidewalk with 5' connection along EB Riverside just west of Pleasant Valley					
Sidewalks	SY	$ 35.00	370	206	$ 7,194.44
Ramp (TY 1)	EA	$ 1,200.00		-	$ -
Removal	SY	$ 9.92		164	$ 1,626.88
Street Trees (30 ft spacing)	EA	$ 500.00		-	$ -
					$ 8,821.32
Add 12' sidewalk connection along NB Grove from Riverside to .25 miles south					
Sidewalks	SY	$ 35.00	1,400	1,867	$ 65,333.33
Ramp (TY 1)	EA	$ 1,200.00		2	$ 2,400.00
Street Trees (30 ft spacing)	EA	$ 500.00		47	$ 23,500.00
					$ 91,233.33
Add 12' sidewalk connection along SB Montopolis between Riverside and Oltorf					
Sidewalks	SY	$ 35.00	650	867	$ 30,333.33
Ramp (TY 1)	EA	$ 1,200.00		6	$ 7,200.00
Street Trees (30 ft spacing)	EA	$ 500.00		22	$ 11,000.00
					$ 48,533.33
Replace 4' sidewalks with 12' connection along SB Montopolis from Riverside to .25 miles north					
Sidewalks	SY	$ 35.00	1,400	1,867	$ 65,333.33
Ramp (TY 1)	EA	$ 1,200.00		60	$ 72,000.00
Removal	SY	$ 9.92		622	$ 6,170.24
Street Trees (30 ft spacing)	EA	$ 500.00		47	$ 23,500.00
					$ 167,003.57
Summary					
Sidewalks	SY	$ 35.00	7,705	10,339	$ 361,861.11
HAWK Signal	EA	$ 80,000.00		1	$ 80,000.00
Cross Walk Striping	LF	$ 2.20		160	$ 352.00
Ramp (TY 1)	EA	$ 1,200.00		84	$ 100,800.00
Removal	SY	$ 9.92		897	$ 8,898.24
Street Trees (30 ft spacing)	EA	$ 500.00		213	$ 106,500.00
					$ 658,411.35

[1] Assumes no ROW needed for sidewalk placement

Bicycle Improvements

	Unit	Cost/Unit	Quanitity	Total Cost
Lakeshore Sharrow Lanes (Riverside to Pleasant Valley)				
Signs (Bike Route)	EA	$ 452.75	10	$ 4,527.49
Pavement Marking (Double Arrows)	EA	$ 101.30	34	$ 3,444.20
Pavement Marking (Bike Symbol)	EA	$ 114.99	34	$ 3,909.75
Pavement Marking (Lane Line)	LF	$ 0.38	4,100	$ 1,562.35
				$ 13,443.79
Grove Sharrow Lanes (Roy G. Guerrero Park to Montopolis)				
Signs (Bike Route)	EA	$ 452.75	18	$ 8,149.49
Pavement Marking (Double Arrows)	EA	$ 152.89	70	$ 10,702.18
Pavement Marking (Bike Symbol)	EA	$ 114.99	70	$ 8,049.49
				$ 26,901.15
Montopolis Sharrow Lanes (Oltorf to SH 183)				
Signs (Bike Route)	EA	$ 452.75	23	$ 10,413.23
Pavement Marking (Double Arrows)	EA	$ 152.89	92	$ 14,065.73
Pavement Marking (Bike Symbol)	EA	$ 114.99	92	$ 10,579.32
				$ 35,058.28
Tinnin Ford Bike Lanes (Riverside to Lakeshore)				
Signs (Bike Lane)	EA	$ 452.75	6	$ 2,716.50
Pavement Marking (Arrow)	EA	$ 101.30	14	$ 2,140.44
Pavement Marking (Bike Symbol)	EA	$ 114.99	14	$ 1,609.90
Pavement Marking (Lane Line)	LF	$ 0.38	1,780	$ 678.29
				$ 7,145.12
Burton Bike Lanes (Riverside to Oltorf)				
Signs (Bike Lane)	EA	$ 452.75	10	$ 4,527.49
Pavement Marking (Arrow)	EA	$ 101.30	34	$ 3,444.31
Pavement Marking (Bike Symbol)	EA	$ 114.99	34	$ 3,909.75
Pavement Marking (Lane Line)	LF	$ 0.38	4,200	$ 1,600.45
				$ 13,482.00
Elmont Bike Lanes (Tinnin Ford to Country Club Creek Trail)				
Signs (Bike Lane)	EA	$ 452.75	10	$ 4,527.49
Pavement Marking (Arrow)	EA	$ 101.30	30	$ 3,039.10
Pavement Marking (Bike Symbol)	EA	$ 114.99	30	$ 3,449.78
Pavement Marking (Lane Line)	LF	$ 0.38	3,800	$ 1,448.03
				$ 12,464.40
Arena Bike Lanes (Town Creek to Riverside)				
Signs (Bike Lane)	EA	$ 452.75	5	$ 2,263.75
Pavement Marking (Arrow)	EA	$ 101.30	8	$ 810.43
Pavement Marking (Bike Symbol)	EA	$ 114.99	8	$ 919.94
Pavement Marking (Lane Line)	LF	$ 0.38	975	$ 371.53
				$ 4,365.65
Parker Bike Lanes (Riverside to Oltorf)				
Signs (Bike Lane)	EA	$ 452.75	11	$ 4,980.24
Pavement Marking (Arrow)	EA	$ 101.30	38	$ 3,849.52
Pavement Marking (Bike Symbol)	EA	$ 114.99	38	$ 4,369.72
Pavement Marking (Lane Line)	LF	$ 0.38	4,700	$ 1,790.98
				$ 14,990.47
Town Creek Bike Lanes (Lakeshore to Arena)				
Signs (Bike Lane)	EA	$ 452.75	6	$ 2,716.50
Pavement Marking (Arrow)	EA	$ 101.30	4	$ 405.21
Pavement Marking (Bike Symbol)	EA	$ 114.99	4	$ 459.97
Pavement Marking (Lane Line)	LF	$ 0.38	540	$ 205.77
				$ 3,787.45

Intersection Improvements

	Unit	Cost/Unit	Quanitity	Total Cost
IH 35				
Removal	SY	$ 9.92	1062	$ 10,535.04
Pavement	SF	$ 6.54	0	$ -
Right Turn Lane	ea	$ 30,000.00	1	$ 30,000.00
Curb	LF	$ 2.86	1126	$ 3,220.36
Striping	LF	$ 0.38	1126	$ 427.88
Crosswalk Striping (12")	LF	$ 2.20	80	$ 176.00
Ramp (TY 1)	ea	$ 1,200.00	1	$ 1,200.00
Ramp (TY 21)	ea	$ 1,440.57	1	$ 1,440.57
Signals	ea	$ 150,000.00	0	$ -
ROW	SF	$ 5.00	2000	$ 10,000.00
				$ 56,999.85
Lakeshore				
Removal	SY	$ 9.92	870	$ 8,630.40
Pavement	SF	$ 6.54	908	$ 5,938.32
Right Turn Lane	ea	$ 30,000.00	1	$ 30,000.00
Curb	LF	$ 2.86	977	$ 2,794.22
Striping	LF	$ 0.38		$ -
Crosswalk Striping (12")	LF	$ 2.20	400	$ 880.00
Ramp (TY 1)	ea	$ 1,200.00	6	$ 7,200.00
Ramp (TY 21)	ea	$ 1,440.57	2	$ 2,881.14
Signals	ea	$ 150,000.00	1	$ 150,000.00
				$ 208,324.08
Arena/Parker				
Removal	SY	$ 9.92	471	$ 4,672.32
Pavement	SF	$ 6.54		$ -
Curb	LF	$ 2.86	584	$ 1,670.24
Striping	LF	$ 0.38		$ -
Crosswalk Striping (12")	LF	$ 2.20	480	$ 1,056.00
Ramp (TY 1)	ea	$ 1,200.00	8	$ 9,600.00
Ramp (TY 21)	ea	$ 1,440.57		$ -
Signals	ea	$ 150,000.00	0	$ -
				$ 16,998.56
Tinnin Ford/Burton				
Removal	SY	$ 9.92	182	$ 1,805.44
Pavement	SF	$ 6.54	0	$ -
Curb	LF	$ 2.86	376	$ 1,075.36
Striping	LF	$ 0.38	0	$ -
Crosswalk Striping (12")	LF	$ 2.20	480	$ 1,056.00
Ramp (TY 1)	ea	$ 1,200.00	8	$ 9,600.00
Ramp (TY 21)	ea	$ 1,440.57	0	$ -
Signals	ea	$ 150,000.00	0	$ -
				$ 13,536.80
Willow Creek				
Removal	SY	$ 9.92	335	$ 3,323.20
Pavement	SF	$ 6.54	0	$ -
Curb	LF	$ 2.86	764	$ 2,185.04
Striping	LF	$ 0.38	0	$ -
Crosswalk Striping (12")	LF	$ 2.20	400	$ 880.00
Ramp (TY 1)	ea	$ 1,200.00	6	$ 7,200.00
Ramp (TY 21)	ea	$ 1,440.57	0	$ -
Signals	ea	$ 150,000.00	0	$ -
				$ 13,588.24
Pleasant Valley				
Removal	SY	$ 9.92	2699	$ 26,774.08
Pavement	SF	$ 6.54	4900	$ 32,046.00
Curb	LF	$ 2.86	845	$ 2,416.70
Striping	LF	$ 0.38	480	$ 182.40
Crosswalk Striping (12")	LF	$ 2.20	640	$ 1,408.00
Ramp (TY 1)	ea	$ 1,200.00	12	$ 14,400.00
Ramp (TY 21)	ea	$ 1,440.57	0	$ -
Signals	ea	$ 150,000.00	0	$ -
				$ 77,227.18
Montopolis				
Removal	SY	$ 9.92	331	$ 3,283.52
Pavement	SF	$ 6.54	18432	$ 120,545.28
Curb	LF	$ 2.86	2128	$ 6,086.08
Striping	LF	$ 0.38	3828	$ 1,454.64
Crosswalk Striping (12")	LF	$ 2.20	420	$ 924.00
Ramp (TY 1)	ea	$ 1,200.00	8	$ 9,600.00
Ramp (TY 21)	ea	$ 1,440.57	0	$ -
Signals	ea	$ 150,000.00	0	$ -
ROW	SF	$ 5.00	20400	$ 102,000.00
				$ 243,893.52

City of Austin Corridor Study

Riverside Drive

Cost Estimates – Technical Approach

The Riverside cost estimate was divided into three separate segments along the Riverside Drive alignment from IH-35 to Ben White Boulevard (HWY 71). Segment 1 incorporates the alignment from IH-35 to just west of the intersection at Willow Creek Drive. Segment 2 incorporates the alignment from west of the Willow Creek Drive intersection to just east of the Wickersham Lane intersection. Finally, Segment 3 incorporates the alignment from east of Wickersham Lane to Ben White Blvd.

This cost estimate was developed based upon the four lane typical sections for constrained right-of-way provide by HDR, four lane typical section with parking provided by HDR, water and wastewater utility GIS data from the City of Austin database, field observations, and limited schematic CAD drawings within each segment as provided by HDR. The assumed quantities in each segment are based off a typical amount per STA (100' of roadway alignment).

For Segment 1 and Segment 3, a schematic CAD drawing was provided for a portion of the overall segment length. The schematic information provided was used to extrapolate the typical section quantities for the full segment. For example, for Segment 1, a CAD drawing was provided which graphically depicted approximately 2,260 LF of improvements (22.6 stations) over the total segment length of 4,800 LF (48 stations). Within that provided schematic, approximately 1,420 LF of roadway section had no parking, 410 LF of roadway had parking on one side and 430 LF of roadway had parking on two sides. The information was used to interpolate an assumed section over the entire 4,800 LF of roadway improvements. A schematic CAD drawing was provided for the entire length of Segment 2. For this segment, the improvement quantities were measured from the graphics and applied to the entire alignment.

Each segment has been subdivided into several categories which capture the nature of improvements for the future project. For all quantities, please reference the spreadsheet for additional assumptions made while creating quantities. The improvements have been categorized as follows:

<u>General Improvements</u> – This includes improvements applied within the right-of-way which are in addition to the four-lane typical section surface improvements. These costs include seeding for erosion control and within the median, construction erosion control (includes entrances, rock berms and silt fences), preparation of right-of-way, signs, excavation, water and wastewater relocation, illumination, pedestrian H.A.W.K.S, residential driveways, commercial driveways.

