Preliminary Review of The Katy Corridor Coalition Concept

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EXECUTIVE SUMMARY

This report summarizes the preliminary review of the Katy Corridor Coalition (KCC) concept for the reconstruction of Katy Freeway and highlights issues and concerns that may require further investigation. While the KCC concept is technically possible to construct, it does not appear to be feasible considering the amount of additional work, time and money it would entail.

Depressing the freeway, as the KCC concept envisions, would require significant additional excavation amounting to removal of almost 9 million cubic yards of soil. The addition of approximately 17.6 miles of concrete retaining walls along the entire length of the project from Beltway 8 to Washington Avenue will require approximately 572,000 additional cubic yards of concrete. Constructing the retaining walls, supported by drilled shafts, would require significant increases in drilled shafts for walls and bridge structures. Diverting streams below the depressed freeway would require construction of extensive structures and pump stations. To meet these and the other significant changes that would be required under the KCC concept, the cost of the Katy Freeway Reconstruction would increase by approximately $500 million above the current estimate for the same section of the Texas Department of Transportation (TxDOT) IH 10 Project Plan.

Implementation of the KCC concept would require that all underground utility (e.g., water lines, sewer lines, electric cables, gas pipelines, telephone cables, etc.) relocations be completed in advance, rather than concurrently as under the TxDOT IH 10 Project Plan. Phasing of construction activities under the KCC concept would also need to be sequential, rather than concurrent as planned. The massive amount of excavation required by the KCC concept would require an additional 700 days. As a consequence of these three aspects of the KCC concept, construction would take an additional three years beyond that currently projected for the TxDOT IH 10 Project Plan. Under the KCC concept, where utility lines cross IH 10, the utility lines would have to be relocated below the depressed roadway. Such relocation would be extremely costly and may require pump stations for gravity dependent systems such as sewer lines. As an alternative, the utilities could be elevated above grade, although this would significantly reduce the possible aesthetic benefits of the KCC concept.

The KCC concept, moreover, does not meet either the American Association of State Highway or Transportation Officials (AASHTO) or TxDOT design standards and, therefore, would not qualify for federal funding under Federal Highway Administration (FHWA) guidelines. The TxDOT IH 10 Project Plan meets the current design and operating criteria established for this segment of the Federal Interstate Highway System.

Although a plan generally implementing the KCC concept might be possible to develop, such a plan would not provide the public with a better, timelier, more cost effective or more environmentally benign facility than the TxDOT IH 10 Project Plan. Rather, the alleged benefits of the KCC concept are outweighed by the huge increase in construction costs and the significant additional time, which would be needed to complete the project. The additional cost to implement the KCC concept is estimated to be approximately $500 million, an amount that outstrips TxDOT's present ability to fund and complete the project in a timely manner. The cost for the project segment most affected by the KCC concept (Washington Avenue and Beltway 8) alone would increase from $620 million to over $1,120 million, almost twice current cost. Moreover, even if additional funding were obtainable, at least three more years would be required to construct the project, delaying completion until 2012 or later.

Major engineering and other issues addressed in this preliminary review include: operations, drainage and flood control, constructibility, landscaping, noise mitigation, air quality, economic impacts, future rail and safety. The most important of these issues are:

- Cost: The additional cost to implement the KCC concept is estimated to be $500 million, an amount that outstrips TxDOT's present ability to fund and complete the project in a timely manner. The cost for the project segment most affected by the KCC concept (Washington Avenue to Beltway 8) alone would increase from $620 million to over $1,120 million, almost twice current cost.

- Schedule: If additional funding were obtainable, at least three more years would be required to construct the project, delaying completion until 2012 or later.

- Drainage: The KCC concept would require providing adequate flow capacity by dropping the enormous volumes of water from Spring Branch Creek and adjacent waterways north of IH 10 below the depressed roadway and pumping the water back up south of IH 10. Because this system would replace a drainage system dependent entirely on gravity flow and integrated with existing drainage patterns, the KCC concept would result in significant alterations to existing drainage patterns at substantial additional construction and operational costs to TxDOT. The KCC concept would substantially increase risk of flooding adjacent properties with associated hazards to the traveling public on the main lanes of the freeway.

- Design Standards: The KCC concept does not meet either AASHTO or TxDOT design standards and, therefore, does not qualify for federal funding under FHWA guidelines.

Because of the significantly increased cost, significant delays, inherent engineering difficulties and the inability to meet applicable design standards along with the absence of significant benefits, the KCC concept would not be a viable alternative to the TxDOT IH 10 Project Plan and would not provide users of IH 10 with a cost-effective or timely transportation facility.

PRELIMINARY REVIEW OF THE KATY CORRIDOR COALITION CONCEPT

IH 10 FROM BELTWAY 8 TO WASHINGTON AVENUE

INTRODUCTION

This preliminary review of the Katy Corridor Coalition (KCC) concept for depressing a section of IH 10 between the interchange with Beltway 8 in the west and Washington Avenue in the east has been undertaken at the request of the Texas Department of Transportation (TxDOT). The evaluation of the KCC is preliminary and could be subject to revision if additional information is provided. The KCC concept was evaluated on its own merits and also was compared with the current TxDOT IH 10 Project Plan for the reconstruction of the Katy Freeway. A description of the TxDOT IH 10 Project Plan is contained in the Final Environmental Impact Statement (FEIS) Reevaluation Report and its accompanying schematic.

The TxDOT IH 10 Project Plan meets the goals, objectives and requirements for the reconstruction of the Katy Freeway, as defined during the planning and environmental impact review stages and meets the design and operating criteria established for this segment of the Federal Interstate Highway System.

Basic information regarding the KCC concept was obtained from the KCC and from its website. The website presents a number of objections to the TxDOT IH 10 Project Plan and a list of stated goals claimed for the KCC concept. Several artists' renderings are included with claims that the drawings represent a way to significantly reduce the width of right-of- way (ROW), noise, air pollution, etc. No engineering analysis has been provided to date by the KCC to substantiate their claims, nor has detailed engineering design been provided.

BACKGROUND

Plans for the reconstruction and widening of the Katy Freeway have been working their way through the state and federally prescribed planning process for over two decades. The design life of the original Katy Freeway was passed almost twenty years ago, and major rehabilitation is long overdue. Early efforts by TxDOT to address growing needs of west Houston in the 1980s included a proposal to double deck the freeway by building continuous elevated express lanes over the existing main lanes. The proposal met with massive public opposition and was shelved. TxDOT then examined various options for the reconstruction efforts, including a collector-distributor (CD) system for the frontage road traffic.

The Intermodal Surface Transportation Efficiency Act (ISTEA) passed by Congress in late 1991 mandates that all significant new or added capacity transportation projects undertake an early planning effort developing a preferred modal concept before funds are committed and environmental assessments begin. Major Investment Study (MIS) planning for Katy Freeway started in late 1994, and through a series of public meetings identified, screened and analyzed various alternatives. The Houston-Galveston Area Council, the regional Metropolitan Planning Organization, approved a Preferred Conceptual Alternative in October 1997. Several cities and citizens' groups from the Memorial Villages participated in the MIS planning efforts; the Spring Valley I -10 Expansion Committee and the Hedwig Village I -10 Corridor Committee were among the most active. The cities and the citizens' committees articulated many concerns, recommendations and requests. A depressed design option was discussed early in the MIS process, but ruled not viable because of the large amounts of storm water run-off caused by a depressed roadway and laterally crossing creeks and streams from extensive drainage watersheds north of the freeway. This depressed design option was considered again in the early phase of preliminary engineering (called "schematic design") after the completion of the MIS and rejected for the same reason.

The environmental analysis of the project started in early 1998, and a Draft Environmental Impact Statement (DEIS) was released in January 2000. The concluding public hearing on the DEIS was held on March 27, 2001, and a final Record of Decision (ROD) was issued on August 30, 2002. The adopted alternative in the Final Environmental Impact Statement (FEIS) consists of an at-grade roadway with two managed lanes in the middle, four main lanes and three frontage road lanes in each direction. Additional auxiliary main and frontage road lanes are included to provide lane balance at interchanges and ramps. This approved alternative is called the *TxDOT IH 10 Project Plan* in this report.

In February in 2003, the KCC first presented their alternative concept of depressing a section of IH 10 to TxDOT. This alternative is referred to as the *KCC concept* in this report.

PURPOSE OF PRELIMINARY REVIEW

This preliminary review compares the KCC concept for the Katy Freeway reconstruction between Beltway 8 and Washington Avenue with the TxDOT IH 10 Project Plan. Reviews of the KCC concept with the TxDOT IH 10 Project Plan in the flowing contexts:

1. Operational and Safety Issues
2. Drainage Issues
3. Constructibility Issues
4. Scheduling Issues
5. Cost Estimate
6. Other Issues

DESCRIPTION OF FACILITY CONCEPT PROPOSED BY THE KCC

The KCC concept was released to the media on January 16, 2003. In a meeting with the TxDOT Houston District Engineer on February 24, 2003, KCC representatives requested that TxDOT review the KCC concept. The concept, as described on the KCC website (www.katycorridor.org), has been used as the basis for this preliminary review. The KCC concept differs from the TxDOT IH 10 Project Plan in four key areas:

- Under the KCC concept, the main lanes and managed lanes are depressed for the entire length between the eastern touchdown of the Beltway 8 direct connectors and Washington Avenue.
- Under the KCC concept, the number of through lanes for main lanes and frontage roads are reduced by one in each direction to three main lanes and two frontage road lanes.
- Under the KCC concept, two “Local-thru” or collector-distributor (CD) lanes in each direction are added for short trips between Gessner and Silber with auxiliary lanes between access points.
- Under the KCC concept, a dedicated 50-foot wide reserve in the middle of the freeway right-of-way is provided for future rail between Beltway 8 and Old Katy Road at Post Oak Road.

The KCC concept, however, does not differ from the TxDOT IH 10 Project Plan in the total number of lanes, which are typically 18 lanes and auxiliary lanes between interchanges.

The KCC objectives, as discussed in the material posted on their website, are to provide a mobility alternative that is socially, economically and environmentally beneficial to the entire community. The major concerns expressed by KCC with the TxDOT IH 10 Project Plan are the lack of commitment to mass transit, flood control, noise and air/health issues. KCC claims, without any engineering documentation, that its concept would:

- reduce the number of lanes by better functional use of the pavement area;
- provide better flood protection for the adjacent neighborhoods;
- minimize neighborhood noise;
- reduce neighborhood air pollution;
- increase freeway safety;
- allow for future capacity increases by reserving space for rail; and
- improve the aesthetics of the corridor.

These issues are addressed as appropriate in the preliminary review which follows.

ASSUMPTIONS

During the preliminary review of the KKC Concept, a number of general conditions were formulated and assumptions made in order to permit a valid comparison with the TxDOT IH 10 Project Plan design. These conditions and assumptions have been established based on a limited and preliminary engineering review of the concept. In a more-detailed engineering analysis of the concept, modifications of the present conditions and assumptions may be warranted. The following conditions and assumptions have been utilized in this preliminary review of the KCC concept:

1. The TxDOT IH 10 Project Plan is the baseline for preliminary review comparisons (See Exhibit 1).
2. TxDOT and American Association of State Highway and Transportation Officials (AASHTO) design standards must be maintained. These standards are required for federal interstate highways.

3. The KCC concept should provide same level of mobility as the TxDOT IH 10 Project Plan.
4. The depressed section would start west of Gessner after the touchdown of the Beltway 8 interchange ramps, proceed under Gessner and remain depressed through the IH 10/IH 610 interchange and UPRR bridge to the end of the current depressed section at Washington Avenue.
5. The typical depth of the depressed roadway would be 22 feet from ground surface to top of pavement. (5.5 feet structure depth plus minimum vertical clearance of 16.5 feet over the freeway lanes).
6. Pavement and subgrade would be three feet deep (eight inches deeper than the TxDOT IH 10 Project Plan) because of soil conditions and water table.
7. Depth profile would be relatively constant throughout the depressed area except for the already-depressed areas at Post Oak Road, IH 610 and the UPRR bridge.
8. Beltway 8 and IH 610 interchange ramps and mainlanes would stay at the same elevation as the TxDOT IH 10 Project Plan.
9. Retaining walls and bridge columns would be placed on drilled shafts.
10. Waterways (creeks and streams) would cross under the depressed roadway and be pumped back up to grade on the other side.
11. Ramps connecting frontage roads and collector-distributor (CD) lanes would not exceed four percent grades.
12. Braided ramps (crossover grade separated ramps) would not be considered because of the additional ROW needed and because of the added elevation differences in the KCC concept.
13. The proposed CD lanes, main lanes, managed toll lanes and future rail would pass under the cross streets. (There is not sufficient distance between cross streets in most places to allow CD roadways to rise up to the frontage road grade level and down again).
14. Utilities would be relocated in the border area between the frontage roads and the edge of the ROW or under the frontage roads.
15. Utility crossings must be sunk below the depressed roadway at elevations greater than 30 feet below the existing ground level. Utility bridges were not considered because they would require additional depth of excavation of the depressed roadway.
16. To preserve service, all utility relocation/installation must be completed prior to excavation for the depressed freeway.

PRELIMINARY REVIEW FINDINGS

OPERATIONAL AND SAFETY ISSUES

KATY CORRIDOR COALITION PROPOSED DESIGN CONCEPT

The concept proposed by the Katy Corridor Coalition is shown on the attached Exhibits 2 and 3. Exhibit 2 provides a plan view of a typical segment, depicting the general layout of the various KCC concept subsystems (two HOV/Toll lanes, three main lanes, two collector-distributor lanes with auxiliary lanes, two frontage road lanes and reserved space for future rail). The plan view also shows the approximate location of the three cross-sections included in Exhibit 3. These cross-sections show the lane configurations at the various transition points between the collector-distributor lanes and the adjacent general-purpose main lanes and the frontage roads. The dimensions in the KCC concept cross-sections from the website were difficult to read and therefore the dimensions and other descriptive items in Exhibit 3 were enhanced without changing the basic concept. It is noted that the dimensions were not consistent from one cross-section to another and that the ROW needs varied for each cross-section with a low of 406 feet and a high of 419 feet. Other locations on the KCC website show that their proposed ROW uses the higher value of 419 feet. The cross-sections as shown do not accommodate the proposed outside belt of trees or detention areas that the KCC concept has located outside this 419 feet ROW envelope.

REQUIRED MODIFICATIONS TO THE KCC CONCEPT TO MEET DESIGN STANDARDS

The KCC concept does not meet the current design standards. Therefore, the KCC concept had to be modified to conform with AASHTO and TxDOT standards. Exhibit 4 shows one of the typical KCC cross-sections before and after these modifications. For the purpose of this preliminary review, the following modifications were made:

1. The reserved space for future rail was decreased to 45.5 feet to accommodate concrete barriers separating the rail envelope from the vehicular traffic operations.
2. Inside four-foot buffers were added to the HOV/Toll lanes.
3. The separation between the HOV/Toll Lanes and the mainlanes was increased from 12 to 20 feet, in each direction, to provide minimum 10-foot shoulders for each of the facilities (the desirable standard is 24 feet).
4. The CD lanes are maintained at the same grade level as the main lanes throughout because of insufficient distances between cross street structures to allow the CD lanes to rise to the frontage road levels and down again.
5. An additional CD auxiliary lane in each direction has been added in the middle segment of the CD facility because of the traffic demands.
6. The CD facility has been further modified from two 15-foot lanes to two 12-foot lanes with an outside 12-foot shoulder.
7. The outside border width has been increased from 10 feet to 25 feet to accommodate utilities.

These modifications increased the ROW width under the KCC concept to 488 feet, slightly more than the TxDOT IH 10 Project Plan, and serve as the basis for the preliminary review. It should be noted that space for additional detention areas or green space for planting of trees along the edge of the facility as indicated in the KCC concept would add to the ROW requirements.

Another significant difference between the KCC concept and the TxDOT IH 10 Project Plan is the location of ramps for access to and from the freeway. The table below shows one assumed solution to the placement of ramps for the major cross streets being served within the KCC concept. Considerable effort would be required during final design to achieve an acceptable interface between frontage road operations and the reduced number of access ramps. Also noted on the table is the maximum distance that would have to be traveled to reach the general-purpose lane from the major cross street, and vice-versa. In some instances a driver would negotiate multiple signalized intersections before reaching general-purpose high-speed lane travel.

