Texas Department of Transportation

IH 635 Managed Lanes Project
Technical Provisions

Attachment 01-1A

Project Limits

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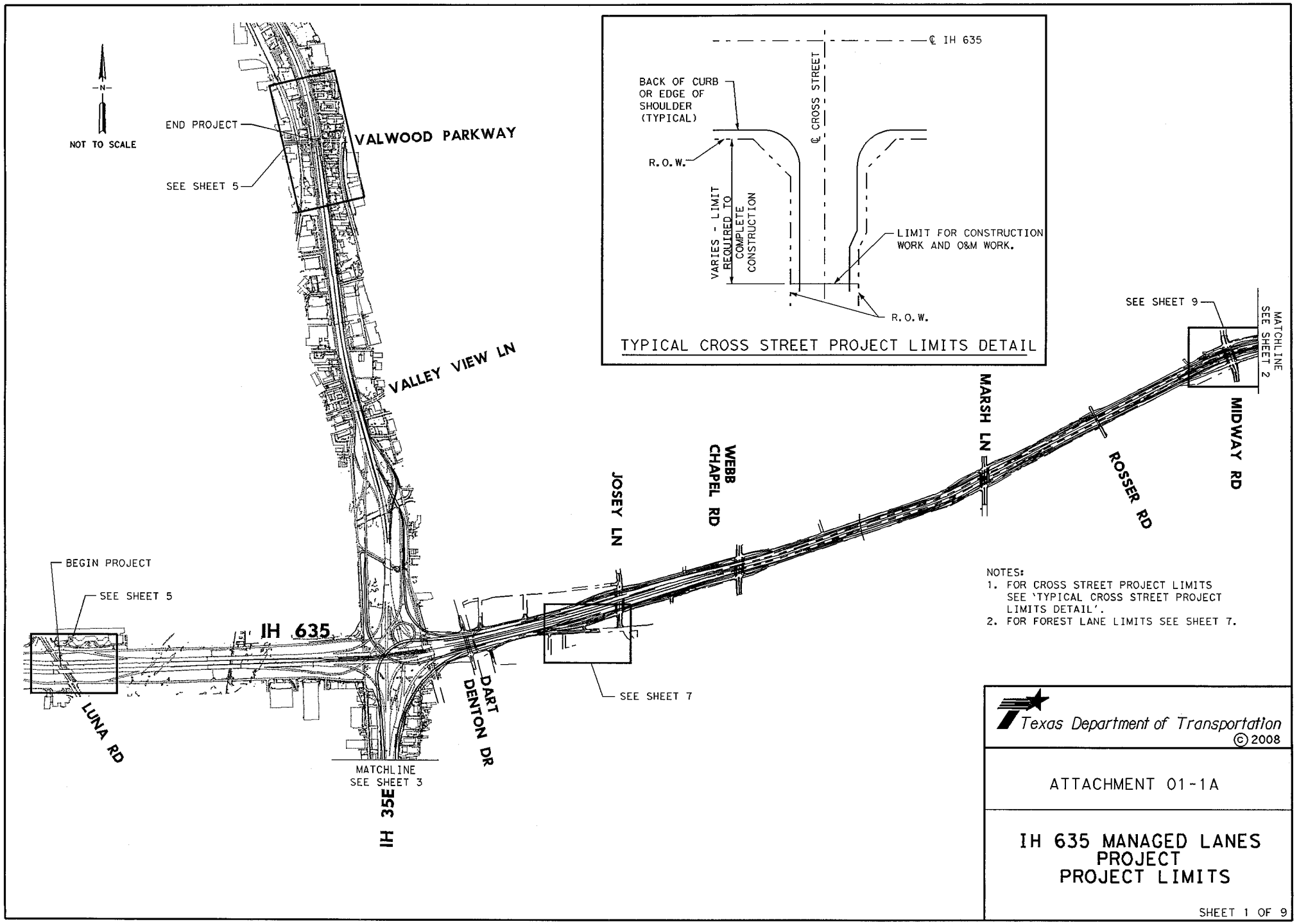
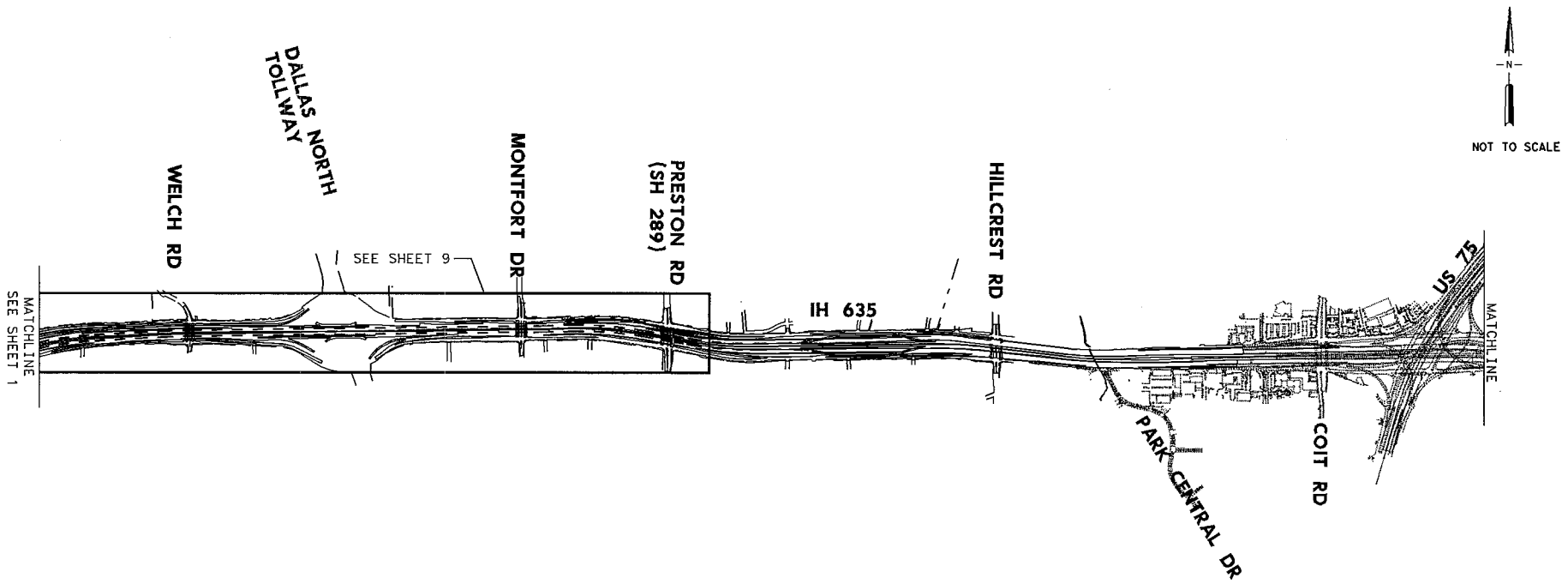


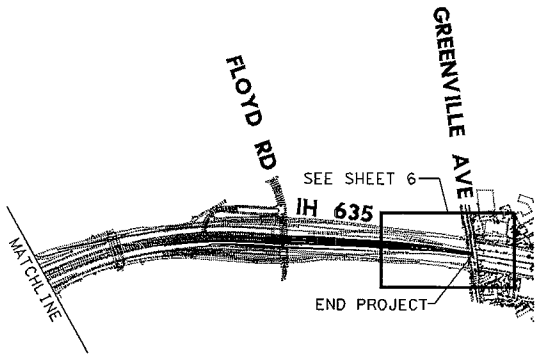
NOTES:
1. FOR CROSS STREET PROJECT LIMITS SEE 'TYPICAL CROSS STREET PROJECT LIMITS DETAIL'.
2. FOR FOREST LANE LIMITS SEE SHEET 7.

Texas Department of Transportation

ATTACHMENT 01-1A

IH 635 MANAGED LANES PROJECT PROJECT LIMITS





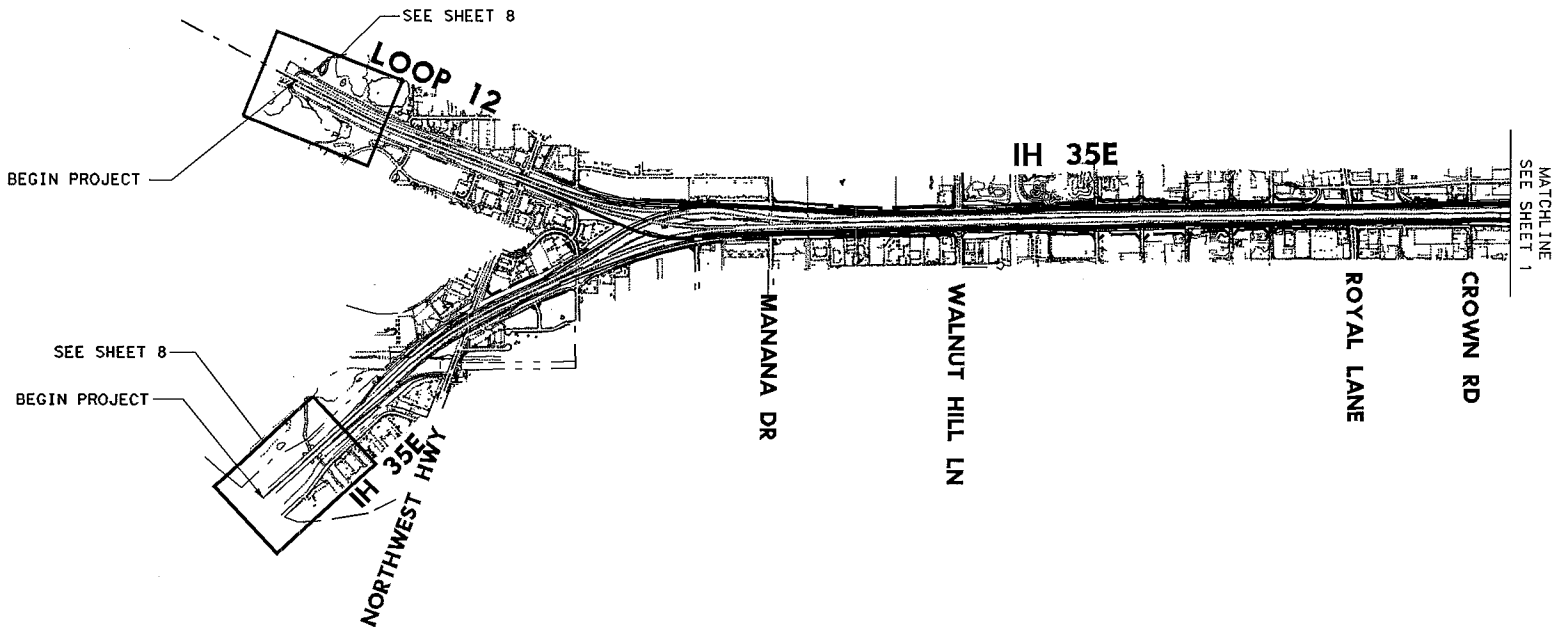
NOTE:
FOR CROSS STREET PROJECT LIMITS SEE 'TYPICAL CROSS STREET DETAIL' ON SHEET 1.