<u>Drainage Improvements</u> – This includes small RCP, replacing curb inlets, new storm drain manholes, and any other improvements specific to the segment.

Streetscape Improvements - These are improvements that will be utilized by pedestrians and bicyclists rather than the actual construction of the sidewalk. This includes trees, tree wells, benches, bicycle racks, curb ramps, trash cans, guide signs, bus shelters and sidewalk removal.

Rail Improvements – The rail improvement include the infrastructure directly associated with the potential urban rail corridor. Cost information was derived from the Austin Urban Rail Conceptual Engineering Order of Magnitude Cost Estimate provided by the City of Austin. The base costs include required vehicles (based upon each segment length), but do not include any indirect system costs, E&A costs, or additional contingencies as detailed in the Cost Estimate.

Roadway Improvements - These quantities are based the typical roadway section provided by HDR for both a constrained right-of-way and a four lane typical section with parking. This includes sidewalk, paving, lime treated sub-base, seeding in the setback, parking meters, striping, curb and gutter, median pavers. For this cost estimate, it is assumed that a uniform section of 8" concrete paving over 6" lime treatment is applied across the entire section and under curbs. A 22' wide rail corridor track way zone was excluded, where appropriate. Overall, the amount of sidewalk applied to the segment length was 85% based on the schematic CAD drawings applied over all segments. For each segment, there is a separate spreadsheet which references a tab entitled SEG X ROADWAY IMPROVEMENTS. The separate roadway improvements spreadsheet was developed in order to determine the overall cost of the segment based on the anticipated amount of parking located within that segment. The total is then rolled up into the SEG X tab as the Roadway Improvements Summary.

Intersections – This includes all additional costs for the intersections which will have traffic lighting. All other intersection quantities not lighted have been included under general improvements as commercial driveways.

The primary source for the cost estimate is from the average City of Austin bid prices from 27NOV2007 to 02APR2012. In some cases, the source of the costs used in the estimate spreadsheet is from TxDOT or other sources. The Unit Costs tab in the cost estimate summarizes the unit cost used for each item and the sources of each cost if derived somewhere other than the City of Austin bid prices.

Riverside Drive Improvements Overall Cost Estimate		
By Segment		
SEGMENT 1 - IH 35 TO WILLOW CREEK - 30% of Corridor		$85,777,383
SEGMENT 2 - WILLOW CREEK TO WICKERSHAM- 10% of Corridor		$31,951,087
SEGMENT 3 - WICKERSHAM TO US 71- 60% of Corridor		$171,265,485
Sub-Total		**$288,993,955**
Micscellaneous Description		
Traffic Control	4.0%	$11,559,758
Contingency	20.0%	$57,798,790.98
Sub-Total		**$69,358,549**
TOTAL		**$358,352,504**
TOTAL/MILE		**$103,676,779**

Riverside Drive Roadway Improvements Only		
Segment (without Urban Rail Elements)		
SEGMENT 1 - IH 35 TO WILLOW CREEK - 30% of Corridor		$9,845,282
SEGMENT 2 - WILLOW CREEK TO WICKERSHAM- 10% of Corridor		$6,640,387
SEGMENT 3 - WICKERSHAM TO US 71- 60% of Corridor		$19,401,283
Sub-Total		**$35,886,951**
Micscellaneous Description		
Traffic Control	4.0%	$1,435,478
Contingency	20.0%	$7,177,390
Sub-Total		**$8,612,868**
TOTAL		**$44,499,820**
TOTAL/MILE		**$12,874,468**

Urban Improvements Rail Only		
Segment (with Urban Rail Elements)		
SEGMENT 1 - IH 35 TO WILLOW CREEK - 30% of Corridor		$75,932,101
SEGMENT 2 - WILLOW CREEK TO WICKERSHAM- 10% of Corridor		$25,310,700
SEGMENT 3 - WICKERSHAM TO US 71- 60% of Corridor		$151,864,202
TOTAL		**$253,107,003**
TOTAL/ROUTE MILE		**$82,714,707**

CITY OF AUSTIN

EAST RIVERSIDE DRIVE CORRIDOR IMPROVEMENTS

SEGMENT 1 - IH 35 TO WILLOW CREEK - 30% of Corri

Segment Total Length (STA)= 48.0

Each STA = 100 lf

Bid Code	Item Description	Unit	Segment 1 Total Quantity	Unit Cost ($/unit) From UNIT COSTS Sheet	Segment Construction Cost	NOTES:
General Improvements						
604S-C	Seeding	SY	1,333	$2.00	$2,667	SEEDING AREA NOT INCLUDED IN SETBACK BETWEEN OF CURB AND ROW (INCLUDED ELSEWHERE)- EROSION CONTROL AND MEDIAN ISLANDS
641S	Construction Entrance	EA	2	$1,300.00	$2,667	ASSUME 2 ENTRANCES PER SEGMENT
639S	Rock Berm	LF	192	$30.00	$5,760	ASSUME 20 LF OF ROCK BERM PER 500 FT OF ROADWAY
642S	Silt Fence	LF	9,600	$2.50	$24,000	ASSUME SILT FENCE THE ENTIRE LENGTH OF THE PROJECT ON BOTH SIDES
101S-B	Prep ROW	STA	48	$1,000.00	$48,000	
824S	Signs	EA	96	$300.00	$28,800	ASSUME 2 SIGNS PER STA
110S-A	Excavation	CY	17,529	$35.00	$613,511	ASSUME EXCAVATION OF EXISTING ROAD TO PROPOSED SECTION ASUUMING THE FINISHED PROFILE EQUALS EXISTING PROFILE = 8" CONC+ 6" LIME * 85 WIDE EXCAVATION (EXISTING ROAD WIDTH)
W&WW	Water and Wastewater Relocations	LS	1	$207,517.00	$207,517	
4	Illumination	EA	72	$6,000.00	$432,000	ASSUME 3 POLES PER 200 LF, ALLOWS FOR 2 POLES IN SIDEWALK, AND ONE FOR RAIL PLATFORM
1	Pedestrian Hybrid Beacons (PHB)	EA	1	$80,000.00	$80,000	
DRV-1	Residential Driveways	EA	0	$3,056.29	$-	SEE RESIDENTIAL AND COMMERCIAL DRIVEWAYS TAB FOR DETAILED QUANTITIES
DRV-2	Commercial Driveways	EA	38	$6,470.57	$245,882	SEE RESIDENTIAL AND COMMERCIAL DRIVEWAYS TAB FOR DETAILED QUANTITIES
Drainage Improvements						
510-ASD24	24" RCP	LF	3,840	$70.00	$268,800	ASSUME 80% OF SEGMENT NEEDS AN UPGRADED STORM SEWER TRUNK LINE
510-ASD18	18" RCP	LF	1,800	$60.00	$108,000	ASSUME 25 LF PER ADDITIONAL CI
508S-I10S	10' Curb Inlet	EA	72	$3,500.00	$252,000	ASSUME 2 CI/300 LF FOR NEW CURB INLETS TO BRING ROAD TO CODE, RELOCATED EXISTING CI TO PROPOSED CURB LINE, ACCOUNT FOR RAISED MEDIANS ETC
506 M1WW	4' Storm Sewer Manhole	EA	8	$5,000.00	$40,000	ESTIMATE FOR CONNECTING NEW CURB INLETS
Streetscape Improvements						
437S-B-72	Tree Well	EA	336	$2,000.00	$672,212	ASSUME 75% OF TREES IN TREE WELLS
608S	Tree	EA	448	$350.00	$156,850	GRAPHICAL - FROM BASE FILE
432S-SAC-1	Benches	EA	48	$2,200.00	$105,600	ASSUME 1 BENCH PER STA
432S-SAC-3	Bicycle Racks	EA	144	$395.00	$56,880	1 RACK OF 3 PER STA
432S-RP-1	Curb Ramps	EA	120	$1,200.00	$144,000	GRAPHICAL - 12 RAMPS / 500 FT SAMPLE
2	Other: Trash Cans, Guide signs	LS	1	$5,000.00	$5,000	
01025-5	Bus Stop Shelters	EA	1	$10,000.00	$10,000	ASSUME 1 PER SEGMENT
104S-C	Sidewalk Removal	SF	51,840	$4.50	$233,280	ASSUME ALL EXISTING SIDWALK TO BE REMOVED, 6' SIDEWALK IS 90% OF SEGMENT ON BOTH SIDES
Rail Improvements						
		RM (Route Mile	0.92	$82,714,707	$75,932,101	SEE RAIL SPREADSHEET FOR DETAIL - CONSTRUCTION COSTS ONLY
Roadway Improvements Summary						SEE ROADWAY IMPROVEMENT TAB FOR DETAILED QUANTITIES
432S-4	Sidewalk - 4" Conc	SF	75,733	$6.00	$454,396	
360S-A-8	8" Conc Paving	SY	41,666	$65.00	$2,708,281	ASSUMES PAVEMENT ACROSS ENTIRE ROADWAY AND TRACK WAY INCLUDING MEDIAN/PLATFORM
203S-A	Lime Treatment	SY	41,666	$5.50	$229,162	
604S-C	Seeding	SY	5,185	$2.00	$10,371	SEEDING IS WITHIN SETBACK AREA
3	Parking Meters	EA	54	$12,000.00	$647,363	
860S-A-4SY	Striping - Paint	LF	44,160	$0.40	$17,664	
871S-A-4W	Striping - Thermoplastic	LF	44,160	$1.00	$44,160	
430S-B	Curb & Gutter	LF	17,376	$22.00	$382,272	
480SNS	Median Pavers	SF	41,136	$6.00	$246,816	
Intersections Summary						SEE DETAILED INTERSECTION QUANTITIES IN INTERSECTIONS TAB
	IH 35				$252,000	
	Lakeshore Blvd				$280,034	
	Parker Ln/Arena Dr				$280,576	
	Royal Crest Dr				$265,746	
	Burton Dr/Tinnin Ford Rd				$283,015	
				TOTAL	**$85,777,383**	