ASSUMED RAMP PLACEMENT WITH DEPRESSED DESIGN

Westbound direction main lanes access points as shown in Exhibit 6:

Ramp M1 – Off-ramp from general purpose lanes serving:
- Antoine
- Wirt
- Bingle (Approximately 2 miles from the off-ramp)

Ramp M2 – Off-ramp from general-purpose lanes serving:
- Campbell
- Blalock
- Bunker Hill
- Gessner (Approximately 3.5 miles from the off-ramp)

Ramp M3 – On-ramp to general-purpose lanes serving:
- Silber (Approximately 2.5 miles from on-ramp)
- Antoine
- Wirt

Ramp M4 – On-ramp to general-purpose lanes serving:
- Bingle (Approximately 2.5 miles from on-ramp)
- Campbell
- Blalock

Bunker Hill and Gessner westbound traffic would access the general-purpose lanes directly using the current frontage road on-ramp located in the vicinity of Beltway 8.

The basis for the Modified Typical Section is supported by the TxDOT IH 10 Project Plan Origin Destination Table (Exhibit 5) and minimum lane requirements analysis shown in Exhibit 6. A further preliminary analysis was performed to determine the minimum number of lanes required to achieve lane balance. The results of this analysis are shown in Exhibit 7. This preliminary analysis was very limited in scope and would require extensive further analysis of an actual operative system.

HIGHWAY SYSTEMS

Mainlanes (General Purpose Lanes)

Under the KCC concept, the purpose and function of these lanes would be similar to the TxDOT IH 10 Project Plan, except that the flow of through-traffic might be improved, because of the reduction of the number of access points along the route. Three mainlanes would be provided for most of the length of the study area. The horizontal alignment of the lanes would generally be on a tangent, while the vertical alignment would be flat. This design might provide a safer and more stable traffic operational condition with longer sight distance for the driver. The mainlane traffic signage might be easier to employ, because fewer merge and decision points needing signage would be present. A constant running speed might be easier to attain and maintain by drivers. The capacity of the roadway might be utilized more efficiently.

Ramp access points would follow the same design criteria as for the TxDOT IH 10 Project Plan. As discussed above, there would be fewer ramps. Fewer ramps might allow for improved weaving distances for merging mainlane traffic. This design might lend itself to improved mainlane operational safety.

The reconfiguration of mainlane access would require a new access study to satisfy federal requirements on an interstate highway.

Managed Lanes

Under the KCC concept, no change is envisioned in the design and operation of the system of managed lanes, as compared with the TxDOT IH 10 Project Plan.

Collector-Distributor

This element of the proposed KCC concept would function as the collector and distributor of movements between the mainlanes and frontage roads, required by the different functions of the different roadways. This CD set of lanes would be designed for moderate speed, based on the need to have vehicles merge safely into and out of the high-speed mainlanes. The addition of the CD system would impose additional constraints on the number of access points that can be provided. In some instances, a driver would have to travel a significant distance along the CD system and/or frontage roads before reaching an access with the mainlanes.

As the driver travels along the CD system, many opportunities for weaving conflict would be possible, because of the number of desired local access points along the Katy Freeway. In many instances, additional signage would be needed to advise motorists of impending decision points. The CD system would be continuous along the study route satisfying the demand for access to and from the general-purpose lanes between Gessner and Silber. Lane balance with the general-purpose lanes would be critical. The connections between these two road systems are called “transfer roads” and would consist of up to two lanes in some cases. The CD systems as well as the connecting roads (referenced on attached exhibits as “Auxiliary Lanes”) require shoulders of the same width as provided for the mainlanes. The AASHTO design speed for a CD system would need to be no less than ten mph below the speed of the general-purpose lanes because of speed differentials.

Where more than one interchange is being serviced, additional maintenance efforts would be involved, in part to provide clear weaving and access direction to the driver. The CD system would require additional signing beyond that required under the TxDOT IH 10 Project Plan and more frequent maintenance of pavement markings. While AASHTO recommends a fixed barrier separation between the general-purpose lanes and a CD system, the KCC concept only provides proper shoulder width to minimize the right of way footprint, and therefore the operation would have to rely exclusively on traffic enforcement.

The modified cross section shown in Exhibit 4 differs from the KCC concept in that the CD lanes would need to be maintained at the same elevation as the mainlanes, because insufficient distance between most cross streets does not allow the CD roadways to rise up to the frontage road grade level and down again. This recommended approach would allow the merging condition between the general-purpose lanes to be accomplished more efficiently.

Ramps and Frontage Roads

Under the KCC concept, these two components of the highway system would function similarly to the TxDOT IH 10 Project Plan. The main difference is that the number of ramps to and from the frontage roads would be reduced because braided ramps (crossover grade separated ramps) may not be accommodated within acceptable design criteria. In the westbound direction, this reduction would eliminate the Wirt and Bunker Hill off-ramps and the Bunker Hill on-ramp. In addition, the ramps between Bingle and Campbell would be reversed to provide for mainlane access ramp M3. The eastbound direction would experience similar reductions in access points. Ramp grades may be more severe with the addition of the CD system (up to four percent grade versus the 2.5 percent in the TxDOT IH 10 Project Plan) because of the limited distance between the cross streets. The KCC concept, with only two basic lanes on the frontage roads, would adversely affect the traffic operations in the outside lane, particularly in areas where the abutting properties need access, thus warranting a third lane. It is also noted that the separate return lanes from the U-turn lanes would not be compatible with TxDOT standards. Outside right hand turn lanes at minor local streets, as shown on the KCC concept, would add to the ROW requirements.

LIGHT RAIL TRANSIT

The KCC concept would reserve a fifty-foot wide corridor in the center of the right of way for light rail transit. The concept would provide for a two-track operation. Normally, the tracks would be constructed parallel to each other spaced fifteen feet apart. Horizontal clearance to the concrete barrier rail adjacent to the managed lanes would be sufficient to provide for the rail car's dynamic envelope as well as proper clearance for safety purposes. A ballasted rail system would be applicable for this installation. However, direct fixation (modified for noise mitigation) would be needed to control running noises of the vehicles.

If the KCC concept were to be implemented, provisions for other rail appurtenances, such as station type and locations, siding locations for emergency operations and disabled transit vehicle storage would have to be addressed.

The TxDOT IH 10 Project Plan provides for a future corridor for light rail transit in the area currently allocated for toll lanes, by strengthening the bridge decks and roadway pavements in the areas where the light rail system would be built. The Harris County Toll Road Authority (HCTRA) has signed an agreement with TxDOT to build toll lanes that would pay off the capital investment from toll revenues. After repayment, TxDOT has the right to remove the toll lanes and replace them with light rail or other transportation usage. In addition, TxDOT, on behalf of METRO, has the right to buy-out the toll road at any time and replace it with light rail. TxDOT is also considering other options to accommodate both the toll lanes and light rail at the same time.

SUMMARY OF KCC CONCEPT IMPACTS ON TRAFFIC OPERATIONS

The preliminary analysis of traffic operations regarding the KCC concept indicates:

1. Flat grade (same elevation as mainlanes) is required to be assumed for the CD system because of design limitations.

2. Significant weaving movements would occur along the length of CD system.
3. Limited points of access to and from general-purpose lanes would require drivers to travel longer distances in CD system to access general-purpose lanes.
4. Steeper ramp grades between frontage and CD roads would be required.
5. There would be fewer access points between frontage roads and CD roads.
6. Operating efficiency of frontage roads would be reduced with two lanes only.

DRAINAGE ISSUES

The KCC concept is not sufficiently detailed to determine whether all the concept's inherent drainage problems could be addressed by adding substantial pumping capacity, adding redundancy of the additional pumping capacity and adding back-up power for the additional pumping capacity. Although the Katy Freeway consists of roughly 400 surface acres, any design for the facility must accommodate cross drainage for 8400 acres of watershed north of IH 10. The KCC Concept would require providing adequate flow capacity by dropping the enormous volumes of water from Spring Branch Creek and adjacent waterways north of IH 10 below the depressed roadway and pumping it back up south of IH 10. Because this system would replace a drainage system dependent entirely on gravity flow and consistent with existing drainage patterns, the KCC Concept drainage would result in significant alterations to existing drainage patterns, substantial additional construction and operational costs to TxDOT, and additional levels of flooding risk to adjacent properties with associated hazards to the traveling public on the main lanes of the freeway.

It is, moreover, clear that substantial additional pumping capacity would have to be added, that the additional pumping capacity would have to be made redundant and that backup power sources for the additional pumping capacity would have to be added under the KCC concept. Additional right-of-way would be needed to site these additional and redundant pumping facilities and their back-up power sources. Further additional right-of-way of substantial but unknown quantities would be required for more detention facilities for the additional storm water associated with the depressed freeway concept.

Regardless of the detailed design of the depressed freeway under the KCC concept, the freeway would inevitably be more prone to flooding during extraordinary weather events.

TxDOT drainage policy requires the construction of a drainage system within state highway right-of-way, including outfalls, to accommodate the storm water that originates within and reaches state highway right- of-way from naturally-contributing drainage areas. Specific guidelines based on this policy and related FHWA rules include the following:

- The design flood assumption for main lanes of Interstate highways shall not be less than the 50-year frequency flood event.

- Storm sewers for depressed freeways are designed to accommodate at least a 50-year frequency flood event.

- No net increase in peak flows (up to and including the 100-year flood event) to the downstream drainage network because of improvements to the roadway.

This policy is not intended to provide regional improvements to adjacent drainage waterways. Regional flood control improvements are the responsibility of other agencies. TxDOT policy, rather, seeks to provide safe passage for traffic even during rare flood events and to avoid adverse drainage impacts to adjacent properties. The TxDOT IH 10 Project Plan includes several new detention ponds and other drainage mitigation facilities in the study area to hold storm water until it can be metered to the outfalls without impact. A similar policy and approach was used in this preliminary review of the KCC concept for depressing IH 10 from Gessner to Washington Avenue.

This preliminary review is further based on the following assumptions:

- Separate storm sewer systems would be required for the depressed main lanes and for each of the frontage roads.
- No frontage roads would exist between the IH 10/610 Interchange and Washington Avenue.
- Existing storm sewer along IH 10 main lanes from Washington Avenue to White Oak Bayou would be used for the proposed outfall from depressed IH 10 main lanes east of IH 610.

An important drainage consideration not addressed under the KCC concept is the provision for cross drainage, or the conveyance of storm water from one side of the highway to the other. Within the corridor identified by the KCC concept, there are eight major drainage crossings with a collective watershed area of about 8400 acres. All of these waterways or systems drain from north to south, and are specifically listed as follows:

Drainage Waterway / System	Drainage Area Upstream of IH 10	100-year Discharge	TxDOT IH 10 Project Plan's Proposed Structure under IH 10	Location
W151 Ditch / System	656 ac.	1178 cfs	3-8'x8' Box Culvert	Witte Rd. / Gessner Rd. area
Hunter's Creek	250 ac.	555 cfs.	3-6'x4' Box Culvert	Campbell Rd.
Briar Branch	1050 ac.	2160 cfs.	3-10'x10' Box Culvert	Bingle Rd.
Spring Branch	4700 ac.	6717 cfs.	Approx. 180' Span Bridges	Wirt Rd.
Niemann Branch (W138)	1056 ac.	2315 cfs.	1-10'x10' Box Culvert	East of Antoine
W137 Ditch / System	320 ac.	754 cfs.	2-10'x8' Box Culvert	East of Silber near FBC
IH 610 System	150 ac.	500 cfs. +/-	108" Concrete Pipe	IH 610
Memorial Park Drainage Ditch	240 ac.	600 cfs.	96" Concrete Pipe + Pump Station	West Side of UPRR Underpass

The TxDOT IH 10 Project Plan for cross drainage at IH 610 and the UPRR underpass would also work for the KCC concept. However, the KCC concept would require significant and expensive modifications to the cross drainage facilities at the other crossings. Though other alternatives are possible, this preliminary review assumed that cross drainage conveyance at W151 Ditch, Hunter's Creek, Briar Branch, Niemann Branch, and W137 Ditch would be provided through large pump stations. These pump stations would be in addition to those required to evacuate the depressed main lanes. Drainage from off-site areas north of IH 10 would drop into cross drainage culverts below the depressed main lanes and be conveyed and lifted by large pump stations south of IH 10 into the existing downstream waterways. Stilling basins would be provided to avoid increased erosion in downstream channels from pump discharge lines.

Because of a much larger discharge and channel section at Spring Branch, this preliminary review assumed the Spring Branch flows would be conveyed through a deep tunnel under IH 10, below the invert of the existing stream. The tunnel would connect through an outlet structure to Spring Branch downstream of IH 10, where flows would equalize with the natural channel. The invert of the tunnel would drain through a low flow pipe to an outfall at Buffalo Bayou, approximately a mile downstream of IH 10.

The following storm sewer outfalls were considered in this preliminary review:

1. Witte Road Outfall at Station 1625+00 (W151);
2. Campbell Road Outfall at Station 1707+00 (Hunter's Creek Branch);
3. Bingle Road Outfall at Station 1753+00 (Briar Branch);
4. Spring Branch Outfall at Station 1795+00 (Spring Branch Creek);
5. Niemann's Branch Outfall at Station 1833+00 (W138-00-00);
6. IH 610 Trunk line Outfall at Station 1904+00 (IH10/610 Interchange); and
7. White Oak Bayou Outfall (drainage area between IH10/610 Interchange and Washington Avenue)

Pump stations would also be required to move storm water from the depressed roadway to detention facilities and subsequent discharging into these outfalls at a metered rate. Storm water from the depressed roadway would need to be pumped completely to provide capacity for another similar storm event. The depressed main lane drainage system would be provided with a pump station at each outfall, on the south side of the freeway alignment.

The detention facilities provided by the TxDOT IH 10 Project Plan for both main lane and frontage road systems have been sized for the 100-year frequency and should be sufficient to meet some of the depressed roadway requirements. However, because of the significant change in existing drainage patterns that would result from the depressed freeway section, some allowance for additional off site detention would need to be made in the cost estimate described below. Also, to maintain existing 100-year sheet flow patterns in off-site areas north of IH 10, it may be necessary to adjust or raise frontage road grades on the north side above that provided in the TxDOT IH 10 Project Plan.

Preliminary sizes for these cross drainage, storm sewer systems and pump stations and associated additional right of way areas were computed and quantified for cost estimates.

Given the inherent increased risk of flooding and given the increased costs and engineering difficulties associated with the drainage problems associated with KCC concept, any claimed benefits associated with this aspect of the KCC concept would be outweighed by the additional right-of-way, costs, risk of flooding and project delays.

CONSTRUCTIBILITY ISSUES

GEOTECHNICAL

The primary geotechnical consequence of the depressed roadway under the KCC concept would be the need to provide retaining structures adjacent to the excavation. The depth of excavation would be driven by the need for a minimum clearance below the cross street bridges of 16.5 feet. With a depth of structure estimated at 5.5 feet and an additional seven feet for pavement, sub-grade, and drainage inlet structures, the total retained height would be an estimated 29 feet.

The general soil condition along the alignment is a clay layer that extends from the surface to depths ranging from about 12 to 20 feet. Below this clay layer, a sand layer extends below the planned base of the pavement at about 24.5 feet below existing grade. The thickness of this sand layer is highly variable ranging from approximately ten to over 50 feet thick. The clay strength ranges from firm to very stiff with shear strengths ranging from about 0.5 to 1.5 tsf. The clay is also generally highly plastic, and exhibits significant shrink-swell behavior in response to seasonal moisture variations. The sand layer is fine-grained and silty.

A number of alternative retaining methods for the KCC concept have been assessed, including: cantilevered drilled shaft retaining walls, retained earth systems, tied-back drilled shaft retaining walls, deep soil mixing and soil nailing. Refer to Exhibit 6. In general, all of the systems investigated, except cantilevered retaining walls, would require some disturbance of the subsurface, at distances of up to 20 to 30 feet behind the face of the wall. This disturbance would cause potential problems with existing utilities and storm water trunk lines, as well as preventing future utilities placement. Discussion with local contractors indicates that utilities would have to be totally removed in order to give a clean construction site. This requirement, together with other constructibility issues, indicate that cantilevered drilled shaft retaining walls would be the most cost effective approach in an urban area such as the IH 10 corridor. Three projects were investigated, all of which utilized cantilevered drilled shaft retaining walls: US 59 in Houston, Central Expressway in Dallas, and a major depressed freeway project in Denver.

