

Draft Final Report



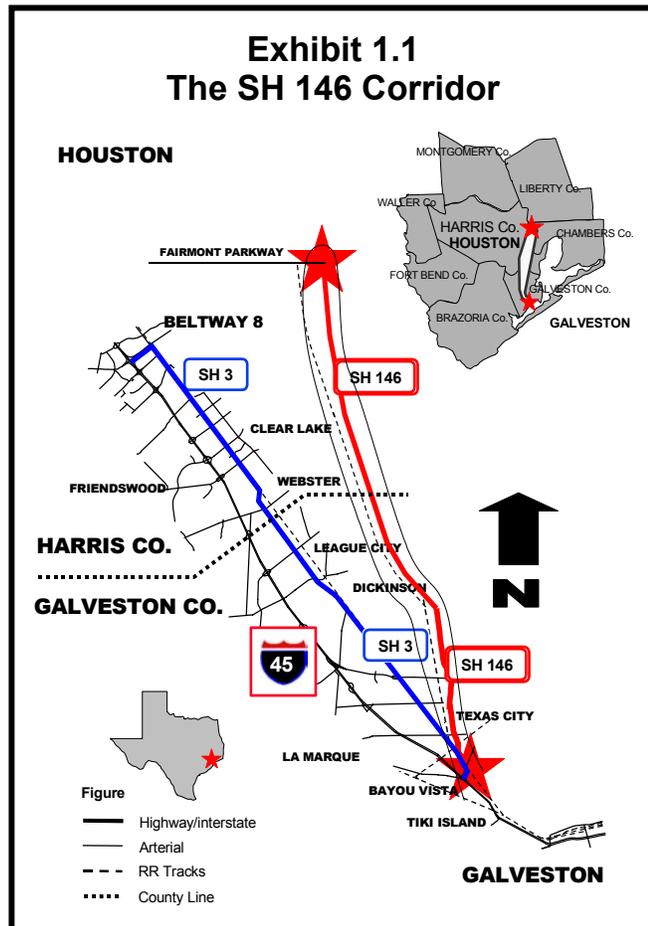
1.0 Introduction

The Houston metropolitan region, consisting of the eight-county area of Harris, Galveston and surrounding counties, represents the fourth largest city in the United States, and the largest in the State of Texas. Houston is also one of the fastest growing cities in the U.S. in terms of both population and employment. With this growth, the region has seen significant increases in travel demand on an aging highway and arterial street network. Many of the region's primary transportation corridors are currently congested during peak commuting periods, with some being congested throughout the day.

One such corridor is the State Highway 146 (SH 146) Corridor, extending along SH 146 between Fairmont Parkway in La Porte and IH 45 south in Galveston (see Exhibit 1.1). This corridor has been identified by the Houston-Galveston Area Council (H-GAC), the region's Metropolitan Planning Organization (MPO) as a candidate for significant infrastructure investment. Under the federal Transportation Equity Act for the 21st Century (TEA 21), a Major Investment Study (MIS), also known as corridor study, is

required before undertaking any urban area transportation improvements having significant capital costs and for which Federal Funding may be required. A MIS is a multimodal study to evaluate various alternatives for meeting the mobility needs within an identified corridor. The Texas Department of Transportation (TxDOT) initiated a MIS for the SH 146 Corridor to address mobility needs within the corridor through the year 2022.

The purpose of this MIS is to determine and identify the transportation needs of the SH 146 Corridor over the next 20 years and to develop transportation solutions that most closely meets these identified needs.



The MIS process involves multiple steps, including:

- The assembly and evaluation of data related to the existing conditions and constraints within the corridor;
- The identification of the problems and needs within the corridor;
- The development of goals and objectives for the study;
- The development and evaluation of viable alternatives; and,
- The development of a Locally Preferred Alternative that recommends future transportation investments to be made within the corridor.

1.1 The SH 146 Corridor

As previously described, the SH 146 Corridor extends along State Highway 146 between Fairmont Parkway in La Porte and IH 45 south in Galveston. The corridor lies in the southeast portion of the Houston-Galveston region, stretching approximately 24 miles in length. For the purpose of this study, the corridor is defined to extend one-half mile to the east of SH 146 and one-half mile to the west of SH 146.

The corridor supports significant urban and suburban development on its north end, passing through fourteen municipalities. The corridor also passes through several significant natural and environmental resources such as Clear Creek and Galveston Bay. These and other natural resources make the corridor an important ecological corridor, which must be protected against adverse impacts from infrastructure improvements.

Relatively high population and employment levels for a primarily suburban corridor are reflected by the estimated trip characteristics observed within the corridor. In year 2000, the Average Daily Traffic (ADT) on the northern portion of the corridor was approximately 50,000 vehicles per day (VPD). By 2022, ADT is expected to grow to approximately 74,000. This represents an increase in traffic of almost 50% in the next 20 years. Traffic in other sections of the corridor is also expected to increase.

Furthermore, examining the projected growth within the corridor (population, employment, and trips), the greatest growth is expected near the middle of the corridor at the Harris/Galveston County Line. This suggests that the northern portion of the corridor (La Porte) is reaching build-out and that the next ring of sub-urbanization is rapidly occurring near the middle of the corridor. This new ring of growth affects travel patterns within the corridor and further contributes to the increasing congestion levels observed on SH 146.

Travel patterns within the corridor reinforce the need to plan for improved roadway facilities. In the year 2000, weekday trips remaining within the corridor represented approximately 65 percent of the total trips generated by the corridor. Only 35 percent of the total daily trips either left the corridor or entered the corridor from outside the study area. This does not hold true for weekends and holidays, when tourist attractions brought in a large percentage of trips from outside the study area. These travel patterns are expected to be maintained through the year

2022, suggesting that the regional travel facilities, such as SH 146, will continue to be used for shorter intra-corridor type trips as well as the regional ones.

Existing north-south roadways serving the corridor consist exclusively of SH 146. Other roadways such as SH 3 and IH 45 provide limited relief to this primary route.

SH 146 is an older facility. Many structures along its route will require reconstruction within the next 20 years.

In the past, Bay Area Transportation Partnership provided local transit services in Galveston County. Bay Area Transportation Partnership no longer provides transit service in the corridor and no other transit entity has indicated that they would provide transit service along the SH 146 corridor.

1.2 Study Participants

As part of objectives for the study, a range of agency and public representatives were invited to participate in the MIS process. Agency participation in the study was provided through the Steering Committee and the Advisory Committee. The Steering Committee was primarily made up of transportation agencies that would be responsible for implementation of infrastructure improvements within the corridor. The Advisory Committee consisted of corridor stakeholders who would be affected by the MIS recommendations. In addition, the general public was invited to offer their comment and feedback through an open public involvement process described in chapter 2.

SH 146 corridor MIS Steering Committee Members

Members of the Steering Committee included local, state and federal transportation and environmental agencies. Approval and potential funding will be required from these agencies to implement any recommendations made as a result of the SH 146 corridor MIS. Agencies Participating in the Steering Committee included:

- Texas Department of Transportation (TxDOT);
- Federal Highway Administration (FHWA);
- Federal Transit Administration (FTA);
- Houston-Galveston Area Council (H-GAC) – serving as the Metropolitan Planning Organization (MPO) for the region;
- Harris County;
- Galveston County;
- Union Pacific Railroad; and,
- Texas Natural Resource Conservation Commission (TNRCC).

SH 146 corridor MIS Advisory Committee Members

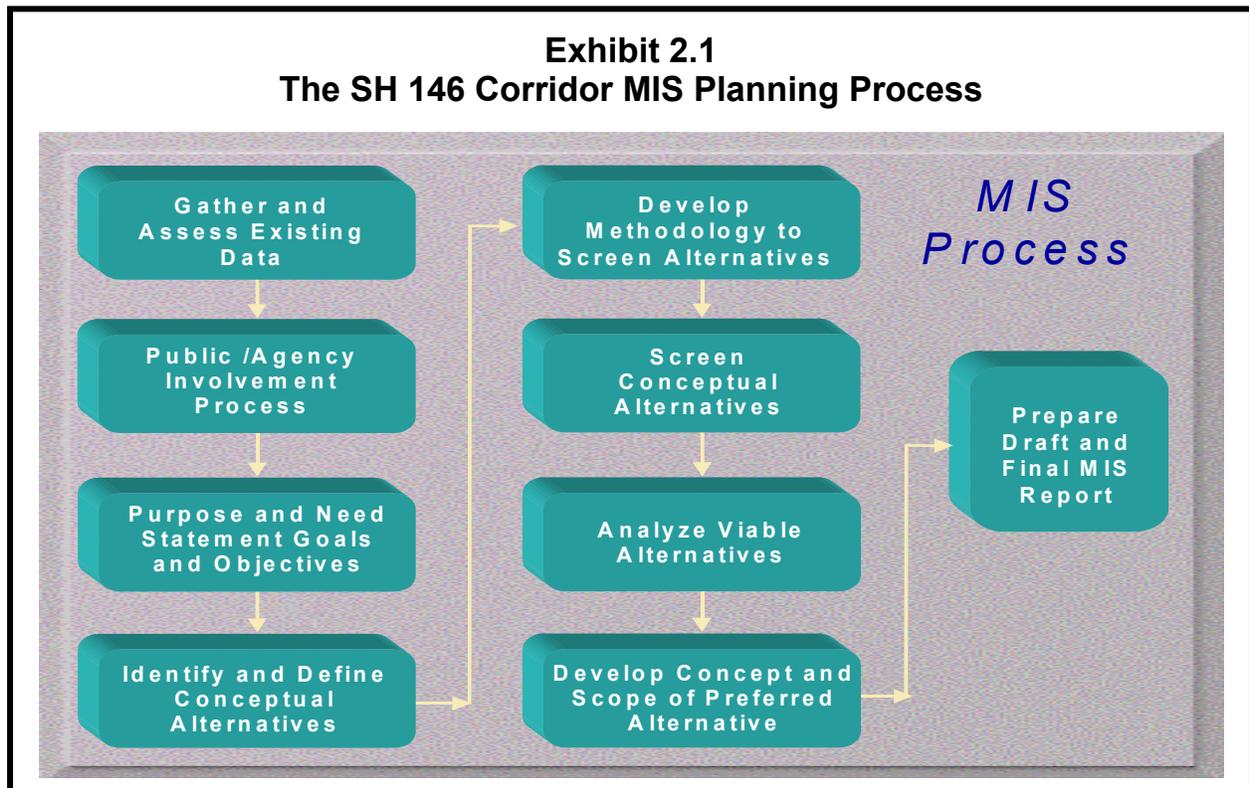
Members of the Advisory Committee included representatives from a broad spectrum of stakeholders within the corridor, as well as representatives from environmental and community organizations. Members of the Advisory Committee included representatives from:

- City of Bayou Vista;
- City of Clear Lake Shores;
- City of El Lago;
- City of Hitchcock;
- City of Kemah;
- City of La Marque;
- City of La Porte;
- City of League City;
- City of Pasadena;
- City of Seabrook;
- City of Shoreacres;
- City of Taylor Lake Village;
- City of Texas City;
- City of Houston;
- City of Baytown;
- City of Dear Park;
- Harris County;
- Galveston County;
- Clear lake Chamber of Commerce;
- Metropolitan Transit Authority of Harris County;
- Pasadena Chamber of Commerce;
- Texas City-La Marque Chamber of Commerce;
- Harris County Toll Road Authority;
- University of Houston;
- Federal Highway Administration;
- Federal Transit Administration;
- Texas Department of Transportation;
- Houston-Galveston Area Council;
- United States Coast Guard;
- Texas Natural Resources Conservation Commission;
- Texas Department of Public Safety;
- Port of Houston;
- Port of Galveston;
- Port of Texas City;
- Bay Area Transportation Partnership;
- State and Federal Elected Officials;



2.0 Public Involvement

In addition to the involved agencies, affected municipalities and stakeholders, the general public were consulted through a proactive public involvement process to identify the problems and needs within the corridor. An organizational outreach program was also initiated through groups such as the Center for Conflict Analysis and Management, Bay Area Transportation Partnership (formerly Clear Lake Transportation Partnership), Bay Area Citizens Advisory Panel (BAYCAP), Seashore Community Advisory Panel (SEACAP), and other similar organizations.



2.1 The SH 146 Corridor MIS Planning Process

The process used in the development of the SH 146 Corridor MIS followed closely the MIS guidelines outlined by both TEA 21 and TxDOT. A flow diagram of this process is shown in Exhibit 2.1. Throughout the MIS process, documentation was prepared for each of the milestones. The following reports are available through TxDOT's Houston District:

- *SH 146 Corridor MIS Summary of Data Collection;*
- *SH 146 Corridor MIS Statement of Purpose and Need;*

- *SH 146 Corridor MIS Alternatives Screening Report;*
- *SH 146 Corridor Modeling Methodology and Traffic Analysis Report;*
- *SH 146 Corridor MIS Environmental Analysis Report;*
- *SH 146 Corridor MIS Alternatives Evaluation Report; and,*
- *SH 146 Corridor MIS Summary of Public Involvement Programs.*

2.2 Public Involvement Process

The Texas Department of Transportation (TxDOT), the lead agency for the SH 146 Corridor MIS, adopted a Public Involvement Program (PIP) during the early phase of the study. The PIP offered the public a variety of formal and informal opportunities to interact with the MIS and the involved technical staff.