CITY OF AUSTIN

EAST RIVERSIDE DRIVE CORRIDOR IMPROVEMENTS

SEGMENT 2 - WILLOW CREEK TO WICKERSHAM- 10%

Segment Total Length (STA)= 27.25

Each STA = 100 lf

Bid Code	Item Description	Unit	Segment 2 Total Quantity	Unit Cost ($/unit) From UNIT COSTS Sheet	Segment Construction Cost	NOTES:
General Improvements						
604S-C	Seeding	SY	23,000	$2.00	$46,000	SEEDING AREA NOT INCLUDED IN SETBACK BETWEEN OF CURB AND ROW (INCLUDED ELSEWHERE) AMOUNT IN PARK AREA- EROSION CONTROL AND MEDIAN ISLANDS
641S	Construction Entrance	EA	2	$1,300.00	$46,000	ASSUME 2 ENTRANCES PER SEGMENT
639S	Rock Berm	LF	109	$30.00	$3,270	ASSUME 20 LF OF ROCK BERM PER 500 FT OF ROADWAY
642S	Silt Fence	LF	5,450	$2.50	$13,625	ASSUME SILT FENCE THE ENTIRE LENGTH OF THE PROJECT ON BOTH SIDES
101S-B	Prep ROW	STA	27	$1,000.00	$27,250	
824S	Signs	EA	55	$300.00	$16,350	ASSUME 2 SIGNS PER STA
110S-A	Excavation	CY	9,951	$35.00	$348,295	ASSUME EXCAVATION OF EXISTING ROAD TO PROPOSED SECTION ASUUMING THE FINISHED PROFILE EQUALS EXISTING PROFILE = 8" CONC+ 6" LIME * 85 WIDE EXCAVATION (EXISTING ROAD WIDTH)
W&WW	Water and Wastewater Relocations	LS	1.00	$106,089.60	$106,090	SEE WATER AND WASTEWATER TAB FOR DETAILED QUANTITIES
4	Illumination	EA	41	$6,000.00	$245,250	ASSUME 3 POLES PER 200 LF, ALLOWS FOR 2 POLES IN SIDEWALK, AND ONE FOR RAIL PLATFORM
1	Pedestrian Hybrid Beacons (PHB)	EA	1	$80,000.00	$80,000	
DRV-1	Residential Driveways	EA	0	$3,056.29	$-	SEE RESIDENTIAL AND COMMERCIAL DRIVEWAYS TAB FOR DETAILED QUANTITIES
DRV-2	Commercial Driveways	EA	11	$6,470.57	$71,176	SEE RESIDENTIAL AND COMMERCIAL DRIVEWAYS TAB FOR DETAILED QUANTITIES
PARK-1	Pedestrian Shade Structures	LF	200	$-	$-	
PARK-2	Park Stage Area	LS	1	$-	$-	
PARK-3	Unloading Buildings Near Train	EA	2	$-	$-	
PARK-4	Shaded Picnic Area	EA	2	$-	$-	
Drainage Improvements						
510-ASD24	24" RCP	LF	2,180	$70.00	$152,600	ASSUME 80% OF SEGMENT NEEDS AN UPGRADED STORM SEWER TRUNK LINE
510-ASD18	18" RCP	LF	1,022	$60.00	$61,313	ASSUME 25 LF PER ADDITIONAL CI
508S-I10S	10' Curb Inlet	EA	41	$3,500.00	$143,063	ASSUME 2 CI/300 LF FOR NEW CURB INLETS TO BRING ROAD TO CODE, RELOCATED EXISTING CI TO PROPOSED CURB LINE, ACCOUNT FOR RAISED MEDIANS ETC
506 M1WW	4' Storm Sewer Manhole	EA	8	$5,000.00	$40,000	ESTIMATE FOR CONNECTING NEW CURB INLETS
CULV EXTENSION	Box Culvert Extension	LS	1	$35,300.00	$35,300	SEE CULVERT EXTENSION TAB FOR DETAILED QUANTITIES
Streetscape Improvements						
437S-B-72	Tree Well	EA	269	$2,000.00	$537,000	ASSUME 50% OF TREES IN TREE WELLS
608S	Tree	EA	537	$350.00	$187,950	GRAPHICAL - FROM BASE FILE
432S-SAC-1	Benches	EA	27	$2,200.00	$59,950	ASSUME 1 BENCH PER STA
432S-SAC-3	Bicycle Racks	EA	82	$395.00	$32,291	1 RACK OF 3 PER STA
432S-RP-1	Curb Ramps	EA	27	$1,200.00	$32,700	GRAPHICAL - 12 RAMPS / 500 FT SAMPLE
2	Other: Trash Cans, Guide signs	LS	1	$5,000.00	$5,000	
01025-5	Bus Stop Shelters	EA	1	$10,000.00	$10,000	ASSUME 1 PER SEGMENT
104S-C	Sidewalk Removal	SF	29,430	$4.50	$132,435	ASSUME ALL EXISTING SIDWALK TO BE REMOVED, 6' SIDEWALK IS 90% OF SEGMENT ON BOTH SIDES
Rail Improvements						
		RM (Route Mile	0.31	$82,714,707	$25,310,700	SEE RAIL SPREADSHEET FOR DETAIL
Roadway Improvements Summary						SEE ROADWAY IMPROVEMENT TAB FOR DETAILED QUANTITIES
432S-4	Sidewalk - 4" Conc	SF	70,554	$6.00	$423,323	
360S-A-8	8" Conc Paving	SY	30,883	$65.00	$2,007,364	ASSUMES PAVEMENT ACROSS ENTIRE ROADWAY AND TRACK WAY INCLUDING MEDIAN/PLATFORM
203S-A	Lime Treatment	SY	30,883	$5.50	$169,854	
604S-C	Seeding	SY	3,048	$2.00	$6,096	SEEDING IS WITHIN SETBACK AREA
3	Parking Meters	EA	9	$12,000.00	$102,000	
860S-A-4SY	Striping - Paint	LF	24,743	$0.40	$9,897	
871S-A-4W	Striping - Thermoplastic	LF	24,743	$1.00	$24,743	
430S-B	Curb & Gutter	LF	23,190	$22.00	$510,175	
480SNS	Median Pavers	SF	16,594	$6.00	$99,561	
Intersections Summary						SEE DETAILED INTERSECTION QUANTITIES IN INTERSECTIONS TAB
	Willow Creek Dr				$275,969	
	Pleasant Valley Rd				$288,165	
	Wickersham Ln				$290,333	
				TOTAL	**$31,951,087.28**	

CITY OF AUSTIN

EAST RIVERSIDE DRIVE CORRIDOR IMPROVEMENTS

SEGMENT 3 - WICKERSHAM TO US 71- 60% of Corrido

Segment Total Length (STA)= 107.25

Each STA = 100 lf

Bid Code	Item Description	Unit	Segment 3 Total Quantity	Unit Cost ($/unit) From UNIT COSTS Sheet	Segment Construction Cost	NOTES:
General Improvements						
604S-C	Seeding	SY	2979	$2.00	$5,958	SEEDING AREA NOT INCLUDED IN SETBACK BETWEEN OF CURB AND ROW (INCLUDED ELSEWHERE)
641S	Construction Entrance	EA	4	$1,300.00	$5,958	ASSUME 2 ENTRANCES PER SEGMENT
639S	Rock Berm	LF	429	$30.00	$12,870	ASSUME 20 LF OF ROCK BERM PER 500 FT OF ROADWAY
642S	Silt Fence	LF	21450	$2.50	$53,625	ASSUME SILT FENCE THE ENTIRE LENGTH OF THE PROJECT ON BOTH SIDES
101S-B	Prep ROW	STA	107	$1,000.00	$107,250	
824S	Signs	EA	215	$300.00	$64,350	ASSUME 2 SIGNS PER STA
110S-A	Excavation	CY	39166	$35.00	$1,370,814	ASSUME EXCAVATION OF EXISTING ROAD TO PROPOSED SECTION ASUUMING THE FINISHED PROFILE EQUALS EXISTING PROFILE = 8" CONC+ 6" LIME * 85 WIDE EXCAVATION (EXISTING ROAD WIDTH)
W&WW	Water and Wastewater Relocation	LS	1	$889,890.20	$889,890	SEE WATER AND WASTEWATER TAB FOR DETAILED QUANTITIES
4	Illumination	EA	161	$6,000.00	$965,250	ASSUME 3 POLES PER 200 LF, ALLOWS FOR 2 POLES IN SIDEWALK, AND ONE FOR RAIL PLATFORM
1	Pedestrian Hybrid Beacons (PHB)	EA	4	$80,000.00	$320,000	
DRV-1	Residential Driveways	EA	28	$3,056.29	$85,576	SEE RESIDENTIAL AND COMMERCIAL DRIVEWAYS TAB FOR DETAILED QUANTITIES
DRV-2	Commercial Driveways	EA	41	$6,470.57	$265,293	SEE RESIDENTIAL AND COMMERCIAL DRIVEWAYS TAB FOR DETAILED QUANTITIES
Drainage Improvements						
510-ASD24	24" RCP	LF	8580	$70.00	$600,600	ASSUME 80% OF SEGMENT NEEDS AN UPGRADED STORM SEWER TRUNK LINE
510-ASD18	18" RCP	LF	4022	$60.00	$241,313	ASSUME 25 LF PER ADDITIONAL CI
508S-I10S	10' Curb Inlet	EA	161	$3,500.00	$563,063	ASSUME 2 CI/300 LF FOR NEW CURB INLETS TO BRING ROAD TO CODE, RELOCATED EXISTING CI TO PROPOSED CURB LINE, ACCOUNT FOR RAISED MEDIANS ETC
506 M1WW	4' Storm Sewer Manhole	EA	12	$5,000.00	$60,000	ESTIMATE FOR CONNECTING NEW CURB INLETS
Streetscape Improvements						
437S-B-72	Tree Well	EA	738	$2,000.00	$1,475,989	ASSUME 75% OF TREES IN TREE WELLS
608S	Tree	EA	984	$350.00	$344,397	GRAPHICAL - FROM BASE FILE
432S-SAC-1	Benches	EA	107	$2,200.00	$235,950	ASSUME 1 BENCH PER STA
432S-SAC-3	Bicycle Racks	EA	322	$395.00	$127,091	1 RACK OF 3 PER STA
432S-RP-1	Curb Ramps	EA	268	$1,200.00	$321,750	GRAPHICAL - 12 RAMPS / 500 FT SAMPLE
2	Other: Trash Cans, Guide signs	LS	1	$5,000.00	$5,000	
01025-5	Bus Stop Shelters	EA	3	$10,000.00	$30,000	ASSUME 3 PER SEGMENT
104S-C	Sidewalk Removal	SF	115830	$4.50	$521,235	ASSUME ALL EXISTING SIDWALK TO BE REMOVED, 6' SIDEWALK IS 90% OF SEGMENT ON BOTH SIDES
Rail Improvements						
		RM (Route Mile	1.84	$82,714,707	$151,864,202	SEE RAIL SPREADSHEET FOR DETAIL
Roadway Improvements Summary						SEE ROADWAY IMPROVEMENT TAB FOR DETAILED QUANTITIES
432S-4	Sidewalk - 4" Conc	SF	164093	$6.00	$984,555	ASSUMES PAVEMENT ACROSS ENTIRE ROADWAY AND TRACK WAY INCLUDING MEDIAN/PLATFORM
360S-A-8	8" Conc Paving	SY	91758	$65.00	$5,964,292	
203S-A	Lime Treatment	SY	91758	$5.50	$504,671	
604S-C	Seeding	SY	12155	$2.00	$24,310	SEEDING IS WITHIN SETBACK AREA
860S-A-4SY	Striping - Paint	LF	82154	$0.40	$32,861	
871S-A-4W	Striping - Thermoplastic	LF	82154	$1.00	$82,154	
430S-B	Curb & Gutter	LF	38825	$22.00	$854,139	
480SNS	Median Pavers	SF	101566	$6.00	$609,395	
Intersections Summary						SEE DETAILED INTERSECTION QUANTITIES IN INTERSECTIONS TAB
	Crossing Pl				$286,268	
	Faro Dr				$281,660	
	Grove Blvd				$291,959	
	Montopolis Dr				$281,118	
	Maxwell Ln/Frontier Valley Dr				$278,679	
	SH71 (Ben White Blvd)				$252,000	
				TOTAL	**$171,265,485.03**	

Figure C-1: Four-lane Typical Section with Constrained Right-of-Way (Segments 1, 2 and 3)