Cantilevered drilled shaft retaining walls at the heights envisioned would have lateral movements at the top of the walls of several inches during excavation, as follows:

- 60-inch shafts - 6-7 inch lateral deflection, 70 feet long
- 72-inch shafts - 4-5 inch lateral deflection, 80 feet long
- 84-inch shafts - 3-4 inch lateral deflection, 80 feet long

Since the cross street bridge decks would already be in place during excavation, the bridges would need to be detailed to accommodate the movement. Discussion with TxDOT bridge staff concluded that this would be reasonable and has been assumed as the design approach to the bridges. The lateral movement issue also carries over to anything built adjacent to the top of the wall, such as frontage road pavements. However, this would not be a significant problem since drainage is usually directed away from the top of wall, and detailing could accommodate the potential movement.

Preliminary analysis indicates that 60-inch shafts for retaining walls away from bridges, and 84-inch shafts at bridge locations would produce acceptable results.

A summary of the measured groundwater levels, referenced to the proposed top of pavement at 23 feet below ground surface follows:

1. West of Station 1730 (Section 4) - about 5 to 10 feet above pavement level;
2. Station 1730 to 1815 (Section 3 from Wirt west) - at pavement level;
3. Station 1815 to 1885 (Section 3 from Antoine east) - about 2 to 5 feet above pavement level;
4. Station 1885 to 1930 (Section 2 west of the RR bridge) - about 2 to 5 feet below pavement level;
5. Station 1930 to 1940 (Section 2 RR bridge east) - about 5 feet above; and pavement level.

Note that these groundwater table measurements are the values measured primarily during drilling of borings for construction, and that water tables will fluctuate with time. It would be prudent to assume that water tables somewhat higher would occur over at least a portion of most years.

Based on this data, some sort of dewatering would be required under the KCC concept over most of the project alignment as shown in Exhibit 8. Along most of the alignment, silty fine sand would be encountered at or near the pavement elevation. Local experience indicates that flow rates from these materials are not high. A combination of three approaches to control the groundwater would be required. The first approach would be to provide standard drainage details at the retaining walls. The second approach would be to provide a drainage layer extending under the pavement, consisting of 8 inches of clean crushed aggregate, separated from the sub-grade by a filter fabric. The third approach would be to provide a trench drain at the edge of the depressed section, filled with clean aggregate wrapped in filter fabric. This could be constructed in the backfill of the storm sewers that would be needed to conduct drainage water from the retaining wall and pavement drainage layers.

There would probably be localized areas where the water flow from the sand is higher than could be accommodated in this system. An allowance would need to be provided for some permanent dewatering wells, grouting or a combination. Based on typical conditions in the sand layers in the area, the steady state average flow volume would be less than 1 gallon/day/linear foot of alignment. This means that the flow into the storm water system because of groundwater drainage would be trivial compared with the flow volumes developed during the design precipitation event. The groundwater table lowering would be less than 5 feet at locations outside the right of way. Given the over-consolidated nature of the clays in this area, this additional load (about 300psf) would not cause significant settlements.

For the pavement, the drainage layer beneath it would be intended to intercept any flow that would cause a buoyant condition. The main risk here would be that a failure in the pumping system would cause water to backflow into the pavement drainage layer and would cause an uplift condition to occur. A bypass detail would need to be developed so that if the pumping system fails and excess water accumulates in the drainage layer, water would be able to flow out on top of the pavement so that no uplift would occur on the pavement itself. This would not be the typical condition, but rather only a failsafe to avoid damage to the pavement while the pumping system was serviced.

Preliminary review of the pavement design was not performed to determine whether the thickness of the structure would need to be increased to account for a saturated sub-grade.

Any utility buried beneath the pavement in the depressed section should be designed to resist buoyant uplift, since a buoyant condition might occur. Refer to discussion in Exhibit 8. The prophylactic methods would be to bury the utility deep enough that the buoyant weight of soil above the utility is enough to resist the buoyant force, to thicken the bottom slab of the culvert to add weight to the culvert, or possibly to construct shelves off the side of the culvert to provide additional vertical resistance because of the weight of the soil above the shelves.

UTILITIES

There are a large number of water, sanitary sewer, gas, power, and telecommunications utilities, running parallel to the roadway throughout the existing IH 10 corridor. Wherever these utilities conflict with the proposed roadway, they would be relocated into 25-foot wide utility corridors between the frontage roads and the ROW line as shown in the Subsurface Utility Configuration in Exhibit 9. The same approach would apply to the KCC concept. But as the deep excavation would demolish the existing utilities, under the KCC concept it would be imperative that all utilities be relocated and functioning before the excavation starts. The most significant consequence would likely be the need for the telephone company to splice all fiber optic cable before abandoning its existing system. There are several different telephone networks in the area and splicing times have been estimated at up to 800 days.

There are also five sanitary sewers, seven water, six gas, two crude oil and ten telecommunications utilities that cross the KCC concept depressed section limits. These utility crossings would have to be relocated to deeper profiles very near to their present locations, since there is not enough room within the longitudinal utility corridor to collect the transverse utilities together and make combined crossings. The crossings would need to be constructed using a combination of open cut north of the existing roadway (where no roadway interference exits) and trenchless technology south of the existing facility (to prevent interruptions to existing mainlane and frontage road traffic). The sanitary sewer crossings would require pumps to lift the flow back to the gravity flow system. The alternative, locating the utilities in overhead crossings, would negate much of the claimed aesthetic benefits of the depressed freeway facility.

CROSS STREETS

The depression of the freeway facility under the KCC concept would result in the elimination of mainlane overpass bridges at Gessner, Bunker Hill, Echo/Blalock, Campbell, Bingle/Voss, Wirt, Antoine and Silber. These bridges would be replaced by underpasses. The underpass orientation of structures at North Post Oak and the UPRR would remain.

The new bridges would need to accommodate the same number of lanes for each cross street, as in the TxDOT IH 10 Project Plan, with a central median between northbound and southbound traffic. In addition, U-turn lanes would need to be provided in both directions, with space for pedestrian walkways and bicycle lanes in the medians between the through lanes and the U-turn lanes.

The new bridges would need to be constructed in the first phase of construction so that the cross streets would remain in service throughout the excavation of the depressed section. The bridge foundations and piers would need to be installed from the current roadway surface through the use of drilled shafts. At interior bents, formed concrete piers would need to be installed inside steel casing placed through the overburden to the top of the foundation. The columns would need to conform to the Green Ribbon Report recommendations for straight-sided rectangular shapes. Abutments would need to be integral with the drilled shaft retaining walls at each end of the bridges.

To maintain cross street traffic during bridge construction, the structures would need to be installed in a series of separate steps. The eastern half of each bridge would need to be constructed while existing traffic is routed to the west, and then the western half of the bridges would need to be constructed while the existing traffic is routed to the east. The existing number of cross street lanes cannot be maintained during each step because the existing IH 10 overpass bridge columns would interfere with traffic shifted to the east or west. Therefore, only three total lanes would be available during the installation of each step. To minimize disruption, only one bridge could be constructed at a time in any two-mile segment, allowing overflow traffic to use nearby cross streets as detours.

The bridges would need to be constructed with three simple spans, with the interior bents placed at each edge of the proposed Light Rail Reserved Right of Way. The resulting span lengths over the mainlanes and collector/distributor lanes would exceed the limits for precast concrete girders. Therefore, the bridges would need to be constructed with steel trapezoidal girders for the main spans. The profile of the bridges would match the cross slope of the depressed pavement below, to maintain constant clearance between the two.

Although the construction of the cross street bridges would be complicated by having to build the columns and pier caps in tight, excavated work zones, there might be off-setting savings by being able to install the girders and deck at-grade. Accordingly, the current TxDOT estimated unit prices for steel and concrete bridges could be used for the KCC concept.

CONSTRUCTION SEQUENCING

As discussed above, there can be very little schedule overlap between the relocation of the utilities and the initial roadway items under the KCC concept. Therefore, all ROW must be acquired and then the utilities must be relocated prior to any excavation. This means that no roadway work can begin until these advance activities are completed.

The general construction sequence for the depressed section from Gessner to Campbell is show in Exhibits 10A through 10G. The following is the assumed construction sequencing under the KCC concept.

In Phase I (Exhibit 10B), the north side drilled shaft retaining walls would be installed. In addition, the foundations, columns and caps for the interior bridge bents would be placed, and the northern span and the middle span of the new cross street bridge structures would be constructed. Depressed stream crossings would be built utilizing open cut for the intake/drop structure and then micro tunneling below the existing roadways to an excavated receiving pit on the south side. The receiving pit would be used to install the pump station. The deep utility crossings would also be constructed with a similar combination of open cut and trenchless technology. After these activities are complete, the westbound frontage road would be constructed.

In Phase II (Exhibit 10C), the depressed westbound mainlanes would need to be excavated with a layback slope on the south side of the excavation. The extent of excavation would be limited so that the lay-back slope of 1.5:1 intercepts the surface north of the existing west bound frontage road. Within the limits of the full depth excavation the pavement structural section would be built. All existing traffic would still be operating in its current location, but the new westbound frontage road would be placed in service to provide access to abutters.

In Phase III (Exhibit 10D), the westbound mainlanes and the reversible HOV lane would be relocated onto the new depressed facility. All westbound ramps and frontage would be fully operational. The existing westbound mainlanes and frontage road pavement and structures would be demolished. The center portion would then be excavated with a layback slope on the south side of the excavation. The extent of excavation would be limited so that the layback slope of 1.5:1 intercepts the surface north of the existing eastbound mainlanes. Within the limits of the full depth excavation additional pavement structural sections would be built. Temporary eastbound mainlane ramps would be constructed.

In Phase IV (Exhibit 10E), the eastbound mainlanes would be relocated onto the new depressed roadway facility with temporary ramps providing connection to the existing eastbound frontage road. All existing eastbound mainlanes pavement and structures would be demolished and the south side retaining walls would be constructed. Once the existing mainlane bridges are removed, the southern span of the cross street bridges would be built. All remaining roadway excavation would be completed in this phase, and final mainlane pavement would be built along with new eastbound ramps. Parts of the eastbound frontage road would also be constructed.

In Phase V (Exhibit 10F), the eastbound mainlane traffic would be moved from its temporary location on the new westbound pavement to its final location. The remaining work on the eastbound frontage road would be completed.

From Campbell to Silber the new alignment would swing south to avoid the Woodlawn Cemetery. This would complicate construction because there would not be enough room to the north to build portions of the new roadway without impacting the existing roadway. Therefore, in this area an additional phase would need to be added that builds temporary mainlanes and frontage roads on ROW acquired to the south.

From Silber to Washington Avenue there would be relatively little change to the existing construction sequencing, since the new facility is already designed to be partially depressed.

Local access provisions during the various construction phases for EMS, fire, and police would be a significant concern as it was during the recent reconstruction of US 59. Impacts to the local businesses would also need to be considered for loss of revenue and access caused by the longer construction time.

RIGHT-OF-WAY

This preliminary review indicates that the KCC concept depressed roadway would require more ROW than currently planned to be acquired. The addition of a 50-foot wide strip reserved for future light rail would probably offset any potential lane reductions created by the collector/distributor system. There is a potential that as further examination occurs during detailed design, the total width of the KCC concept depressed roadway may increase beyond the current ROW limits. This potential is not included in the cost estimate, but should be considered in determining a contingency. Additional ROW would also be required for pump stations and stilling ponds at every outfall and pump stations at cross drainage structures, for potential off-site detention facilities and for the additional green belt area as sketched in the KCC concept. An allowance for these items is included in the cost estimate contained in this report.

SCHEDULE

A preliminary schedule for the KCC concept has been developed as part of this preliminary review, and is included as Exhibits 11 and 12. This schedule is intended to be used only as a guide. Further detailed analysis beyond the scope of this preliminary review would be required to provide greater level of detail.

The current bid letting date for the TxDOT IH 10 Project Plan package from west of Gessner to Silber is February 2005. The current construction sequencing plans allow utility relocations to occur simultaneously with mainlane construction for a period of 12 months. Follow-on cable pulling and splicing for telecommunications facilities can continue after that period with little impact to the baseline construction schedule. This is possible because the existing utilities can remain, with temporary manholes in new pavement, until the relocated systems are complete.

The KCC concept cannot take advantage of concurrent roadway construction and utility relocation because the existing utilities would be demolished by excavation and therefore must wait until the utility relocations are complete. Therefore, although utility construction can start at the same time, the bid letting date for the depressed roadway contract would need to be delayed until October 2006 to allow the utility companies time to install their physical plant. The start of Phase II (excavation) is tied to the time required to complete utility cable pulling and splicing, and cannot start until October 2007. Although there would be significant engineering effort required to prepare a new set of construction plans, this work can overlap with utility relocations and should not impact the depressed roadway bid letting date.

The durations of Phases II, III and IV are controlled by the time required to excavate the depressed roadway. The schedule was built using multiple crews and shifts to increase the production rates for excavation, but the massive amount of material to be dug, transported and disposed requires 700 additional days of work that were not required in the TxDOT IH 10 Project Plan. Accordingly, the estimated completion date for the KCC concept is July 2011. Compared with the TxDOT IH 10 Project Plan, this is a delay of approximately three years.

For the TxDOT IH 10 Project Plan package from Silber to Washington Avenue, the most critical delay would be re-engineering the construction plans. This contract is on schedule to be bid in July 2003, and the plans are complete. Although the impact to the design in this area is not as great as in the package from Gessner to Silber, there would be a minimum of a one-year delay. This period can be used to allow utility relocations to proceed, but there would still be additional delay to account for the need to complete all telecommunication cable pulling and splicing prior to excavation. Given these factors, it is reasonable to assume that this section would be complete no sooner than July 2009. Compared with the TxDOT IH 10 Project Plan, this is a delay of approximately two years.

Impacts of these identified delays on concurrent construction work on IH 610 have not been determined or analyzed.

COST ESTIMATE

A preliminary cost estimate for the KCC concept has been developed as part of this preliminary review, and is included as Exhibit 13. This cost estimate is limited by the time available for the study and is intended to provide a range of probable additional costs above the current TxDOT IH 10 Project Plan. Further analysis beyond the scope of this preliminary review would be required to provide a greater level of detail.

The preliminary cost estimate is developed in 2003 dollars using a high and low range of probable increases to the TxDOT IH 10 Project Plan. The use of a high and low range is necessary because of the lack of sufficient engineering from the KCC in their conceptual stage. The high range of estimated costs represents the probable upper limit, or worst-case for an increase in cost. The low range represents the probable lower limit in the projected increase in cost, given the best-case set of assumptions.

Major items of assumed additional work include the following:

1. drilled shafts increase 883,000 linear feet;
2. retaining walls increase 640,000 square feet;
3. increased excavation in the amount of 8,952,000 cubic yards (equal to 895,200 full truck loads);
4. cross drainage, off-site detention for runoff impact mitigation from ROW, additional storm sewer for mainlanes and frontage roads and pump stations for depressed mainlanes; and
5. additional ROW for cross drainage and regional detention, off-site detention basins and seven additional depressed section pump stations.

The preliminary estimate of costs for the KCC concept indicates that there would be an increase of $431 to $634 million in 2003 dollars. Lengthening the schedule completion time by about three years, moreover, would add more cost because of anticipated inflation. Likely added cost because of inflation, however, is not included in the cost range.

The major items, contributing to the added costs, are attributable to:

1. retaining walls (drilled shafts and facing panels) - $132 to $192 million;
2. additional drainage requirements - $108 to $130 million;
3. additional ROW for drainage systems - $58 to $93 million;
4. allowance for contingency at 10 percent - $39 to $52 million;
5. roadway excavation - $37 to $47 million;
6. mobilization - $27 to $47 million; and
7. additional engineering and program management- $51 to $69 million.

Replacing the mainlane bridges with the new bridge crossings would result in an estimated reduction of $13 to $17 million.