Public meetings were the primary public involvement technique used to encourage the participation of community and business-based organizations, environmental interest groups, bicycle advocates, transportation providers and planning organizations, the trucking industry, public safety officials, advocates for people with disabilities, concerned citizens, and others. Additionally, regular meetings of advisory committee, presentations to community groups, and solicitation of written input were used to reach targeted audiences.

2.3 Public Meetings

At three significant study milestones, a series of two public meetings were held during the Major Investment Study, for a total of 6 individual meetings.

The first series of public meetings were held on August 22, and 23, 2000. These meetings offered the public an opportunity to provide input about transportation problems and needs within the SH 146 Corridor. With the public comment, the MIS team established the goals and objectives for the MIS.

The second series of public meetings were held on November 28 and 29, 2000. Public input at these meetings was used to develop a range of conceptual alternatives and to help narrow the concepts to seven viable alternatives for addressing corridor needs. These meetings gave the public an opportunity to comment on the seven viable alternatives developed from technical analysis and earlier public comments. Public input from these meetings was used in the selection of a preferred alternative.

The third series of public meetings were held on February 19 and 20, 2002. The public commented on the recommended preferred alternative proposed by TxDOT. Public input from the third series of meetings will be used by decision-makers in finalizing plans for the Corridor.

2.4 Outreach

In order to encourage attendance at public meetings, and garner participation in the public involvement process, the MIS team widely publicized the outreach programs throughout the Corridor. Individual pieces of literature were distributed throughout the corridor during the conduct of the study. Prior to each series of public meetings, efforts included:

- Distributing a TxDOT SH 146 Corridor MIS newsletter with detailed information about the meetings, venues and agendas;
- Informing residents about the meetings through press releases;
- Placing public notices and advertisements in the major Corridor newspapers, the Houston Chronicle and other local newspapers;
- Sending press releases and public service announcements to Corridor media, including newspapers, radio and television stations; and,
- Maintaining a continuously accessible TxDOT web-site about the SH 146 MIS.

2.5 Advisory Committee meetings

As part of the MIS, an Advisory Committee was formed as an open representative body of the municipal jurisdictions, special interest groups, and business and community groups within the corridor. Four meetings of the Advisory Committee were held at key milestones throughout the study:

- July 17, 2000 at TxDOT's Headquarters in Houston, Texas;
- October 25, 2000 at TxDOT's Headquarters in Houston, Texas;
- January 10, 2001 at the City of La Porte City Hall, La Porte, Texas; and,
- January 23, 2002, at TxDOT's Headquarters in Houston, Texas.

The Advisory Committee linked the MIS staff to the public through elected county and city officials and community leaders. Advisory Committee meetings were usually held shortly before the full series of public meetings. Advisory Committee members were kept informed of the progress of the MIS, so that they in turn could keep their constituents informed. Advisory Committee members helped to focus the upcoming public meetings on the particular concerns of their constituents.

2.6 Presentations to Community Groups

In addition to the formal public meetings, numerous presentations were made to community groups. TxDOT and technical staff made every effort to be available to speak on behalf of the project. Groups to whom presentations were made included:

- Bay Area Transportation Partnership (formerly, Clear Lake Transportation Partnership)
- Bay Area Citizens Advisory Panel (BAYCAP);
- Seashore Community Advisory Panel (SEACAP);
- Mayors of the Cities along the corridor; and,
- Port of Houston Authority (PHA) Community Advisory Group meeting.

Presentations to such groups typically included a brief presentation of the project and question and answer session. In all, over 200 people attended the various small-group presentations made by TxDOT over the life of the study.

2.7 Public Involvement Summary

The public involvement process initiated in support of the SH 146 Corridor MIS was developed to provide a proactive means for developing and incorporating public participation in the study. Public participants were consulted for their opinions, preferences, and needs with regards to mobility needs, problems, alternative concepts, and evaluation procedures proposed for the corridor.

Comments received during the public involvement process (both formal and informal) were integrated into the development of the recommended preferred alternative. Examples of this integration include:

- The development of the documented problems and needs based on public comment from the first series of public meetings; and,
- Inclusion of a bicycle facility along SH 146 based on comments received from stakeholders and the Advisory Committee.

The success of the public involvement process was achieved by many participants being involved in an open and proactive process, one that matched the magnitude and importance of the SH 146 Corridor MIS.



3.0 Study Purpose and Needs, Goals and Objectives

As part of the MIS process, the existing conditions within the corridor were evaluated, including:

- Mobility and safety characteristics;
- Environmental and community constraints;
- Evacuation plans and capabilities of the corridor; and,
- Condition of the existing transportation infrastructure and transit systems.

3.1 Identified Problems and Needs

The SH 146 Corridor Problems and Needs were identified with input from the advisory committee and the public at the public meetings held August 22 and 23, 2000. The steering committee adopted the Problems and Needs and they were published in the Existing Conditions and Problem and Needs section of the Technical Memorandum No. 1, issued on October 6, 2000. The adopted set of Problems and Needs identified for the corridor are as follow:

Traffic Congestion

- In the northern section of the corridor, demand exceed capacity on a recurring basis during daily commute periods. Specific bottlenecks along SH 146 occur at NASA Road 1, FM 2094, and FM 518.
- In the middle section of the corridor, seasonal recreational and special event directional demand exceeds capacity on a regular basis. This excess demand typically occurs during the weekends and is in addition to an underlying bi-directional travel commute demand between the cities of Texas City, Dickinson, Kemah, Seabrook, La Porte, and other small communities.

SH 146 Facility Improvement Needs

- Many of the critical SH 146 bridge crossings, particularly the Clear Creek Bridge, have been given emergency remedial strengthening to sustain the life of the structures, but have not undergone major rehabilitation since they were constructed.
- Some sections of roadway have not received major pavement maintenance or overlay reconstruction since they were originally implemented. The future viability of these facilities is at risk.
- Safety improvements are necessary at various locations throughout the SH 146 corridor due to high accident rates and sub-standard configurations. Higher than typical accident rates

exist in a number of locations along SH 146. The highest accident rates are at Avenue T (just north of Dickinson Bayou Bridge), the ramps to and from FM 1764 (south of the intersection), FM 517, Loop 197 (north), FM 646, FM 1764 and NASA Road 1.

Parallel Route and Evacuation Needs.

- The lack of hurricane and other evacuation options from Galveston Island and the lower mainland is a safety concern. High tides may threaten evacuation routes on the mainland and the island even before an approaching storm hits.
- Ground level subsidence has contributed to the potential for flooding during typical storms, lending to a reduced ability to provide for evacuation. Lowered elevations threaten emergency evacuation from potential heavy rains and storm surge. Key affected links include SH 146, IH 45 and SH 3 at the Texas City Wye.
- The lack of adequate parallel roadway facilities in the middle section of the corridor is most noticeable during periods of recreational and special event peak demand and when incidents obstruct the Clear Creek Bridge.

Need to Preserve Community/Environmental Resources

- There is a need to improve access to recreational and scenic resources within the SH 146 Corridor. These include Kemah/Seabrook recreational center, parks, marinas, preserves, and related facilities.
- The Environmental Protection Agency (EPA) has designated the Houston-Galveston region as an air quality “non-attainment” area for ozone. Since ozone levels are directly related to the amount of traffic within a region, transportation funding is subject to sanctions if air quality standards are not met.
- Some bridges along SH 146 and various port access roads do not meet truck clearance requirements. The shipping of hazardous materials via ground transportation movements is critical to the ports, but poses safety concerns for residents along affected routes.
- Trains traveling into and out of the ports of Houston and Texas City traverse rail lines having at-grade road crossings. At-grade crossings not only require slower rail speeds, but cause bottlenecks and congestion on the crossing roadways. Residents living near the rail lines are also concerned about safety issues related to the shipment of hazardous materials.
- Clear Creek Bridge, which is a navigable channel, has inadequate clearance for marine needs.
- Growth in port activities indicates a need for improved freight movement to and from the Ports of Houston and Texas City and within freight corridors in the vicinity of the SH 146 Corridor. This need is exacerbated by the inadequacy of the freight rail and highway infrastructures that serve the ports.

- The SH 146 corridor is situated adjacent to a number of environmentally sensitive areas including single family homes, churches, and parks. At various bayou and creek crossings, and near the south end of the corridor, wetlands exist along SH 146. Marine activities are prevalent along Clear Creek and the intracoastal waterways. Transportation improvements must be planned such that any impacts they might have on the natural environment will be avoided or minimized.
- Improvements must reflect sensitivity to adjoining communities that share the corridor. Various churches, schools and potentially historic buildings abut the SH 146 corridor.
- Traffic, population and employment trends reveal the existence of a variety of travel needs throughout the corridor. When developing a plan to meet these needs, both interregional demand and local demand (city to city) should be considered, along with traffic caused by special events and special generators (Kemah/Seabrook recreational center, schools, ports, etc.). The existing roadway facility may be unable to serve these needs. Improvements should make use of existing transportation facilities, but not constrain downstream concepts (for example, the exclusive truck lanes on the north end should not constrain transportation options in other parts of the corridor.)
- Improvements are needed to provide better access to various employment generators, such as Kemah/Seabrook, NASA corridor communities, and ports. The study should take existing local plans into consideration.

3.2 Adopted Goals and Objectives

Goals and Objectives for the SH 146 Corridor Major Investment Study were derived from the evaluation of the problems and needs. The purpose of the goals and objectives was to define the direction and character of the study in order to arrive at a locally preferred alternative. The preferred alternative will guide future mobility infrastructure investments within the corridor to the year 2022. The study Goals and Objectives that are documented below were adopted by the Steering Committee, and included in the *Statement of Purpose and Need*. The adopted Goals and Objectives for the SH 146 Corridor MIS are:

Goal 1: Reduce Traffic Congestion

Improve corridor mobility in a cost-effective manner, realizing that the underlying cause of congestion may differ depending upon location within the corridor.

Objectives:

- Reduce recurring congestion due to commute trips.
- Provide travel options for special event and peak tourist season travel.

- Reduce travel times between key locations within and through the corridor.
- Provide improvements within the capital and operating financial capacities of the appropriate agencies. New mobility concepts should make maximum use of existing travel facilities, but may differ from existing technologies and designs.
- Provide for smooth transitions with existing roadway facility and street network within the Cities along the corridor.
- Some modes of travel, such as freight, bicycle, and pedestrian are constrained or limited by the existing roadway facility. Study alternatives should seek opportunities to enhance all current modes of transportation along the corridor.
- Be consistent with regional highway, thoroughfare and transit plans within the region.

Goal 2: Improve Hurricane Evacuation

Maximize the evacuation capability of the SH 146 Corridor, given existing environmental and community constraints.

Objectives:

- Maximize the functional capacity of the SH 146. Determine if the existing SH 146 facility is sufficient to meet regional evacuation needs.
- Provide evacuation alternatives from the lower mainland areas along Galveston Bay.
- Improve the evacuation capability of SH 3, within the SH 146 corridor.
- Develop a transportation facility that provides “smart” communications to evacuees during a storm (i.e. - information on alternative routing changes in storm conditions, accident congestion information, etc.).
- Develop a transportation system that will remain functional during flooding conditions.

Goal 3: Improve Safety

Improve driving safety within the SH 146 Corridor.

Objectives:

- Provide a consistent and uniform driving environment for the driver at all intersections through the corridor.

- Provide information to direct corridor tourists/visitors who may be unfamiliar with the Houston-Galveston metropolitan area.
- Assure that existing and future transportation facilities are developed to current state, local and national standards, providing adequate design clearances for truck, marine, and rail crossings.
- Eliminate or minimize at-grade rail crossings within the corridor that affect traffic flows.

Goal 4: Provide Travel Options

Provide a balanced and coordinated transportation system that provides travel alternatives and opportunities to corridor residents and visitors.

Objectives:

- Develop a transportation system that provides options for meeting the travel needs of people, goods and services in a safe, efficient and comfortable manner.
- Provide a variety of appropriate modal and facility options for travelers throughout the corridor (e.g., improved options for non-freeway travel, improved options for bicycle and pedestrian access).
- Preserve opportunities for future transportation technologies within the corridor (e.g., commuter rail or special event rail access to Galveston Island).

Goal 5: Protect Natural and Social Environment

Provide a transportation system that serves the regional land use/development patterns now and in the future and which minimizes the impacts to the natural and social environment.

Objectives:

- Reduce, eliminate or mitigate any adverse impact that the transportation project may have on cultural facilities, parkland and other features of the natural environment while at the same time improving public access to such resources.
- Improve access to existing and emerging employment centers, communities, and major attractions within the corridor.
- Improve access to the Port of Houston and Port of Texas City to reduce regional freight congestion on the existing travel network.

- Provide a transportation system that minimizes the negative impacts to primary and secondary land use development.
- Preserve the vitality of the corridor communities.
- Reduce or minimize any adverse impacts the transportation project may have on air quality and noise.
- Eliminate, minimize, or mitigate water pollution/damage to sensitive wetlands and animal habitat within the corridor.
- Minimize residential and business dislocation which could cause community disruption.
- Maximize the accommodation of utilities within the SH 146 right-of-way to minimize the need for additional utility corridors, thus preserving the environmental integrity of the corridor.