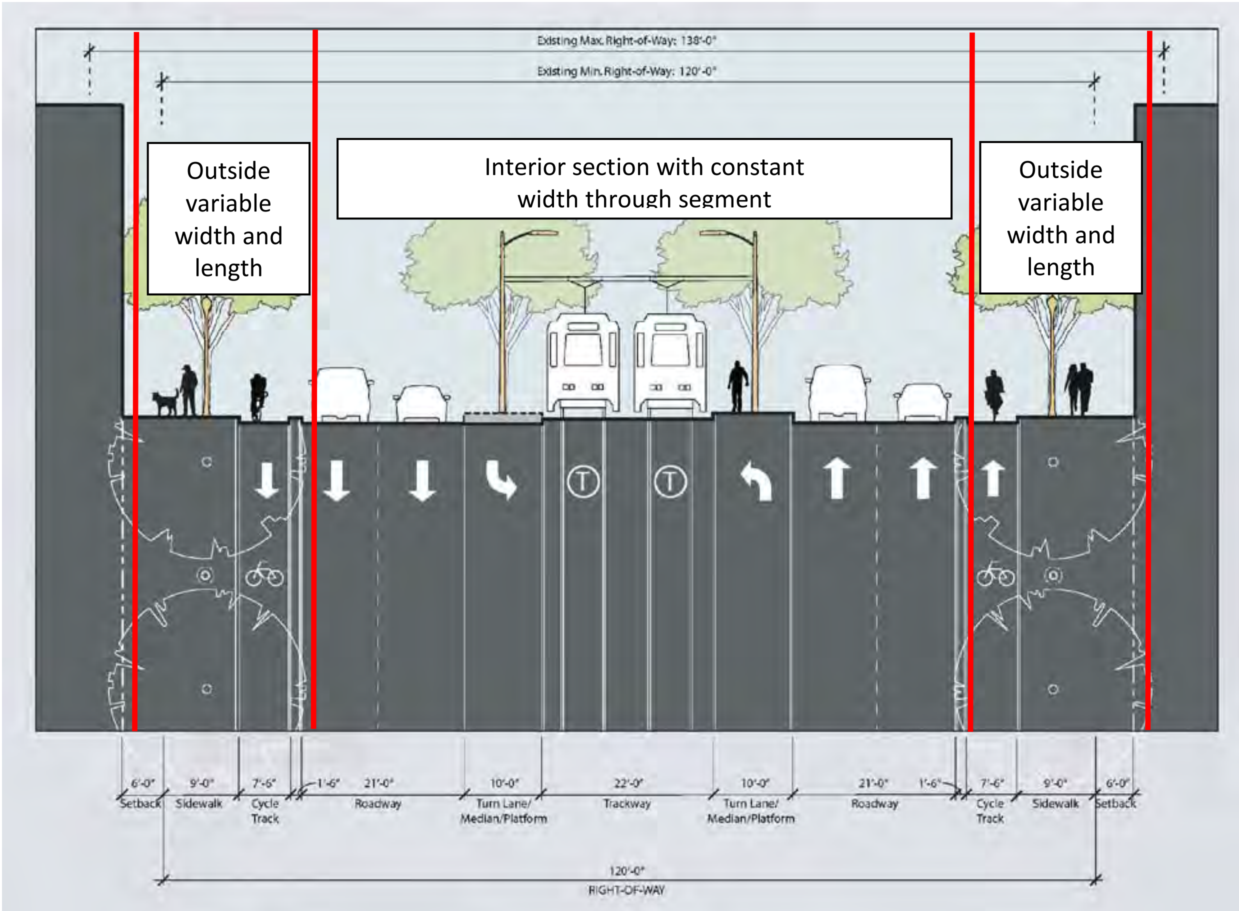
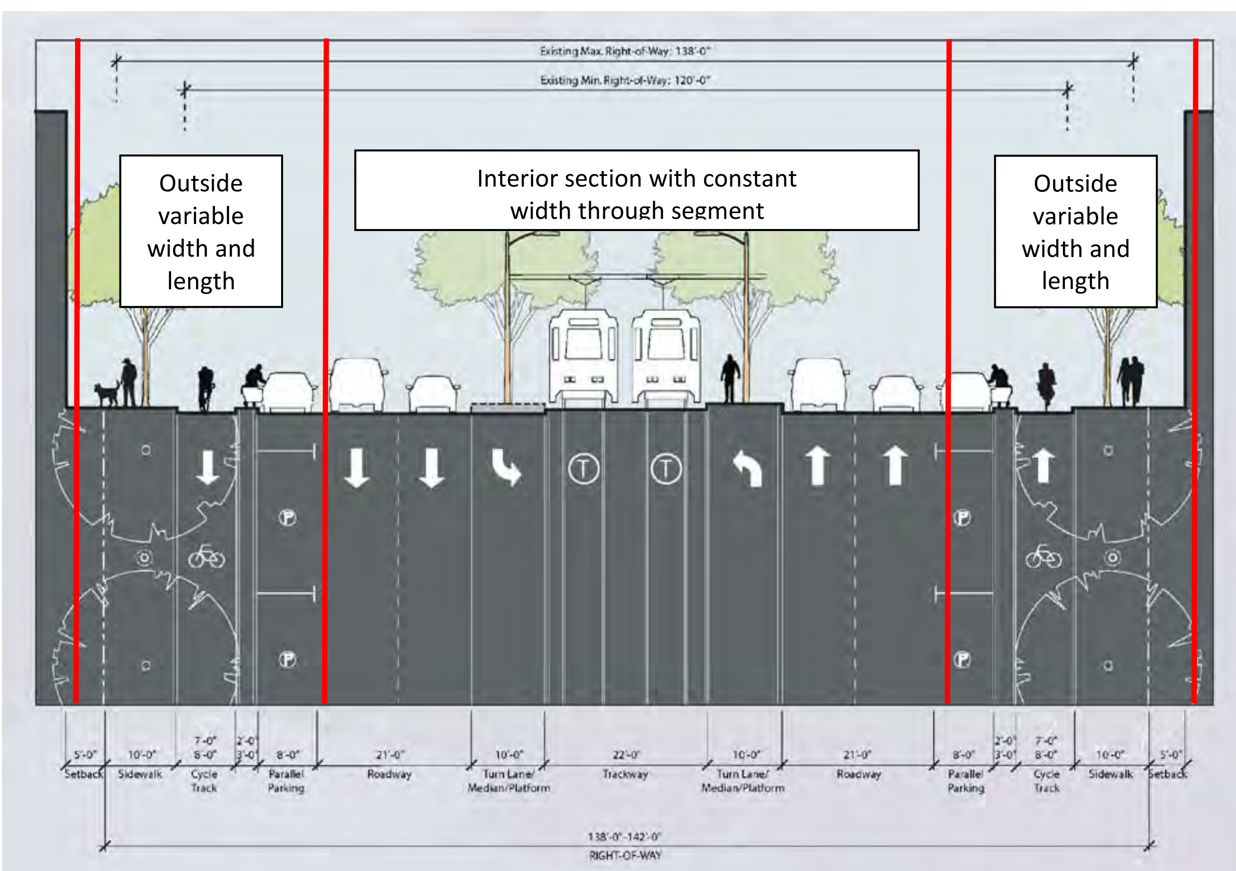


Figure C-2: Four-lane Typical Section with Parking (Segments 1, 2 and 3)



CITY OF AUSTIN
EAST RIVERSIDE DRIVE CORRIDOR IMPROVEMENTS
SEGMENT 1 - IH 35 TO WILLOW CREEK - 30% of Corridor
Segment Total Length (STA)= 48.0
Each STA = 100 lf

VARIABLE WIDTH AND LENGTH

Bid Code	Item Description	Unit	Segment 1 Total Quantity	Unit Cost ($/unit) From UNIT COSTS Sheet	Segment Construction Cost	NOTES:
Sidewalk/Cycle Track/Parking Improvements-No Parking						USE CONSTRAINED ROW TYPICAL SECTION
Improvements From ROW to Inside Edge of Parking or Outside of Cycle Track						
432S-4	Sidewalk - 4" Conc	SF	46144	$6.00	$276,862	ASSUMES 2 - 9' SIDEWALKS - SIDEWALKS 85% OF STA
360S-A-8	Cycle Track - 8" Conc Paving	SY	5027	$65.00	$326,726	ASSUMES 2 - 7.5' CYCLE TRACKS - FULL PAVEMENT SECTION
203S-A	Cycle Track - Lime Treatment	SY	5027	$5.50	$27,646	ASSUMES 2 - 7.5' CYCLE TRACKS - FULL PAVEMENT SECTION
604S-C	Seeding - Vegetated Areas	SY	3418	$2.00	$6,836	ASSUMES 2 - 6' SETBACK
Sidewalk/Cycle Track/Parking Improvements- Parking One Side						COMBINE CONSTRAINED ROW SECTION AND TYPICAL SECTION WITH PARKING
Improvements From ROW to Inside Edge of Parking or Outside of Cycle Track						
432S-4	Sidewalk - 4" Conc	SF	14063	$6.00	$84,380	ASSUMES 1 - 9' SIDEWALK AND 1 10' SIDEWALK - SIDEWALKS 85% OF STA
360S-A-8	Cycle Track - 8" Conc Paving	SY	1500	$65.00	$97,481	ASSUMES 1 - 7.5' CYCLE TRACK AND 1 - 8' CYCLE TRACK - FULL PAVEMENT SECTION
203S-A	Cycle Track - Lime Treatment	SY	1500	$5.50	$8,248	ASSUMES 1 - 7.5' CYCLE TRACK AND 1 - 8' CYCLE TRACK - FULL PAVEMENT SECTION
604S-C	Seeding - Vegetated Setback	SY	905	$2.00	$1,809	ASSUMES 1 - 6' SETBACK AND 1 - 5' SETBACK
360S-A-8	Parking Spaces - 8" Conc Paving	SY	140	$65.00	$9,128	ASSUMES 8 FT SPACES
203S-A	Parking Spaces- Lime Treatment	SY	140	$5.50	$772	ASSUMES 8 FT SPACES
3	Parking Meters	EA	17	$12,000.00	$208,991	ASSUMES 20' PARKING SPACES - 1 METER/10 SPACES
Sidewalk/Cycle Track/Parking Improvements- Parking Two Sides						USE TYPICAL SECTION WITH PARKING
Improvements From ROW to Inside Edge of Parking or Outside of Cycle Track						
432S-4	Sidewalk - 4" Conc	SF	15526	$6.00	$93,154	ASSUMES 2 - 10' SIDEWALKS - SIDEWALKS 85% OF STA
360S-A-8	Cycle Track - 8" Conc Paving	SY	1624	$65.00	$105,534	ASSUMES 2 - 8' CYCLE TRACKS - FULL PAVEMENT SECTION
203S-A	Cycle Track - Lime Treatment	SY	1624	$5.50	$8,930	ASSUMES 2 - 8' CYCLE TRACKS - FULL PAVEMENT SECTION
604S-C	Seeding - Vegetated Setback	SY	863	$2.00	$1,725	ASSUMES 2 - 5' SETBACK
360S-A-8	Parking Spaces - 8" Conc Paving	SY	309	$65.00	$20,079	ASSUMES 8 FT SPACES
203S-A	Parking Spaces- Lime Treatment	SY	309	$5.50	$1,699	ASSUMES 8 FT SPACES
3	Parking Meters	EA	37	$12,000.00	$438,372	ASSUMES 20' PARKING SPACES - 1 METER/10 SPACES

CONSTANT WIDTH THROUGH SEGMENT

Bid Code	Item Description	Unit	Segment 1 Total Quantity	Unit Cost ($/unit) From UNIT COSTS Sheet	Segment Construction Cost	NOTES:
Roadway Improvements - Typical Section with Constrained ROW & Typical Section with Parking						ALL TYPICAL SECTIONS HAVE SAME 84-FT SECTION THROUGH THE CENTER
Improvements From Inside Edge of Parking or Outside of Cycle Track to Opposite Parking or Cycle Track						
360S-A-8	8" Conc Paving	SY	33067	$65.00	$2,149,333	ASSUMES PAVEMENT ACROSS ENTIRE ROADWAY (EXCLUDES 22' FOR TRACKWAY)
203S-A	Lime Treatment	SY	33067	$5.50	$181,867	
430S-B	Curb & Gutter - Sidewalks	LF	9840	$22.00	$216,480	GRAPHICAL - FROM FACE OF CURB LEVEL, ONLY ON OUTSIDE LIMITS, INCLUDES CURB RETURNS ETC
430S-B	Curb & Gutter - Cycle Track Barrier	LF	7536	$22.00	$165,792	GRAPHICAL - MEASURED DISTANCE=1776 FROM "CYCLE CURB" LAYER X 2 FOR BOTH SIDES OF BARRIER
480SNS	Median Pavers - Cycle Track Barrier	SF	7536	$6.00	$45,216	ASSUMES 3' FOC TO FOC BARRIER
480SNS	Median/Platform - Median Pavers	SF	33600	$6.00	$201,600	COMBINED MEDIAN LENGTH =1580 LF , AVERAGE WIDTH = 10=FT
860S-A-4SY	Striping - Paint	LF	44160	$0.40	$17,664	GRAPHICAL - TOTAL LENGTH ON STRIPING LAYER = 20786 LF IN BASE FILE
871S-A-4W	Striping - Thermoplastic	LF	44160	$1.00	$44,160	GRAPHICAL - TOTAL LENGTH ON STRIPING LAYER = 20786 LF IN BASE FILE

SUMMARY ALL SECTIONS - USED FOR SEG TAB

Bid Code	Item Description	Unit	Segment 1 Total Quantity	Unit Cost ($/unit)	Segment Construction Cost
Roadway Improvements Summary - Variable and Constant					
432S-4	Sidewalk - 4" Conc	SF	75733	$6.00	$454,396
360S-A-8	8" Conc Paving	SY	41666	$65.00	$2,708,281
203S-A	Lime Treatment	SY	41666	$5.50	$229,162
604S-C	Seeding	SY	5185	$2.00	$10,371
3	Parking Meters	EA	54	$12,000.00	$647,363
860S-A-4SY	Striping - Paint	LF	44160	$0.40	$17,664
871S-A-4W	Striping - Thermoplastic	LF	44160	$1.00	$44,160
430S-B	Curb & Gutter	LF	17376	$22.00	$382,272
480SNS	Median Pavers	SF	41136	$6.00	$246,816
				TOTAL	**$ 4,740,484.74**