Based on the range of probable cost it is reasonable to assume that the estimated costs would increase by approximately $500 million (2003 dollars) above the current estimate for the TxDOT IH 10 Project Plan. As a basis for comparison, the estimated cost (2003 dollars) for the segment of the project most affected by the KCC concept, Sections 2, 3 and 4 of the TxDOT IH 10 Project Plan (west of Gessner to Washington Ave), is $622 million. The total cost to include the KCC concept for the same segment would be $1.1 billion, which would be an increase of over 80 percent over the currently-budgeted funds for this segment.

Another comparison shows that the total estimated costs (2003 dollars) for the TxDOT IH 10 Project Plan are $1.6 billion. The total cost to include the KCC concept would be $2.1 billion, which would be an increase of over 30 percent over the currently-budgeted funds for the entire project.

OTHER ISSUES

LANDSCAPE ARCHITECTURE

The TxDOT IH 10 Project Plan includes architectural enhancements to help the new highway blend with the surrounding areas. The TxDOT *Green Ribbon Report* was developed as the baseline standard for new construction. These recommendations are being carried a step further in coordination with several of the adjacent communities, with the goal of providing unique identification enhancements wherever possible.

The TxDOT IH 10 Project Plan proposes to place a combination of grass, bushes and trees in the space between the mainlanes and the frontage roads (outer separation), but only grass sod in the space between the frontage roads and the edge of ROW (border width). The border width is the designated utility corridor for all private and municipal utilities that run parallel to the roadway. This corridor was established because of safety concerns about having utility maintenance or reconstruction crews operating within the roadway itself. The main reason for not placing larger vegetation in the border width is the density of utilities below, which make placement of trees difficult and access to the utilities, in emergency situations, expensive.

TxDOT landscaping plans indicate that approximately 10,500 trees would be planted from IH 610 to Beltway 8. A typical plan view is shown in Exhibit 14. In addition, there would be bushes planted below the canopy to fill in between the trees, essentially only broken by the bridge embankments, entrance ramps and exit ramps.

For the reasons discussed above, the KCC concept would have essentially the same area available to plant trees as the TxDOT IH 10 Project Plan and no increase in total tree plantings is anticipated.

The bridge embankments and structures have been enhanced by the *Green Ribbon Report,* as depicted in the attached Exhibit 15, and discussions are ongoing with surrounding communities on ways to personalize the features to each neighborhood.

ENVIRONMENTAL IMPACTS

The TxDOT IH 10 Project Plan has received a Record of Decision (ROD) from the Federal Highway Administration, which certifies that the project meets applicable environmental requirements. There are a number of environmental issues, however, that would be areas of concern under the KCC concept, including:

1. **Permits:**

   Under the TxDOT IH 10 Project Plan, U. S. Army Corps of Engineers (USACE) Nationwide Permits cover all waterway modifications. The proposed depressed roadway concept would require individual USACE permits for all waterway crossings, which permitting likely would require significant time. Although the schedule discussed above assumes that the permitting process would not impact the critical path, there is a significant possibility that the number of the proposed waterway modifications would trigger an extended USACE review.

2. **Air Quality:**

   KCC has not made available any analysis to assess the impacts on carbon monoxide and other air quality-related benefits claimed under the KCC concept. However, KCC claims that the depressed roadway would provide improved air quality through the claimed planting of additional trees. However, as discussed above, the number and size of trees and other vegetation would be the same for both the TxDOT IH 10 Project Plan and the KCC concept. By default there can be no improvement if all components are the same.

   KCC also claims that its concept would provide improved air quality by virtue of its depressed structure. No analysis, however, has been provided to support this claim. Current state-of-the-art modeling and analysis techniques used to determine air quality impacts would not take differences in grade into account for this facility. There are two factors that must be considered in evaluating the claimed air quality benefits of the depressed freeway structure:

   a. The most critical factor is the relative distance between the source and the sensitive receptor, which does not change between the TxDOT IH 10 Project Plan and the KCC concept.
   b. The mixing of air and diffusion of pollutants would be the same for both depressed and at-grade facilities because of the width of the facility.

For these reasons, the KCC concept would have the same air quality consequences as the TxDOT IH 10 Project Plan.

3. **Other Impacts:**

Impacts to the local businesses under the KCC concept must be considered, including losses in revenue, access, displacements and additional years of disruption during construction.

There is a significant potential that more hazardous material sites than currently identified would be encountered during the enormously-expanded excavation of the depressed roadway. In addition, the proposed mitigation for known hazardous material sites would change, since the material would be excavated and would have to be moved to a certified disposal repository. No analysis of the cost impacts or schedule delays for added hazardous material mitigation has been performed for this preliminary review, nor included in contingency estimates.

Finding a location to dispose of the approximately ten million cubic yards of excavated material, and the impact to neighborhoods during transport of the material through urban areas, would require further extensive analysis that was not performed as part of this preliminary review.

Although there may be a reduction in noise levels because of the depression of the mainlane traffic in the KCC concept, the TxDOT IH 10 Project Plan meets all current environmental noise guidelines. In addition, the frontage roads would generate sufficient noise to require incorporating noise wall mitigation under the KCC concept.

No analysis has been provided by the KCC to assess the environmental impacts from the KCC concept on such issues as land use impacts, social impacts, water quality impacts, wetland impacts, endangered species impacts, impacts to cultural resources, socioeconomic impacts, secondary and cumulative impacts.

CONCLUSION

This preliminary review determines that due to the half billion dollar cost increase, three years additional construction time, inherent engineering difficulties, increased risk of flooding, and the inability to meet applicable design standards, along with the absence of significant benefits, the KCC concept is not a viable alternative to the TxDOT IH 10 Project Plan and would not provide users of IH 10 with a cost-effective or timely transportation facility.

Cost: The additional cost to construct the KCC concept is estimated to be approximately $500 million. This additional cost is significant and may not be accepted by the Federal Highway Administration as a feasible alternative to provide the claimed noise and visual mitigation, since the TxDOT IH 10 Project Plan provides acceptable means of mitigation for the environmental impacts associated with the project at a much lower cost. Without federal support, the additional cost to construct the KCC concept would have been borne by the State of Texas and others, diverting finite resources from other projects.

Schedule: The KCC concept would delay the completion of the reconstruction of the Katy Freeway by at least three years. The major aspects of the delay relate to additional right-of- way acquisition, utility relocation and excavation. Under the TxDOT IH 10 Project Plan, a significant amount of highway construction can be done concurrently with right-of-way acquisition and utility relocations. This would not be the case under the KCC concept, where the additional right-of-way acquisition and utility relocations would have to be completed in advance prior to roadway excavation. Once excavation starts, an additional 700 days would be needed to dig, transport and dispose of 9 million additional cubic yards of dirt. Although wetlands permitting was not included as a critical path item in the schedule, there would be significant risk that the wetlands permitting with the U.S. Army Corps of Engineers would adversely affect the schedule.

Drainage Issues: The TxDOT IH 10 Project Plan accommodates storm water runoff created by the new facility as well as all runoff from approximately 8400 acres north of IH 10 that presently reaches the existing facility. This accommodation includes several cross drainage culverts, a bridge waterway crossing, storm sewer systems and detention ponds in the study area. There are several outfalls and crossing waterways that carry the storm water to Buffalo Bayou. Under the TxDOT IH 10 Project Plan, waterway crossings are allowed to remain relatively undisturbed. This would not be the case under the KCC concept since the depression of the roadway would create a barrier for the natural stream flow. Solutions assessed include drop tunnel structures with mechanical pumps and deep tunnel crossings of IH 10. These systems would be very expensive, and obtaining approval to construct the improvements would require individual permits from the United States Army Corps of Engineers. It is unclear how long it would take to gain approval from the USACE to make changes in the drainage system requiring such a large drainage area to be dependent upon a mechanical means to provide positive drainage.

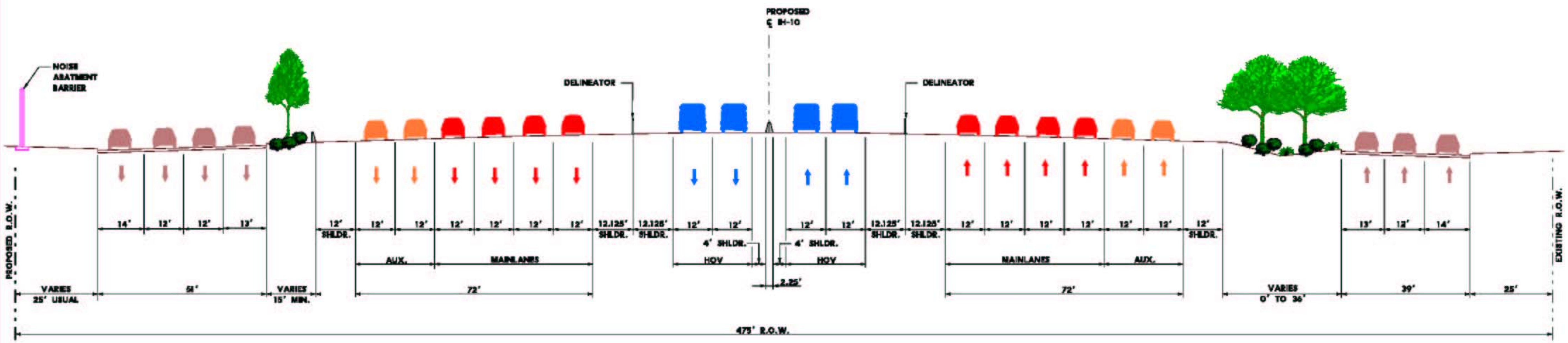
Design and Other Issues: The KCC concept does not meet several AASHTO and TxDOT design standards, including shoulder widths, auxiliary lane weaving distances, lane balance and separation between the different roadway systems. Modifying the concept to meet current design standards would require additional lanes and more right-of-way than shown on the KCC concept typical sections.

The addition of the Collector-Distributor (CD) system would have a significant impact on access for local traffic. Certain access ramps would have to be eliminated under the KCC concept, causing significant additional travel along the CD and frontage road systems. This travel would be at a slower speed and additional traffic signing would be required to properly guide the drivers to their destination. Under the TxDOT IH 10 Project Plan, direct access from the general purpose main lanes to major cross streets is provided. There may be social and economic impacts on local businesses that rely on the higher level of access provided by the TxDOT IH 10 Project Plan.

The KCC concept would require modifications to the construction methods used in the TxDOT IH 10 Project Plan. In general there would be drilled shaft cantilever retaining walls to support the soil along the depressed roadway with a granular aggregate layer beneath the pavement structure to relieve groundwater pressure. Utilities that cross the depressed roadway would have to be installed lower, with pump stations required at gravity flow utilities, or placed in unaesthetic overhead crossings. Cross street bridges would need to be built early to allow operations to continue throughout the excavation of the depressed roadway.

A number of other critical issues related to the KCC concept are described in this preliminary review. In order to fully analyze the costs and limitations of the KCC concept, the method of construction, impacts to local businesses along the Katy Freeway including permanent loss of access to the traveling public, reduced and inconvenient access, loss in revenue for a longer period of time because of increase in construction duration, additional noise impacts associated with the drainage pumping stations, and the potential of significant findings of hazardous materials from deep highway excavations present unanswered questions that need to be addressed in greater depth.

In summary, while it appears the KCC concept may be technically possible to construct, it does not appear to be feasible considering the additional work, time, risks and money it would entail.



TxDOT IH10 PROJECT PLAN
TYPICAL SECTION

EXHIBIT 1

PRELIMINARY

N.T.S.

FILE: TXDOT-TYP.DGN

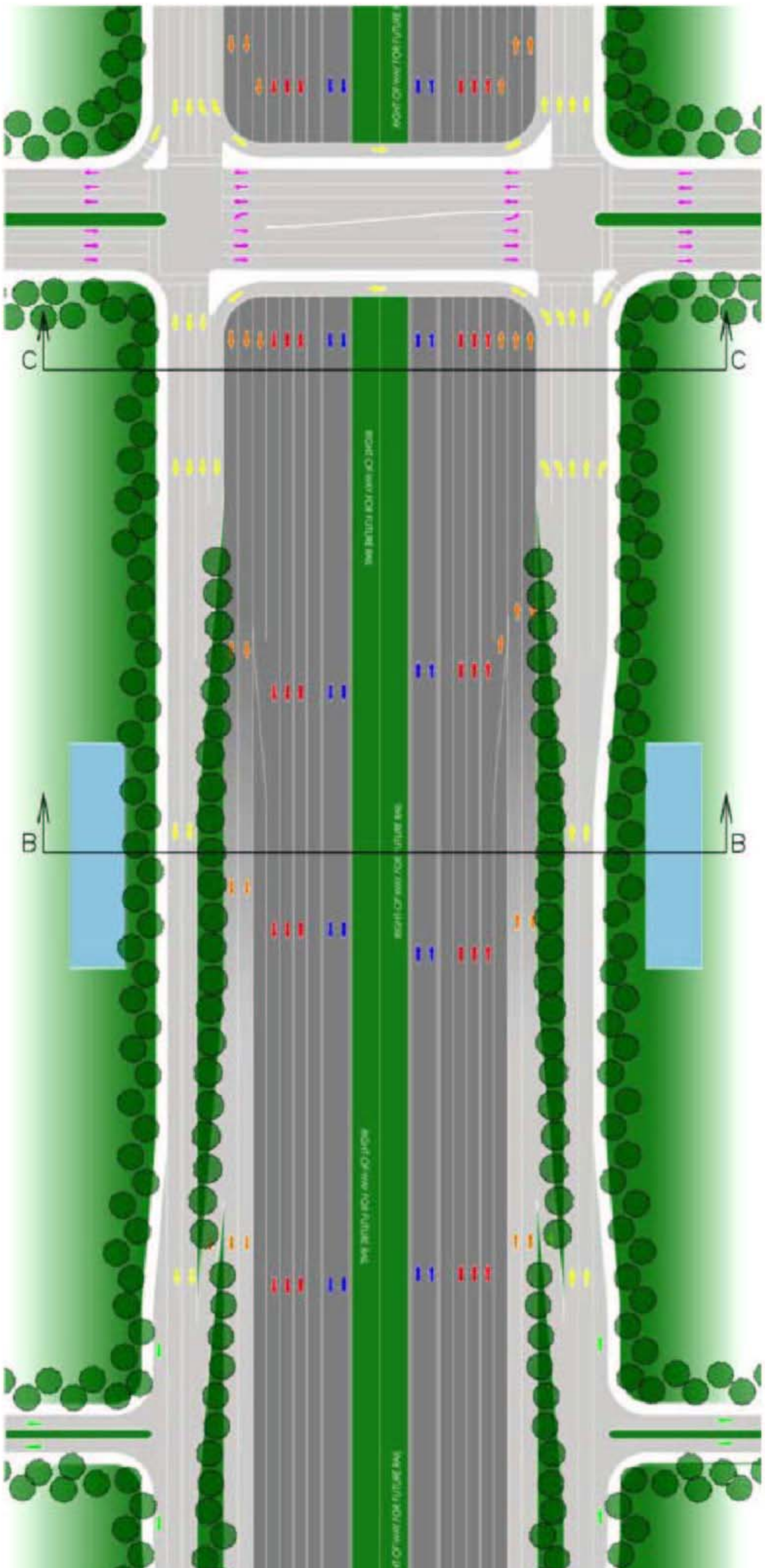
CADD DGN: 1000 | DATE: APRIL 15, 2003

PARSONS BRINCKERHOFF

Texas Department of Transportation

I-10/KATY FREEWAY
RECONSTRUCTION PROGRAM

TxDOT
TYPICAL SECTION



- HOV & Transit Lanes
- Main I-10 Lanes
- Service Lane for On/Off Ramp
- Service Lane for Local Traffic
- Crossing Street at Grade
- Pedestrain Access
- Commerical/Residential Access
- Detention Pond
- Green Buffer Zone