Texas Department of Transportation

ATTACHMENT 01-1A

IH 635 MANAGED LANES PROJECT
PROJECT LIMITS

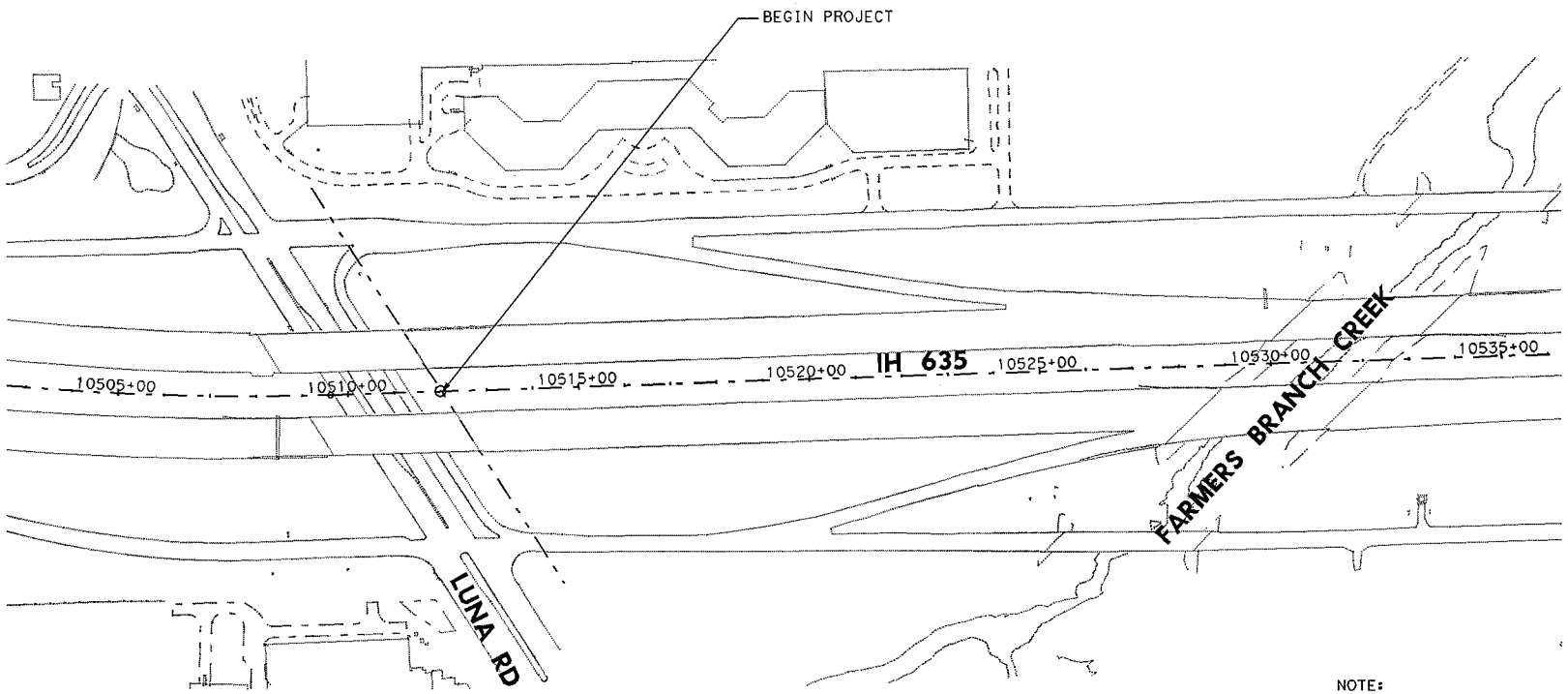
NOT TO SCALE

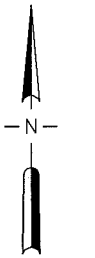


Texas Department of Transportation

ATTACHMENT 01-1A

IH 635 MANAGED LANES PROJECT
PROJECT LIMITS





NOT TO SCALE

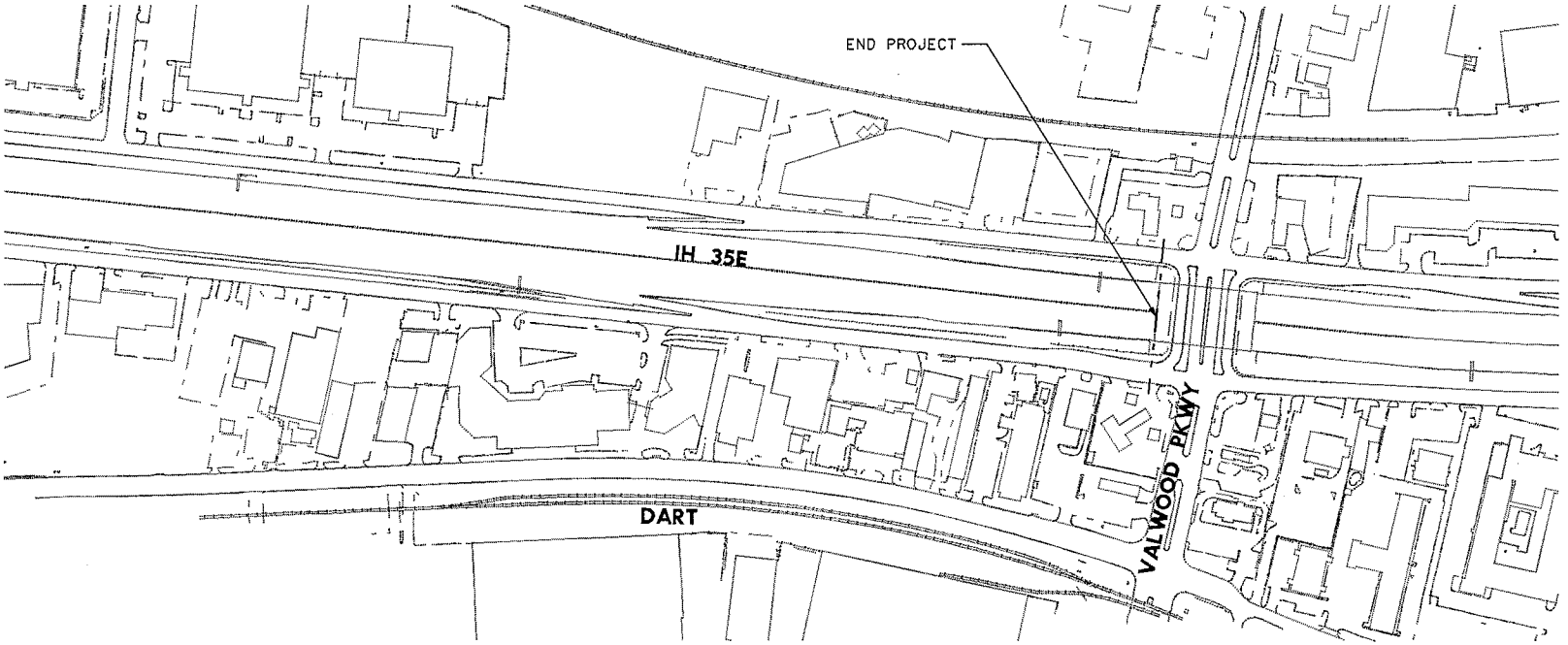
NOTE:
PROJECT BEGINS AT EAST ABUTMENT OF LUNA RD OVERPASS.

Texas Department of Transportation

ATTACHMENT 01-1A

IH 635 MANAGED LANES PROJECT PROJECT LIMITS

NOT TO SCALE

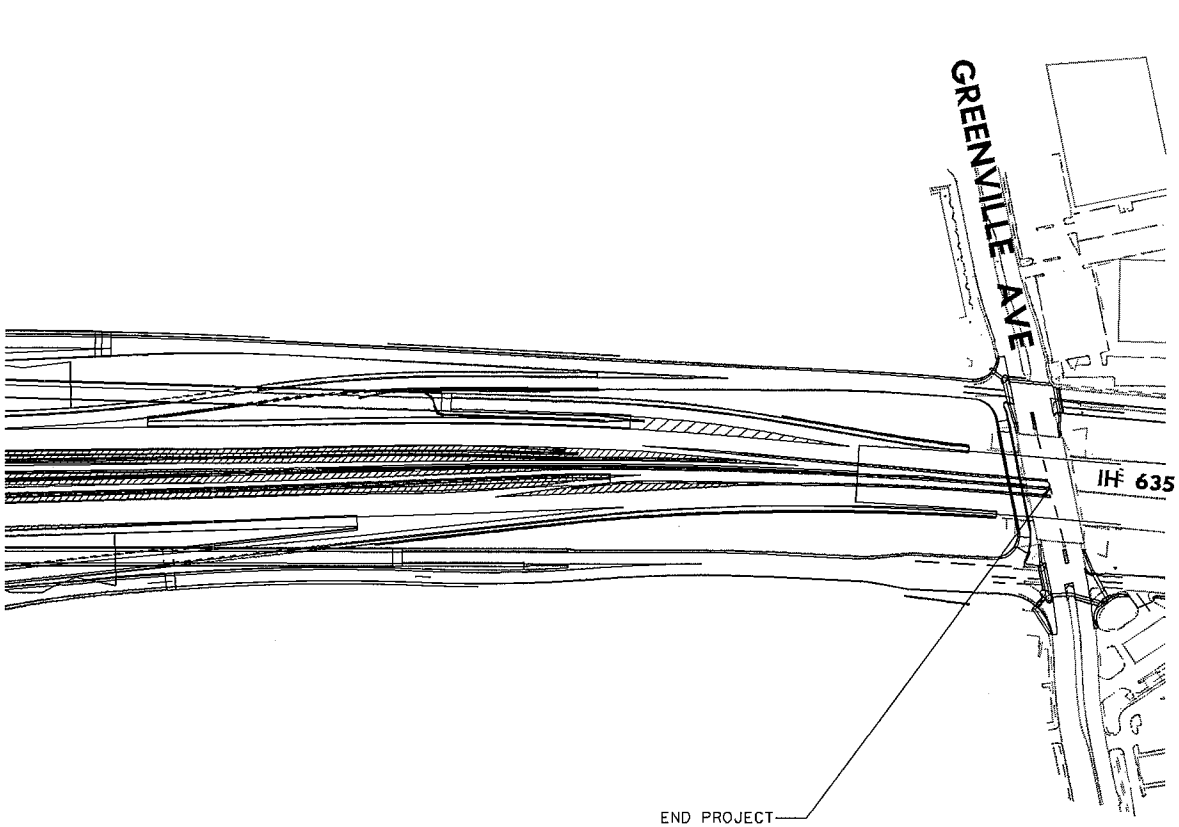


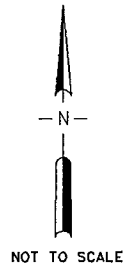
NOTE:
PROJECT ENDS AT SOUTH ABUTMENT OF VALWOOD PARKWAY OVERPASS.