CITY OF AUSTIN
EAST RIVERSIDE DRIVE CORRIDOR IMPROVEMENTS
SEGMENT 2 - WILLOW CREEK TO WICKERSHAM- 10% of Corridor
Segment Total Length (STA)= 27.25
Each STA = 100 lf

OUTSIDE VARIABLE WIDTH AND LENGTH

Bid Code	Item Description	Unit	Segment 1 Total Quantity	Unit Cost ($/unit) From UNIT COSTS Sheet	Segment Construction Cost	NOTES:
Sidewalk/Cycle Track/Parking Improvements-No Parking						USE CONSTRAINED ROW TYPICAL SECTION
Improvements From ROW to Inside Edge of Parking or Outside of Cycle Track						
432S-4	Sidewalk - 4" Conc	SF	35190	$6.00	$211,140	ASSUMES 2 - 9' SIDEWALKS - SIDEWALKS 85% OF STA
360S-A-8	Cycle Track - 8" Conc Paving	SY	3833	$65.00	$249,167	ASSUMES 2 - 7.5' CYCLE TRACKS - FULL PAVEMENT SECTION
203S-A	Cycle Track - Lime Treatment	SY	3833	$5.50	$21,083	ASSUMES 2 - 7.5' CYCLE TRACKS - FULL PAVEMENT SECTION
604S-C	Seeding - Vegetated Areas	SY	2607	$2.00	$5,213	ASSUMES 2 - 6' SETBACK
Sidewalk/Cycle Track/Parking Improvements- Parking One Side						COMBINE CONSTRAINED ROW SECTION AND TYPICAL SECTION WITH PARKING
Improvements From ROW to Inside Edge of Parking or Outside of Cycle Track						
432S-4	Sidewalk - 4" Conc	SF	6864	$6.00	$41,183	ASSUMES 1 - 9' SIDEWALK AND 1 -10' SIDEWALK - SIDEWALKS 85% OF STA
360S-A-8	Cycle Track - 8" Conc Paving	SY	732	$65.00	$47,576	ASSUMES 1 - 7.5' CYCLE TRACK AND 1 - 8' CYCLE TRACK - FULL PAVEMENT SECTION
203S-A	Cycle Track - Lime Treatment	SY	732	$5.50	$4,026	ASSUMES 1 - 7.5' CYCLE TRACK AND 1 - 8' CYCLE TRACK - FULL PAVEMENT SECTION
604S-C	Seeding - Vegetated Setback	SY	442	$2.00	$883	ASSUMES 1 - 6' SETBACK AND 1 - 5' SETBACK
360S-A-8	Parking Spaces - 8" Conc Paving	SY	59	$65.00	$3,830	ASSUMES 8 FT SPACES
203S-A	Parking Spaces- Lime Treatment	SY	59	$5.50	$324	ASSUMES 8 FT SPACES
3	Parking Meters	EA	9	$12,000.00	$102,000	ASSUMES 20' PARKING SPACES - 1 METER/10 SPACES - BUS STOPS NO PARKING?????

CONSTANT WIDTH THROUGH SEGMENT

Bid Code	Item Description	Unit	Segment 1 Total Quantity	Unit Cost ($/unit) From UNIT COSTS Sheet	Segment Construction Cost	NOTES:
Roadway Improvements - All Cross Sections						ALL TYPICAL SECTIONS HAVE SAME 84-FT SECTION THROUGH THE CENTER
Improvements From Inside Edge of Parking or Outside of Cycle Track to Opposite Parking or Cycle Track						
432S-4	Sidewalk - 4" Conc	SF	28500	$6.00	$171,000	THIS IS THE ADDITIONAL AMOUNT OF SIDEWALK IN PARK AREA MEASURED GRAPHICALLY
360S-A-8	8" Conc Paving	SY	825	$65.00	$53,625	THIS IS THE ADDITIONAL AMOUNT OF ROADWAY IN PARK AREA (FOR U-TURN LANES) MEASURED GRAPHICALLY
203S-A	Lime Treatment	SY	825	$5.50	$4,538	THIS IS THE ADDITIONAL AMOUNT OF ROADWAY IN PARK AREA MEASURED GRAPHICALLY
360S-A-8	8" Conc Paving	SY	25433	$65.00	$1,653,167	ASSUMES PAVEMENT ACROSS ENTIRE ROADWAY AND TRACK WAY INCLUDING MEDIAN/PLATFORM
203S-A	Lime Treatment	SY	25433	$5.50	$139,883	
430S-B	Curb & Gutter - Sidewalks	LF	20301	$22.00	$446,628	GRAPHICAL - FROM FACE OF CURB LEVEL, ALL CURB EXCEPT ASSOCIATED W/TRACK
430S-B	Curb & Gutter - Cycle Track Barrier	LF	2889	$22.00	$63,547	GRAPHICAL - MEASURED DISTANCE=1776 FROM "CYCLE CURB" LAYER X 2 FOR BOTH SIDES OF BARRIER
480SNS	Median Pavers - Cycle Track Barrier	SF	2889	$6.00	$17,331	ASSUMES 3' FOC TO FOC BARRIER
480SNS	Median/Platform - Median Pavers	SF	13705	$6.00	$82,230	EXTRA SIDEWALK AREA AND PEDESTRIAN AREA ON PAVERS LEVEL
860S-A-4SY	Striping - Paint	LF	24743	$0.40	$9,897	GRAPHICAL - TOTAL LENGTH ON STRIPING LAYER = 20786 LF IN BASE FILE
871S-A-4W	Striping - Thermoplastic	LF	24743	$1.00	$24,743	

SUMMARY ALL SECTIONS - USED FOR SEG TAB

Bid Code	Item Description	Unit	Segment 1 Total Quantity	Unit Cost ($/unit) From UNIT COSTS Sheet	Segment Construction Cost
Roadway Improvements Summary - Variable and Constant					
432S-4	Sidewalk - 4" Conc	SF	70554	$6.00	$423,323
360S-A-8	8" Conc Paving	SY	30883	$65.00	$2,007,364
203S-A	Lime Treatment	SY	30883	$5.50	$169,854
604S-C	Seeding	SY	3048	$2.00	$6,096
3	Parking Meters	EA	9	$12,000.00	$102,000
860S-A-4SY	Striping - Paint	LF	24743	$0.40	$9,897
871S-A-4W	Striping - Thermoplastic	LF	24743	$1.00	$24,743
430S-B	Curb & Gutter	LF	23190	$22.00	$510,175
480SNS	Median Pavers	SF	16594	$6.00	$99,561
				TOTAL	**$3,353,013**

CITY OF AUSTIN
EAST RIVERSIDE DRIVE CORRIDOR IMPROVEMENTS
SEGMENT 3 - WICKERSHAM TO US 71- 60% of Corridor
Segment Total Length (STA)= 107.25
Each STA = 100 lf

	Bid Code	Item Description	Unit	Segment 3 Total Quantity	Unit Cost ($/unit) From UNIT COSTS Sheet	Segment Construction Cost	NOTES:
VARIABLE WIDTH AND LENGTH	**Sidewalk/Cycle Track/Parking Improvements-No Parking**						USE CONSTRAINED ROW TYPICAL SECTION
	Improvements From ROW to Inside Edge of Parking or Outside of Cycle Track						
	432S-4	Sidewalk - 4" Conc	SF	164093	$6.00	$984,555	ASSUMES 2 - 9' SIDEWALKS - SIDEWALKS 85% OF STA
	360S-A-8	Cycle Track - 8" Conc Paving	SY	17875	$65.00	$1,161,875	ASSUMES 2 - 7.5' CYCLE TRACKS - FULL PAVEMENT SECTION
	203S-A	Cycle Track - Lime Treatment	SY	17875	$5.50	$98,313	ASSUMES 2 - 7.5' CYCLE TRACKS - FULL PAVEMENT SECTION
	604S-C	Seeding - Vegetated Areas	SY	12155	$2.00	$24,310	ASSUMES 2 - 6' SETBACK
CONSTANT WIDTH THROUGH SEGMENT	**Roadway Improvements - All Cross Sections**						ALL TYPICAL SECTIONS HAVE SAME 84-FT SECTION THROUGH THE CENTER
	Improvements From Inside Edge of Parking or Outside of Cycle Track to Opposite Parking or Cycle Track						
	360S-A-8	8" Conc Paving	SY	73883	$65.00	$4,802,417	ASSUMES PAVEMENT ACROSS ENTIRE ROADWAY (EXCLUDES 22' FOR TRACKWAY)
	203S-A	Lime Treatment	SY	73883	$5.50	$406,358	
	430S-B	Curb & Gutter - Sidewalks	LF	21986	$22.00	$483,698	GRAPHICAL - FROM FACE OF CURB LEVEL, ONLY ON OUTSIDE LIMITS, INCLUDES CURB RETURNS ETC
	430S-B	Curb & Gutter - Cycle Track Barrier	LF	16838	$22.00	$370,442	GRAPHICAL - MEASURED DISTANCE FROM "CYCLE CURB" LAYER X 2 FOR BOTH SIDES OF BARRIER
	480SNS	Median Pavers - Cycle Track Barrier	SF	16838	$6.00	$101,030	ASSUMES 3' FOC TO FOC BARRIER
	480SNS	Median/Platform - Median Pavers	SF	84728	$6.00	$508,365	COMBINED MEDIAN LENGTH =1580 LF , AVERAGE WIDTH = 10=FT
	860S-A-4SY	Striping - Paint	LF	82154	$0.40	$32,861	GRAPHICAL - TOTAL LENGTH ON STRIPING LAYER = 20786 LF IN BASE FILE
	871S-A-4W	Striping - Thermoplastic	LF	82154	$1.00	$82,154	

	Bid Code	Item Description	Unit	Segment 3 Total Quantity	Unit Cost ($/unit)	Segment Construction Cost
SUMMARY ALL SECTIONS - USED FOR SEG TAB	**Roadway Improvements Summary - Variable and Constant**					
	432S-4	Sidewalk - 4" Conc	SF	164093	$6.00	$984,555
	360S-A-8	8" Conc Paving	SY	91758	$65.00	$5,964,292
	203S-A	Lime Treatment	SY	91758	$5.50	$504,671
	604S-C	Seeding	SY	12155	$2.00	$24,310
	860S-A-4SY	Striping - Paint	LF	82154	$0.40	$32,861
	871S-A-4W	Striping - Thermoplastic	LF	82154	$1.00	$82,154
	430S-B	Curb & Gutter	LF	38825	$22.00	$854,139
	480SNS	Median Pavers	SF	101566	$6.00	$609,395
					TOTAL	**$9,056,376**

Culvert Extension Improvements

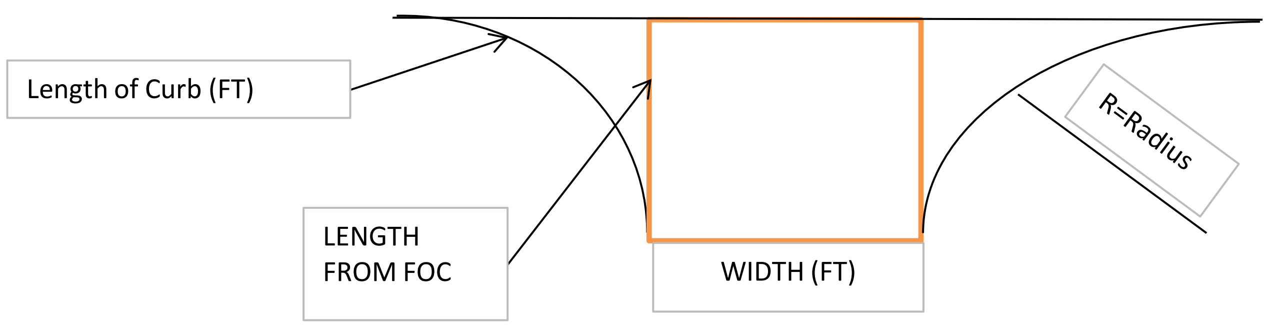
Bid Code	Item Description	Unit	Cost/Unit	Quantity	Total Cost	NOTES:
Culvert extension located at SE of intersection of Riverside Drive and Willow Creek Road.						
432-PRC	Pedestrian Railing	LF	$70.00	55	$3,850.00	Assume 2 boxes side by side.
559S	Box Culvert	LF	$485.00	30	$14,550.00	Assume culverts extented 15 lf beyond existing roadway on one side only.
591S-G	Concrete Rip-Rap	CY	$270.00	20	$5,400.00	Assume concrete used for approach apron at 5" thick, 40 lf wide, and 33 lf long.
508S-H	Headwall	EA	$11,500.00	1	$11,500.00	
				Total	**$35,300.00**	