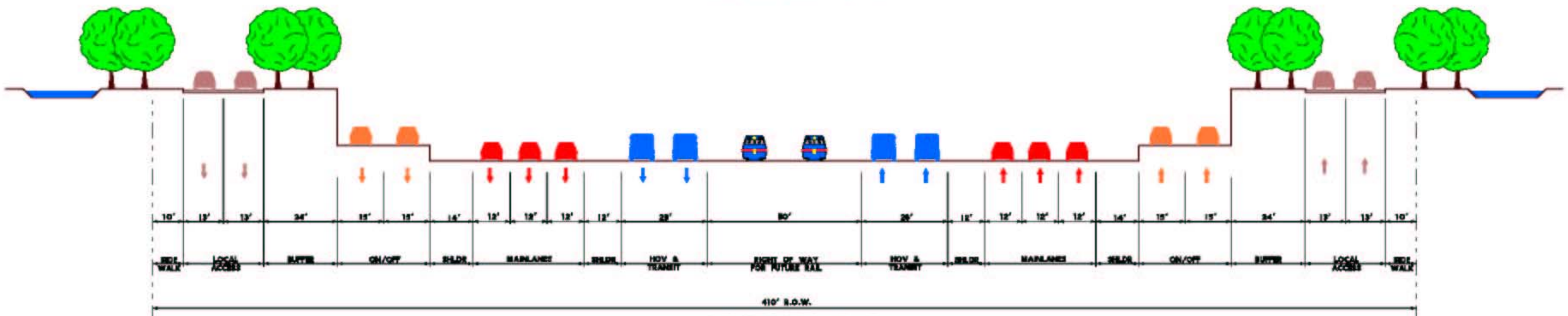
KATY

CORRIDOR COALITION CONCEPT

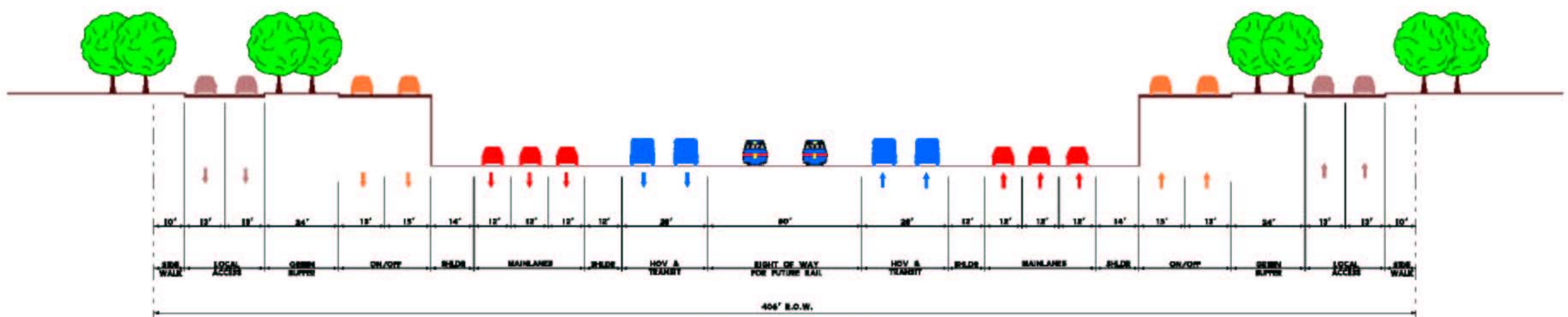
PLAN VIEW

EXHIBIT 2

SECTION C-C



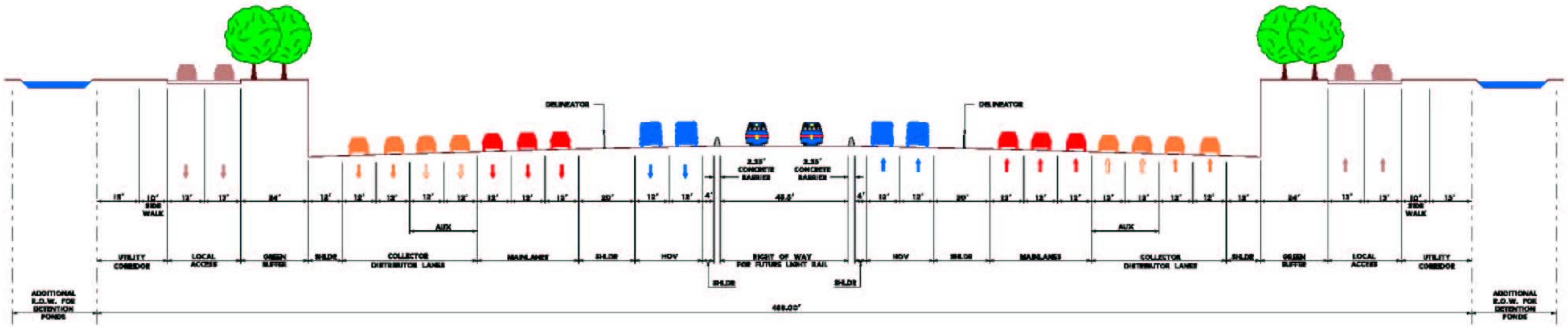
SECTION B-B



SECTION A-A

KATY CORRIDOR COALITION CONCEPT CROSS-SECTIONS

EXHIBIT 3

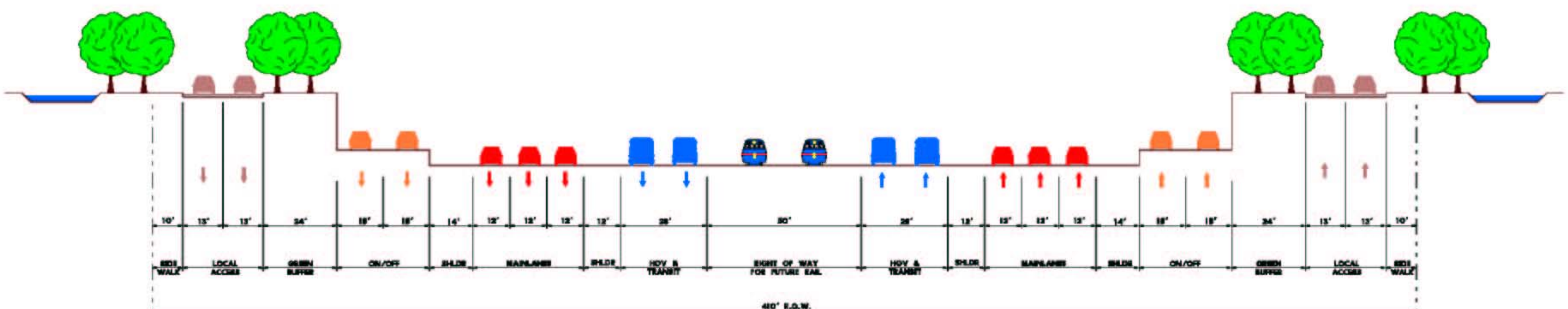


MODIFIED KATY CORRIDOR COALITION CONCEPT

(TO ACCOMMODATE TRAFFIC VOLUME AND AASHTO/TXDOT DESIGN REQUIREMENTS)

(SECTION B-B)

APPROXIMATE LOCATION: WEST OF BINGLE



KATY CORRIDOR COALITION CONCEPT

(SECTION B-B)

APPROXIMATE LOCATION: WEST OF BINGLE

EXHIBIT 4

IH 10 Origin Destination Study
Westbound - IH 610 to Beltway 8
Base Origin Destination Table

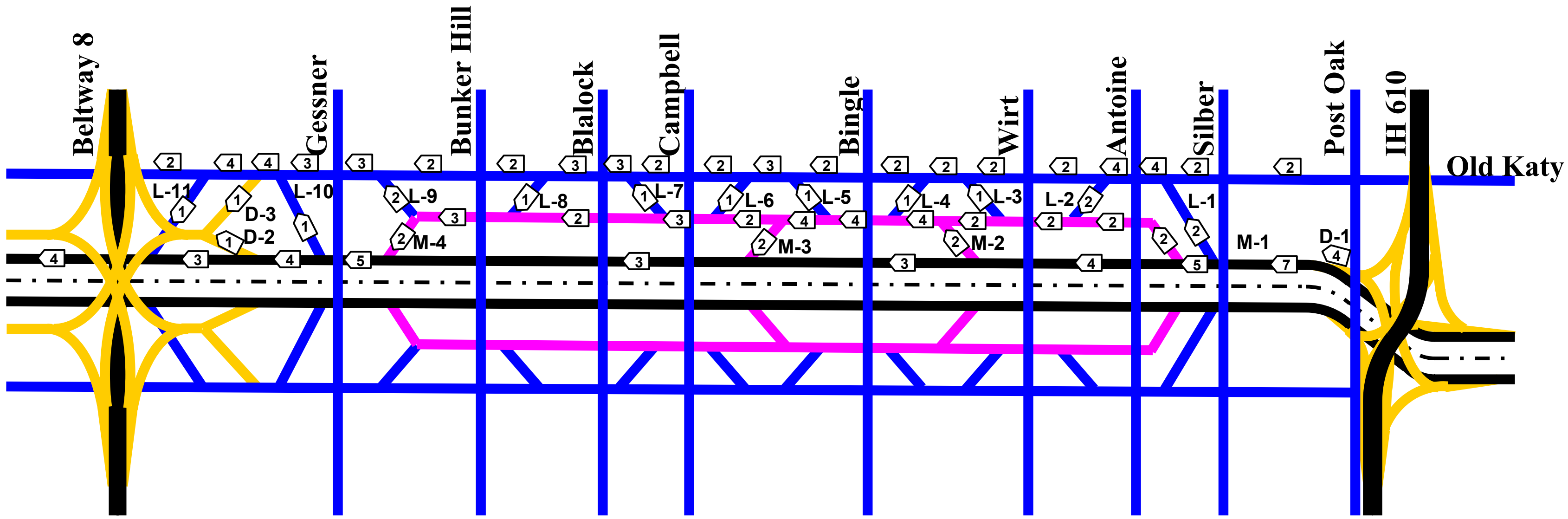
Origins	Totals	Silber	Antoine	Wirt	Bingle	Campbell	Blalock	Bunker Hill	Gessner	BW 8	Sam Houston	IH 10	Totals
Totals	24360	410	1800	1500	1200	1400	1100	1200	2500	2300	1600	9350	24360
Gessner	1600									278	193	1129	1599
Bunker Hill	1400								247	200	139	813	1400
Blalock	900							77	145	118	82	478	900
Campbell	1100						85	87	164	132	92	539	1100
Bingle	1600					155	112	115	215	174	121	708	1600
Wirt	1200				102	106	77	79	148	119	83	485	1200
Antonie	1000			105	76	79	57	59	110	89	62	362	1000
Silber	700		83	64	47	49	35	36	68	55	38	223	700
Post Oak	1460	40	169	131	96	99	72	73	138	111	78	453	1460
IH 610	6300	174	728	564	413	428	310	317	595	481	335	1956	6301
IH 10	7100	196	820	636	465	483	350	357	670	542	377	2204	7101
		410	1800	1500	1200	1400	1100	1200	2500	2300	1600	9350	24360

Destinations

EXHIBIT 5

IH 10 Katy Freeway Corridor
IH 610 to Beltway 8
Local Through Lane Ramping
Minimum Lane Requirements

Scale 1" = 5000'



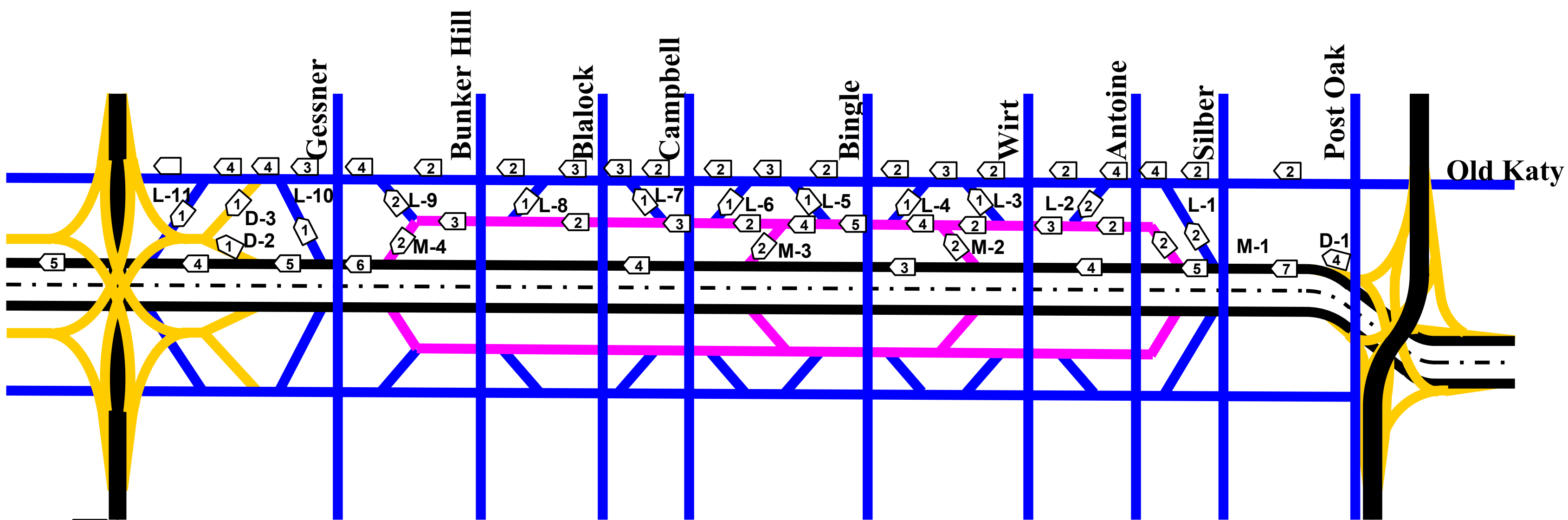
Number of Lanes
Cross Streets, Frontage Roads, and Ramps
Collector Distributors
Mainlanes

Note: Managed Lanes and space for future rail not shown for clarity. Minimum 2-lane Frontage Roads, 2-lane Local Through lanes and 3-lane Mainlanes.

EXHIBIT 6

IH 10 Katy Freeway Corridor
IH 610 to Beltway 8
Local Through Lane Ramping

Minimum Lane Requirements with Lane Balance
Scale 1" = 5000'



Number of Lanes
Cross Streets, Frontage Roads, and Ramps
Collector Distributors
Mainlanes

Note: Managed Lanes and space for future rail not shown for clarity. Minimum 2-lane Frontage Roads, 2-lane Local Through lanes and 3-lane Mainlanes.

EXHIBIT 7

HVJAssociates, Inc.
Geotechnical, Environmental & Materials Engineers

6120 S. Dairy Ashford
Houston, Texas 77072
Voice: 281-933-7388
Fax: 281-933-7293
http://www.hvj.com

MEMORANDUM

Date: March 7, 2003

To: David Milner
Parsons Brinckerhoff

From: Mike Hasen

Re: I-10 Depressed Section
Geotechnical Design Input

The following discussion summarizes the information we have developed to date ont eh above issue.

Bridge Drilled Shaft Foundation Design

I evaluated the drilled shaft capacity information we've developed for the various bridge locations. Our borings only go to 75 feet in general so they are not really deep enough to make a definitive assessment. I looked at the accumulative allowable capacity below 40 feet in our borings, and made an assumption that the rate of increase below 75 feet would be the same as the rate of increase above 75 feet. I found that we could group the bridge locations into 2 groups as shown below:

<u>Gessner, Bunker Hill, Blalock, IH-610, UPRR</u>
0.57 tons/ft diameter/ft shaft
400 tons capacity on a single shaft would require 100, 81, and 66 foot long shafts for 6, 7, and 8 foot diameters, respectively.

<u>Campbell, Bingle, Wirt, Antoine, Silber, N. Post Oak</u>
0.43 tons/ft diameter/ft shaft
400 tons capacity on a single shaft would require 107, 87, and 70 foot long shafts for 7, 8, and 9 foot diameters, respectively.

Retaining Wall Design

After discussion with GEC staff we agreed that cantilevered drilled shaft retaining walls would be the basis of the conceptual design. The lateral movements at the top of shaft would be accommodated through detailing of the bridges and frontage roads adjacent to the top of shaft, no bracing, deadmen, or tiebacks would be used to reduce the lateral movement at the top of shaft. We have analyzed the lateral movement and required length of various sized shafts assuming a 25 foot high retaining wall as shown below.

60-inch shafts - 6-7 inch lateral deflection, 70 feet long
72-inch shafts - 4-5 inch lateral deflection, 80 feet long
84-inch shafts - 3-4 inch lateral deflection, 80 feet long

I would recommend 60-inch shafts for retaining walls away from bridges, and 84-inch shafts at bridge locations.