These Goals and Objectives are form the basis for development and evaluation of mobility alternatives to address the identified Problems and Needs of the corridor. These Goals and Objectives were adopted by the Steering Committee and received public support.



4.0 Conceptual Corridor Alternatives

In developing a Major Investment Study (MIS), a broad range of alternative transportation solutions must be considered to address the mobility and other identified needs of the corridor. Such a multi-modal approach was developed for the SH 146 Corridor MIS in response to the adopted goals and objectives. This multi-modal approach was intended to provide decision-makers with a broad spectrum of transportation options from which to choose a preferred alternative that best meets the identified Goals and Objectives of the study.

The underlying characteristics of the SH 146 Corridor vary throughout the project limits in terms of observed traffic conditions, development patterns, mobility needs and environmental concerns. For this reason, the corridor was divided into four segments for development and evaluation of conceptual alternatives. The segments are defined as Segment 1 (IH 45 to FM 517), Segment 2 (FM 517 to FM 518), Segment 3 (FM 518 to Red Bluff Road), and Segment 4 (Red Bluff Road to Fairmont Parkway) (See Exhibit 4.1). These segments define areas with similar land uses, demographics, traffic characteristics, and public concerns.

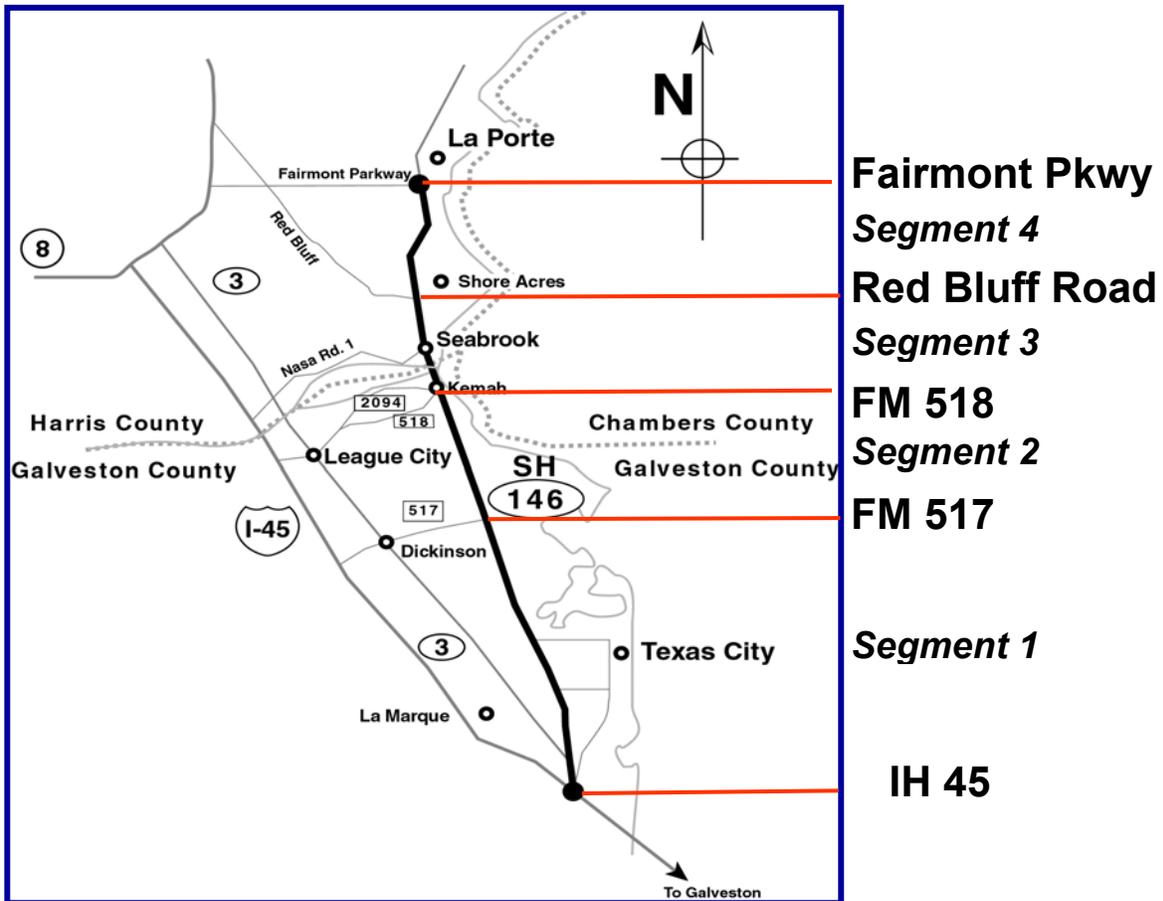


Exhibit 4.1 Corridor Segments

Based on these corridor segments, a range of initial or conceptual alternatives was developed, including:

- No-Build Alternative;
- Transportation Systems Management (TSM) Alternative; and
- Ten Modal Alternatives.

The 10 Modal Alternatives are comprised of various combinations of improvements proposed for each of the identified corridor segments. These investment levels were mixed and matched by corridor segment.

The 10 Modal Alternatives, combined with the No-Build and TSM Alternatives, comprised the 12 conceptual alternatives evaluated at the screening level.

Each of the conceptual alternative categories is defined in the following subsections.

4.1 No-Build Alternative

The No-Build Alternative assumed the current roadway configuration plus enhancements of regional significance that are already under construction or that have committed funding sources.

The No-Build Alternative incorporated regionally significant projects included in Houston-Galveston Area Council's (H-GAC) Regional Transportation Improvement Plan (TIP) as well as similar plans developed by the City of Houston; Harris and Galveston Counties; TxDOT; and corridor communities.

Enhancements included in the No-Build Alternative would be expected to be in place by the year 2022. Representative enhancements include:

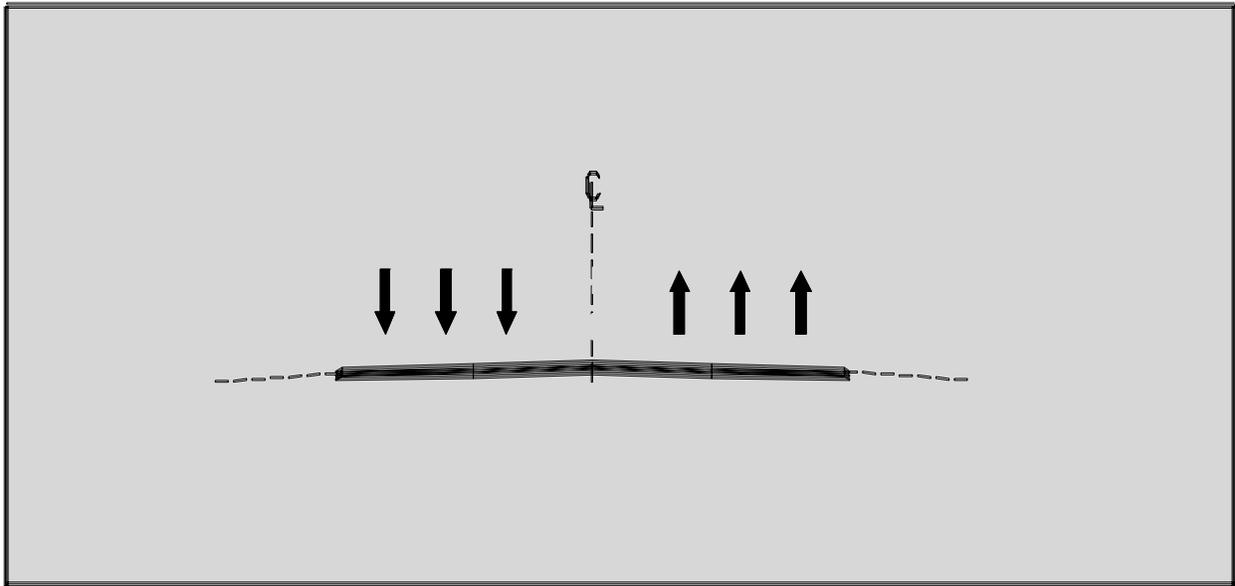
- SH 96 currently under construction between IH 45 and SH 146. The 4-lane divided SH 96 will intersect SH 146 approximately 0.8 mile south of FM 518;
- Bridge over Dickinson Bayou (2 lanes for southbound traffic), and connecting roadways;
- North Loop 197 grade separation (2 lanes each direction), and connecting roadways;
- Bridge overpass at SH 3 and Texas City Terminal Railway (TCT) (2 lanes each direction), and widen existing 2-lane connecting roadways to a 4-lane facility.

4.2 Transportation System Management (TSM) Alternative

The TSM Alternative includes the existing and committed programs under the No-Build Alternative, plus traffic systems and demand management programs such as flow metering, surveillance cameras and increased dynamic message signing (DMS), as well as synchronized traffic signals along State Highway 146. Minor construction projects were also included in the TSM Alternative to improve the operation of the existing transportation network. The programmatic and minor construction improvements included in the TSM Alternative were assumed to have a positive affect on reducing congestion and raising travel speeds within the corridor.

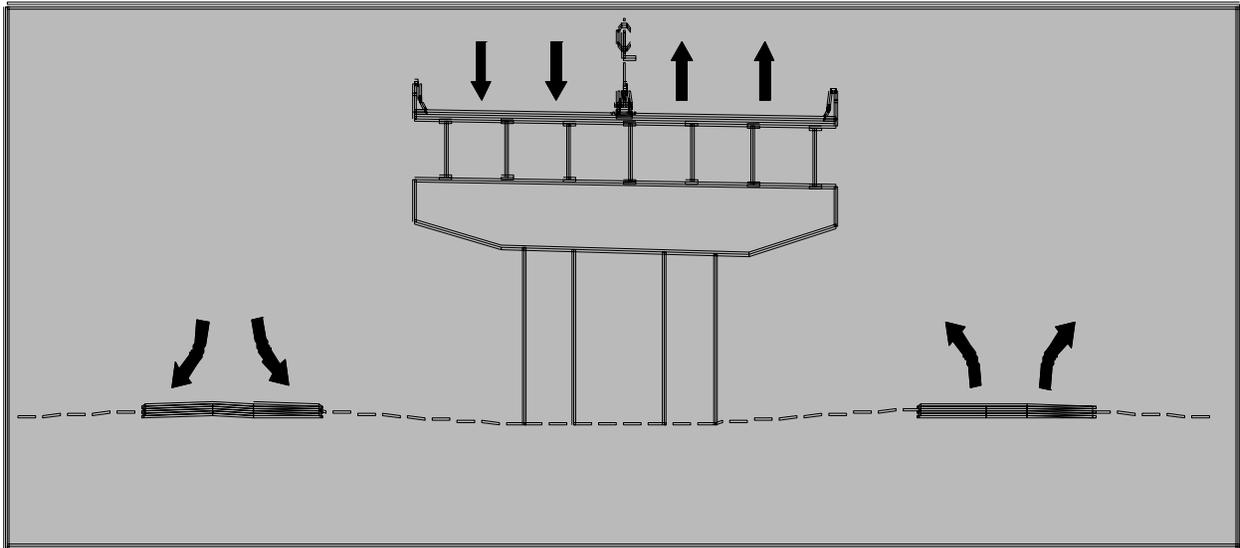
4.3 Arterial Alternatives

The existing facility throughout most of the corridor consists of arterial sections, which are generally four lanes (two lanes in each direction with a median lane that provides continuous left-turn lanes). This alternative could expand the arterial to six-lanes based upon future traffic projections.



4.4 Arterial with grade separation alternative

This alternative is similar to the arterial alternative except grade separations would be provided at major connecting roadways.