Texas Department of Transportation

ATTACHMENT 01-1A

IH 635 MANAGED LANES PROJECT
PROJECT LIMITS



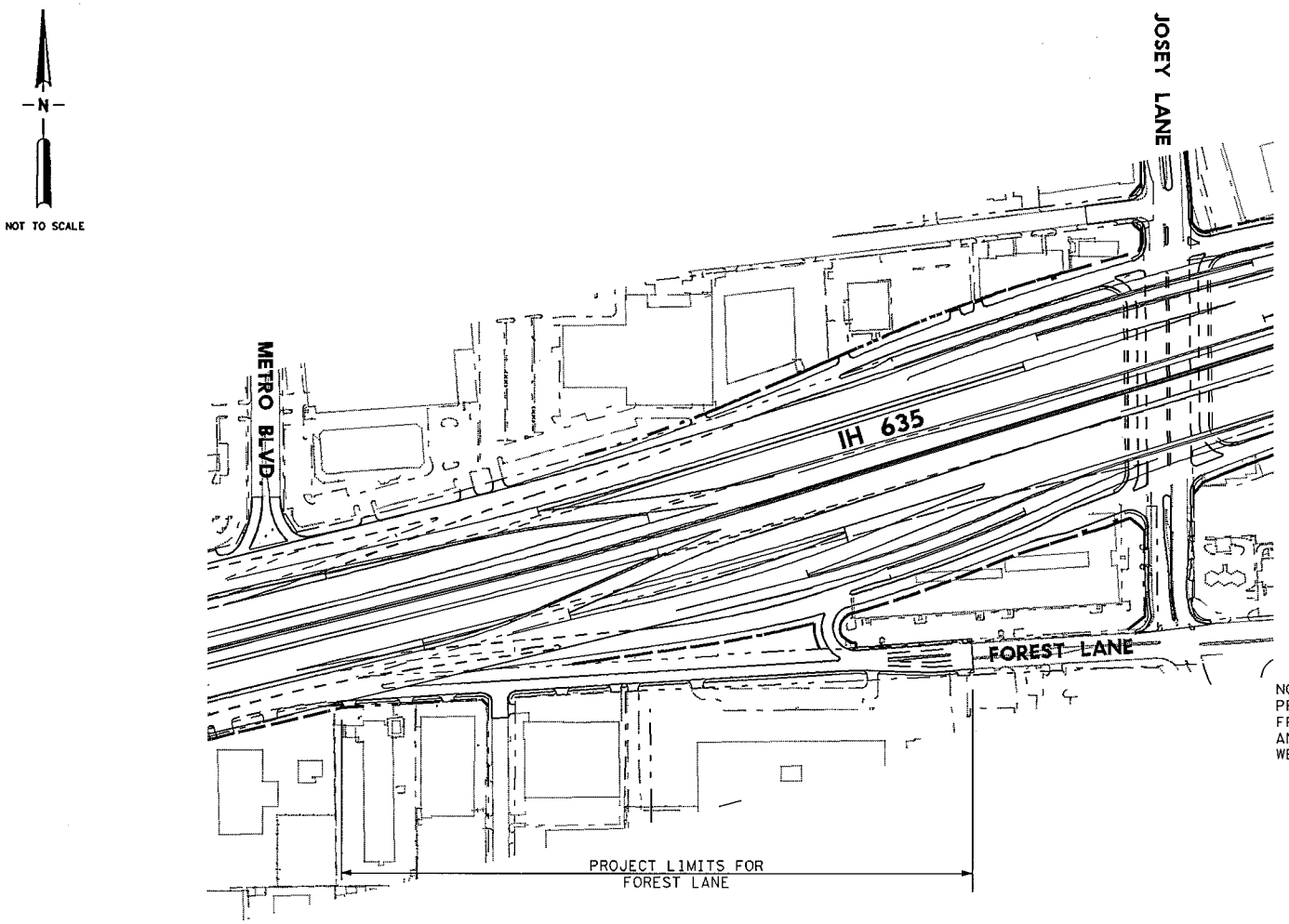


NOT TO SCALE

Texas Department of Transportation

ATTACHMENT 01-1A

IH 635 MANAGED LANES PROJECT PROJECT LIMITS

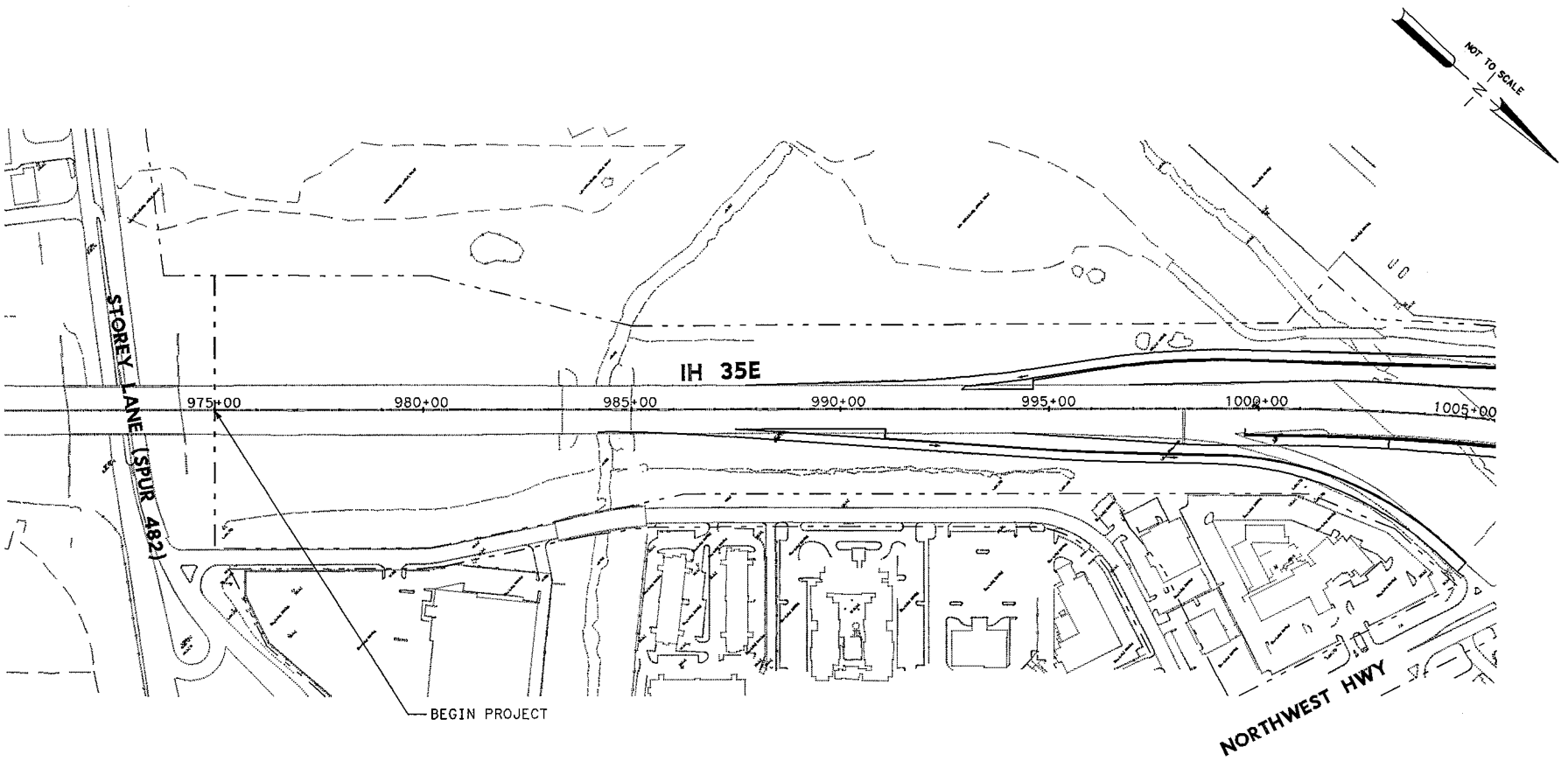


NOTE:
PROJECT LIMITS ALONG FOREST LANE EXTEND FROM THE INTERSECTION OF FOREST LANE AND THE EB FRONTAGE ROAD UPTO 473 FT WEST OF CENTERLINE JOSEY LANE.

Texas Department of Transportation

ATTACHMENT 01-1A

IH 635 MANAGED LANES PROJECT
PROJECT LIMITS



NOTE:
PROJECT BEGINS AT THE NORTH ABUTMENT OF THE IH 35E BRIDGES OVER STOREY LANE.

Texas Department of Transportation

ATTACHMENT 01-1A

IH 635 MANAGED LANES PROJECT PROJECTS LIMITS

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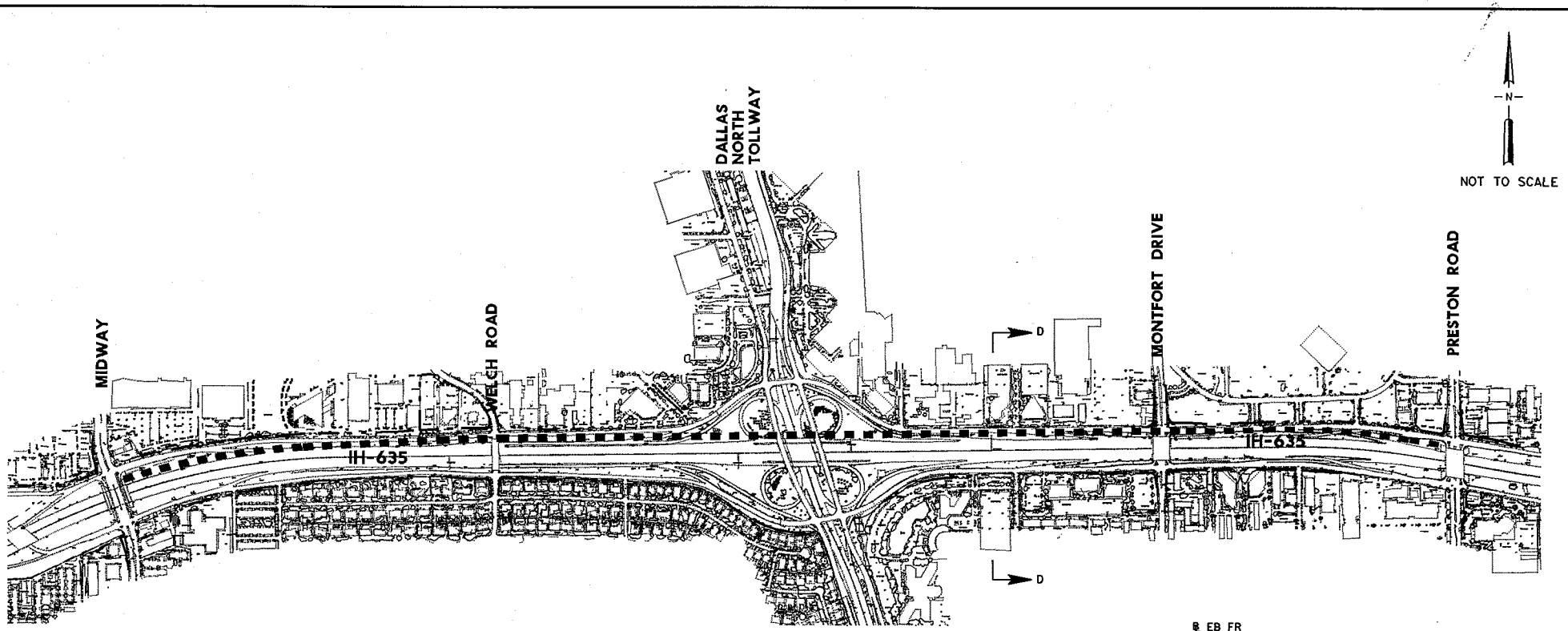
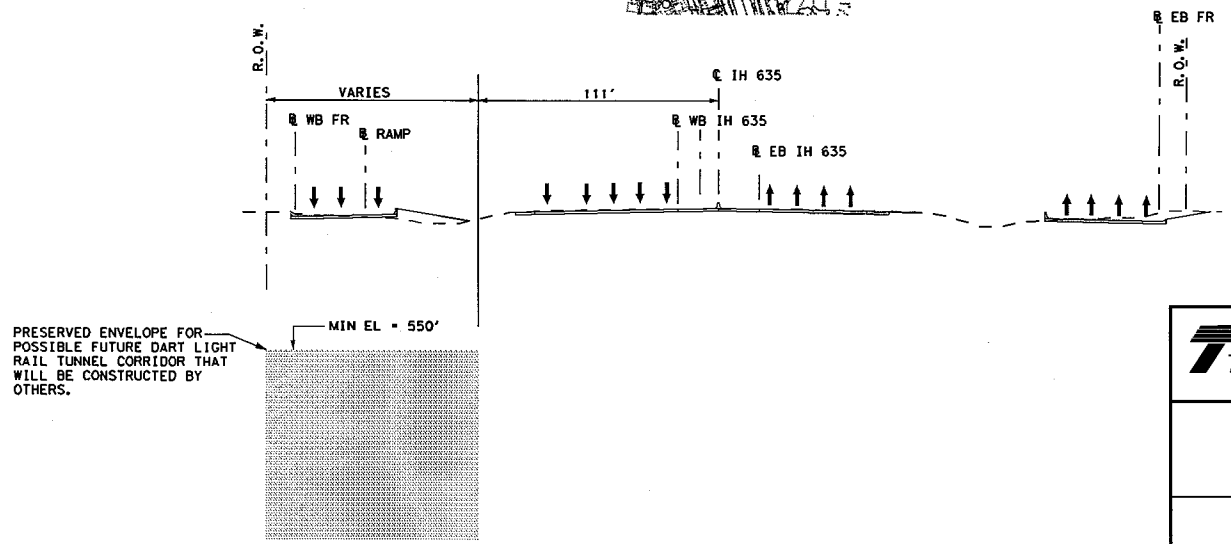




SECTION D-D
DART TUNNEL ENVELOPE
NOT TO SCALE

Texas Department of Transportation

ATTACHMENT 01-1A

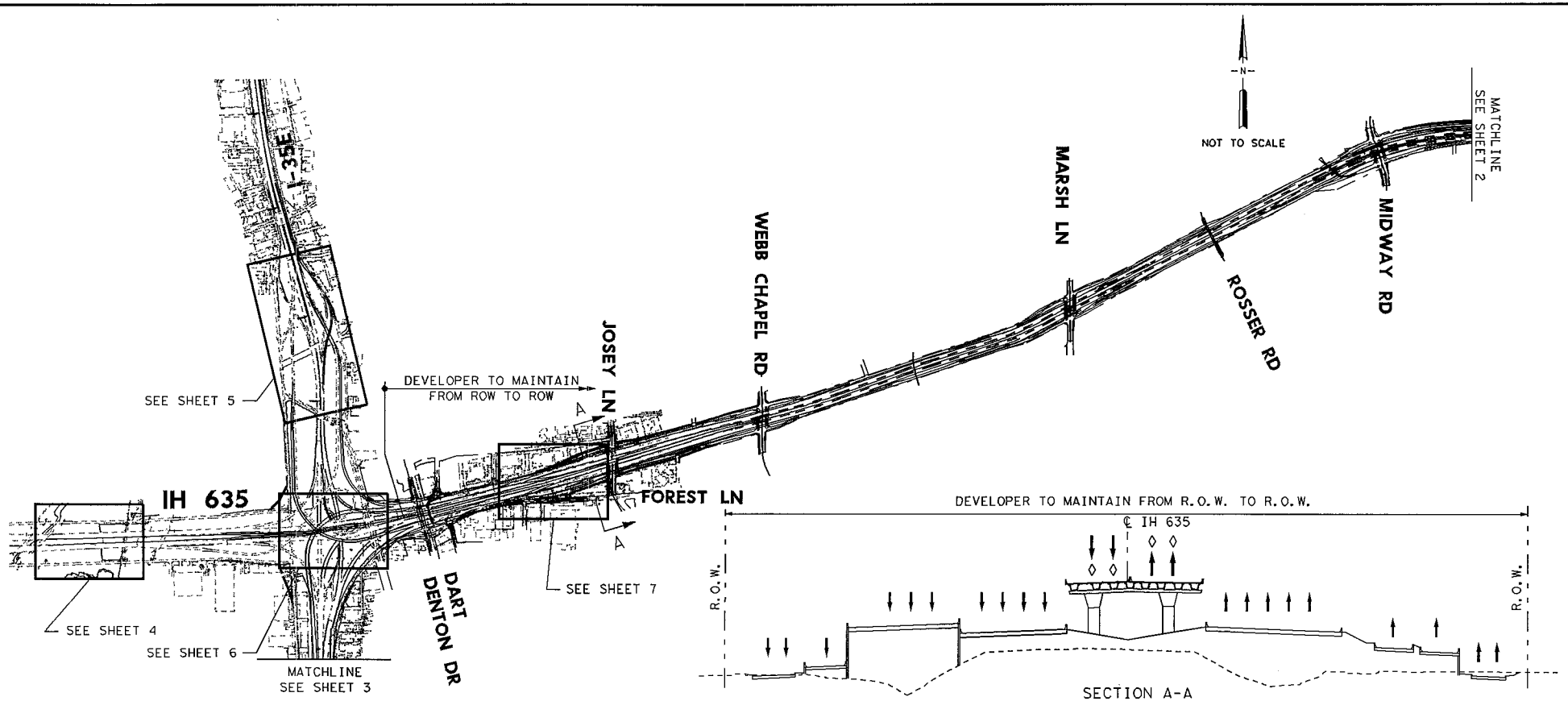
IH 635 MANAGED LANES PROJECT PROJECTS LIMITS

Texas Department of Transportation

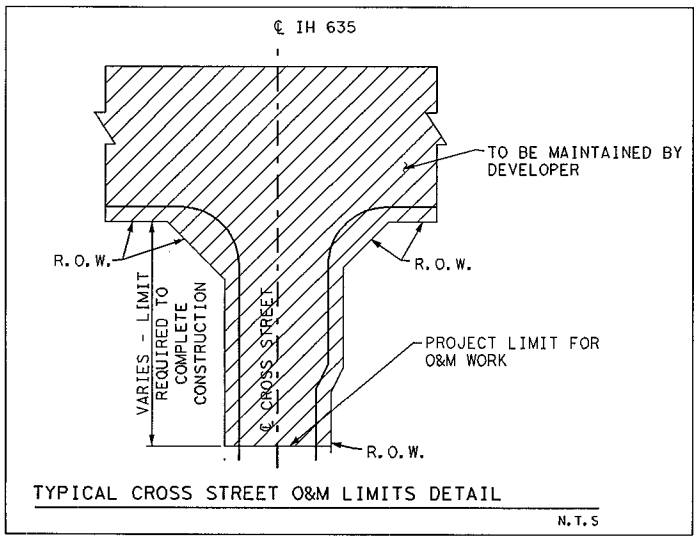
IH 635 Managed Lanes Project
Technical Provisions