Dewatering
Regarding the groundwater table, I've been looking through the compilation of our data. A summary of the measured groundwater levels referenced to the proposed top of pavement at 23 feet below ground surface is given below.

West of Station 1730 (Section 4) - about 5 to 10 feet above pavement level
Station 1730 to 1815 (Section 3 from Wirt west) - at pavement level
Station 1815 to 1885 (Section 3 from Antoine east) - about 2 to 5 feet above pavement level
Station 1885 to 1930 (Section 2 west of the RR bridge) - about 2 to 5 feet below pavement level
Station 1930 to 1940 (Section 2 RR bridge east) - about 5 feet above pavement level

Note that these groundwater table measurements are the values measured primarily during drilling of our borings, and that water tables will fluctuate with time. It would be prudent to assume that water tables somewhat higher would occur over at least a portion of most years.

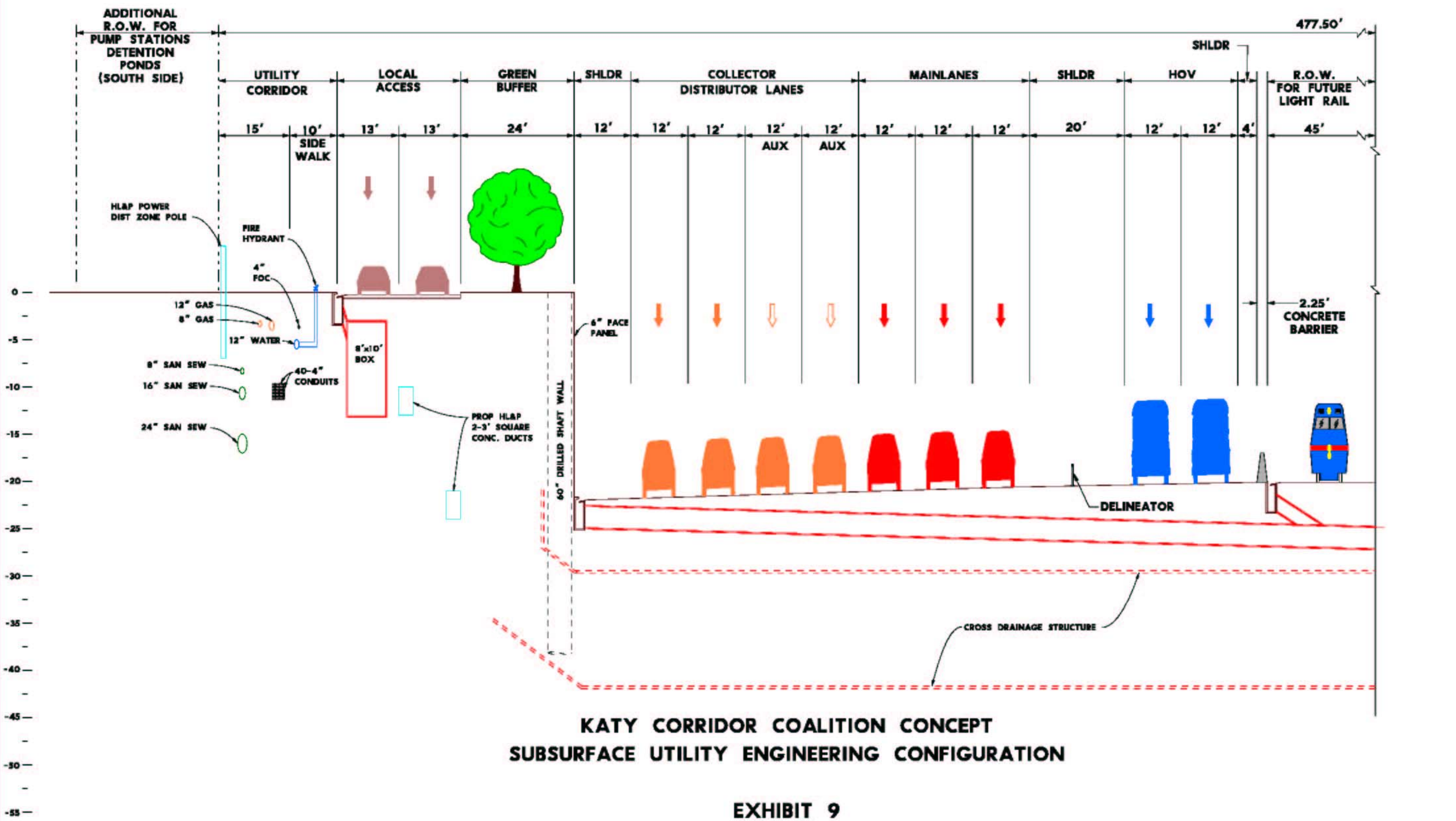
Based on the data we will need some sort of dewatering over most of the project alignment. Along most of the alignment silty fine sand will be encountered at or near the pavement elevation. Our experience is that flow rates from these materials are not high. I recommend a combination of three approaches to control the groundwater. The first will be the normal drainage at the retaining walls. Second would be a drainage layer extending under the pavement comprising 8 inches of clean crushed aggregate separated from the subgrade by a filter fabric. The third would be a trench drain at the edge of the depressed section filled with clean aggregate wrapped in filter fabric. This could be constructed in the backfill of the storm sewers that will be needed to conduct drainage water from the retaining wall and pavement drainage layers.

We should realize that there will probably be localized areas where the water flow from the sand is higher than can be accommodated in this system. We should probably budget for some permanent dewatering wells, grouting or a combination. We are still evaluating the flow rates, extent of water table depression behind the walls, and areas that might need more permanent wells or grouting. This information should form a reasonable basis for costing most of the project. We will provide more guidance on the other issues during the next week.

Bouyancy
I believe that any utility buried beneath the pavement in the depressed section should be designed to resist buoyant uplift since we can't guarantee that a buoyant condition will never occur. The methods to resist this would be to bury the culverts deep enough that the buoyant weight of soil above the culvert is enough to resist the buoyant force, to thicken the bottom slab of the culvert to add weight to the culvert, or possibly to construct shelves off the side of the culvert to provide additional vertical resistance due to the weight of the soil above the shelves.

The buoyant unit weight of soil can be taken as 60 pcf. The buoyant weight of concrete should be taken as about 85 pcf. You can analyze the box based on the anticipated burial depth to see how much net buoyancy remains to be resisted after the weight of soil above the box and the weight of the box concrete is accounted for. I believe that either the base thickening or the shelf idea should be enough to get a suitable buoyancy resistance.

Regarding the pavement itself, the drainage layer beneath the pavement would be intended to intercept any flow that would cause a buoyant condition. The main risk here would be that a failure in the pumping system would cause water to backflow into the pavement drainage layer and cause an uplift condition to occur. We would need to develop a bypass detail so that if the pumping system fails and excess water accumulates in the drainage layer that it would be able to flow out on top of the pavement so that no uplift would occur on the pavement itself. Of course this would not be the typical condition, only a last resort to avoid damage to the pavement while the pumping system was serviced.