Residential and Commercial Driveways

Bid Code	Item Description	Quantity	Unit	Cost/Unit	Total Cost	NOTES:
Type 1 Residential Driveways						**Assumes Type 1 Residntial Per COA Standard Drawing No. 433S-1**
360S-A-8	8" Conc Paving	18	SY	$65.00	$1,160.61	Width = 15', Radius = 5', Length of replacement from FOC back = 10'
203S-A	6' Lime Treatment	18	SY	$5.50	$98.21	Surface Area (sf)** = 160.7
110S-A	Excavation	41	CY	$35.00	$1,449.87	Length of Curb on One side (ft) = 7.9
430S-B	Type II Curb	16	LF	$22.00	$347.60	Quantity applied to both commercial and unsignalized intersecting roadways.
				Subtotal	**$3,056.29**	
Type 2 Commercial Driveways*						**Assumes Type 2 Commercial Per COA Standard Drawing No. 433S-2**
360S-A-8	8" Conc Paving	38	SY	$65.00	$2,476.50	Width = 30', Radius = 10', Length of replacement from FOC back = 10'
203S-A	6' Lime Treatment	38	SY	$5.50	$209.55	Surface Area (sf)** = 342.9
110S-A	Excavation	88	SF	$35.00	$3,093.72	Length of Curb on One side (ft) = 15.7
430S-B	Type II Curb	31	LF	$22.00	$690.80	
				Subtotal	**$6,470.57**	

*Commercial Driveways also incorporate the intersecting roadways which do not have any traffic lighting associated with them.

**Area measured from CAD generated graphics for typical section



Driveway Counts	Segment 1	Segment 2	Segment 3
Residential Driveways	0	0	28
Commercial	38	11	41

Water and Wastewater						Replacement of parallel utilities underneath the rail alignment.
Bid Code	**Item Description**	**Quantity**	**Unit**	**Cost/Unit**	**Total Cost**	**NOTES:**
Segment 1						
510AWW	Replace Sanitary Sewer 12" and Under	1200	LF	$78.00	$93,600.00	
506 M1WW	Replace SSMH	4	EA	$5,000.00	$20,000.00	Assume one manhole per 300 lf pipe
510AW	Replace Water Main Up to 24"	520	LF	$100.00	$52,000.00	
511S	Replace Water Valves	1	EA	$1,100.00	$1,100.00	Assume one valve per 500 lf
506ABEE	Abandon Existing Manholes	4	EA	$510.00	$2,040.00	Same as Replacement
511S-B	Relocate Hydrant	3	EA	$3,000.00	$9,000.00	GRAPHICAL - NUMBER OF HYDRANTS OVER WHOLE SEGMENT IN ROW, COST FOR NEW HYDRANT ASSEMBLY
510-AW 6DIA	WL Extension for Hydrant Relocation	60	LF	$70.00	$4,200.00	ASSUME 20 LF OF 6' DI WL PER HYDRANT
506-4	Adjust manhole	35	EA	$352.20	$12,327.00	GRAPHICAL - 6 SS +29 WW OVER ENTIRE SEGMENT
504S-3W	Adjust Water valve	53	EA	$250.00	$13,250.00	GRAPHICAL - INCLUDES CONTROL VALVES, METERS, OPERATING VALVES, CONNECTION, BACKFLOW PREVENTERS, ZONE VALVES IN THE ROW
				Subtotal	**$207,517.00**	
Segment 2						
510AWW	Replace Sanitary Sewer 12" and Under	0	LF	$78.00	$-	
506 M1WW	Replace SSMH	0	EA	$5,000.00	$-	Assume one manhole per 300 lf pipe
510AW	Replace Water Main Up to 24"	800	LF	$100.00	$80,000.00	
511S	Replace Water Valves	2	EA	$1,100.00	$2,200.00	Assume one valve per 500 lf
506ABEE	Abandon Existing Manholes	0	EA	$510.00	$-	Same as Replacement
511S-B	Relocate Hydrant	2	EA	$3,000.00	$6,000.00	
510-AW 6DIA	WL Extension for Hydrant Relocation	40	LF	$70.00	$2,800.00	
506-4	Adjust manhole	18	EA	$352.20	$6,339.60	
504S-3W	Adjust Water valve	35	EA	$250.00	$8,750.00	
				Subtotal	**$106,089.60**	
Segment 3						
510AWW	Replace Sanitary Sewer 12" and Under	2800	LF	$78.00	$218,400.00	
506 M1WW	Replace SSMH	10	EA	$5,000.00	$50,000.00	Assume one manhole per 300 lf pipe
510AW	Replace Water Main Up to 24"	5300	LF	$100.00	$530,000.00	
511S	Replace Water Valves	11	EA	$1,100.00	$12,100.00	Assume one valve per 500 lf
506ABEE	Abandon Existing Manholes	10	EA	$510.00	$5,100.00	Same as Replacement
511S-B	Relocate Hydrant	9	EA	$3,000.00	$27,000.00	GRAPHICAL - NUMBER OF HYDRANTS OVER WHOLE SEGMENT IN ROW COST FOR NEW HYDRANT ASSEMBLY ONLY, NO WL
510-AW 6DIA	WL Extension for Hydrant Relocation	180	LF	$70.00	$12,600.00	ASSUME 20 LF OF 6' DI WL PER HYDRANT
506-4	Adjust manhole	41	EA	$352.20	$14,440.20	GRAPHICAL - 10 SS (ESTIMATED) +31 WW OVER ENTIRE SEGMENT
504S-3W	Adjust Water valve	81	EA	$250.00	$20,250.00	GRAPHICAL - INCLUDES CONTROL VALVES, METERS, OPERATING VALVES, CONNECTION, BACKFLOW PREVENTERS, ZONE VALVES IN THE ROW
				Subtotal	**$889,890.20**	

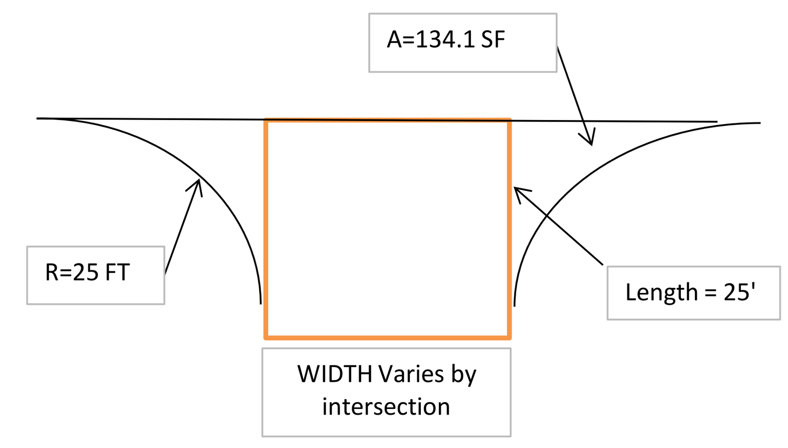
Intersection Improvements

Bid Code	Item Description	North Cross Street Width (ft)	South Cross Street Width (ft)	Excavation Depth (ft)	North Intersection Area (SY)	South Intersection Area (SY)	Total Quantity	Unit	Cost/Unit	Total Cost
IH 35										
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving							SY	$65.00	$-
203S-A	6' Lime Treatment							SY	$5.50	$-
110S-A	Excavation			1.16				CY	$35.00	$-
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$252,000.00**
Lakeshore Blvd		**59**	**23**							
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				194	94	287	SY	$65.00	$18,676.67
203S-A	6' Lime Treatment				194	94	287	SY	$5.50	$1,580.33
110S-A	Excavation			1.16	387	187	222	CY	$35.00	$7,777.16
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$280,034.16**
Parker Ln/Arena Dr		**44**	**40**							
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				152	141	293	SY	$65.00	$19,037.78
203S-A	6' Lime Treatment				152	141	293	SY	$5.50	$1,610.89
110S-A	Excavation			1.16	304	282	227	CY	$35.00	$7,927.53
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$280,576.19**
Royal Crest Dr		**0**	**40**							
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				0	141	141	SY	$65.00	$9,157.78
203S-A	6' Lime Treatment				0	141	141	SY	$5.50	$774.89
110S-A	Excavation			1.16	0	282	109	CY	$35.00	$3,813.39
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$265,746.06**
Burton Dr/Tinnin Ford Rd		**47**	**46**							
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				160	158	318	SY	$65.00	$20,662.78
203S-A	6' Lime Treatment				160	158	318	SY	$5.50	$1,748.39
110S-A	Excavation			1.16	321	315	246	CY	$35.00	$8,604.19
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$283,015.36**
Willow Creek Dr		**24**	**43**							
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				96	149	246	SY	$65.00	$15,968.33
203S-A	6' Lime Treatment				96	149	246	SY	$5.50	$1,351.17
110S-A	Excavation			1.16	193	298	190	CY	$35.00	$6,649.38
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$275,968.88**
Pleasant Valley Rd		**56**	**56**							
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				185	185	371	SY	$65.00	$24,093.33
203S-A	6' Lime Treatment				185	185	371	SY	$5.50	$2,038.67
110S-A	Excavation			1.16	371	371	287	CY	$35.00	$10,032.71
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$288,164.71**
Wickersham Ln		**56**	**64**							
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				185	208	393	SY	$65.00	$25,537.78
203S-A	6' Lime Treatment				185	208	393	SY	$5.50	$2,160.89
110S-A	Excavation			1.16	371	415	304	CY	$35.00	$10,634.19
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$290,332.86**
Crossing Pl		**80**	**25**							
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				252	99	351	SY	$65.00	$22,829.44
203S-A	6' Lime Treatment				252	99	351	SY	$5.50	$1,931.72
110S-A	Excavation			1.16	504	198	272	CY	$35.00	$9,506.41
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$286,267.58**
Faro Dr		**44**	**44**							
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				152	152	304	SY	$65.00	$19,760.00
203S-A	6' Lime Treatment				152	152	304	SY	$5.50	$1,672.00
110S-A	Excavation			1.16	304	304	235	CY	$35.00	$8,228.27
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$281,660.27**
Grove Blvd		**63**	**63**							
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				205	205	410	SY	$65.00	$26,621.11
203S-A	6' Lime Treatment				205	205	410	SY	$5.50	$2,252.56
110S-A	Excavation			1.16	410	410	317	CY	$35.00	$11,085.30
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$291,958.97**
Montopolis Dr		**45**	**41**							
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				155	144	298	SY	$65.00	$19,398.89
203S-A	6' Lime Treatment				155	144	298	SY	$5.50	$1,641.44
110S-A	Excavation			1.16	310	287	231	CY	$35.00	$8,077.90
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$281,118.23**
Maxwell Ln/Frontier Valley Dr		**47**	**30**							
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				160	113	273	SY	$65.00	$17,773.89
203S-A	6' Lime Treatment				160	113	273	SY	$5.50	$1,503.94
110S-A	Excavation			1.16	321	226	211	CY	$35.00	$7,401.23
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$278,679.06**
SH71 (Ben White Blvd)										
INT-1	Upgrade Existing Traffic Signal For Rail						1	LS	$150,000.00	$150,000.00
INT-2	Modify Traffic Signals						1	LS	$100,000.00	$100,000.00
360S-A-8	8" Conc Paving				0	0	0	SY	$65.00	$-
203S-A	6' Lime Treatment				0	0	0	SY	$5.50	$-
110S-A	Excavation			1.16	0	0	0	CY	$35.00	$-
INT-3	Miscellaneous Intersection Improvements						1	EA	$2,000.00	$2,000.00
									Subtotal	**$252,000.00**

NOTES:

Assume intersection improvements are at BCR with no additional ROW required.