Attachment 01-2A

Operations and Maintenance Work Limits



SECTION A-A
N.T.S



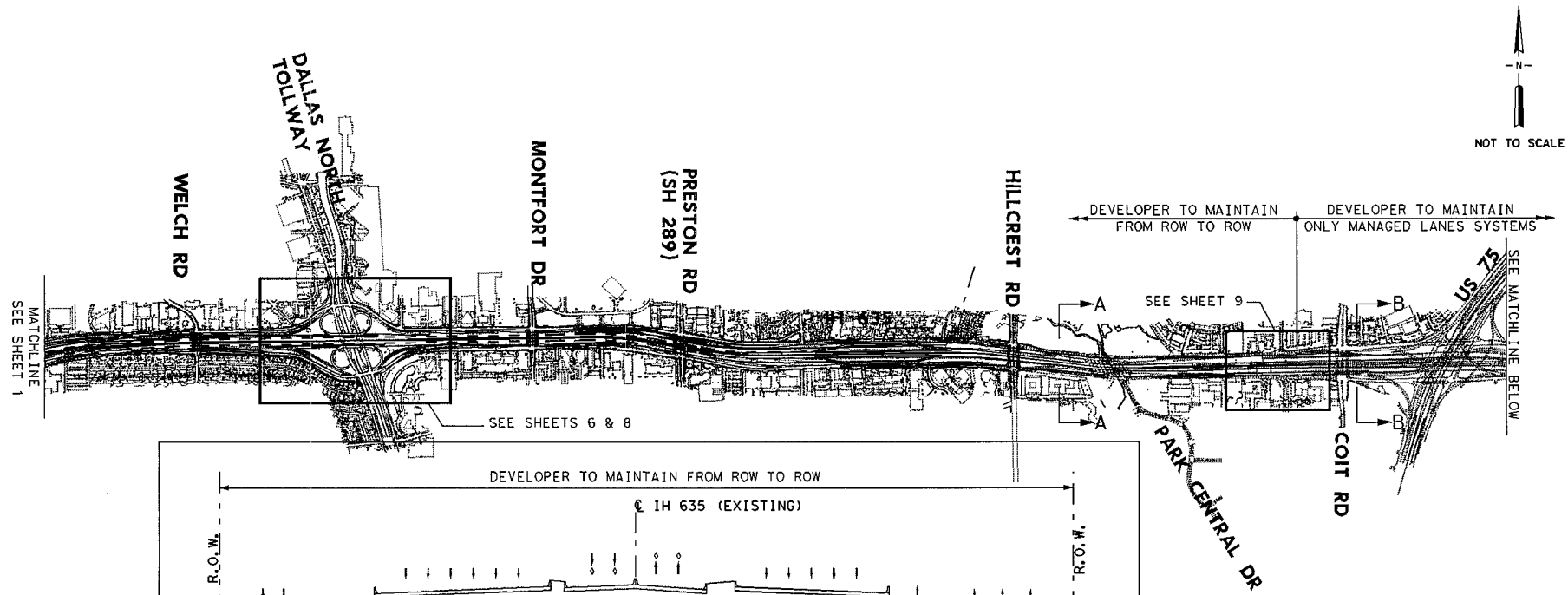
TYPICAL CROSS STREET O&M LIMITS DETAIL
N.T.S

NOTES:
1. SECTION A-A DEPICTS THE LIMITS OF MAINTENANCE. THE ROADWAY CONFIGURATION IS FOR ILLUSTRATIVE PURPOSES ONLY.
2. FOR CROSS STREET O&M LIMITS, SEE 'TYPICAL CROSS STREET O&M LIMITS DETAIL'.

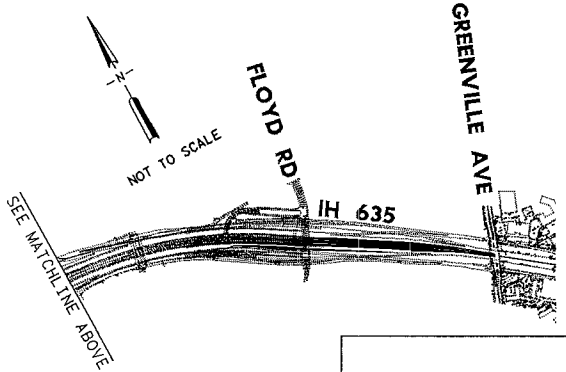
Texas Department of Transportation

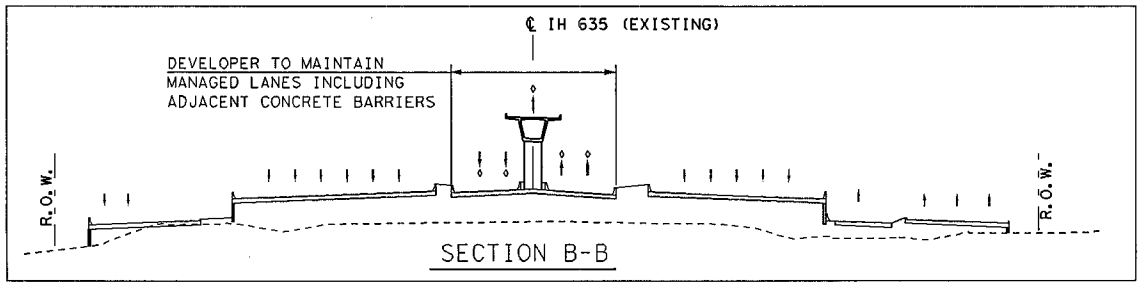
ATTACHMENT 01-2A

IH 635 MANAGED LANES PROJECT OPERATIONS AND MAINTENANCE (O&M) WORK LIMITS



SECTION A-A





SECTION B-B

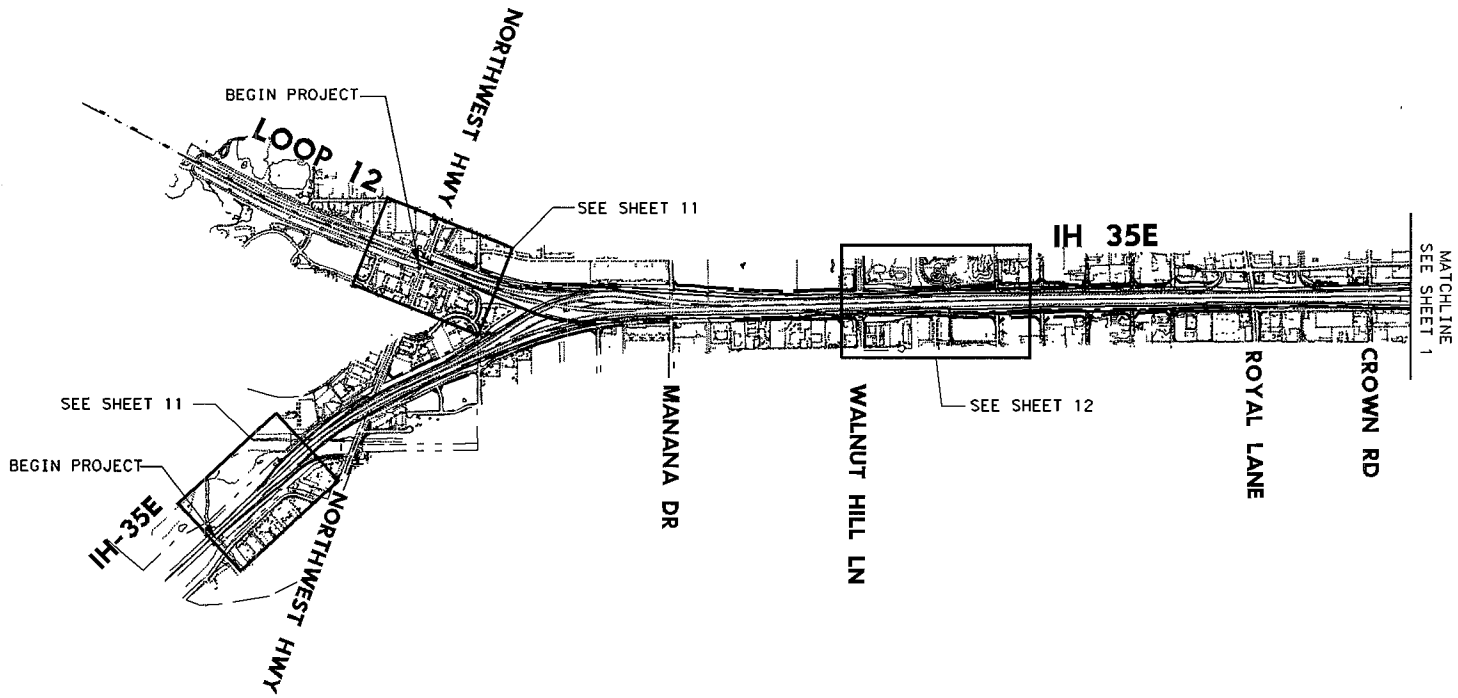
NOTE:
1. SECTIONS A-A AND B-B DEPICT THE LIMITS OF MAINTENANCE. THE ROADWAY CONFIGURATION IS FOR ILLUSTRATIVE PURPOSES ONLY.
2. FOR CROSS STREET MAINTENANCE LIMITS, SEE " TYPICAL CROSS STREET MAINTENANCE LIMITS DETAIL" ON SHEET 1.

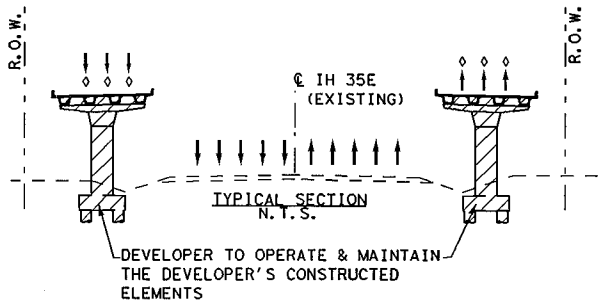
Texas Department of Transportation

ATTACHMENT 01-2A

IH 635 MANAGED LANES PROJECT OPERATIONS AND MAINTENANCE (O&M) WORK LIMITS

NOT TO SCALE



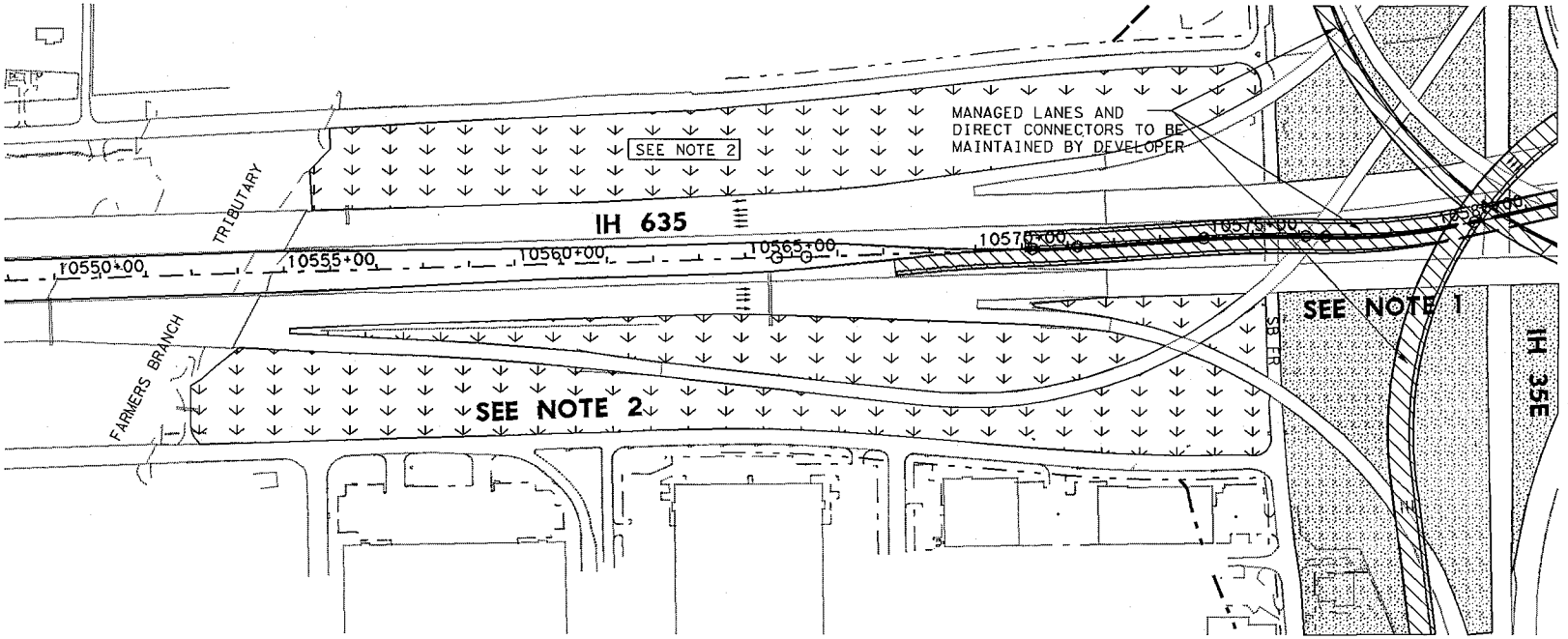


NOTE:
'TYPICAL SECTION' DEPICTS THE LIMITS OF MAINTENANCE. THE ROADWAY CONFIGURATION IS FOR ILLUSTRATIVE PURPOSES ONLY.

Texas Department of Transportation

ATTACHMENT 01-2A

IH 635 MANAGED LANES PROJECT OPERATIONS AND MAINTENANCE (O&M) WORK LIMITS



NOTES:

1. DEVELOPER SHALL MAINTAIN ALL WATER QUALITY FEATURES, OPEN CHANNELS AND DRAINAGE STRUCTURES CONSTRUCTED BY THE DEVELOPER WITHIN THE IH 35E/IH 635 INTERCHANGE. (THE AREA BOUNDED BY HARRY HINES BOULEVARD, THE IH 35E SB FRONTAGE ROAD, AND CROWN ROAD).