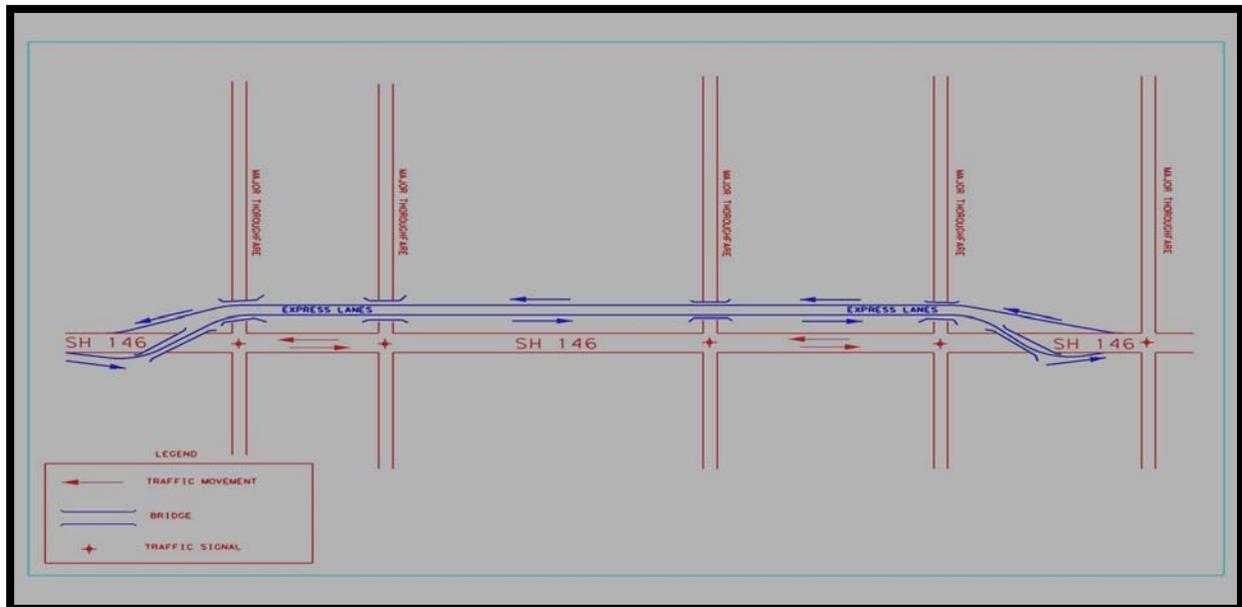
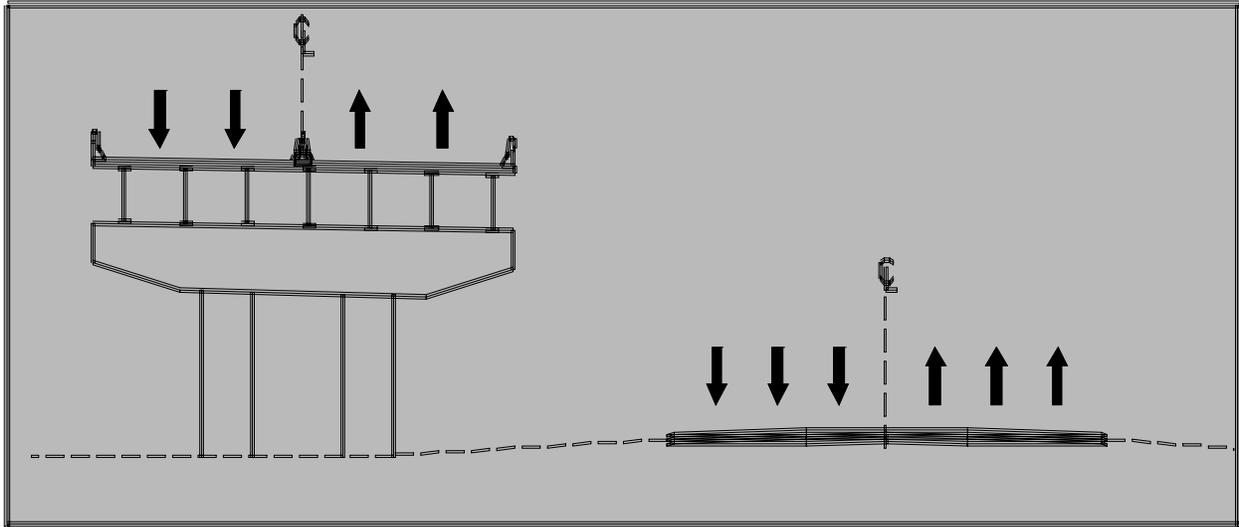


4.5 Arterial with access road alternative

This alternative is similar to the arterial alternative but also includes an adjacent road, which would provide access to local businesses in between connecting roadways.

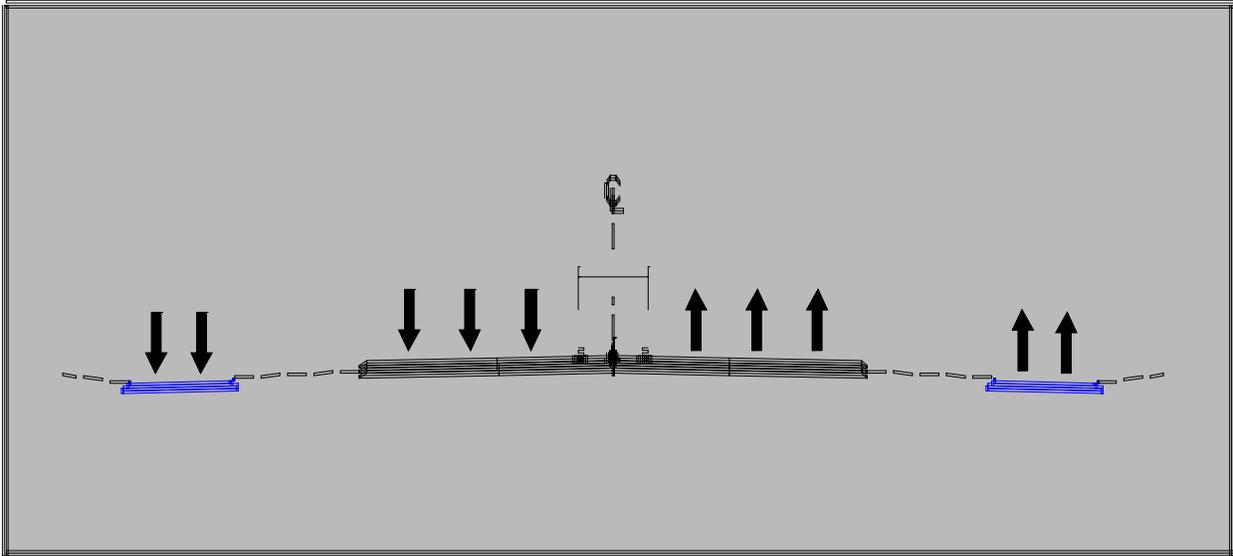
4.6 Arterial with Express lanes alternative

This alternative would provide express lanes adjacent to the existing roadway or expanded existing roadway with a physical barrier for safety. The express lanes would be grade separated at major connecting streets.



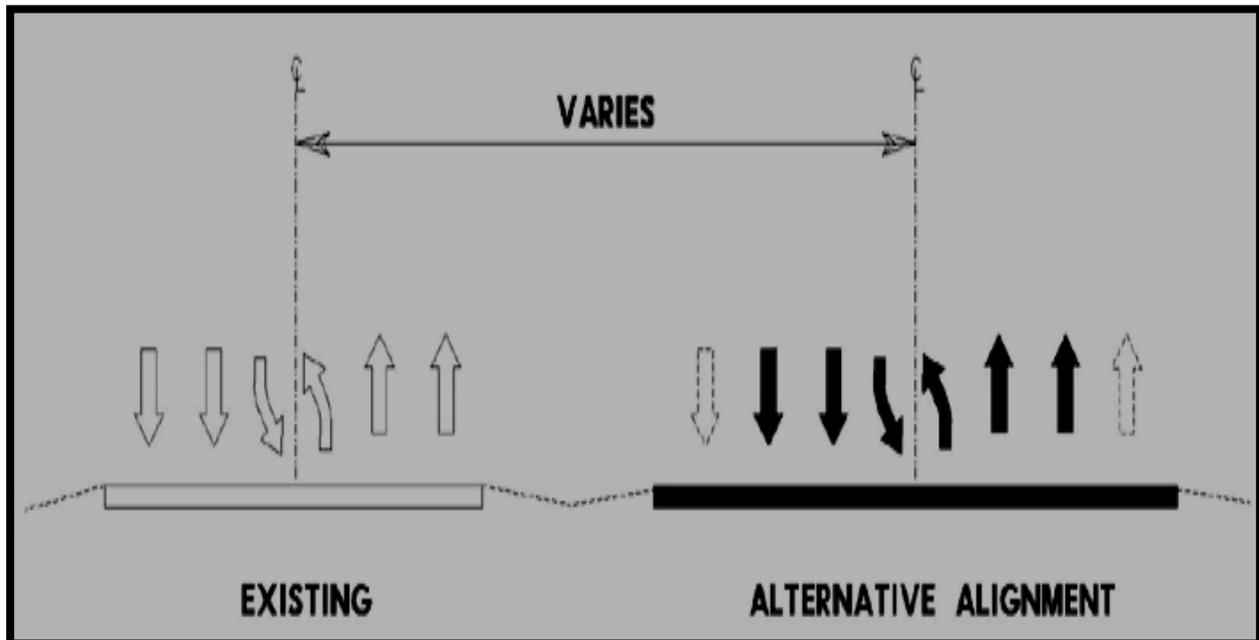
4.7 Freeway with frontage roads alternative

This alternative would provide a facility with one-way frontage roads on both side of the freeway. This alternative includes the standard TxDOT freeway design elements.



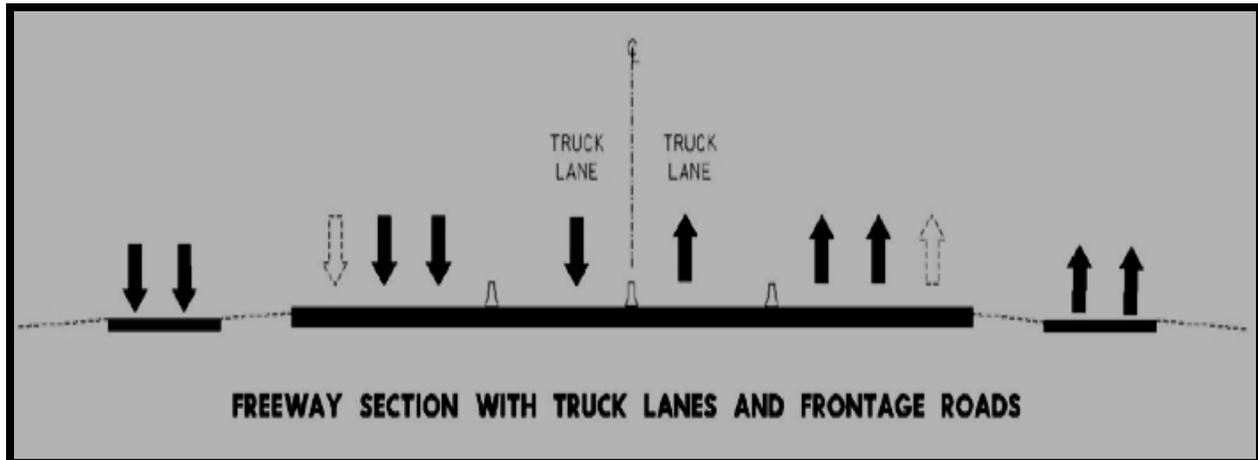
4.8 Alignment option alternative

This alternative would consist of moving the existing SH 146 alignment either to the east or to the west.



4.9 Truck lanes alternative

Exclusive truck lanes could be provided in the median of the freeway, included in the express lanes, or be on an elevated structure in the median or on either side of the arterial roadway. Exclusive truck lane is identified as a corridor wide alternative.



4.10 Transit alternative

The potential for this alternative (high performance bus or rail) is related to the nature of travel demand in the corridor. This includes the purpose of the trip, the time of the day, and the trip's origin and destination. For the purpose of this particular MIS, highway and transit demand forecasting were done separately, with H-GAC playing the lead role.

4.11 HOV lanes alternative

HOV lanes would likely be constructed within the median of a freeway section, to compliment Park and Ride facilities. Like the transit alternative, demand is largely dependent upon potential users having similar origin and destinations. The HOV lane was identified as a corridor wide alternative.

4.12 Non-Motorized modes alternative

This alternative would provide improvements to both bicycle accommodations and pedestrian access. Non-Motorized modes alternative was also identified as a corridor wide Alternative.

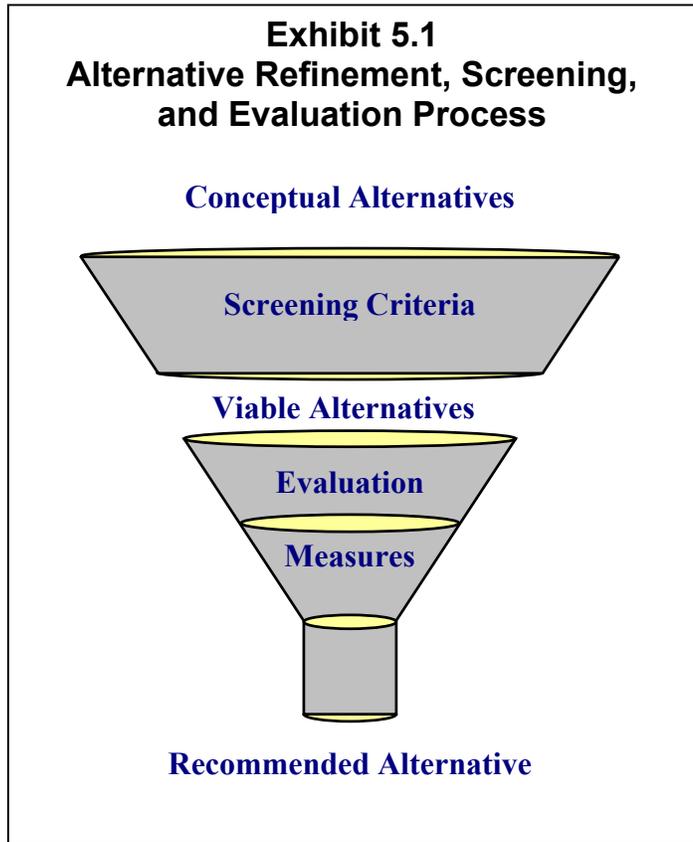
Summary of Conceptual Alternatives

A range of conceptual alternatives were developed for preliminary analysis within the SH 146 Corridor. These conceptual alternatives represented the universe of reasonable alternatives that might address the identified problems and needs within the corridor. They included the No-Build, Transportation Systems Management, and 10 combinations of highway, arterial, and bus transit concepts defined by segment of the corridor. These alternatives were screened and subsequently refined for further detailed analysis.