The intersection improvements are assumed at FOC off Riverside Dr. to BCR at 25' radius based on width of street intersecting street (FOC to FOC).
For every intersecting roadway tie in, the total area of surface adjacent to the radius projected to the curb line on each side of the intersecting street used is 268 ft^2 (134.1 * 2 from CAD graphics) plus the intersecting street width times 25.



Project Bid item	Unit	Item Description	COA Cost	TxDOT Cost	Other Cost	Cost Used	Notes:
1	EA	Pedestrain H.A.W.K.S.			$80,000.00	$80,000.00	From meeting w/ HDR
2	LS	MISCELANOUS SIDEWALK AREA IMPROVEMENTS (TRASH CANS ETC)			$5,000.00	$5,000.00	
3	EA	PARKING PAY STATIONS			$12,000.00	$12,000.00	http://www.mckinneytexas.org/uploadedFiles/Departments/Development_Services/Planning/Long_Range/McKinney%20Rate%20Study,%20Final%20Draft%209.1.10.pdf
4	EA	ILLUMINATION				$6,000.00	ASSUME COST FOR ALL NEW ORNAMENTAL ILLUMINATION PER POLE
01025-5	EA	EMPLOYEE PARKING LOT BUS STOP SHELTER	$10,000.00			$10,000.00	
101S-B	STA	PREPARING RIGHT OF WAY			$1,000.00	$1,000.00	
104S-C	SF	REMOVE P.C. CONCRETE SIDEWALKS AND DRIVEWAYS	$4.50			$4.50	
110S-A	CY	STREET EXCAVATION	$35.00			$35.00	
203S-A	SY	LIME TREATED SUBGRADE (6 IN THICKNESS)	$5.50	$2.25		$5.50	$1.5/sy state , 2.4/sy AUS
210S-A	CY	FLEXIBLE BASE	$45.00			$45.00	
315S-A	SY	SURFACE MILLING	$20.00			$20.00	
340S-B-4	SY	HOT MIX ASPHALTIC CONCRETE PAVEMENT, TYPE C (4" THICK)	$18.00			$18.00	
360S-A	SY	10" CONCRETE BUS PAD	$85.00			$85.00	
360S-A-8	SY	8 IN CONCRETE PAVEMENT	$65.00	$32.00		$65.00	TxDOT from State AVG
430S-B	LF	PC CONCRETE CURB AND GUTTER (FINE GRADING)	$22.00			$22.00	430S-A includes full excanation etc, 430S-B includes minor excavation
432-PRC	LF	Pedestrian ADA Railing-Option 2 (Standard 707S-3)	$70.00			$70.00	
432S-4	SF	NEW P.C. CONCRETE SIDEWALKS, 4 INCH THICKNESS	$6.00			$6.00	
432S-RP-1	EA	PC SIDEWALK CURB RAMP WITH PAVERS (TYPE 1)	$1,200.00			$1,200.00	
432S-SAC-1	EA	STREETSCAPE BENCH (60 INCHES IN LENGTH)	$2,200.00			$2,200.00	
432S-SAC-3	EA	STREETSCAPE BICYCLE RACK	$395.00			$395.00	
432S-SAC-4	EA	STREETSCAPE TRASH RECEPTACLE	$1,880.00			$1,880.00	
437S-B-72	EA	72" TREE GRATE AND FRAME, COMLPETE, IN PLACE	$2,000.00			$2,000.00	
480SNS	SF	CONCRETE PAVER UNITS FOR SIDEWALK	$6.00			$6.00	
504S-1RM	EA	REPOSITIONING & ADJUSTING WATER METERS	$300.00			$300.00	
504S-3W	EA	ADJUSTING WATER VALVE BOXES TO GRADE	$250.00			$250.00	
506 M1WW	EA	Standard Pre-cast Manhole w/ Cast in Place Base, 48" Dia.				$5,000.00	
506-4	EA	MINOR MANHOLE HEIGHT ADJUSTMENT	$352.20			$352.20	
506ABEE	EA	ABANDON EXISTING WW MANHOLE PER EACH	$510.00			$510.00	
508S-I10S	EA	INLET, STANDARD	$3,500.00			$3,500.00	
508S-H	LS	HEADWALL (RCB, 10' x 5')	$11,500.00			$11,500.00	
510-ASD18	LF	PIPE, 18" DIA. RCP TYPE (ALL DEPTHS), INCLUDING EXCAVATION AND BACKFILL	$60.00			$60.00	
510-ASD24	LF	PIPE, 24" DIA., CL III CONCRETE (ALL DEPTHS) INCLUDING EXCAVATION AND BACKFILL	$70.00			$70.00	
510AW	LF	24" D.I. WATER CLASS 250. FITTINGS ARE SUBSIDIARY TO THE BID ITEM.	$100.00			$100.00	
510-AW 6DIA	LF	PIPE, 6" DIA, CLASS 350 DUCTILE IRON TYPE (ALL DEPTHS), INCLUDING EXCAVATION AND BACKFILL	$70.00			$70.00	
510AWW	LF	PIPE, 12" DIA PVC SDR-26 TYPE (ALL DEPTHS), INCLUDING EXCAVATION AND BACKFILL	$78.00			$78.00	
511S	EA	8" MJ GATE VALVE	$1,100.00			$1,100.00	
511S-B	EA	FIRE HYDRANTS	$3,000.00			$3,000.00	
559S	LF	PRECAST CONCRETE BOX CULVERTS, 8 FT X 6 FT	$485.00			$485.00	
591S-G	CY	CONCRETE RIP RAP	$270.00			$270.00	
604S-C	SY	NATIVE SEEDING FOR EROSION CONTROL FIBER MULCH	$2.00			$2.00	
608S	EA	Planting, Tree	$350.00			$350.00	
639S	LF	ROCK BERM	$30.00			$30.00	
641S	EA	STABILIZED CONSTRUCTION ENTRANCE	$1,300.00			$1,300.00	
642S	LF	SILT FENCE FOR EROSION CONTROL	$2.50			$2.50	
824S	EA	TRAFFIC SIGNS	$300.00			$300.00	
860S-A-4SY	LF	PAVEMENT MARKING PAINT, 4-INCH, SOLID YELLOW	$0.40			$0.40	
871S-A-4W	LF	REFLECTORIZED TYPE I THERMOPLASTIC PAVEMENT MARKINGS, 4 INCHES IN WIDTH, WHITE IN COLOR	$1.00			$1.00	
Bridge	SF	RAIL BRIDGE OVER COUNTRY CLUB CREEK	$100.00			$100.00	
DRV-1	EA	Residential Driveways				$3,056.29	
DRV-2	EA	Commercial Driveways				$6,470.57	
INT-1	LS	UPGRADE EXISTING TRAFFIC SIGNAL FOR RAIL			$150,000.00	$150,000.00	From meeting w/ HDR
INT-2	LS	MODIFY TRAFFIC SIGNALS			$100,000.00	$100,000.00	FROM TIA STUDY (RYAN)
INT-3	EA	MISCELANOUS INTERSECTION IMPROVEMENTS				$2,000.00	FOR PEDESTRIAN ISLANDS, ADDITIONAL SIDEWALK, STRIPING, ADA RAMPS
PARK-1	LF	PEDESTRIAN SHADE STRUCTURES					
PARK-2	LS	PARK STAGE AREA					
PARK-3	EA	UNLOADING NEAR TRAINS					
PARK-4	EA	SHADED PICNIC AREA					

Austin Urban Rail Conceptual Engineering Order of Magnitude Cost Estimate

ERC Summary

Item	Cost Category	Quantity	Units	Unit Price	Subtotal	E&A%	E&A	Allocated Cont %	Allocated Contingency	Summary Total	YoE	YoE Subtotal
	Track Miles	6.12	Cost/TM	$41,357,354	All unit prices in 2010 Q1 dollars					Phase Start Year	0.00	
	Route Miles	3.06	Cost/RM	$82,714,707		4.00%	0.17				4.00%	
1.0	Embedded Trackwork - Furnish Girder Rail	-	TF	$80	$0	31%	$0	20%	$0	$0	1.00	$0
2.0	Embedded Trackwork - Construct Track Slab	-	TF	$300	$0	31%	$0	10%	$0	$0	3.50	$0
3.0	Semi-Exclusive - Double Track	4,008	RF	$800	$3,206,000	31%	$993,860	20%	$641,200	$4,841,060	3.50	$0
4.0	Special Trackwork-Turnout/Crossing Diamond	5	EA	$170,000	$850,000	31%	$263,500	10%	$85,000	$1,198,500	1.00	$0
5.0	TPSS (Traction Power Supply System) - OCS - Single Track	-	TF	$250	$0	31%	$0	15%	$0	$0	4.00	$0
6.0	TPSS (Traction Power Supply System) - OCS - Double Track	4,008	RF	$400	$1,603,000	31%	$496,930	20%	$320,600	$2,420,530	4.00	$0
7.0	TPSS - Substation	2	EA	$900,000	$1,366,193	31%	$423,520	20%	$273,239	$2,062,952	4.00	$0
8.0	Traffic Signal - New (or Complete Rebuild)	-	EA	$120,000	$0	31%	$0	20%	$0	$0	4.00	$0
9.0	Traffic Signal Modification - High	4	EA	$75,000	$300,000	31%	$93,000	20%	$60,000	$453,000	4.00	$0
10.0	Traffic Signal Modification - Medium	-	EA	$50,000	$0	31%	$0	20%	$0	$0	4.00	$0
11.0	Traffic Signal Modification - Low	-	EA	$25,000	$0	31%	$0	20%	$0	$0	4.00	$0
12.0	Single Track Signaling System	-	EA	$1,500,000	$0	31%	$0	20%	$0	$0	4.00	$0
13.0	Transit Signal Priority (TSP) Equipment Upgrade Allowance	4,008	TF	$5	$20,038	31%	$6,212	10%	$2,004	$28,253	4.00	$0
14.0	Civil - Roadway Pavement (Allowance)	-	TF	$100	$0	31%	$0	20%	$0	$0	4.00	$0
15.0	Civil - Roadway Reconstruction (Semi-Exclusive)	4,008	RF	$350	$1,402,625	31%	$434,814	30%	$420,788	$2,258,226	4.00	$0
16.0	Civil - Retaining Wall	-	SF	$100	$0	31%	$0	20%	$0	$0	4.00	$0
17.0	Civil - Urban Improvement Allowance (Sidewalks, Driveways, etc)	8,015	TF	$20	$160,300	31%	$49,693	20%	$32,060	$242,053	4.00	$0
18.0	Civil - Curb Ramp/ADA Upgrade Allowance (Per Intersection)	5	EA	$15,000	$75,000	31%	$23,250	20%	$15,000	$113,250	4.00	$0
19.0	Civil - Parking Modification/Conversion Allowance	-	LF	$60	$0	31%	$0	30%	$0	$0	4.00	$0
20.0	Existing Structure - South 1st Street Bridge	-	LS	$19,485,000	$0	31%	$0	30%	$0	$0	4.00	$0
21.0	Existing Structure - Congress Avenue Bridge	-	LS	$13,841,000	$0	31%	$0	30%	$0	$0	4.00	$0
22.0	New Structure - 3rd Street at Shoal Creek	-	SF	$250	$0	31%	$0	30%	$0	$0	4.00	$0
23.0	Replacement Structure - Miscellaneous	-	SF	$100	$0	31%	$0	30%	$0	$0	4.00	$0
24.0	Existing Structure - Riverside Drive at I-35*	-	TF	$700	$0	31%	$0	30%	$0	$0	4.00	$0
25.0	New Structure - Lady Bird Lake (LBL) Crossing	-	SF	$265	$0	15%	$0	40%	$0	$0	3.75	$0
26.0	New Structure - LBL Signature Structure Allowance	-	SF	$400	$0	15%	$0	40%	$0	$0	3.75	$0
27.0	New Structure - E. Riverside at US 183 Elevated Guideway	836	LF	$8,000	$6,690,909	31%	$2,074,182	30%	$2,007,273	$10,772,364	4.00	$0
28.0	Utilities - High Allowance	-	TF	$600	$0	31%	$0	40%	$0	$0	2.75	$0
29.0	Utilities - Medium Allowance	1,320	TF	$300	$396,000	31%	$122,760	40%	$158,400	$677,160	2.75	$0
30.0	Utilities - Low Allowance	6,695	TF	$100	$669,500	31%	$207,545	40%	$267,800	$1,144,845	2.75	$0
31.0	Stormwater Drainage Allowance	4,008	TF	$75	$300,563	31%	$93,174	20%	$60,113	$453,849	4.00	$0
32.0	Street Lighting Modification Allowance	4,008	TF	$10	$40,075	31%	$12,423	30%	$12,023	$64,521	4.00	$0
33.0	Stop Platforms - Standard	-	EA	$80,000	$0	31%	$0	20%	$0	$0	4.00	$0
34.0	Stop Platforms - Semi-Exclusive Median	2	EA	$500,000	$750,000	31%	$232,500	20%	$150,000	$1,132,500	4.00	$0
35.0	Right-of-Way - High Allowance	-	SF	$250	$0	5%	$0	40%	$0	$0	0.75	$0
36.0	Right-of-Way - Medium Allowance	-	SF	$100	$0	5%	$0	40%	$0	$0	0.75	$0
37.0	Right-of-Way - Low Allowance	524	SF	$50	$26,185	5%	$1,309	40%	$10,474	$37,969	0.75	$0
38.0	Vehicles (Assume 1 Vehicle Per Track Mile)	2	EA	$4,000,000	$6,071,970	5%	$303,598	10%	$607,197	$6,982,765	3.00	$0
39.0	Maintenance Facility Allowance**	-	LS	$31,857,859	$0	0%	$0	0%	$0	$0	2.75	$0
40.0	ABIA Extension**	2	RM	$70,000,000	$160,967,091	0%	$0	0%	$0	$160,967,091	4.00	$0
41.0	Mueller Extension**	-	RM	$81,000,000	$0	0%	$0	0%	$0	$0	4.00	$0
42.0	Maintenance of Traffic (4% of direct costs)	23,928,357	$/$	$0.04	$957,134	0%	$0	0%	$0	$957,134	4.00	$0
43.0	Contractor Indirects (10% of direct costs)	23,928,357	$/$	$0.10	$2,392,836	0%	$0	0%	$0	$2,392,836	4.00	$0
	Cost Subtotal				$188,245,419		$5,832,270		$5,123,169	$199,200,858		$0