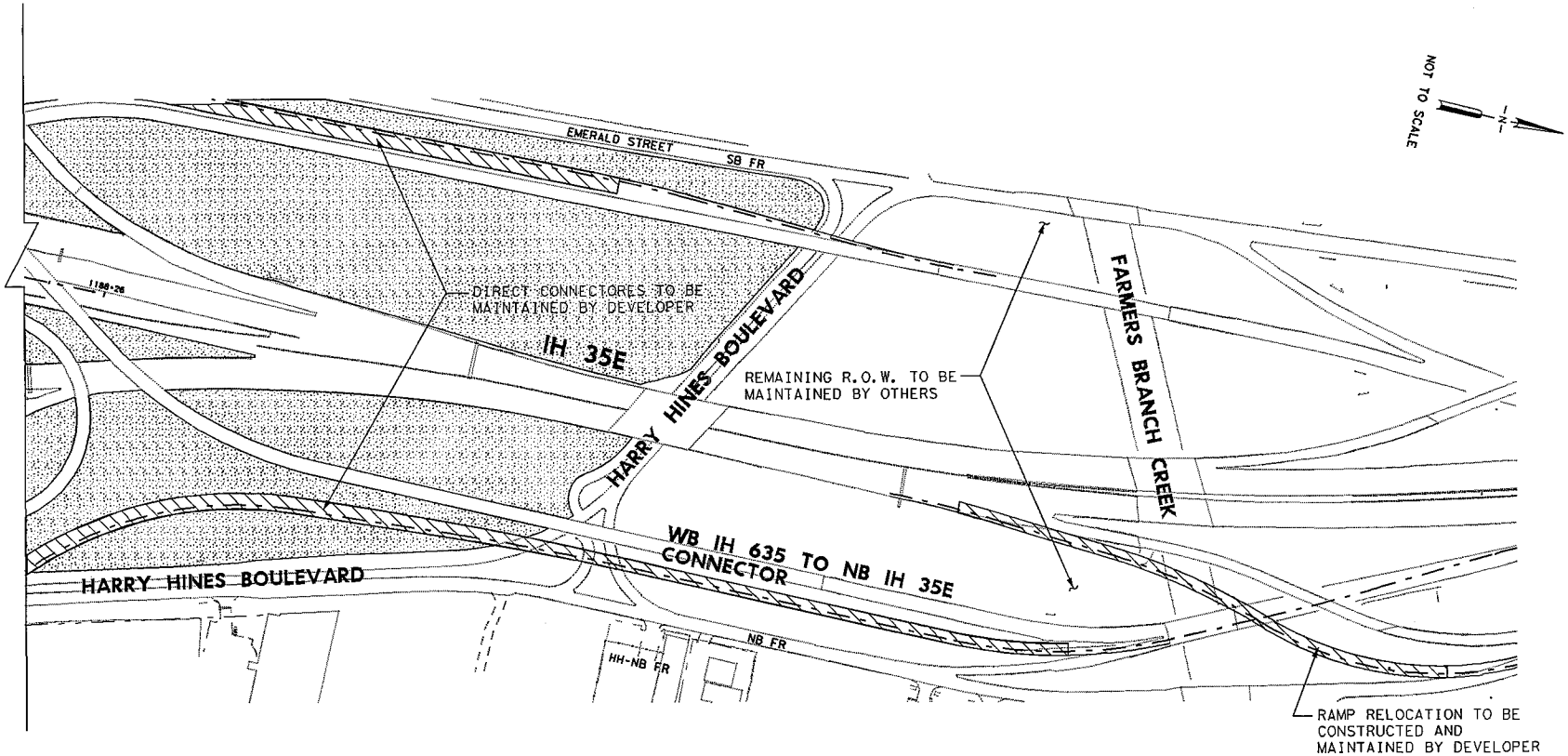
2. BETWEEN THE IH 35E SB FRONTAGE ROAD AND FARMERS BRANCH TRIBUTARY THE DEVELOPER SHALL MAINTAIN ALL DRAINAGE STRUCTURES CONSTRUCTED BY THE DEVELOPER INCLUDING CULVERTS, PIPES, HEADWALLS, ETC. OPEN CHANNELS SHALL BE MAINTAINED BY TxDOT.

3. REMAINING R.O.W. AND HIGHWAY TO BE OPERATED & MAINTAINED BY OTHERS.

Texas Department of Transportation

ATTACHMENT 01-2A

IH 635 MANAGED LANES PROJECT OPERATIONS AND MAINTENANCE (O&M) WORK LIMITS



NOTE
DEVELOPER SHALL OPERATE AND MAINTAIN ALL WATER QUALITY FEATURES, OPEN CHANNELS AND DRAINAGE STRUCTURES CONSTRUCTED BY THE DEVELOPER WITHIN THE IH 35E/IH 635 INTERCHANGE (THE AREA BOUNDED BY HARRY HINES BOULEVARD, THE IH 35E SB FRONTAGE ROAD AND CROWN ROAD).

Texas Department of Transportation

ATTACHMENT 01-2A

IH 635 MANAGED LANES PROJECT OPERATIONS AND MAINTENANCE (O&M) WORK LIMITS

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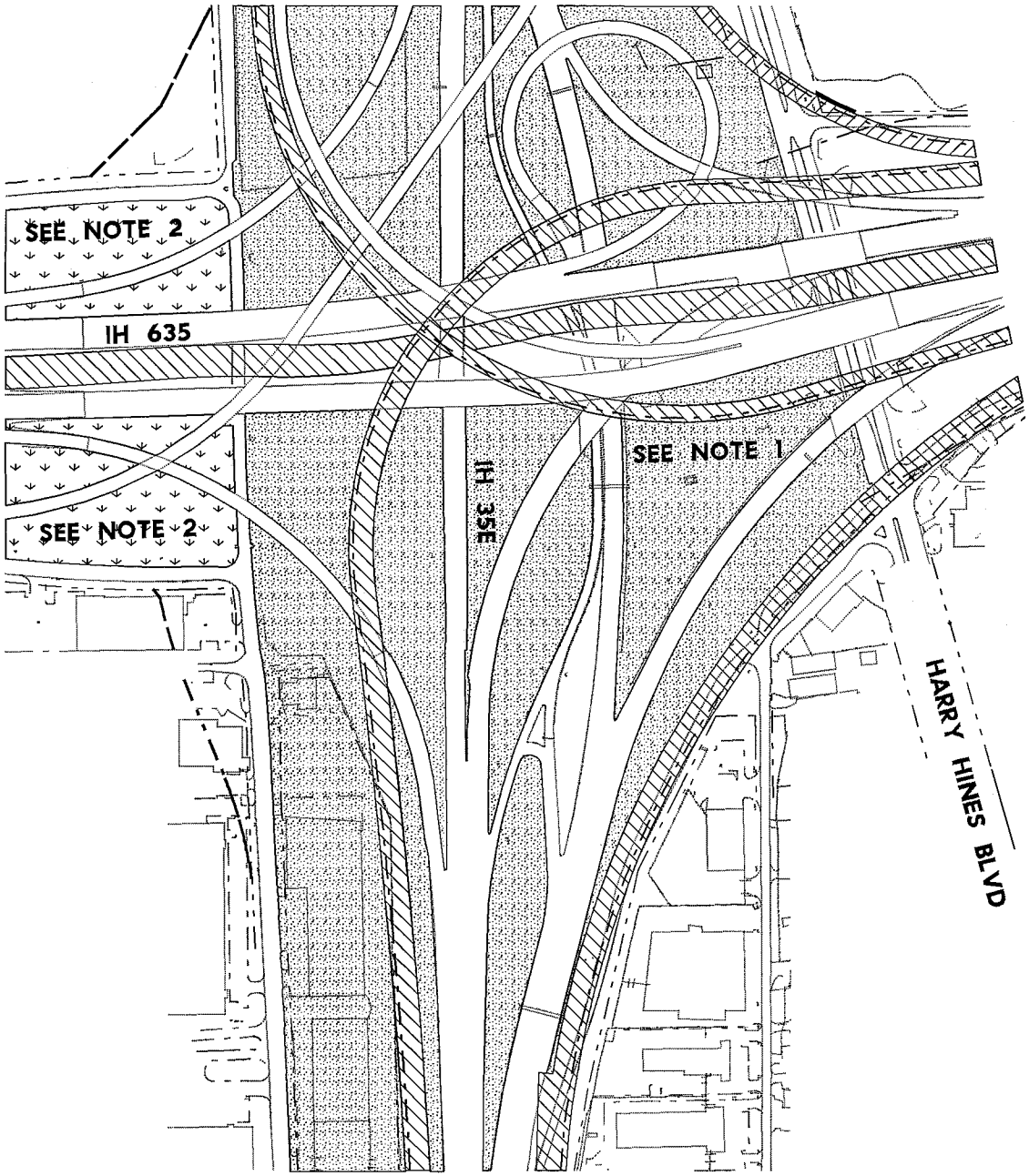

-N-

NOT TO SCALE

NOTES:

1. THE DEVELOPER SHALL OPERATE & MAINTAIN ALL WATER QUALITY FEATURES, OPEN CHANNELS AND DRAINAGE STRUCTURES CONSTRUCTED BY THE DEVELOPER WITHIN THE IH 35E/IH 635 INTERCHANGE (THE AREA BOUNDED FROM EAST BY HARRY HINES BOULEVARD, FROM WEST BY THE IH-35E SB FRONTAGE ROAD, FROM SOUTH BY CROWN ROAD, AND FROM THE NORTH BY HARRY HINES BOULEVARD).

2. BETWEEN THE IH 35E SB FRONTAGE ROAD AND FARMERS BRANCH TRIBUTARY THE DEVELOPER SHALL OPERATE AND MAINTAIN ANY DRAINAGE STRUCTURES INCLUDING CULVERTS, PIPES, HEADWALL, ETC. CONSTRUCTED BY THE DEVELOPER. OPEN CHANNELS SHALL BE MAINTAINED BY OTHERS.

3. THE DEVELOPER SHALL OPERATE & MAINTAIN ELEVATED DIRECT CONNECTORS FROM NORTHBOUND IH 35E TO EASTBOUND IH 635; SOUTHBOUND IH 35E TO EASTBOUND IH 635; WESTBOUND IH 635 TO SOUTHBOUND IH 35E; WESTBOUND IH 635 TO NORTHBOUND IH 35E, AND IH 635 MANAGED LANES INCLUDING ADJACENT CONCRETE BARRIERS.