5.0 Screening of Conceptual Alternatives

The screening process identified for the SH 146 Corridor MIS is similar to the ones used on other Major Investment Studies within the Houston-Galveston region. Initially, a wide range of “conceptual” alternatives was identified that had the potential of meeting the intended mobility goals of the study. These conceptual alternatives were developed with only modest data at the outset of the study and represented the universe of reasonable potential alternatives that might be applicable within the study area. These conceptual alternatives were subjected to a preliminary screening, intended to remove less viable alternatives and to promote those conceptual alternatives with the most promise of successfully meeting the documented needs of the corridor. Once identified, the most promising alternatives, called viable alternatives, were subjected to a much more detailed evaluation. The two-step screening and evaluation process allowed the implementing agencies to examine the widest possible array of alternatives and refine those concepts to a single preferred or recommended alternative. This screening and refinement of alternatives can be depicted as a funneling process, graphically represented in Exhibit 5.1.



5.1 SH 146 Corridors Screening Approach

For the SH 146 Corridor study, the screening process used for the conceptual alternatives was a fatal flaw type analysis. Each of the conceptual alternatives was evaluated in terms of identifying any fatal flaws that might preclude or make its realization difficult. The conceptual alternatives were then screened, resulting in the recommendation of nine viable alternatives including the No-Build and TSM. These nine viable alternatives were then evaluated in detail leading to the selection of a recommended alternative.

The No-Build and the TSM Alternatives are required by the National Environmental Protection Act (NEPA) to be carried forward into the detailed evaluation process so they can be used as a baseline against which the build alternatives can be compared. Consequently, these two alternatives were carried through the initial screening process.

The remaining categories of conceptual alternatives, the build alternatives, were evaluated against screening criteria that reflected the critical aspects of each adopted study goal and objective. The screening criteria were intended to differentiate alternatives within emphasis categories based on their likelihood of addressing the problems and needs of the corridor and satisfying the MIS goals and objectives.

5.2 Screening Criteria

The screening process was based on a series of questions or criteria that represented elements of the goals and objectives. Alternatives were rated as to their ability to pass or fail the individual criteria (i.e., their ability to meet or not meet the criteria). The screening criteria developed for the project and the specific goals to which they relate are as follows:

Goal 1: Reduce Traffic Congestion

Improve corridor mobility in a cost-effective manner, realizing that the underlying cause of congestion may differ depending upon location within the corridor.

Identified Criteria:

- Does the alternative reduce congestion due to the recurring commute trips (intensity or duration)?
- Does the alternative address non-recurring congestion due to incidents and special events?
- Does the alternative reduce travel times between key locations within and through the corridor?
- Does the alternative maximize use of existing facilities?
- Does the alternative have flexibility to accommodate plans and proposals for future transportation improvements?

Goal 2: Improve Hurricane Evacuation

Maximize the evacuation capability of the SH 146 Corridor, considering the existing environmental and community constraints.

Identified Criteria:

- Can the alternative maximize the functional capacity of the SH 146?

- Does the alternative reflect a transportation system that will remain functional during flooding conditions?
- Is the alternative functionally adequate during flooding conditions?
- Will the alternative maximize the evacuation capacity of the corridor?

Goal 3: Improve Safety

Improve driving safety in the SH 146 Corridor.

Identified Criteria:

- Will the alternative improve the safety characteristics of the driving experience in the SH 146 corridor?
- Can the alternative assure that existing facilities can be developed/redeveloped to current TxDOT, FHWA and FTA standards providing adequate design clearances for truck, marine, and rail facilities?

Goal 4: Provide Travel Options

Provide a balanced and coordinated transportation system, which provides travel alternatives and opportunities to corridor residents and visitors.

Identified Criteria:

- Does the alternative reflect transportation systems and options that most closely meet the travel needs of people in an efficient manner?
- Is the alternative consistent with regional highway, thoroughfare, transit, and regional plans by others?
- Does the alternative improve freight movement/efficiency?
- Does the alternative preserve opportunities for future implementation of transportation modes and alternatives within the corridor?

Goal 5: Protect Natural and Social Environment

Provide a transportation system that serves the regional land use/development patterns now and in the future, and that minimizes the impacts to the natural and social environment.

Identified Criteria:

- Does the alternative maximize accessibility and minimize the need for additional land requirements (i.e. minimize impacts on residences and businesses)?
- Does the alternative preserve or promote the vitality of corridor communities?
- Does the alternative improve air and noise quality?
- Does the alternative improve utility opportunities?
- Does the alternative avoid environmental constraints identified within the corridor?

5.3 Screening Analysis and Recommendations

As previously noted, the screening process for the SH 146 corridor MIS was conducted as a fatal flaw analysis for each segment. Each of the Conceptual Alternative categories were evaluated against the screening criteria adopted for the study and were rated based on their ability to pass, marginally pass, or fail within a specific criteria for each goal. Those conceptual alternatives that had a Pass or Marginal Pass rating indicated that the alternative met the stated criteria to some degree. A fail rating indicated that the alternative did not meet the stated criteria or there were other factors, which were overriding reasons for failure.

A summary screening matrix, demonstrating the overall rating evaluation for each of the conceptual alternatives by segment at the goal level is provided in the following Exhibits.

Summary Screening Evaluation Results Matrix - Segment 1

Segment 1 I - 45 to FM 517	Modal Conceptual Alternatives	Goal 1 Reduce Traffic Congestion	Goal 2 Improve Safety	Goal 3 Improve Evacuation Capability	Goal 4 Enhance Travel Options	Goal 5 Protect Natural & Social Environment	Summary
	No-Build	N/A	N/A	N/A	N/A	N/A	Pass applies to entire corridor
	TSM	N/A	N/A	N/A	N/A	N/A	Pass applies to entire corridor
	Arterial	Pass	Pass	Marginal Pass	Pass	Pass	Pass
	Arterial/Grade Separations.	Pass	Pass	Pass	Pass	Pass	Pass
	Arterial/Access Road	Pass	Pass	Marginal Pass	Pass	Pass	Fail (1)
	Arterial/ Express Lanes	Pass	Pass	Pass	Pass	Pass	Fail (2)
	Alternative Alignment	Pass	Pass	Pass	Pass	Fail	Fail (3)
	Frwy/Frontage Roads	Pass	Pass	Pass	Pass	Fail	Fail (2)
	Truck Lanes	Pass	Pass	Pass	Pass	Pass	Corridor Wide Alternative
	Transit (Rail/Bus)	Marginal Pass	Marginal Pass	Marginal Pass	Pass	Marginal Pass	Fail (4)
	HOV Lanes	Marginal Pass	Pass	Marginal Pass	Pass	Pass	Corridor Wide Alternative
Alternate Modes	Fail	Marginal Pass	Fail	Pass	Marginal Pass	Corridor Wide Alternative	

***Note:** A "Pass" rating indicates that the alternative met the stated criteria. A "Marginal Pass" rating indicates that the alternative met the stated criteria to some degree. A "Fail" rating indicates that the alternative did not meet the stated criteria or in the case of the summary, other factors as listed were the overriding reasons.

- (1) Adjacent land development not densely developed enough to warrant this type of facility.**
- (2) Projected traffic demand insufficient to support express lane or freeway type of facility.**
- (3) No viable corridor exists in this segment for a new location facility.**
- (4) Further analysis needed. Evaluation independent of roadway.**

Summary Screening Evaluation Results Matrix – Segment 2

Segment 2 FM 517 to FM 518	Modal Conceptual Alternatives	Goal 1 Reduce Traffic Congestion	Goal 2 Improve Safety	Goal 3 Improve Evacuation Capability	Goal 4 Enhance Travel Options	Goal 5 Protect Natural & Social Environment	Summary
	No-Build	N/A	N/A	N/A	N/A	N/A	Pass applies to entire corridor
	TSM	N/A	N/A	N/A	N/A	N/A	Pass applies to entire corridor
	Arterial	Pass	Pass	Marginal Pass	Pass	Pass	Pass
	Arterial/Grade Separations.	Pass	Pass	Pass	Pass	Pass	Pass
	Arterial/Access Road	Pass	Pass	Marginal Pass	Pass	Pass	Fail (1)
	Arterial/ Express Lanes	Pass	Pass	Pass	Pass	Pass	Fail (2)
	Alternative Alignment	Pass	Pass	Pass	Pass	Fail	Fail (3)
	Frwy/Frontage Roads	Pass	Pass	Pass	Pass	Fail	Fail (2)
	Truck Lanes	Pass	Pass	Pass	Pass	Pass	Corridor Wide Alternative
	Transit (Rail/Bus)	Marginal Pass	Marginal Pass	Marginal Pass	Pass	Marginal Pass	Fail (4)
	HOV Lanes	Marginal Pass	Pass	Marginal Pass	Pass	Pass	Corridor Wide Alternative
Alternate Modes	Fail	Marginal Pass	Fail	Pass	Marginal Pass	Corridor Wide Alternative	

***Note:** A **"Pass"** rating indicates that the alternative met the stated criteria. A **"Marginal Pass"** rating indicates that the alternative met the stated criteria to some degree. A **"Fail"** rating indicates that the alternative did not meet the stated criteria or in the case of the summary, other factors as listed were the overriding reasons.

- (1) Adjacent land development not densely developed enough to warrant this type of facility**
- (2) Projected traffic demand insufficient to support express lane or freeway type of facility**
- (3) No viable corridor exists in this segment for a new location facility**
- (4) Further analysis needed. Evaluation independent of roadway**

Summary Screening Evaluation Results Matrix – Segment 3

Segment 3 FM 518 to Red Bluff	Modal Conceptual Alternatives	Goal 1 Reduce Traffic Congestion	Goal 2 Improve Safety	Goal 3 Improve Evacuation Capability	Goal 4 Enhance Travel Options	Goal 5 Protect Natural & Social Environment	Summary
	No-Build	N/A	N/A	N/A	N/A	N/A	Pass applies to entire corridor
	TSM	N/A	N/A	N/A	N/A	N/A	Pass applies to entire corridor
	Arterial	Pass	Pass	Marginal Pass	Pass	Pass	Pass
	Arterial/Grade Separations.	Pass	Pass	Pass	Pass	Pass	Pass
	Arterial/Access Road	Pass	Pass	Marginal Pass	Pass	Pass	Fail (1)
	Arterial/ Express Lanes	Pass	Pass	Pass	Pass	Pass	Pass
	Alternative Alignment	Pass	Pass	Pass	Pass	Fail	Fail (3)
	Frwy/Frontage Roads	Pass	Pass	Pass	Pass	Fail	Pass
	Truck Lanes	Pass	Pass	Pass	Pass	Pass	Corridor Wide Alternative
Transit (Rail/Bus)	Marginal Pass	Marginal Pass	Marginal Pass	Pass	Marginal Pass	Fail (4)	
HOV Lanes	Marginal Pass	Pass	Marginal Pass	Pass	Pass	Corridor Wide Alternative	
Alternate Modes	Fail	Marginal Pass	Fail	Pass	Marginal Pass	Corridor Wide Alternative	

***Note:** A "Pass" rating indicates that the alternative met the stated criteria. A "Marginal Pass" rating indicates that the alternative met the stated criteria to some degree. A "Fail" rating indicates that the alternative did not meet the stated criteria or in the case of the summary, other factors as listed were the overriding reasons.

- (1) Adjacent land development not densely developed enough to warrant this type of facility**
- (2) Projected traffic demand insufficient to support express lane or freeway type of facility**
- (3) No viable corridor exists in this segment for a new location facility**
- (4) Further analysis needed. Evaluation independent of roadway**

Summary Screening Evaluation Results Matrix – Segment 4

Segment 4 Red Bluff to Fairmont Parkway	Modal Conceptual Alternatives	Goal 1 Reduce Traffic Congestion	Goal 2 Improve Safety	Goal 3 Improve Evacuation Capability	Goal 4 Enhance Travel Options	Goal 5 Protect Natural & Social Environment	Summary
	No-Build	N/A	N/A	N/A	N/A	N/A	Pass applies to entire Corridor
	TSM	N/A	N/A	N/A	N/A	N/A	Pass applies to entire Corridor
	Arterial	Fail	Pass	Marginal Pass	Pass	Pass	Fail (5)
	Arterial/Grade Separations.	Fail	Pass	Pass	Pass	Pass	Fail (5)
	Arterial/Access Road	Fail	Pass	Marginal Pass	Pass	Pass	Fail (5)
	Arterial/ Express Lanes	Pass	Pass	Pass	Pass	Pass	Fail (5)
	Alternative Alignment	Pass	Pass	Pass	Pass	Fail	Fail (3)
	Frwy/Frontage Roads	Pass	Pass	Pass	Pass	Fail	Pass
	Truck Lanes	Pass	Pass	Pass	Pass	Pass	Pass
	Transit (Rail/Bus)	Marginal Pass	Marginal Pass	Marginal Pass	Pass	Marginal Pass	Fail (4)
	HOV Lanes	Marginal Pass	Pass	Marginal Pass	Pass	Pass	Corridor Alternative Wide
	Alternate Modes	Fail	Marginal Pass	Fail	Pass	Marginal Pass	Corridor Alternative Wide

***Note:** A "Pass" rating indicates that the alternative met the stated criteria. A "Marginal Pass" rating indicates that the alternative met the stated criteria to some degree. A "Fail" rating indicates that the alternative did not meet the stated criteria or in the case of the summary, other factors as listed were the overriding reasons.