Unallocated Contingency	15%	$29,880,128.70	4.00	$0
Contractor Mark-up	12%	$23,904,103	4.00	$0
Total Project Cost		$252,985,090		**$0**

* Existing structural analysis was not available at the time of the estimate. Cost for track & surface improvements only

** Unit Price for extensions and maintenance facility includes E&A and Allocated Contingency

44.0	**Professional Services (Breakdown)**			
	Preliminary Engineering	2.0%		$376,276
	Final Design	6.0%		$1,128,827
	Project Management for Design and Construction	5.0%		$940,689
	Construction Administration & Management	8.0%		$1,505,102
	Insurance	2.0%		$376,276
	Legal; Permits; Review Fees by other agencies, etc.	3.0%		$564,413
	Surveys, Testing, Investigation, Inspection	3.0%		$564,413
	Start-up Costs & Agency Force Account Work	2.0%		$376,276
		31.0%		$5,832,270

APPENDIX F
ADDITIONAL IMPROVEMENT CONSIDERATIONS

ADDITIONAL IMPROVEMENT CONSIDERATIONS

In addition to the tools talked about in **Chapter 5 - Improvement Tools**, considerations such as planning level improvements and policies that support operational efficiency along the corridor are listed here in Appendix F.

BICYCLE AND PEDESTRIAN SIGNAGE

Signage for pedestrians, bicyclists, and motorists differ based on roadway and facility type. Signage is used to direct bicyclists where to be and how to ride as well as inform motorists of bicyclists' rights to the roadway. Signage improves safety by reducing conflicts. The Texas Manual on Uniform Traffic Control Devices (TMUTCD) should be referenced regarding the usage and placement of signs.

RAIL

In addition to buses, sidewalks and bicycles, rail provides another way to improve mobility and provide for greater carrying capacity and diversification of modes along the East Riverside Corridor. The implementation of rail along the corridor would have an impact on several operational components of the corridor such as right-of-way, land development, safety, roadway design, traffic congestion, and overall quality of life.

INTERSECTION IMPROVEMENTS

Efficiently designed intersections contribute to maintaining the number of lanes and lane widths and keep costs of roadway systems affordable. Conflict reducing designs provide for low speed entries and turns, separation of conflicts in time and place, positive guidance, and operational clarity. Intersections can be kept compact and efficient through a combination of appropriately narrow lanes, appropriate curb radii, and curb extensions.

ROADWAY MODIFICATIONS

Modifications such as a reduction in lanes or lane widths provide for other modes of transportation within the corridor such as transit or bicycles. Roadway modifications such as these can have a traffic calming affect, reducing motorist's speeds and providing a safer environment for all users of the corridor. A safer environment would encourage all users to spend more time along the corridor, treating it more like a destination and less as a through roadway. Other traffic calming features may include the reduction or elimination of right turn bays and/or radii and the provision of street trees or other landscaping features. Roadway improvements may also have an affect on LOS as modifications could reduce auto capacity.

ON-STREET PARKING

In addition to roadway modifications, on-street parking may have its place along East Riverside Corridor. On-street parking allows shoppers to conveniently access stores bringing business owners more customers and increase the vitality of the area. On-street parking also has a measurable affect on lowering speeds, thus resulting in fewer accidents. In order to accommodate parallel parking a change in the City's on-street parking policy or a validating engineering study may be needed. Current policy states that for roadways 35 mph or higher a 10-foot maneuvering lane must be provided in addition to parking spaces to prevent vehicles from using a lane of traffic to back in. An engineering study may also be provided to eliminate the need a maneuver lane as long as the study demonstrates that the parking design is safe and does not negatively impact roadway operations.

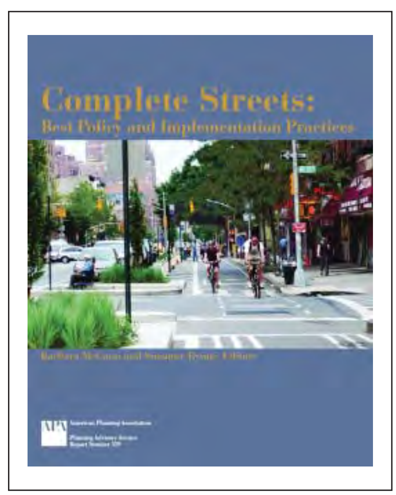
ACCESS MANAGEMENT

Access management along East Riverside Drive is paramount in providing a safe and efficient experience for all users of the corridor as it minimizes congestion and accidents at driveways and median openings due to excess access points into surrounding businesses. Access management does not mean that there is a reduction in access, it focuses on reducing or consolidating duplicate access points such as driveways and median openings. Median and driveway modifications and closures should be implemented to influence traffic patterns and reduce conflict points at rail crossings and parking lot entries to continue to allow motorists access to their destinations where appropriate. In some cases the extension of left-turn bays at intersections may be used to keep the operational integrity of the corridor as median closures will prevent motorists from turning left requiring them to conduct a u-turn at the nearest intersection or use a different travel pattern using the surrounding roadway network.

COMPLETE STREETS POLICIES

Below is a list of sources that provide commonly accepted guidance for complete streets policies. These policies generally allow for considerable flexibility to accommodate all modes of transportation.

- The National Complete Streets Coalition (completestreets.org) – National Complete Streets Coalition's website provides resources and template information on how to Institute a Complete Streets policy.
- American Planning Association's Complete Streets: Best Policy and Implementation Practices – This report produced with the National Complete Streets Coalition draws on lessons learned and best practices from more than 30 communities around the country and provides insight into successful policy and implementation practices that have resulted in complete streets.
- Context Sensitive Solutions (CSS) -The CSS process is an integrated approach to the development of transportation projects. It is both process and product, characterized by a number of attributes. It involves community members, stakeholders, elected officials, and affected local, state, and federal agencies. The CSS process differs from traditional planning processes in that it considers a range of goals and objectives that go beyond the transportation issue. It includes goals related to community livability and sustainability, and seeks to achieve a greater consensus and a streamlined project during later stages of project development and delivery.



APPENDIX G
FUNDING SOURCES

FUNDING SOURCES

The City of Austin recognizes that funding sources are a significant challenge. However, the funding strategy going forward is a combination of guidance from the federal, state, and regional agencies regarding the use of local funds provided by the 2012 General Bond election and the leveraging of grant funding from these sources. Not all of these sources will be applicable for the East Riverside Corridor. However, these funding sources have been used successfully on other similar projects.

Listed below are some funding sources that can be leveraged to complete the East Riverside Corridor.

GENERAL OBLIGATION BONDS

General obligation bonds are a common type of municipal bond that is secured by a state or local government utilizing available resources, such as tax revenues, to repay bond holders. These bonds may be used to fund components of the East Riverside Corridor improvements provided that it is approved by voters.

PUBLIC-PRIVATE PARTNERSHIP (PPP)

A public-private partnership is a governmental (local, state, or federal) service or a private business venture which is funded through the partnership of the government in conjunction with one or more private sector companies.

STATE INFRASTRUCTURE BANK (SIB)

A stated by the Federal Highway Administration, the SIB program gives states the capacity to increase the efficiency of their transportation investment and significantly leverage Federal resources by attracting non-Federal public and private investment. A SIB, much like a private bank, can offer a range of loans and credit assistance enhancement products to public and private sponsors of Title 23 highway construction projects or Title 49 transit capital projects.

TAX INCREMENT FINANCE DISTRICT (TIF)

TIF is a form of financing used to fund development and redevelopment and allows local municipalities to capture a portion of an increase in tax revenue as surrounding properties increase in value due to a public infrastructure investment. This captured increment can be used to fund the intial public infrastructure investment and/or subsequent ones. TIFs can be bonded against as well.

TRANSPORTATION REINVESTMENT ZONE (TRZ)

A TRZ is a form of financing used to fund development and redevelopment of properties adjacent to a planned transportation project. The purpose of this type of funding is to capture the additional property tax received from the adjacent properties arising from the planned project. The additional property taxes from the TRZ are used to pay for the capital costs of a project—specifically the construction costs.

SPECIAL ASSESSMENT DISTRICT (SAD)

This is a defined area within which residents and businesses pay additional taxes in order to fund activities or improvements that benefit their district. The additional taxes may be spent on additional solid waste collection, increased security and capital improvements. Public Improvement Districts (PID) and Local Improvement Districts (LID) work similarly to a SAD as well. These types of assessment districts can be a one-time or on-going assessment.

COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)

CDBG funds may be used for community development activities such as rehabilitation of housing and commercial buildings, construction and improvement of public facilities (e.g. utilities, street paving, and sidewalks), and economic development and job creation/retention activities. CDBG funds can also be used for preservation and restoration of historic properties in low-income neighborhoods as well.

DEVELOPMENT IMPACT FEES

Development impact fees are a method to ensure that newly developed and redeveloped properties pays for the cost to improve the transportation elements of the corridor directly or indirectly impacted by the development.

Below are programs listed by the Federal Highway Administration for transit funding including high capacity transit.

URBANIZED AREA FORMULA PROGRAM

The Urbanized Area Formula Program provides federal assistance to urbanized areas for transit capital and operating assistance as well as transportation related planning. An urbanized area is a designation by the US Department of Commerce, Bureau of the Census, given to incorporated areas with population of 50,000 or more. Funding is apportioned on the basis of legislative formula and only public entities are eligible to receive funding.

JOB ACCESS AND REVERSE COMMUTE PROGRAM

The Job Access and Reverse Commute (JA/RC) Program provides funding for local projects designed to transport low-income individuals to and from employment and employment-related activities, and to develop transportation services for residents of urban centers and rural and suburban areas to suburban employment opportunities. Funds must be awarded through a competitive Call for Projects and eligible entities include operators of public transportation services (including for-profit entities), non-profit organizations, and State or local governmental authorities.

NEW FREEDOM PROGRAM

The New Freedom Program supports new public transportation services and new alternative public transportation services to address the transportation needs of individuals with disabilities that go beyond those required by the Americans with Disabilities Act of 1990 (ADA). Funds must be awarded through a competitive Call for Projects and eligible entities include operators of public transportation services (including for-profit entities), non-profit organizations, and State or local governmental authorities.

Each of these strategies serve as possible funding components to leverage available resources and provide for the long-term vision for the East Riverside Corridor.