Texas Department of Transportation

ATTACHMENT 01-2A

IH 635 MANAGED LANES PROJECT OPERATIONS AND MAINTENANCE (O&M) WORK LIMITS

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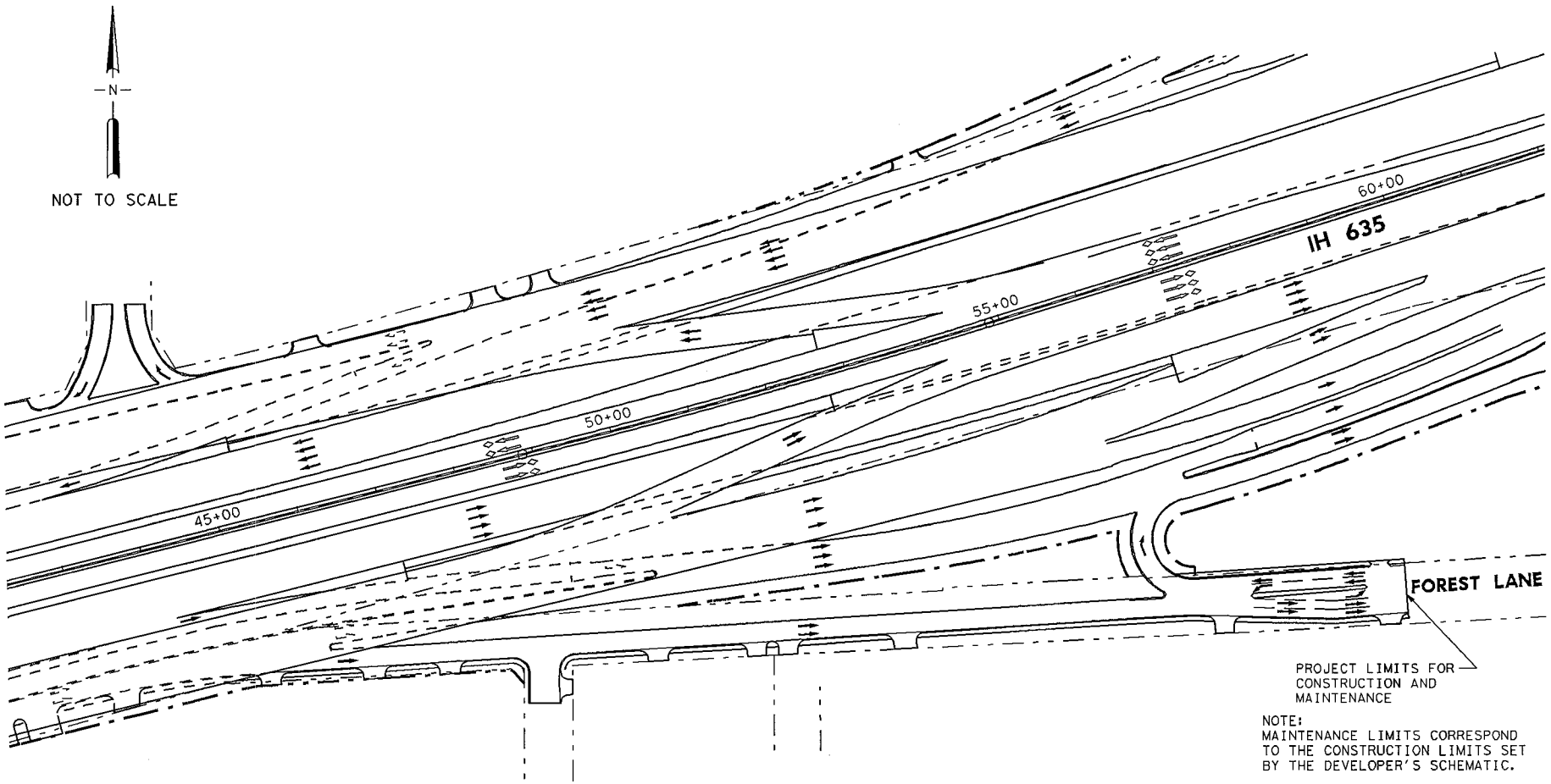
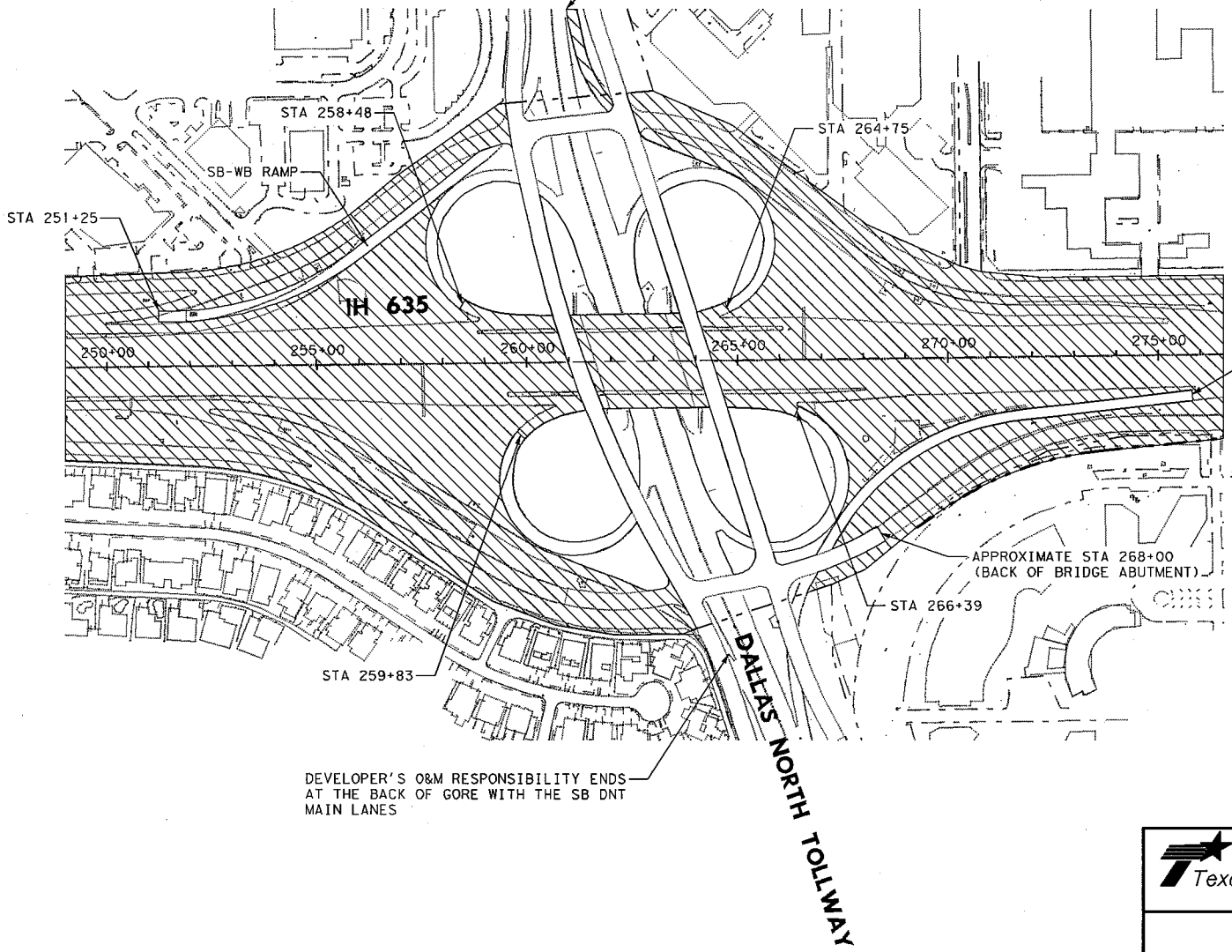


NOTE:
MAINTENANCE LIMITS CORRESPOND TO THE CONSTRUCTION LIMITS SET BY THE DEVELOPER'S SCHEMATIC.

Texas Department of Transportation

ATTACHMENT 01-2A

IH 635 MANAGED LANES PROJECT OPERATIONS AND MAINTENANCE (O&M) WORK LIMITS



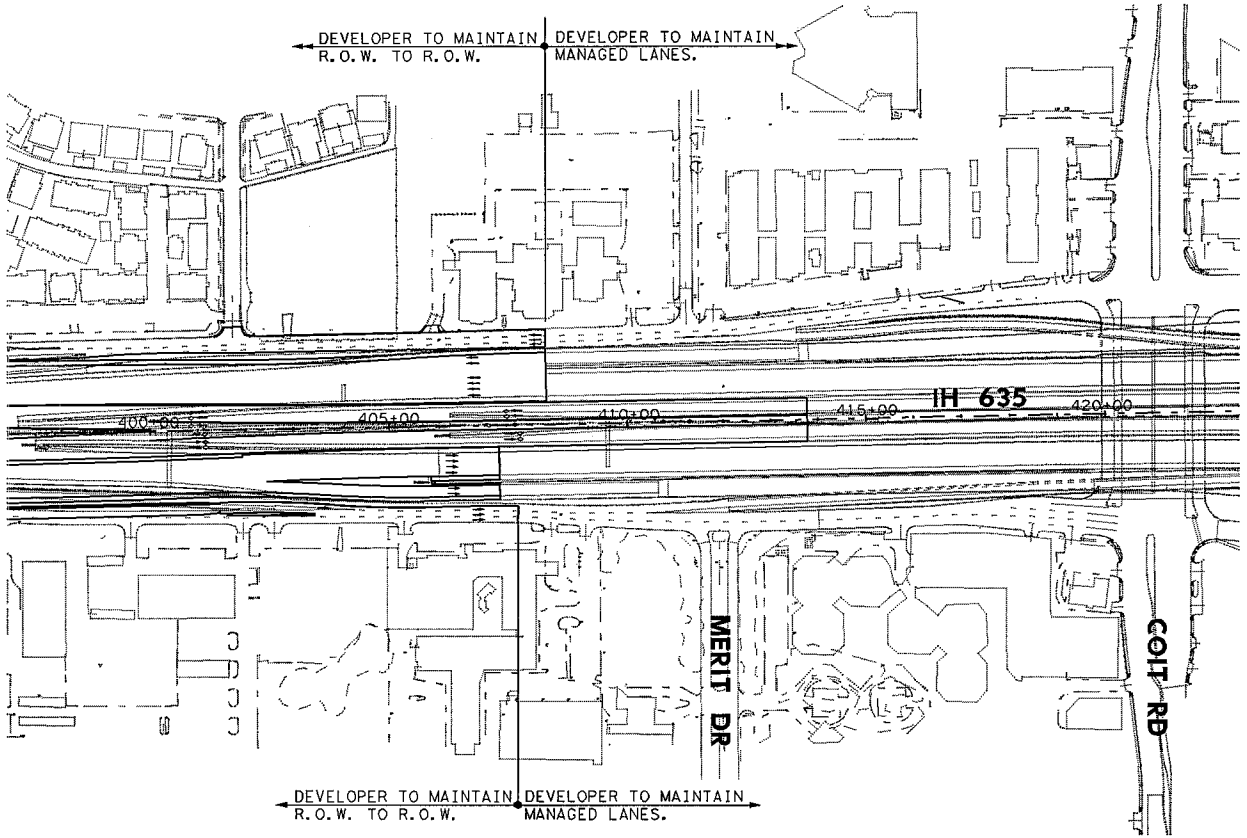
NOTES:

1. THE DEVELOPER'S O&M RESPONSIBILITY SHALL INCLUDE THE PORTION OF THE SB-WB RAMP (RPSDTWB) BETWEEN EXISTING CL IH 635 STATION 251+25 (RCL635) AND THE RAMP'S TIE-IN WITH THE WB GENERAL PURPOSE LANES.
2. STATIONS ARE BASED ON EXISTING CENTERLINE IH 635 STATIONS.
3. DEVELOPER SHALL MAINTAIN PORTIONS OF DNT LOOP RAMPS RECONSTRUCTED BY THE WORK. MINIMUM MAINTENANCE LIMITS ARE SHOWN.