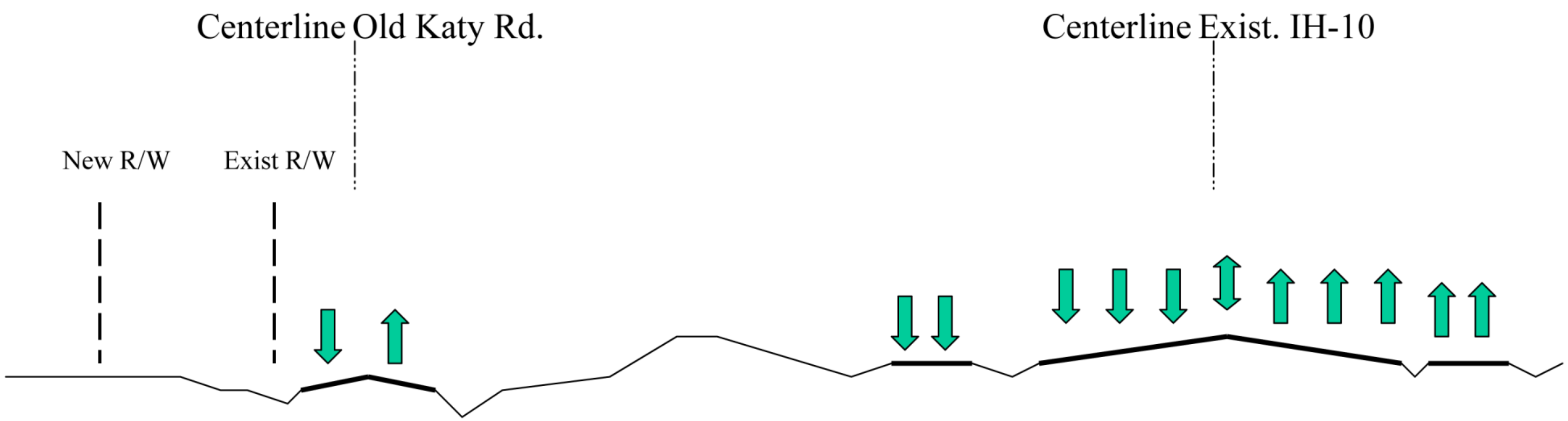


KATY CORRIDOR COALITION CONCEPT
SUBSURFACE UTILITY ENGINEERING CONFIGURATION

EXHIBIT 9

Katy Corridor Coalition Concept

CONSTRUCTION PHASING



Section Looking East

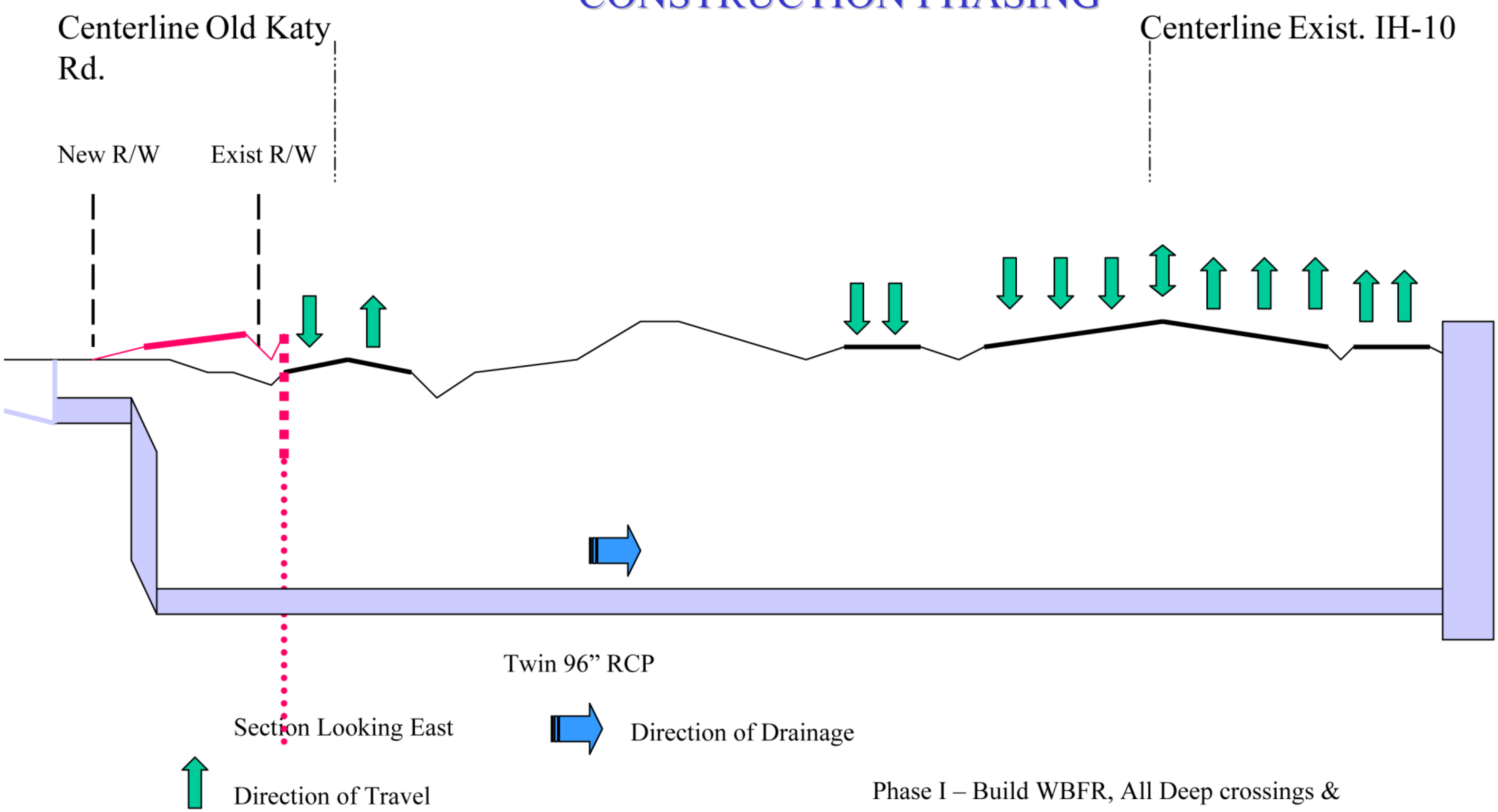
Direction of Travel

Existing IH-10 Freeway section
@ approximately 1775+00

EXHIBIT 10A

Katy Corridor Coalition Concept

CONSTRUCTION PHASING

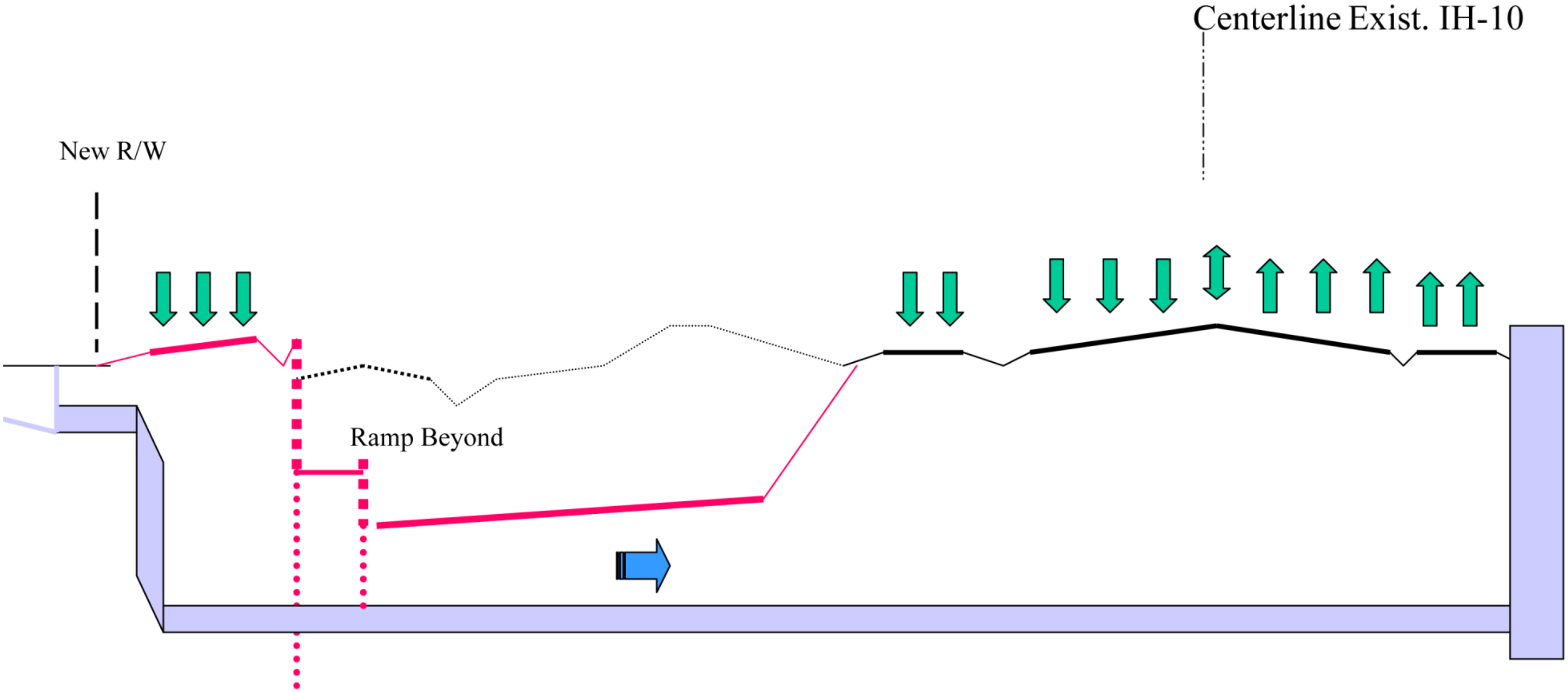


Phase I – Build WBFR, All Deep crossings & North side retaining walls

EXHIBIT 10B

Katy Corridor Coalition Concept

CONSTRUCTION PHASING



Section Looking East

Direction of Drainage

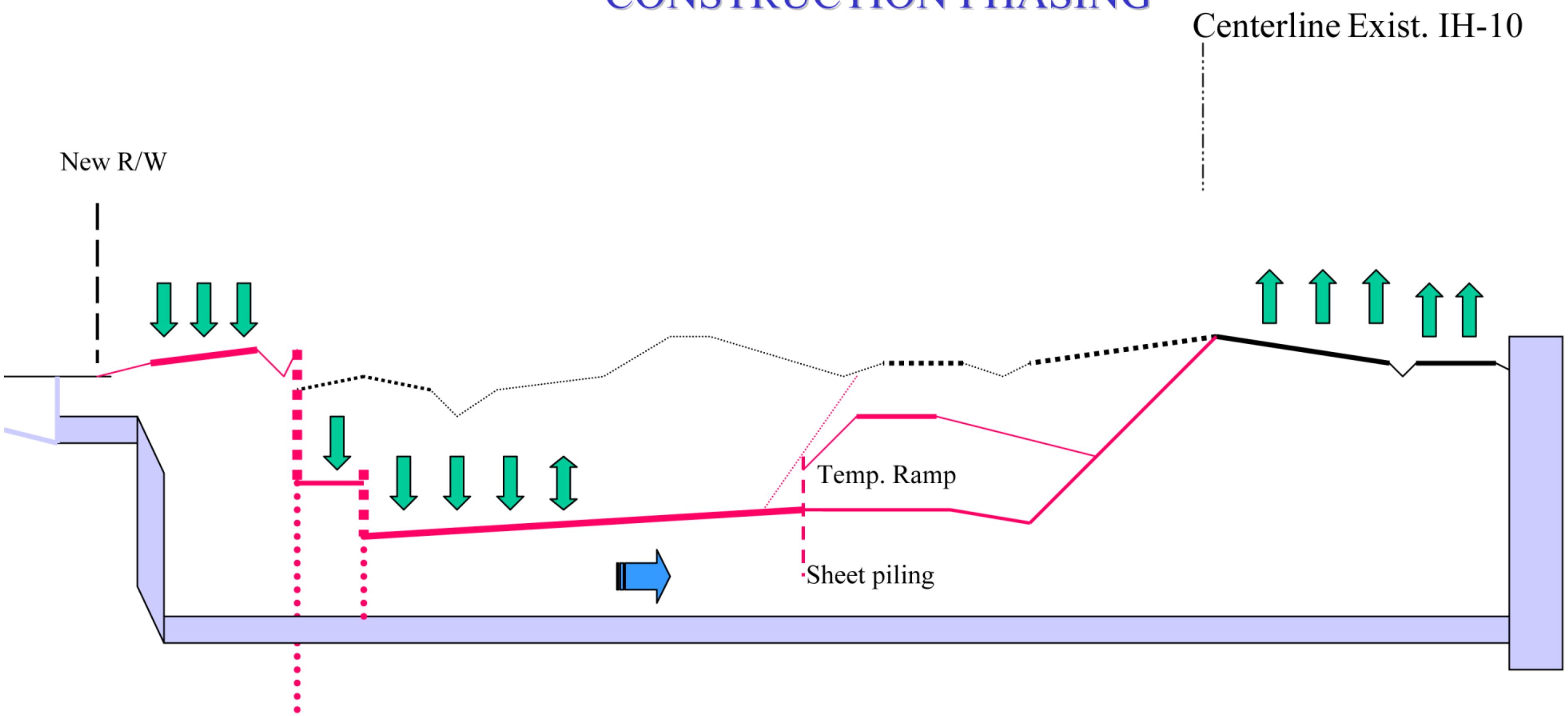
Direction of Travel

Phase II – Move WBFR traffic, Excavate and build WBML

EXHIBIT 10C

Katy Corridor Coalition Concept

CONSTRUCTION PHASING



Section Looking East

Direction of Drainage

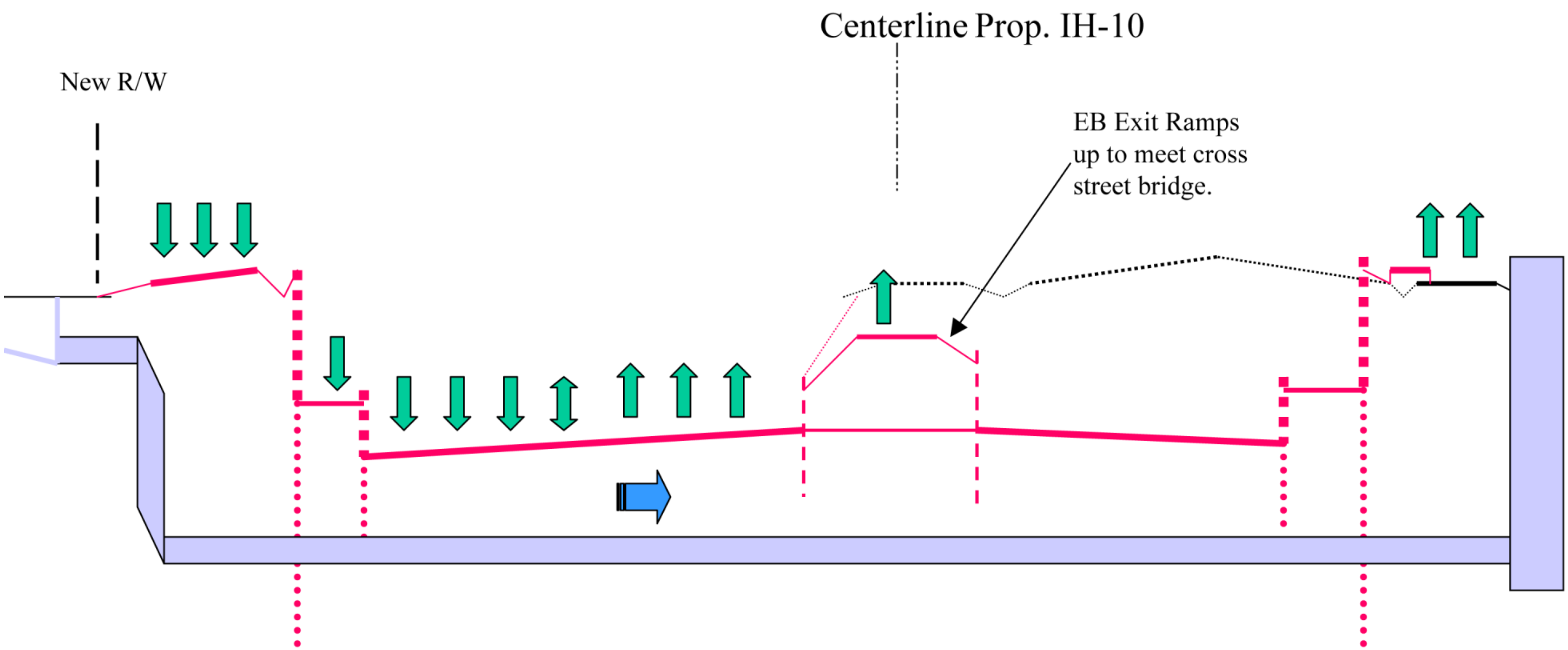
Direction of Travel

Phase III – Move WBML & HOV traffic, Excavate center section leaving temp ramp for EB in Phase IV

EXHIBIT 10D

Katy Corridor Coalition Concept

CONSTRUCTION PHASING



Section Looking East

Direction of Drainage

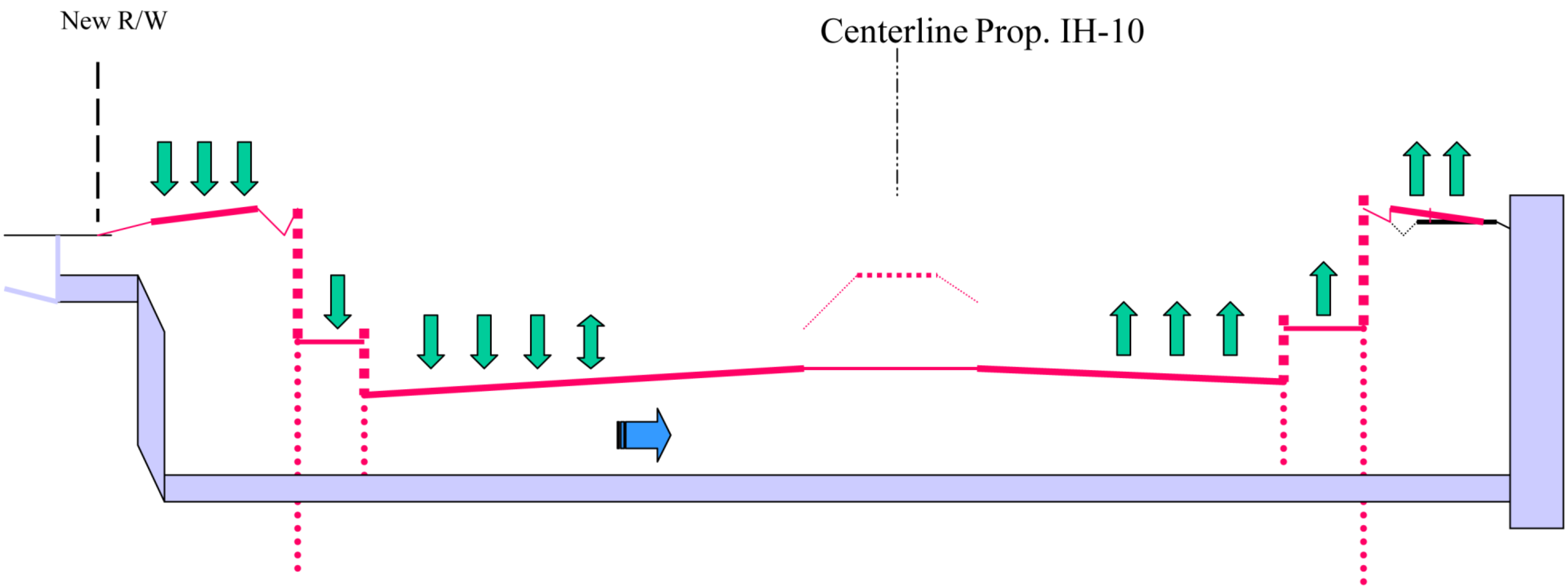
Direction of Travel

Phase IV – Move EBML with temp ramps accessing EBFR via cross-road bridges. Build south Retaining wall and Excavate future EBML.

EXHIBIT 10E

Katy Corridor Coalition Concept

CONSTRUCTION PHASING



Section Looking East

Direction of Drainage

Direction of Travel

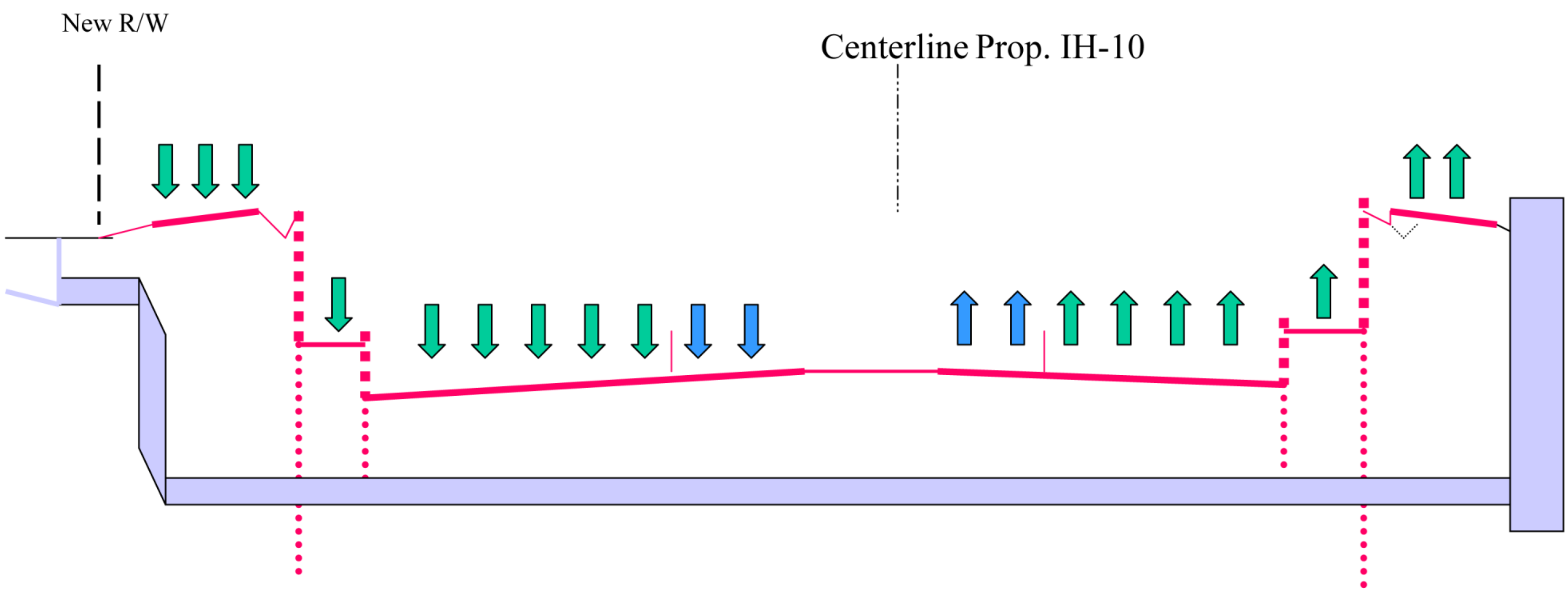
Phase V – Move EBML traffic to south side new pavement. Finish EBFR under traffic. Remove sheet piles and temp EB ramps in Center section.