- (1) Adjacent land development not densely developed enough to warrant this type of facility**
- (2) Projected traffic demand insufficient to support express lane or freeway type of facility**
- (3) No viable corridor exists in this segment for a new location facility**
- (4) Further analysis needed. Evaluation independent of roadway**
- (5) Projected traffic demand exceeds capacity of expanded arterial alternatives**



6.0 Identification of Viable Alternatives

Three corridor wide alternatives were included in the screening analysis and recommendations. These corridor wide alternatives were Truck lanes Alternative, HOV Lanes Alternative, and Alternate Modes Alternative. The results of the evaluation of Truck Lane and HOV Lane alternatives indicated that they passed or marginally passed the screening criteria. However, due to the diverse nature of these facilities having limited access and SH 146 corridor having large number of internal destination, Truck Lane and HOV Lane Alternatives are not compatible with arterial cross section. The Alternate Modes Alternative that would provide improvements to both bicycle accommodation and pedestrian access, received a high public support, hence it was included in all the build alternatives.

6.1 Alternative 1 (No-Build Alternative)

The SH 146 Corridor MIS Steering Committee provided guidance in the development and evaluation of the No-Build Alternative. The adopted definition of the No-Build Alternative consisted of existing and regionally significant committed projects within the corridor. Committed projects included those projects that have committed funding identified in Regional Transportation Plan (VISION 2022). Committed projects are likely to be completed prior to any implementation of a recommended alternative. The purpose of the MIS, and hence the development of a preferred alternative, is to determine the best package of improvements within the identified corridor to meet the long-range needs of the corridor. Once adopted by the Metropolitan Planning Organization, the recommendation will result in the revision of the Regional Transportation Plan (VISION 2022).

The Corridor was divided into four segments for analysis purposes, Segment I (IH 45 to FM 517) Segment II (FM 517 to FM 518), Segment III (FM 518 to Red Bluff Road), and Segment IV (Red Bluff Road to Fairmont Parkway).

Pending the results from the SH 146 Corridor MIS, the adopted Regional Transportation Plan also identified placeholder projects within the SH 146 Corridor to reserve both financial and emissions budgets in the regional plan. Subsequent to the completion of the MIS, these placeholder projects will be removed, replaced and/or modified by the recommended preferred alternative.

The placeholder projects for SH 146 included:

Widen SH 146 to 6 lanes (Urban section) from IH 45 to FM 517;

Widen SH 146 to 6 Lane (Urban Section) and construct Grade Separations at selected intersections from FM 517 to FM 518;

Widen SH 146 to 6 lanes (Urban Section), construct grade separations at selected intersections, and construct Express Lanes from FM 518 to Red Bluff Road;

Widen SH 146 to 8 Main lanes and construct Exclusive Truck Lanes from Red Bluff road to Fairmont Parkway.

6.2 Alternative 2 (Transportation System Management Alternative)

The TSM Alternative included the existing and committed projects (No Build) plus demand management techniques and minor mobility improvements intended to maximize the efficiency of the existing transportation facilities. The elements of the TSM Alternative were incorporated or expanded upon, within the build alternatives. Under the TSM Alternative, the basic lane-configurations that is proposed for SH 146 remain the same as under the No-Build Alternative.

Programs and projects included in the TSM Alternative were categorized into two groups: Transportation Demand Management programs and Transportation Systems Management programs including transit services. As indicated by their names, TSM and TDM elements are largely program oriented and designed to manage the traffic flow and travel demand to achieve higher performance on existing facilities. For example, a car pool ride-matching program could be considered a Transportation Demand Management technique because it reduces the demand for vehicle travel within the corridor. A ramp-metering program, on the other hand, would be an example of a Transportation System Management technique because it manages the flow of traffic onto the primary travel networks. Transit-related projects are typically categorized as TDM programs, but may also consist of discrete construction elements.

TSM improvements documented in the existing transportation improvement plan of VISION 2022 would be expected to be completed under the TSM Alternative. Such improvements would be expected to have their greatest impact and benefit in the near-term as compared to capacity expansion that would be expected to have its greatest benefits further into the future. TSM elements proposed for implementation under the No-Build definition (e.g., VISION 2022 outside the corridor) and, those that affect roadway congestion on facilities other than SH 146 within the corridor, were assumed beneficial to the overall transportation network. These elements were, assumed to be implemented by the committed agencies regardless of the capacity improvements that might be proposed for SH 146.

Discrete elements incorporated in the TSM Alternative can be generalized as:

- Implementing the Regional Congestion Management System (CMS), as identified by H-GAC in their Congestion Management System Implementation Plan;
- Providing minor arterial improvements to existing arterial sections in the Kemah and Seabrook area, including minor signal improvements, cross sections, etc.;
- Expanding existing park-and-pool facilities within the corridor to provide travel demand management opportunities; and,
- Providing preferential arterial transit treatments to transit operations and speeds and provide transit services in Harris County.

Responsibility for implementation of these elements remains with the lead agencies identified by H-GAC. During the design phase of the recommended alternative, it would be TxDOT's responsibility to coordinate with the identified agencies and help ensure that implementation of the preferred alternative does not negate the identified congestion mitigation program.

In addition to the documented congestion mitigation projects, the TSM alternative included additional TSM measures that were recommended to address the regional nature of the mobility issues observed within the corridor, including:

- Promoting a regional bicycle and pedestrian trail on the railroad/utility right-of-way paralleling SH 146;
- Applying a full range of Intelligent Transportation System (ITS) technologies to SH 146:
 - expanded system of observation cameras tied to TRANSTAR and/or a Galveston County Traffic Management Authority
 - flow meters on SH 146
 - electronic lane demarcations on SH 146
 - variable message signs throughout the corridor and on major arterial leading to SH 146
 - improved static signage throughout the corridor, replacing roadside signage with overhead signage and lane designation;
- Increasing mobility assistance patrols and implementing aggressive accident management program, geared towards removing accidents from the travel stream as quickly as possible and reducing the associated delay;
- Extending the timed signal system proposed on SH 146 to include entire length within the corridor, with demand-actuated signals at isolated intersections.

6.3 Alternative 3 (Arterial Alternative)

Alternative 3 was identified as a candidate build alternative in Segments 1, 2, and 3. This alternative would meet the 2022 traffic demand, maintain Level of Service "C" or better at signalized intersections, provide access to local business, provide recreational access, improve safety, and reduce accidents.

6.4 Alternative 4 (Arterial with grade separations)

Alternative 4 was also identified as a candidate build alternative in Segments 1, 2, and 3. This alternative would meet the 2022 traffic demand, increase capacity by reducing delay at intersections, provide access to local business, provide recreational access, improve safety, and reduce accidents by eliminating conflicting movements.

6.5 Alternative 5 (Express Lane with Arterial Roadway)

Alternative 5 was identified as a candidate build alternative in Segment 3. This alternative would improve safety, provide access to local business, provide recreational access, meet 2022 traffic demand, provide express lanes for through traffic including trucks.

6.6 Alternative 6 (Freeway with Frontage roads)

Alternative 6 was also identified as a candidate build alternative in Segment 3. This alternative would improve safety, meet the 2022 traffic demand, reduce congestion, reduce accidents, and provide recreational access.

6.7 Alternative 7 (Expand Existing Freeway Segments)

Alternative 7 was identified as a candidate build alternative in Segment 4. This alternative would improve safety, meet the 2022 traffic demand, reduce congestion, and reduce accidents.

Table below demonstrates a summary of the Corridor Wide Viable Alternatives.

	Segment II	Segment I	Segment III	Segment IV
No-Build	X	X	X	X
TSM	X	X	X	X
Arterial	X	X	X	
Arterial/Grade Separations.	X	X	X	
Arterial/ Express Lanes			X	
Freeway/Frontage Roads			X	
Expand existing Freeway Segments				X



7.0 Evaluation of Viable Alternatives

The “viable alternatives”, those passing the screening analysis, were evaluated in greater detail to determine their relative ability to meet the adopted Goals and Objectives of the study. Specifically, the viable alternatives were evaluated for their ability to:

- Improve mobility by reducing traffic congestion within the corridor;
- Provide adequate evacuation capacity for those portions of south Harris and Galveston Counties served by the SH 146 corridor;
- Improve the safety characteristics of the corridor;
- Improve access to alternate modes of transportation by providing travel options; and,
- Avoid or minimize potential environmental and community impacts within the corridor.

The detailed analysis of the viable alternatives not only examined each of the viable alternatives in total, but also the underlying elements. This process allowed for the selection of the best combination of elements for recommending a preferred alternative.

In addition to the detailed evaluation criteria listed above, detailed planning-level estimates for capital costs and for operation and maintenance costs were developed for each of the viable alternatives. The combined evaluations of mobility, safety, evacuation capability, access to alternate modes, environmental impacts, and project costs, along with public input, formed the basis for selecting a preferred alternative.

7.1 Mobility Analysis

A detailed mobility analysis was conducted for each of the viable alternatives. Mobility can be assessed using a number of evaluation measures including, improvement in travel times and reductions in vehicle miles and hours of travel. These variables are inherently related to the speed and density of traffic flow within the corridor and hence the level of congestion.

As part of the mobility analysis, congestion levels were projected for the corridor using the H-GAC regional travel model. Projected volumes on SH 146 in the year 2022 were compared to roadway capacities provided on these facilities under each of the viable alternatives. Results of this analysis indicated that SH 146 would be congested under the No-Build Alternative. Furthermore, the analysis showed that, Segment I and Segment II of the corridor (Fairmont Parkway to FM 518) would likely be severely congested, experiencing gridlock during the peak commuting periods.

A similar analysis of the TSM and build alternatives indicated that the TSM Alternative would provide only minor reductions in congestion levels compared to the No-Build. All the build alternatives, on the other hand, have the capability to significantly reduce congestion within the corridor, thereby improving mobility.

7.2 Analysis of Evacuation Concerns

Much of the SH 146 Corridor lies within the potential flood zone for major hurricanes making landfall from the Gulf of Mexico. Hurricanes pose a significant threat to the low-lying areas of Harris County and to all of Galveston County. SH 146 serves as an evacuation route for Galveston County. Other evacuation routes serving the south Harris County and Galveston County portions of the region include SH 6 and IH 45, with IH 45 being the primary evacuation route. SH 3, which parallels IH 45 is not currently classified as a primary evacuation route due to inadequate capacity and to portions of the roadway being subject to flooding.

Evacuation is of primary concern to residents and agencies within the SH 146 Corridor. Accordingly, all build alternatives were developed so that all improved segments of the corridor remain accessible during flooding events. Reconstruction of SH 146 will take into consideration, the roadway elevations in a critical flooding level generated by a maximum hurricane storm event as defined by the National Weather Service (Class 5 hurricane).

For Hurricanes, evacuation warnings are typically issued no more than 48 hours in advance of an approaching storm. This 48-hour evacuation window is based on the difficulty of accurately predicting hurricane landfall locations in advance of the event.

The No-Build and TSM Alternatives were found unable to provide for adequate evacuation within the prescribed 48-hour window for the year 2022. All of the build alternatives, however, would be able to achieve evacuation of the affected areas within the 48 hour evacuation window. Thus, all of the build alternatives would meet the evacuation needs of the corridor. However, neither the TSM nor the No-Build Alternatives meet the minimum threshold for acceptable evacuation capabilities.

Because evacuations in the State of Texas are voluntary, and because residents in affected hurricane areas typically delay their departure, the difference between the estimated evacuation time required under each of the build alternatives and the 48-hour evacuation window would provide a margin of safety. Hence, it is likely that any of the build alternatives would meet the evacuation needs of South Harris County and Galveston County served by the SH 146 Corridor.

7.3 Analysis of Safety Concerns Corridor-Wide Safety Concerns

Safety of the future transportation system within the SH 146 Corridor was an indicated concern voiced by numerous participants at the public meetings held in support of the MIS. Safety concerns related to the design of the future facility and the desires to reduce potential future traffic accident rates were incorporated into the development of the build alternatives. Elements related to these concerns are incorporated in all the build alternatives and include:

- Re-design of major intersections to current TxDOT standards: many of the intersections within the corridor were designed to reflect a rural environment. As the corridor has urbanized over the past two decades, the rural designs no longer meet the traffic needs of the existing and future traffic demands.