Texas Department of Transportation

ATTACHMENT 01-2A

IH-635 MANAGED LANES PROJECT OPERATIONS AND MAINTENANCE (O&M) WORK LIMITS



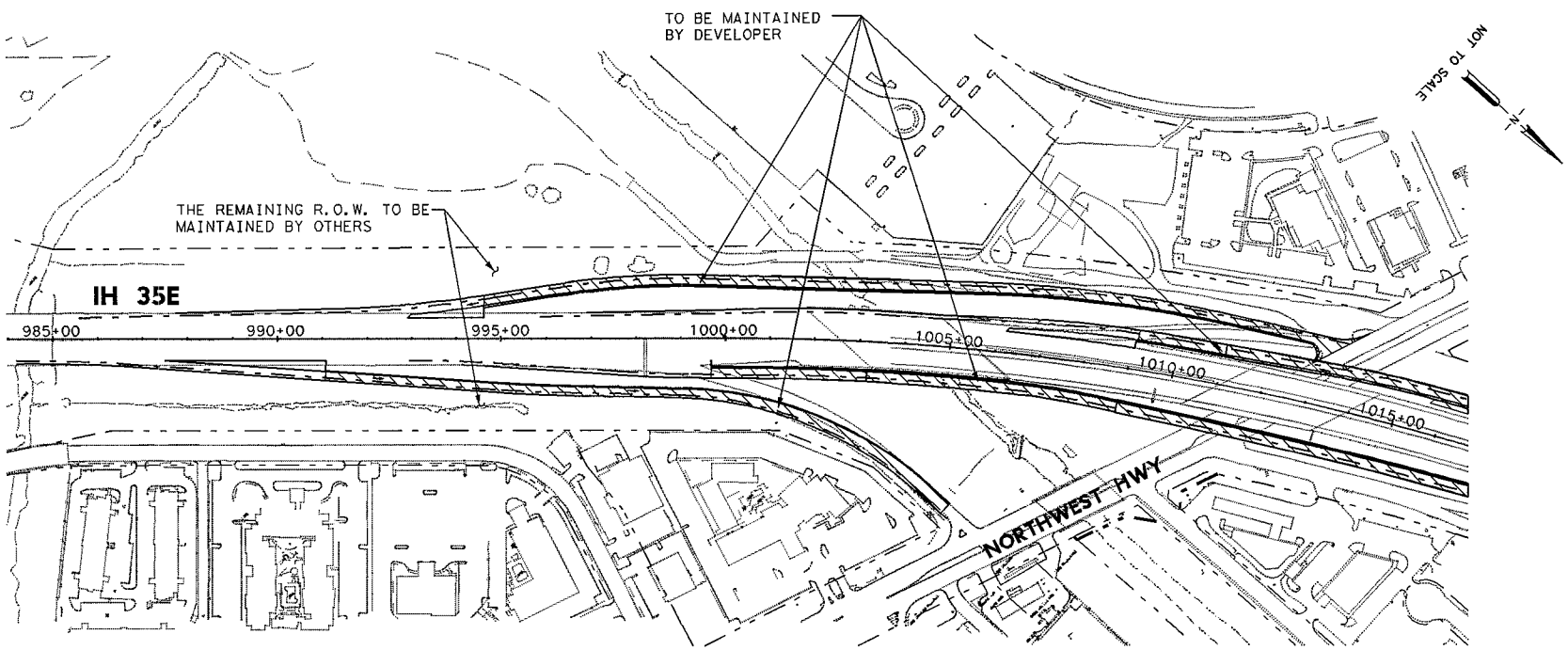
N

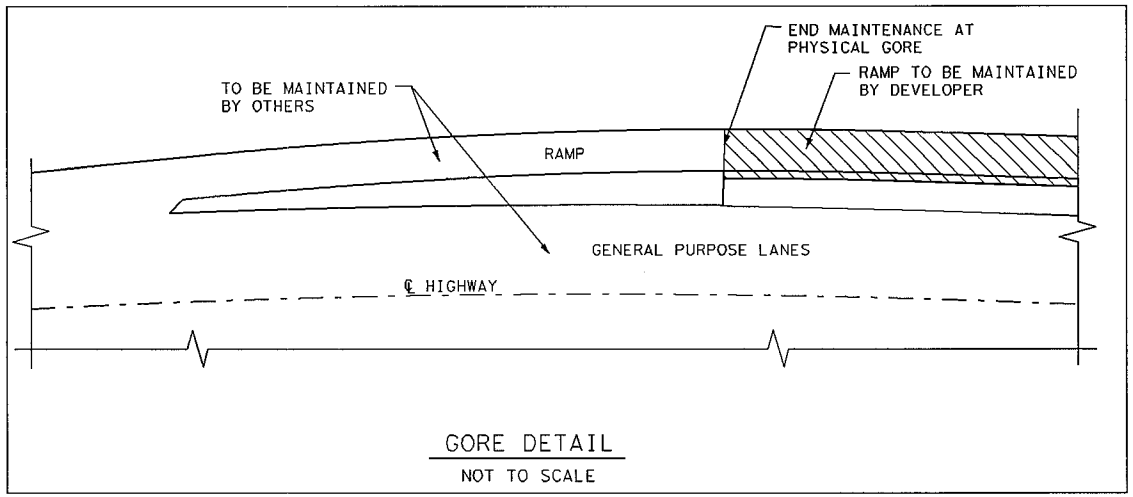
NOT TO SCALE

Texas Department of Transportation

ATTACHMENT 01-2A

IH 635 MANAGED LANES PROJECT OPERATIONS AND MAINTENANCE (O&M) WORK LIMITS





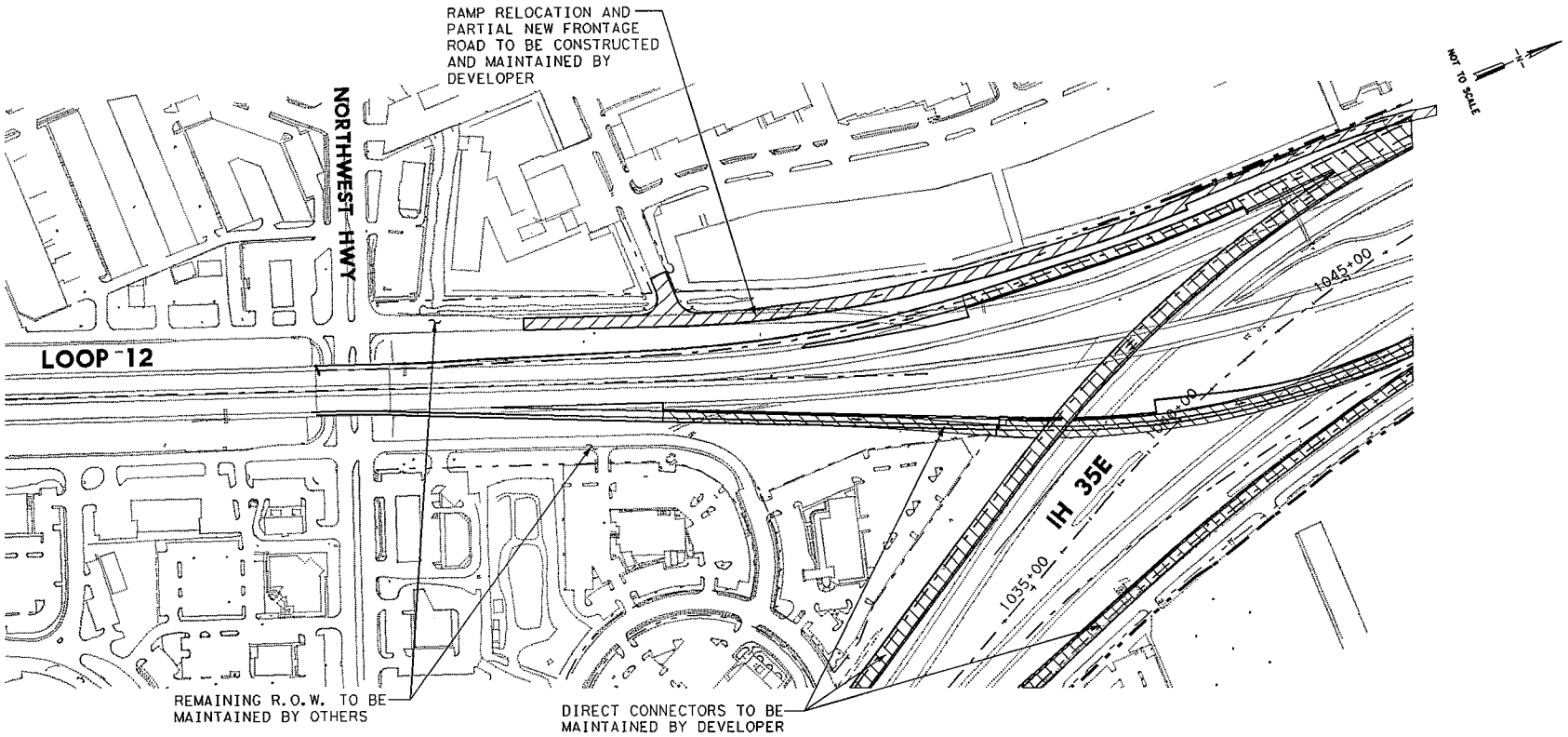
GORE DETAIL

NOT TO SCALE

Texas Department of Transportation

ATTACHMENT 01-2A

IH 635 MANAGED LANES PROJECT OPERATIONS AND MAINTENANCE (O&M) WORK LIMITS

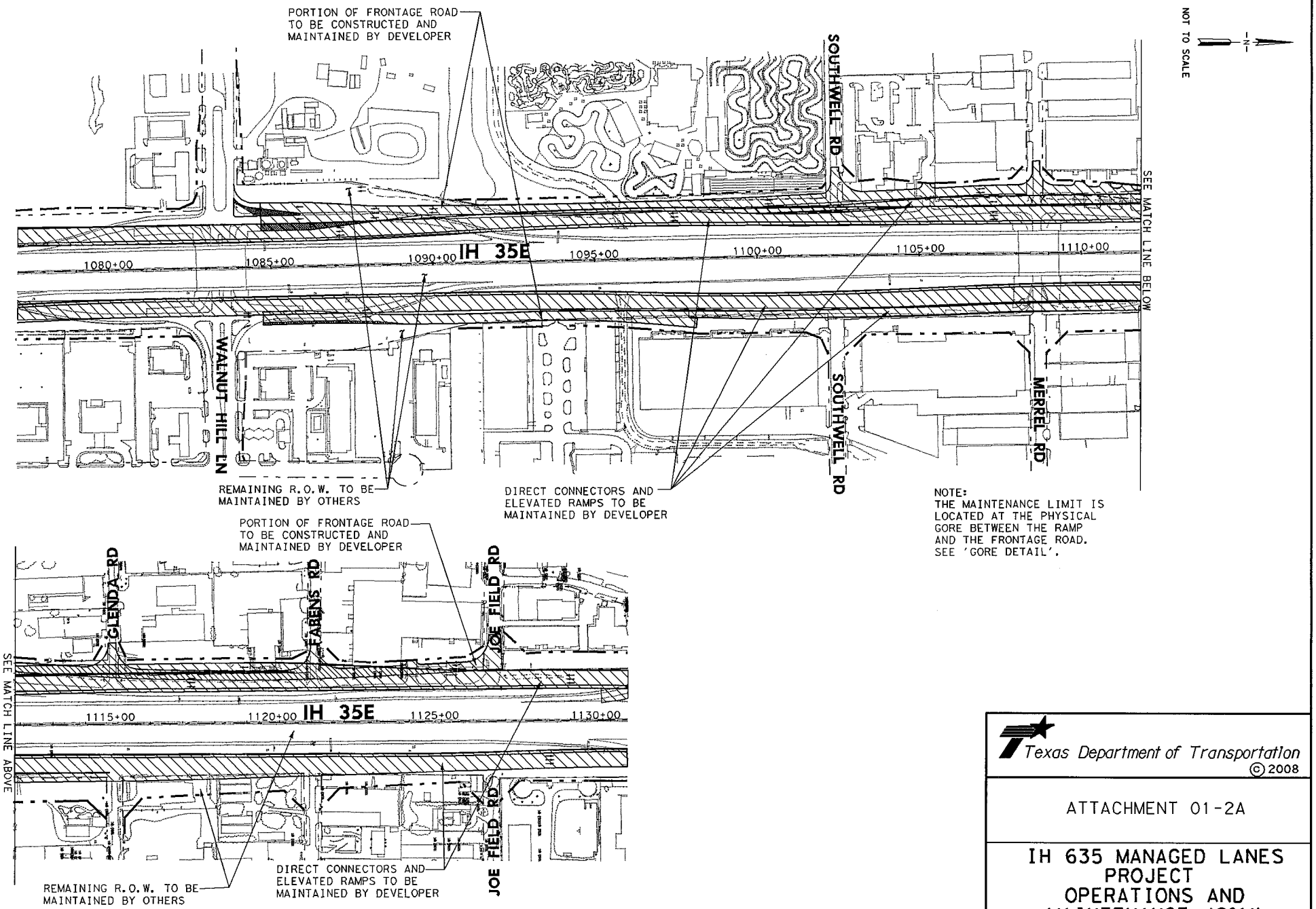


NOTE:
THE MAINTENANCE LIMIT IS LOCATED AT THE PHYSICAL GORE WITH GENERAL PURPOSE LANES. SEE 'GORE DETAIL'.

Texas Department of Transportation

ATTACHMENT 01-2A

IH 635 MANAGED LANES PROJECT OPERATIONS AND MAINTENANCE (O&M) WORK LIMITS



Texas Department of Transportation

ATTACHMENT 01-2A

IH 635 MANAGED LANES PROJECT OPERATIONS AND MAINTENANCE (O&M) WORK LIMITS

Texas Department of Transportation

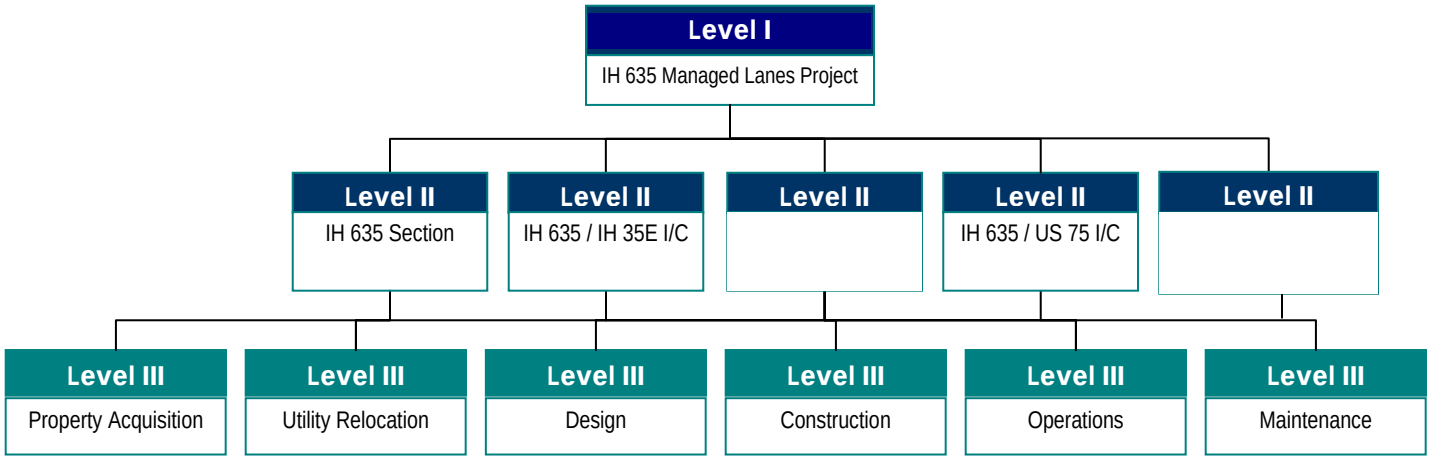
IH 635 Managed Lanes Project
Technical Provisions