EXHIBIT 10F

Texas Department of Transportation

Katy Corridor Coalition Concept

CONSTRUCTION PHASING



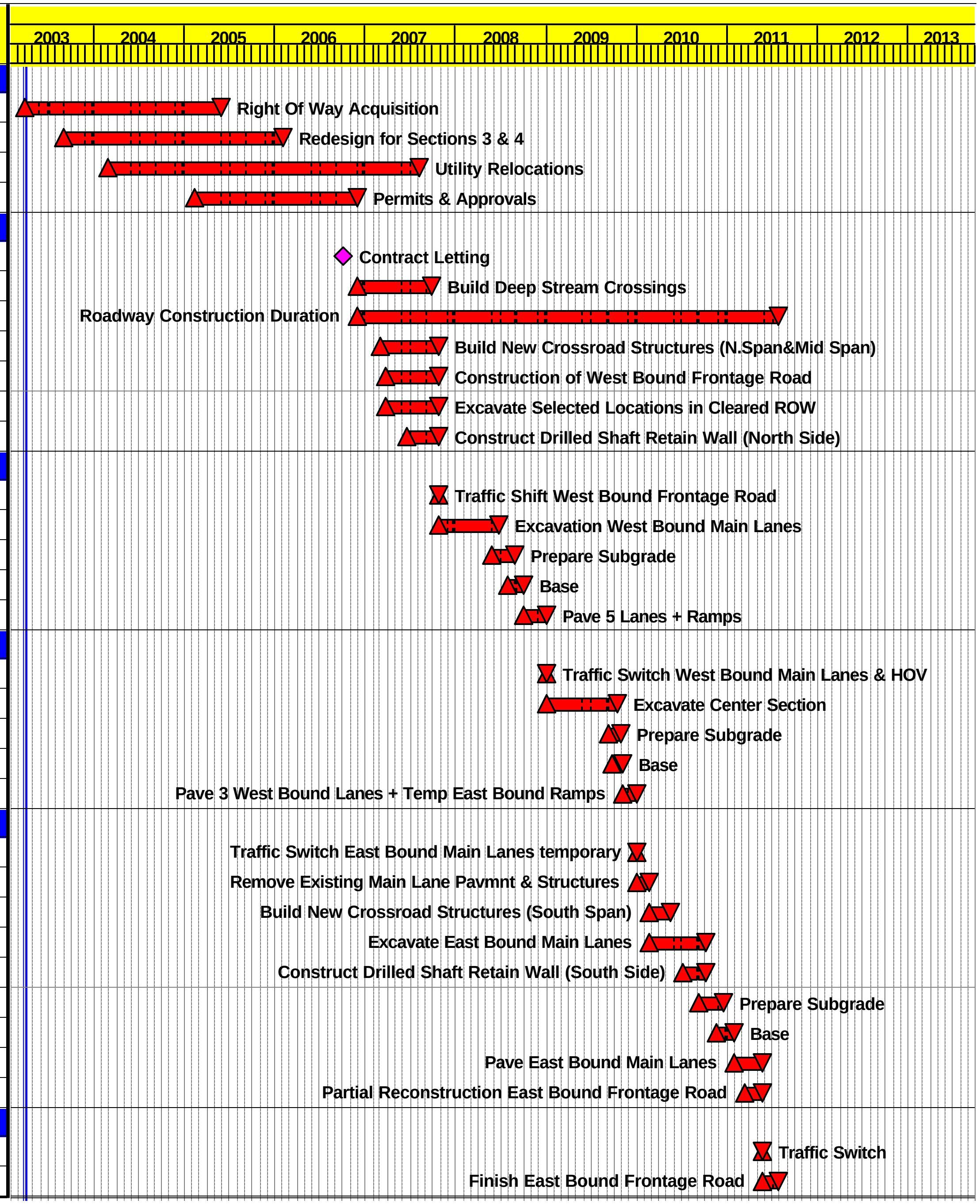
Section Looking East

Direction of Travel   Managed Lanes

Completed Section – All lanes open and traffic in final position.

EXHIBIT 10G

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
Project Overview				
1180	Right Of Way Acquisition	668	01APR03	02JUN05
990	Redesign for Sections 3 & 4	746	02SEP03*	04FEB06
1000	Utility Relocations	1,058	01MAR04	09AUG07
1170	Permits & Approvals	551	16FEB05	01DEC06
Phase I Westbound Frontage Road				
1045	Contract Letting	0	03OCT06*	
1005	Build Deep Stream Crossings	250	02DEC06	25SEP07
1230	Roadway Construction Duration	1,430*	02DEC06	29JUL11
1015	Build New Crossroad Structures (N.Span&Mid Span)	200	02MAR07	24OCT07
1010	Construction of West Bound Frontage Road	180	26MAR07	24OCT07
1025	Excavate Selected Locations in Cleared ROW	180	26MAR07	24OCT07
1020	Construct Drilled Shaft Retain Wall (North Side)	104	23JUN07	24OCT07
Phase II Westbound Depressed Freeway				
1027	Traffic Shift West Bound Frontage Road	1	25OCT07	25OCT07
1030	Excavation West Bound Main Lanes	206	26OCT07	26JUN08
1040	Prepare Subgrade	79	27MAY08	27AUG08
1050	Base	54	29JUL08	30SEP08
1060	Pave 5 Lanes + Ramps	78	01OCT08	02JAN09
Phase III Center Section Depressed Freeway				
1070	Traffic Switch West Bound Main Lanes & HOV	1	03JAN09	03JAN09
1080	Excavate Center Section	240	05JAN09	14OCT09
1090	Prepare Subgrade	40	14SEP09	29OCT09
1100	Base	35	29SEP09	07NOV09
1110	Pave 3 West Bound Lanes + Temp East Bound Ramps	45	09NOV09	02JAN10
Phase IV Eastbound Depressed Freeway				
1120	Traffic Switch East Bound Main Lanes temporary	1	04JAN10	04JAN10
1125	Remove Existing Main Lane Pavmnt & Structures	45	05JAN10	25FEB10
1127	Build New Crossroad Structures (South Span)	70	26FEB10	18MAY10
1130	Excavate East Bound Main Lanes	190	26FEB10	08OCT10
1135	Construct Drilled Shaft Retain Wall (South Side)	78	09JUL10	08OCT10
1140	Prepare Subgrade	88	08SEP10	20DEC10
1150	Base	60	18NOV10	29JAN11
1160	Pave East Bound Main Lanes	100	31JAN11	26MAY11
1165	Partial Reconstruction East Bound Frontage Road	60	18MAR11	26MAY11
Phase V Eastbound Frontage Road				
1210	Traffic Switch	1	27MAY11	27MAY11
1220	Finish East Bound Frontage Road	52	28MAY11	29JUL11



Start Date	01MAR03
Finish Date	29JUL11
Data Date	01APR03
Run Date	17APR03 16:57

Early Bar
Progress Bar
Critical Activity

ALT2

Preliminary Schedule for Construction of KCC Concept

Sheet 1 of 1

EXHIBIT 11

Date	Revision	Checked	Approved
13MAR03	Initial Schedule	SRS	
20MAR03	Revised	SRS	
25MAR03	Revised	SRS	

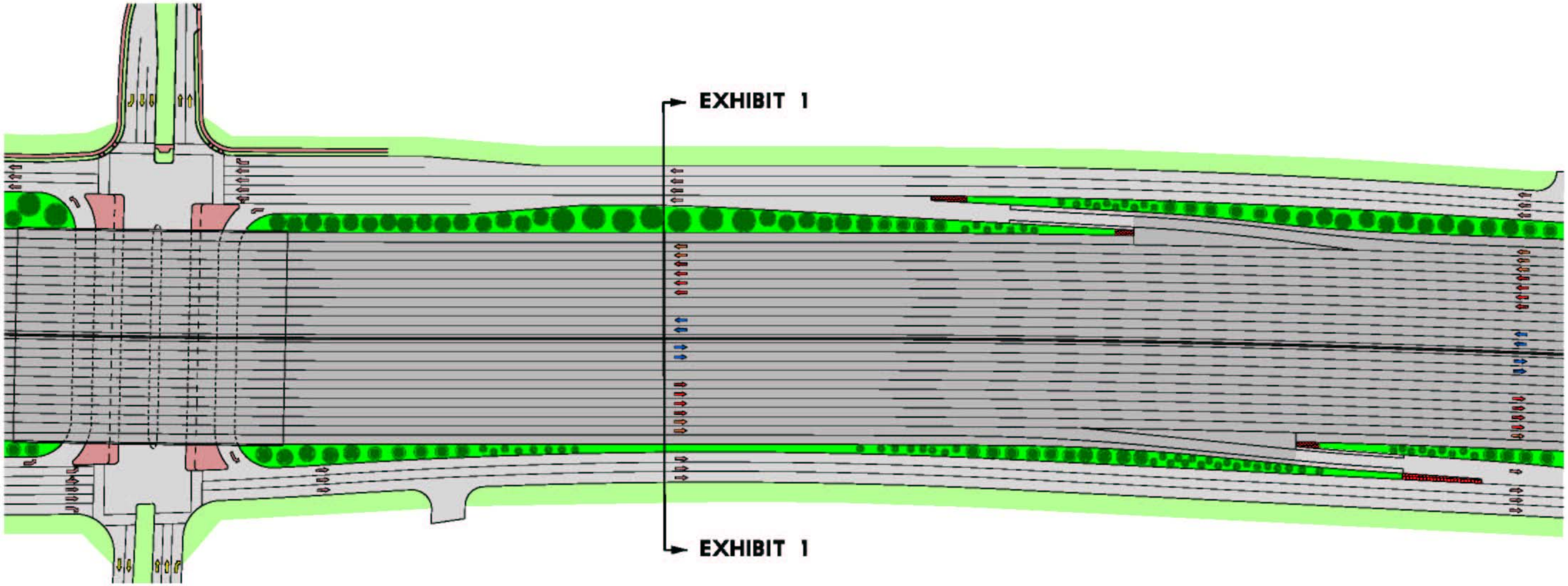
KCC CONCEPT SCHEDULE ASSUMPTIONS

1. A 6-day work week.
2. The six standard holidays per year.
3. No unusual weather or acts of God.
4. Subsequent Phase work will begin 1 working day after the completion of the previous Phase.
5. ROW Acquisition and Utility Relocation will run concurrently with the redesign effort for Sections 3 & 4
6. Permit and Approval process will start approximately 12 months prior to the completion of the redesign effort.
7. Construction of the Deep Stream Crossings will not begin until the completion of the Permit and Approval process.
8. Construction of the New Crossroad Structures will conclude approximately 1 month after the completion of the Deep Stream Crossings.
9. Construction of the WBFR will finish at the same time as the construction of the New Crossroad Structures.
10. Excavating Selected Locations in Cleared ROW will finish at the same time as the Construction of the WBFR.
11. Construction of Drilled Shaft Retaining Wall (N. Side) will finish at the same time as the Excavating Selected Locations in Cleared ROW.
12. Prepare Subgrade in Phases II & III can begin a month prior to the completion of Excavation in their respective Phases.
13. Base activities in Phases II, III & IV can begin a month prior to the completion of Prepare Subgrade.
14. Paving activities in Phases II, III & IV will not begin until the completion of the Base activities.
15. Construction of the new Crossroad Structures (S. Span) in Phase IV will not begin until the removal of Existing Mainlane Pavement & Structures is complete.
16. Excavation in Phase IV will start at the same time as the construction of the new Crossroad Structures.
17. Construction of the Drilled Shaft Retaining Wall (S. Side) in Phase IV will finish at the same time as the Excavation.
18. Prepare Subgrade in Phase IV will begin a month prior to the completion of the Excavation and Construction of the Drilled Shaft Retaining Wall (Partial).
19. Partial Reconstruction of the EBFR in Phase IV will finish at the same time as the Paving of the EBML.

Note: Basis for duration estimates is provided in the constructibility issues.

KATY CORRIDOR COALITION CONCEPT
PRELIMINARY CONSTRUCTION COST ESTIMATE
2003 Dollars

ITEM	UNIT	QUANTITY	LOW ESTIMATE	HIGH ESTIMATE
ADDITIONS RESULTING FROM KCC CONCEPT				
DRILLED SHAFT WALLS (72")	LF	96,430	$15,429,000	$28,929,000
DRILLED SHAFT WALLS (60")	LF	480,000	$67,200,000	$105,600,000
DRILLED SHAFT WALLS (54")	LF	83,450	$10,849,000	$14,604,000
DRILLED SHAFT WALLS (48")	LF	151,200	$18,144,000	$19,656,000
DRILLED SHAFT WALLS (36")	LF	72,000	$6,120,000	$6,480,000
RETAINING WALL FACING PANELS	SF	1,389,000	$13,890,000	$16,668,000
ROADWAY EXCAVATION	CY	9,300,000	$37,200,000	$46,500,000
CROSS ROAD BRIDGES - 8 NEW	SF	360,000	$28,800,000	$32,400,000
20' DIAMETER TUNNEL - SPRING BRANCH	LF	2,400	$8,640,000	$10,560,000
96" RCP - SPRING BRANCH TO BUFFALO BAYOU	LF	5,595	$6,043,000	$7,385,000
DETENTION BASIN EXCAVATION - SPRING BRANCH	AC-FT	250	$2,420,000	$3,025,000
INTAKE STRUCTURE - SPRING BRANCH	EA	1	$900,000	$1,100,000
OUTLET STRUCTURES - LOWER SPRING BRANCH	EA	2	$315,000	$385,000
CROSS DRAINAGE PUMP STATION - W151	LS	1	$7,633,000	$9,160,000
CROSS DRAINAGE PUMP STATION - HUNTERS CREEK BRANCH	LS	1	$4,984,000	$5,981,000
CROSS DRAINAGE PUMP STATION - BRIAR BRANCH	LS	1	$19,397,000	$23,276,000
CROSS DRAINAGE PUMP STATION - NIEMANN BRANCH (W138)	LS	1	$20,789,000	$24,946,000
CROSS DRAINAGE PUMP STATION - W137	LS	1	$6,771,000	$8,125,000
OFF-SITE DETENTION FOR RUNOFF IMPACT MITIGATION FROM ROW	AC-FT	98	$944,000	$1,180,000
ADDITIONAL STORM SEWER FOR MAIN LANES & FRONTAGE ROADS	LS	1	$9,654,000	$11,799,000
PUMP STATIONS FOR DEPRESSED SECTION - 7 LOCATIONS	LS	1	$19,285,000	$23,571,000
8" LAYER SELECT STONE OVER FABRIC SEP	CY	286,000	$13,898,000	$15,188,000
EXTRA CRCP & SUBGRADE - 1975+00 TO 1952+00	LS	1	$2,500,000	$2,500,000
DEEP UTILITY CROSSING WITH PUMP STATIONS	EA	5	$5,900,000	$6,800,000
DEEP UTILITY CROSSING WITH PRESSURE SYSTEMS	EA	15	$3,500,000	$5,700,000
DEEP UTILITY CROSSING FOR TELECOMMUNICATIONS	EA	10	$2,700,000	$7,100,000
HIGH MAST LIGHTING MODIFICATIONS	LS	1	$1,000,000	$1,200,000
TEMPORARY EB RAMPS WITH SHEET PILING	LS	1	$640,000	$800,000
TEMPORARY DETOUR & TEMPORARY 1/2 STRUCTURE AT ANTOINE	LS	1	$5,000,000	$5,800,000
DISPOSAL OF CONTAMINATED SOILS	LS	1	$20,000,000	$30,000,000
SUBTOTAL			$360,545,000	$476,418,000
MOBILIZATION - 7.5% FOR LOW AND 10% FOR HIGH			$27,041,000	$47,642,000
CONTINGENCY - 10%			$38,759,000	$52,406,000
TOTAL ADDITIONAL CONSTRUCTION COSTS			**$426,345,000**	**$576,466,000**
ENGINEERING COSTS @ 12% OF CONSTRUCTION COSTS			$51,161,000	$69,176,000
ROW FOR TUNNEL AND DETENTION AT SPRING BRANCH	AC	15	$16,335,000	$26,130,000
ROW FOR CROSS DRAIN PUMP STATIONS - 5 LOCATIONS	AC	12	$13,068,000	$20,904,000
ROW FOR OFF-SITE DETENTION BASINS	AC	20	$21,236,000	$33,969,000
ROW FOR 7 ADDITIONAL DEPRESSED SECTION PUMP STATIONS	AC	7	$7,623,000	$12,194,000
ROW SUBTOTAL			$58,262,000	$93,197,000
TOTAL ADDITIONS			**$535,768,000**	**$738,839,000**
DELETIONS FROM BASE PLAN				
EMBANKMENT			($10,700,000)	($10,700,000)
MAINLANE BRIDGES AND BRAIDED RAMPS - SECTIONS 3 AND 4			($45,700,000)	($45,700,000)
MSE AND TEMPORARY RETAINING WALLS AND RIPRAP			($32,200,000)	($32,200,000)
MOBILIZATION - 7.5%			($6,645,000)	($6,645,000)
ENGINEERING COSTS @ 10% OF CONSTRUCTION COSTS			($9,525,000)	($9,525,000)
TOTAL DELETIONS			**($104,770,000)**	**($104,770,000)**
NET INCREASE IN COST FOR DEPRESSED CONCEPT			**$430,998,000**	**$634,069,000**



TxDOT IH10 PROJECT PLAN
TYPICAL PLAN VIEW

APPROXIMATE LOCATION: EAST OF CAMPBELL

EXHIBIT 14

PRELIMINARY

N.T.S.

FILE: TXDOT-TYP.DGN	
CADD DGN: 1050	DATE: APRIL 15, 2003
PARSONS BRINCKERHOFF	
Texas Department of Transportation	
I-10/KATY FREEWAY RECONSTRUCTION PROGRAM	
TxDOT PLAN VIEW	

EXHIBIT 15   Green Ribbon Report Bridge Enhancements