- **Increased motorist assistance patrols within corridor:** as part of the TSM Alternative and all the build alternatives, an increase in motorist assistance patrols is proposed. These patrols would assist accident victims and travelers experiencing vehicle difficulty. By removing such incidents from the roadway network efficiently, the potential for secondary and more severe incidents can be removed.
- **Congestion reduction:** all of the build alternatives would reduce congestion within the corridor. A reduction in congestion can reduce the likelihood of accidents within the travel network. Although vehicles may travel at higher speeds on less congested roadways (i.e., closer to the posted speed limit) which can result in the potential for more severe accidents, the overall number of accidents would be expected to be reduced as congestion levels are reduced.

Each of the build alternatives were developed to provide these safety oriented attributes as compared to the No-Build Alternative. The TSM alternative would not provide the congestion reduction capabilities provided by the build alternatives, nor would it provide for the redesign of the intersections. Hence, it can be argued that the build alternatives provide a relatively higher level of potential safety than do the No-Build or TSM alternatives. This does not indicate that the No-Build and TSM alternatives are inherently unsafe, only that the build alternatives would provide a relatively higher degree of potential safety.

7.4 Access to Alternate Modes of Transportation

Development patterns within the SH 146 Corridor are heavily dependent on the automobile as the primary mode of travel. However, public and agency involvement in the study indicated a need to expand access to alternate modes of transportation within the corridor, including improved access to bicycle and pedestrian facilities. Consideration of access needs for each of these modes were incorporated as part of the development of alternatives for the SH 146 Corridor.



Bicycle and Pedestrian Access

As part of the public involvement process, request for improved bicycle and pedestrian facilities within the corridor were voiced by both residents and jurisdictional agencies within the corridor. Bicycle usage of SH 146 was also observed on several field surveys.

To meet the assumed increase in bicycle and pedestrian demand likely to develop by the Year 2022, an off-road bicycle/pedestrian facility adjacent to SH 146 was included as part of the TSM and all Build Alternatives. The proposed bicycle/pedestrian facility would create a backbone to provide connectivity for trails system developed by local municipal agencies. Because it was proposed under the TSM and all build alternatives, access to bicycle/pedestrian oriented facilities throughout the corridor would be enhanced, regardless of which alternative is recommended.

7.5 Potential Environmental Impacts

An analysis of the potential environmental constraints and impacts within the SH 146 corridor MIS study area was completed for each of the viable alternatives. The evaluation represents an identification of potential issues at sufficient detail to differentiate between the alternatives being evaluated. Once TxDOT and the Metropolitan Planning Organization adopt a Locally Preferred Alternative, a detailed environmental assessment or impact analysis will be required.

Potential impacts related to the following issues will be included in the environmental evaluation:

- land use impacts;
- social and environmental justice;
- right-of-way requirements;
- displacements;
- economic and joint development;
- air quality and noise;
- floodplains;
- visual aesthetics;
- cultural, historical, and archeological resources;
- biological resources
 - wetlands
 - soils
 - wildlife habitat
 - threatened and endangered species;
- hazardous waste;
- secondary and cumulative impacts;
- irreversible and irretrievable commitments;
- permits; and,
- construction impacts.

The MIS environmental analysis was documented in the SH 146 Corridor MIS Environmental Evaluation Report. TxDOT, as the lead agency is responsible for conducting the detailed environmental assessment or impact analysis during the schematic design phase of the project.

The MIS environmental evaluation indicated that there were relatively few environmental or community constraints within the corridor that would be adversely affected by implementation of any of the build alternatives as compared to the No-Build and TSM Alternatives.

The purpose of this section of the final MIS report is to highlight the minor differences between the alternatives. Potential impacts projected for the various alternatives represent those identified at the preliminary MIS level that may not be avoidable. These potential impacts will

require mitigation if they can not be avoided during the detailed engineering and planning phases of the project.

7.5.1 Right-of-Way Needs and Impacts on Corridor Land Uses

Additional right-of-way (ROW) will be required under all of the Build Alternatives. The majority of ROW needs, are in segment II and segment III of the corridor (between FM 517 and Red Bluff Road). The No-Build and TSM Alternatives would require minimal ROW, if selected. All of the build alternatives would require additional ROW if they are implemented. However, regardless of alternative selected, impacts to surrounding land uses are expected to be minor.

7.5.2 Displacements and Relocations

Displacements caused by the various SH 146 corridor MIS alternatives were identified where a business, residential, or other land use would potentially be entirely or substantially displaced by a specific alternative.

For the No-Build and TSM Alternatives, no displacements were identified within the corridor, based on the preliminary MIS environmental analysis

For all of the build alternatives, the same level of displacements were projected. Those displacements occur primarily within the segments II, and III of the corridor where some businesses adjacent to SH 146 are projected to be displaced.

7.5.3 Access to Community Facilities and Services; Public Health and Safety; and Economic Development

The No-Build and TSM Alternatives were projected to have no net impacts or benefits regarding access to community facilities and services or impacts related to public health and safety, nor would they be expected to have a negative or positive impact on economic development.

Because all of the Build Alternatives would improve mobility over the No-Build and TSM Alternatives, they are all projected to have positive benefits related to the access to community facilities and services and to the improvement of public health and safety. Similarly, because all of the build alternatives would improve access to employment sites throughout the corridor, they would be expected to improve overall economic opportunities within the corridor.

7.5.4 Social and Environmental Justice

Impacts related to environmental justice are not envisioned under the No-Build, TSM, or any of the Build Alternatives.

7.5.5 Cultural/Historical Resource

No potential impacts are projected within the north and middle segments of the corridor related to cultural and historical resources for any of the build alternatives.

A potential impact to unknown sites of historical significance exists throughout the corridor. The potential for impacts to such sites, although low, exists for any of the build alternatives.

7.5.6 Visual Quality and Aesthetics

Elevated structures and grade-separated intersections proposed under any of the build alternatives might have some visual impacts to the surrounding land uses. However, where these potential elevated elements are concentrated in existing commercial or industrial areas, the resulting impacts are expected to be low.

7.5.7 Biological Resources

The SH 146 Corridor was analyzed for potential biological resources, including an analysis of potential impacts from implementation of each of the alternatives. Specifically, potential impacts to the following biological resources were examined:

- Prime soils,
- Dry land wildlife habitat,
- Wetlands, and
- Flood plains.

Overall, impacts projected under each of these biological categories are a direct result of the need for additional right-of-way in the middle segments of the corridor or due to existing resources within state owned right-of-way that will be utilized during project implementation. Identified impacts to biological resources are similar under all the build alternatives. The identified potential impacts were not judged to limit the viability of any of the build alternatives. Any impacts that cannot be avoided during detailed planning and design would require mitigation during construction.

7.5.8 Impacts to Hazardous Waste Sites

Relative impacts to known hazardous waste sites within the corridor were similar for all build alternatives. No issues were identified within the corridor that would have precluded any of the alternatives from being selected. Any potential impact identified during detailed schematic design would require mitigation and consideration during the design phase of the preferred alternative.

7.5.9 Air and Noise

Estimated air quality impacts from all the alternatives were projected to be below the National Ambient Air Quality Standards (NAAQS), indicating a low potential for long-term impacts; thus, potential impacts from implementing the preferred alternative would not limit its viability.

Potential 2022 noise impacts from any of the build alternatives were projected to be greater than those projected under the no-build alternative. These areas would require consideration of noise mitigation. During the development of the build alternatives, consideration of noise mitigation would be required. Under the no-build alternative, there would be no requirement for the consideration of noise mitigation due to existing and projected traffic demand.

7.5.10 Flood Plains and Jurisdictional Water Crossings

Much of the SH 146 Corridor incorporates low-lying areas of Harris and Galveston Counties. The build alternatives, because they represent expansions of existing roadways, would affect additional acreage lying in established floodplains (relative to the No-Build and TSM Alternatives). Roadway improvements within identified floodplains would require design to avoid the risk of adverse impacts on drainage.

All of the build alternatives cross probable jurisdictional waters within the SH 146 Corridor. However, at this stage of analysis, the number of the existing culvert crossings that would be converted to bridge crossings as a result of the recommended preferred alternative could not be determined. Because of this uncertainty, no quantitative assumptions could be made regarding the effects of implementing a build alternative.

7.5.11 Secondary and Cumulative Impacts/Irreversible and Irretrievable Commitments

Secondary and cumulative impacts associated with the proposed improvements in the SH 146 Corridor are those impacts which occur as a result of the improved mobility characteristics of the proposed improvements but not directly due to the expanded roadways. For example, improved mobility would provide an opportunity for additional development in the Kemah and Seabrook area. This additional development would have impacts on the surrounding communities and environment. These potential impacts, due to the development that may evolve due to the improved mobility, would be considered secondary impacts. Cumulative impacts are those impacts that occur as a result of the accumulation of individual direct impacts.

In terms of secondary and cumulative impacts, all of the build alternatives have the potential for similar negative impacts:

- Increased capacity and improved intersections on SH 146 could accelerate land development in all sections, with the most likely land use types being commercial and residential in the north and middle sections and commercial and industrial in the south section. This

development could potentially create adverse affects on cultural resources, beneficial or adverse affects on visual quality, and beneficial affects on economic activities.

- Potential increases in traffic noise and decreases in air and water quality could adversely affect wildlife and wildlife habitat near existing roadways.
- Potential indirect affects to wetlands could occur from the continued fragmentation of existing wetland parcels. Potential increased runoff from residential, commercial, industrial and transportation land uses encouraged by improved mobility could carry additional contaminants into receiving wetlands within the corridor.
- All of the build alternatives would be expected to cause slightly higher indirect and cumulative affects on terrestrial resources, threatened and endangered species, and sensitive species historically known to occur within the study area.

By acknowledging the potential for these secondary and cumulative impacts, communities within and surrounding the SH 146 Corridor may be able to reduce these potential impacts through efficient land use planning.

7.5.12 Permit and Coordination Requirements

Any improvements within the SH 146 Corridor would require a range of permits that are secured prior to implementation. Permits related to water and air quality, federal highways, navigable waterways, endangered species, farmland protection, emergency management, hazardous waste, and utilities would be required. Such permits would not be needed under the No-Build or TSM except for those elements of the alternatives that result in new construction.

7.5.13 Construction Impacts

Any of the build alternatives for the SH 146 Corridor would require construction of major new elements. This construction may generate mobility, air quality, noise, and water quality concerns during implementation. These impacts can be mitigated through detailed planning and design that would establish methods for managing the potential risks.

7.5.14 Irreversible and Irretrievable Commitments

The potential environmental and community impacts identified for the preferred alternative or each of the alternatives represent irreversible and irretrievable commitments within the corridor. In other words, should the preferred alternative be implemented, the sum of those impacts generated that cannot be subsequently removed represent irreversible and irretrievable commitments that must be mitigated.

Given the similarity of the potential impacts identified for the preferred alternative and the build alternatives, no distinction can be made between them. The No-Build and TSM Alternatives would be expected to result in few impacts if any, hence there would be few irreversible or irretrievable commitments made. Potential impacts projected under all of the build alternatives were not of a magnitude to suggest that any of the build alternatives not be selected.



8.0 Recommended Preferred Alternative

8.1 Recommendation Process

Based on the technical evaluation of the viable alternatives and on their underlying elements, a recommendation for a preferred alternative was developed. The recommendation was based directly on the five primary goals identified for the SH 146 Corridor MIS: reduce congestion, improve hurricane evacuation, improve safety, increase access to alternate modes of transportation, and protect the natural and community environment of the corridor. If during the schematic and environmental process, it is determined that the selected preferred alternative is inadequate to solve the future transportation and/or environmental needs along the corridor, TxDOT will make adjustments to the schematic in order to best meet the needs of the communities along the corridor.

Reduce Congestion

The evaluation of mobility benefits developed during the alternative evaluation process indicated that the No-Build and TSM Alternatives did not meet the basic mobility needs of the corridor. Arterial with grade separation in Segment I, Arterial with grade separation in Segment II, arterial with express lanes in Segment III, and freeway with frontage roads for Segment IV, from a mobility perspective, was recommended as the preferred alternatives for each segment.

Improve Hurricane Evacuation

Evaluation of hurricane evacuation capacity of the SH 146 Corridor indicated that in the Year 2022, the No-Build and TSM Alternatives would not meet the evacuation needs of the SH 146 Corridor. The evaluation also indicated that any of the build alternatives would meet the minimum evacuation needs of the corridor.

Improve Safety

From a corridor-wide safety perspective, all of the build alternatives would be expected to provide a relatively greater level of safety than the No-Build or TSM Alternatives. This is because the build alternatives would necessitate upgrading of the design of SH 146, eliminating any safety constraints or concerns within the existing corridor.

Increase Access to Alternative Modes of Transportation

Access to bicycle and pedestrian facilities would be equally improved by any of the build alternatives relative to the No-Build and TSM Alternatives by the introduction of an off-road bicycle and pedestrian facility adjacent to SH 146. The proposed facility was incorporated in all the build alternatives.

Protect Natural and Community Environment

Analysis of potential environmental impacts for the SH 146 Corridor indicated that the No-Build and TSM Alternatives would have few or no negative impacts on the surrounding natural or community environments; however, these alternatives would provide few benefits in terms of meeting the other goals and objectives of the study.

The environmental analysis indicated that selection of a build alternative would result in some impacts; however, the potential impacts would be similar for all alternatives, regardless of which build alternative is selected. Furthermore, given that the project extends for some 24 miles and incorporates fourteen independent cities, the identified impacts that could be created compared to similar projects are modest in nature and magnitude. The analysis of potential environmental and community impacts did not indicate a bias towards any of the build alternatives, nor did the analysis indicate potential impacts of a magnitude that would suggest any of the build alternatives to be infeasible.

8.2 Recommended Elements for a Preferred Alternative

The elements of the recommended alternative, based on the technical analysis and public comments, are provided below. Typical roadway lane configurations for SH 146 are shown in Exhibits 8.1, 8.2, and 8.3.

Segments I and II – IH 45 to FM 518

- Provide four (4) general-purpose arterial lanes from IH 45 to FM 517.
- Provide six (6) general purpose arterial lanes from FM 517 to FM 518.

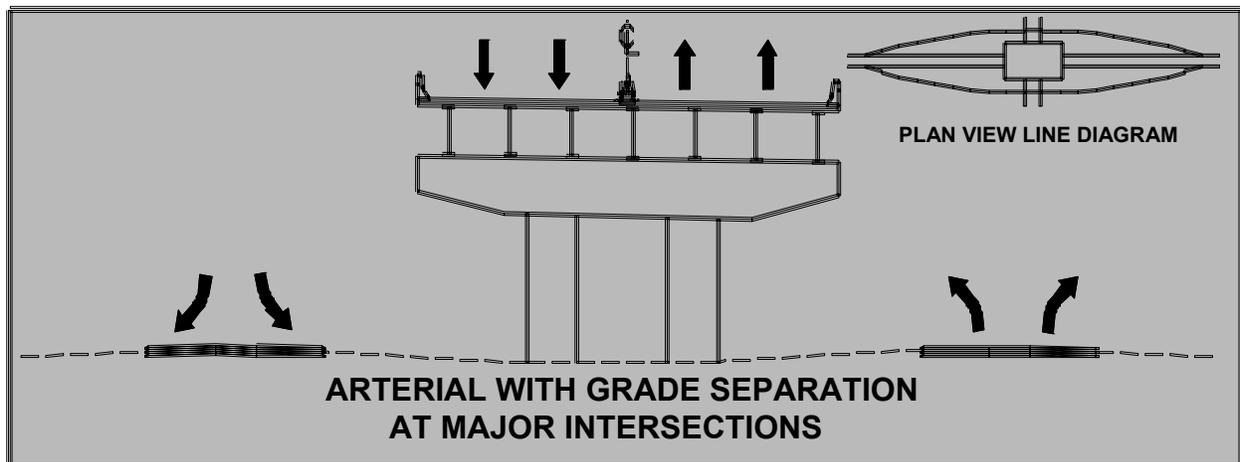


Exhibit 8.1

SH 146 Recommended Preferred Alternative in Segments I and II.

Segment III – FM 518 to Red Bluff Road

Provide six (6) general-purpose arterial lanes and express lanes from FM 518 to Red Bluff road.

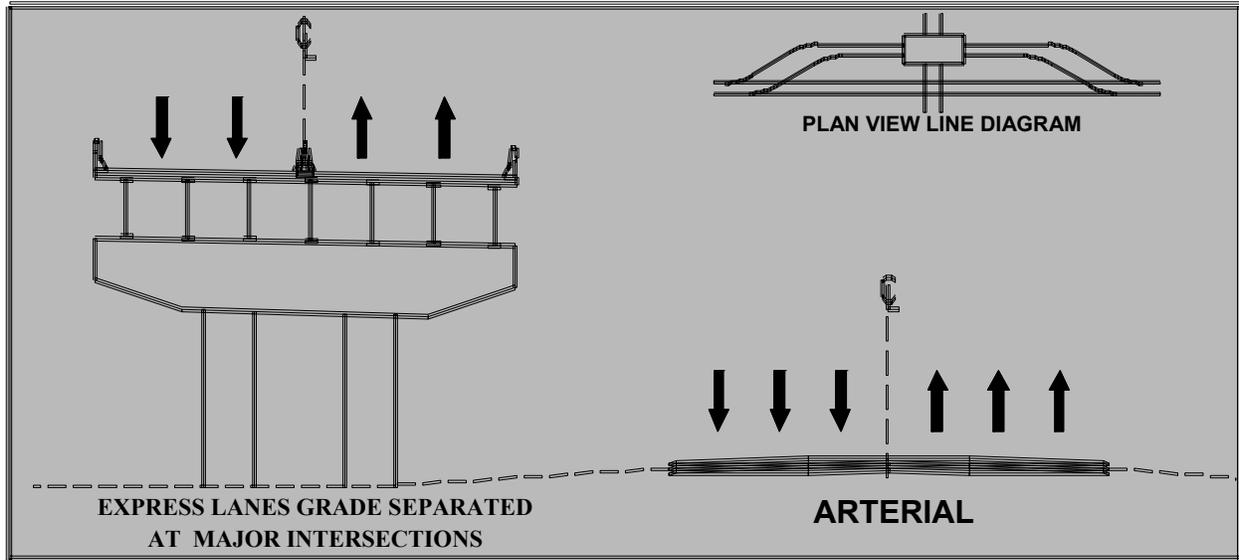


Exhibit 8.2

SH 146 Recommended Preferred Alternative in segment III

Segment IV – Red Bluff Road to Fairmont Parkway

Provide six (6) general-purpose freeway lanes with frontage roads and potential future HOV lanes from Red Bluff road to Fairmont Parkway.

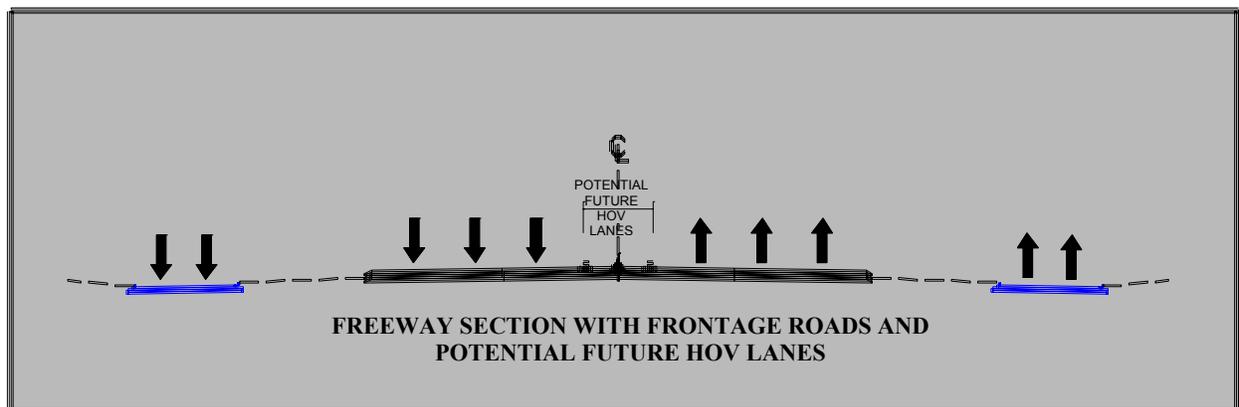


Exhibit 8.3

SH 146 Recommended Preferred Alternative in segment IV.

The identified recommended elements represented a comprehensive approach for meeting the transportation needs of the Corridor.

Recommended Preferred Alternatives are described in Exhibit 8.4

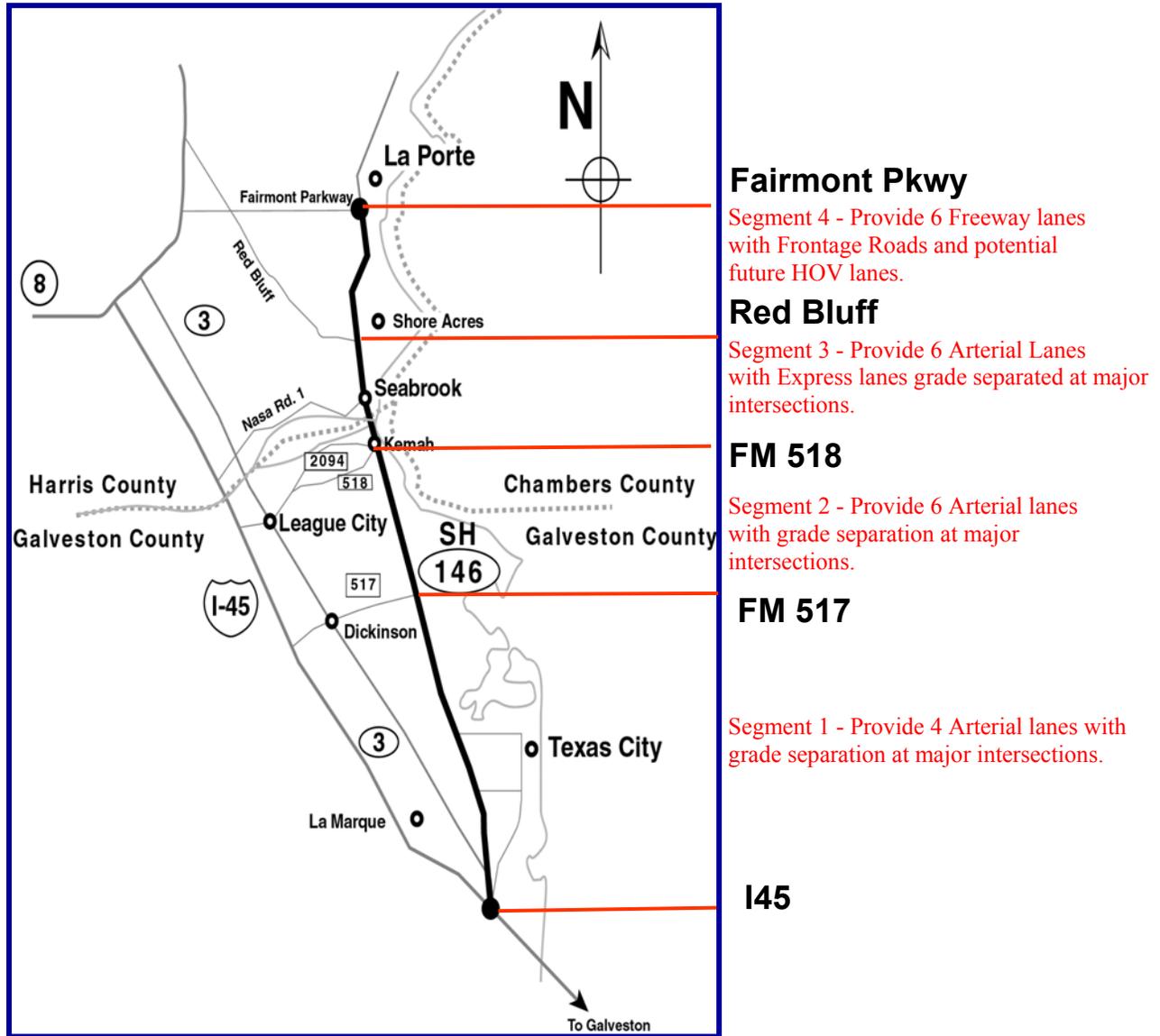


Exhibit 8.4

Corridor Wide Recommendations

- TSM Improvements
 - ❖ Improved traffic signal systems
 - ❖ Operational and circulation improvements
 - ❖ Increased bus transit services
 - ❖ Bicycle/Pedestrian facilities
 - ❖ Expansion of park-and-ride/park-and-pool facilities
 - ❖ Motorist information systems
 - ❖ Intersection improvements
 - ❖ Rideshare support programs

Abstract

The proposed action is the reconstruction of twenty-four miles of the State Highway 146 (SH 146) corridor, stretching between Interstate Highway 45 in Texas City to Fairmont Parkway in La Porte, Texas. In addition to rebuilding the existing facility, the proposed action would add general-purpose roadway capacity throughout the corridor.

The proposed action would bring SH 146 to current TxDOT Standards. Of the alternatives evaluated, the proposed action to develop the Preferred Alternative provides the best opportunity to meet the needs of the corridor residents through the year 2022. In comparison to other alternatives considered, the proposed action most closely meets the mobility demands while at the same time avoiding or minimizing environmental and community impacts typically encountered with similar arterial-oriented projects. Mitigation for unavoidable impacts will be defined during the formal environmental documentation and schematic design process. The Houston-Galveston Area Council (H-GAC) will initiate this process subsequent to adoption of the recommended preferred alternatives. H-GAC serves as the Metropolitan Planning Organization for the Houston and Galveston region.

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Conclusions

The development of the Preferred Alternative would improve traffic mobility and safety along the SH 146 corridor. Selection of the preferred alternative, recommended by this MIS is the first phase of the overall implementation of needed transportation improvements in this major highway corridor.

The development of the Preferred Alternative will require adoption of the MIS recommendations by the Houston-Galveston Area Council's Transportation Policy Council. Following the adoption of the recommendations, the proposed project will be included in the Metropolitan Transportation Plan. The project will be developed in compliance with all of the State and Federal requirements.