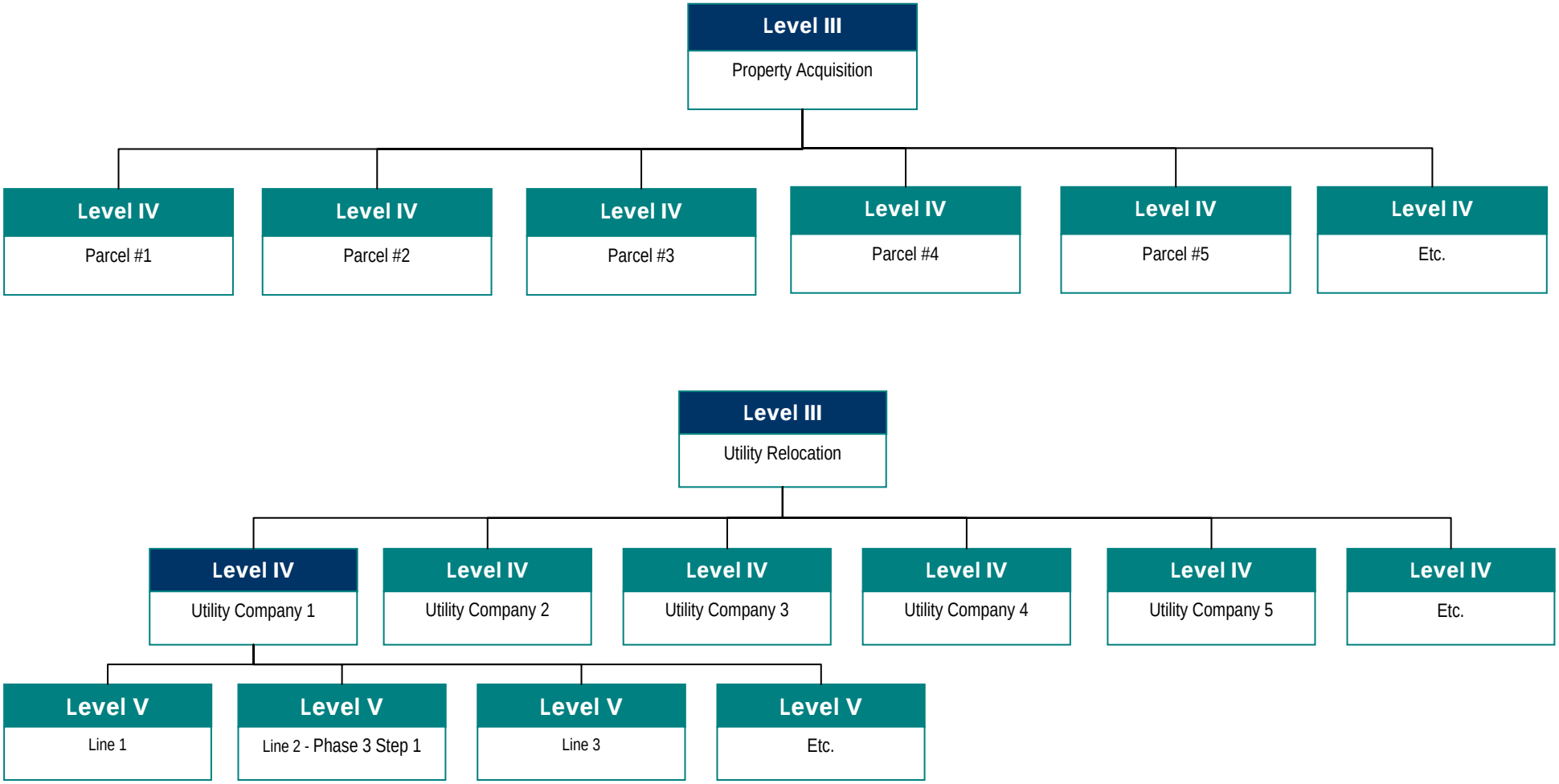
Attachment 02-1A

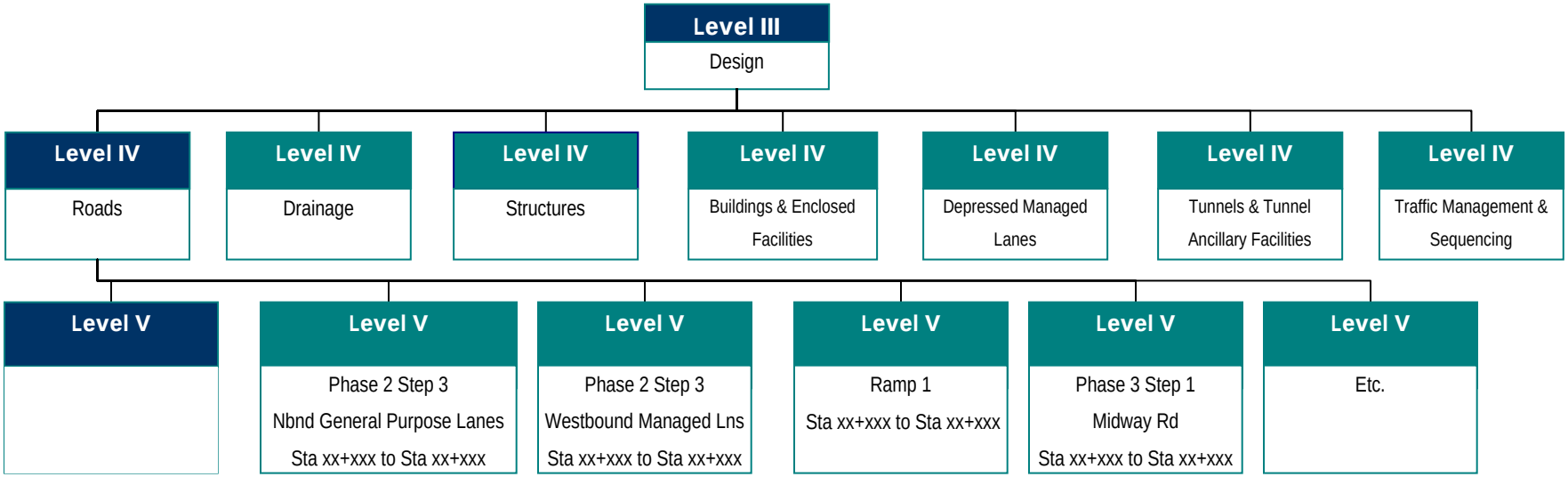
Base Work Breakdown Structure (WBS)

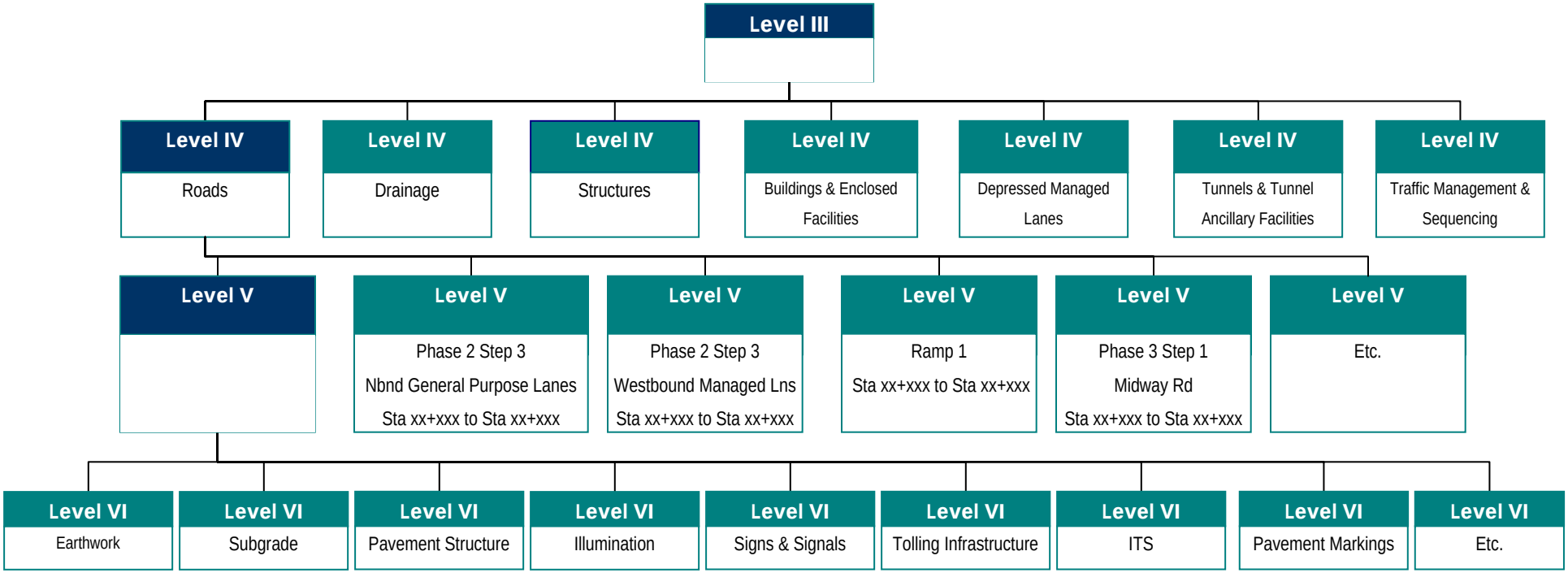
The base Work Breakdown Structure (WBS) provided to the Developer shall be the basis for organizing all Work and shall be used to structure the preliminary Project Baseline Schedule, the Project Baseline Schedule, the Schedule of Values and the Project Pay Request.

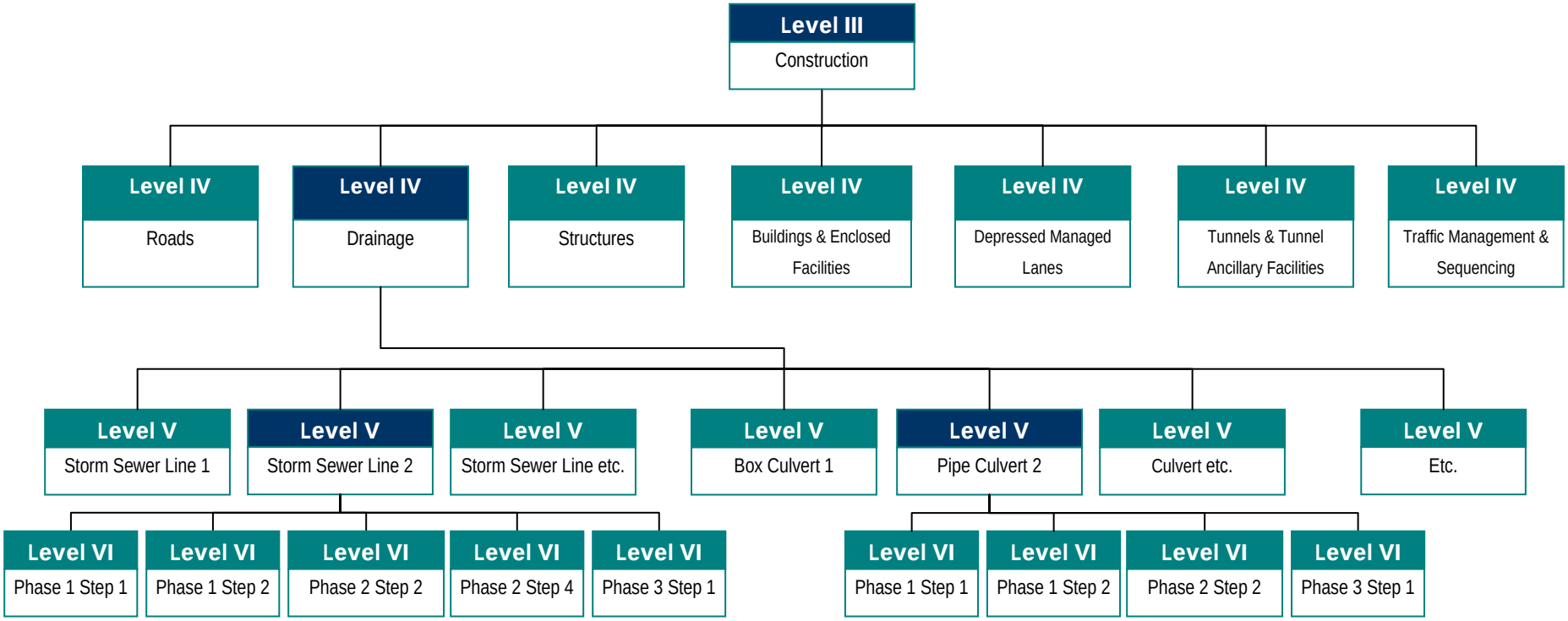
The following base WBS represents Levels I through VI. Levels I though IV shall be as provided in the following base WBS. However, the Developer may revise and / or provide further detail to Levels V and VI to provide a clear understanding of the planned Work.

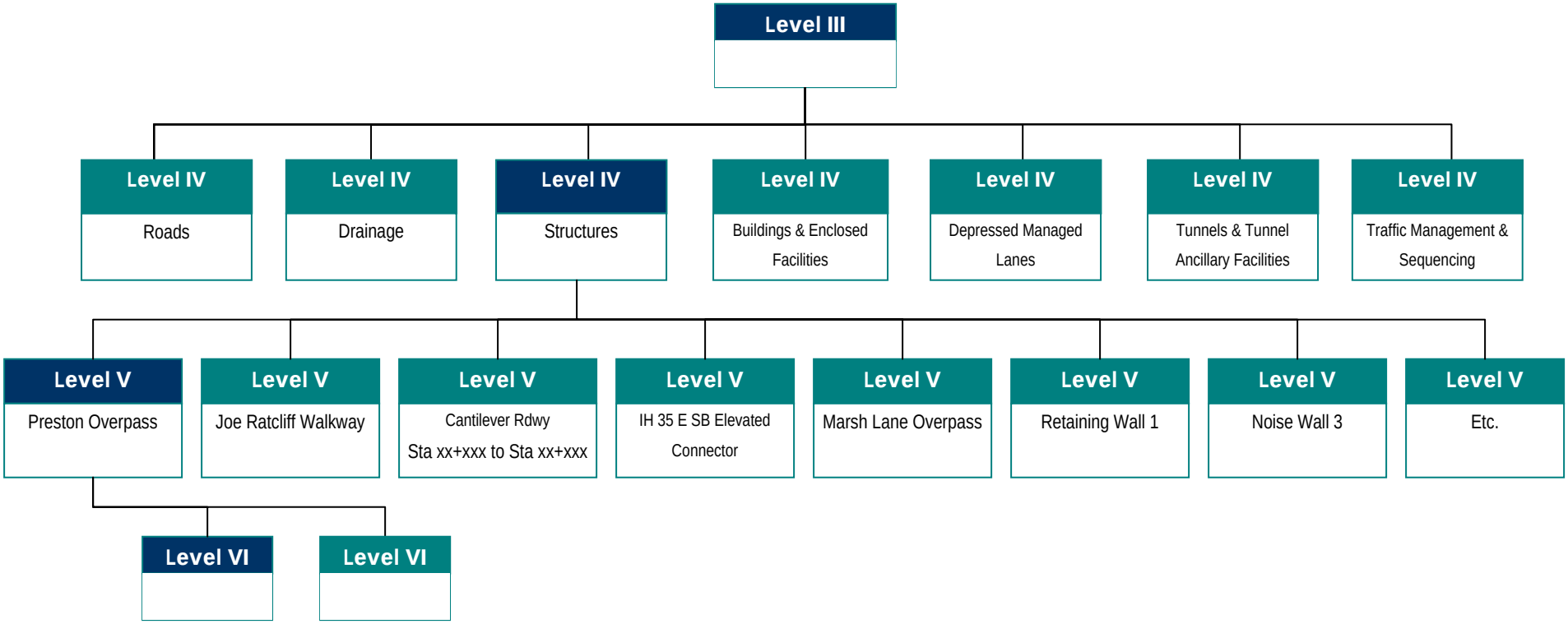

Level I
IH 635 Managed Lanes Project
Level II
IH 635 Section
Level II
IH 635 / IH 35E I/C
Level II
Level II
IH 635 / US 75 I/C
Level II
Level III
Property Acquisition
Level III
Utility Relocation
Level III
Design
Level III
Construction
Level III
Operations
Level III
Maintenance

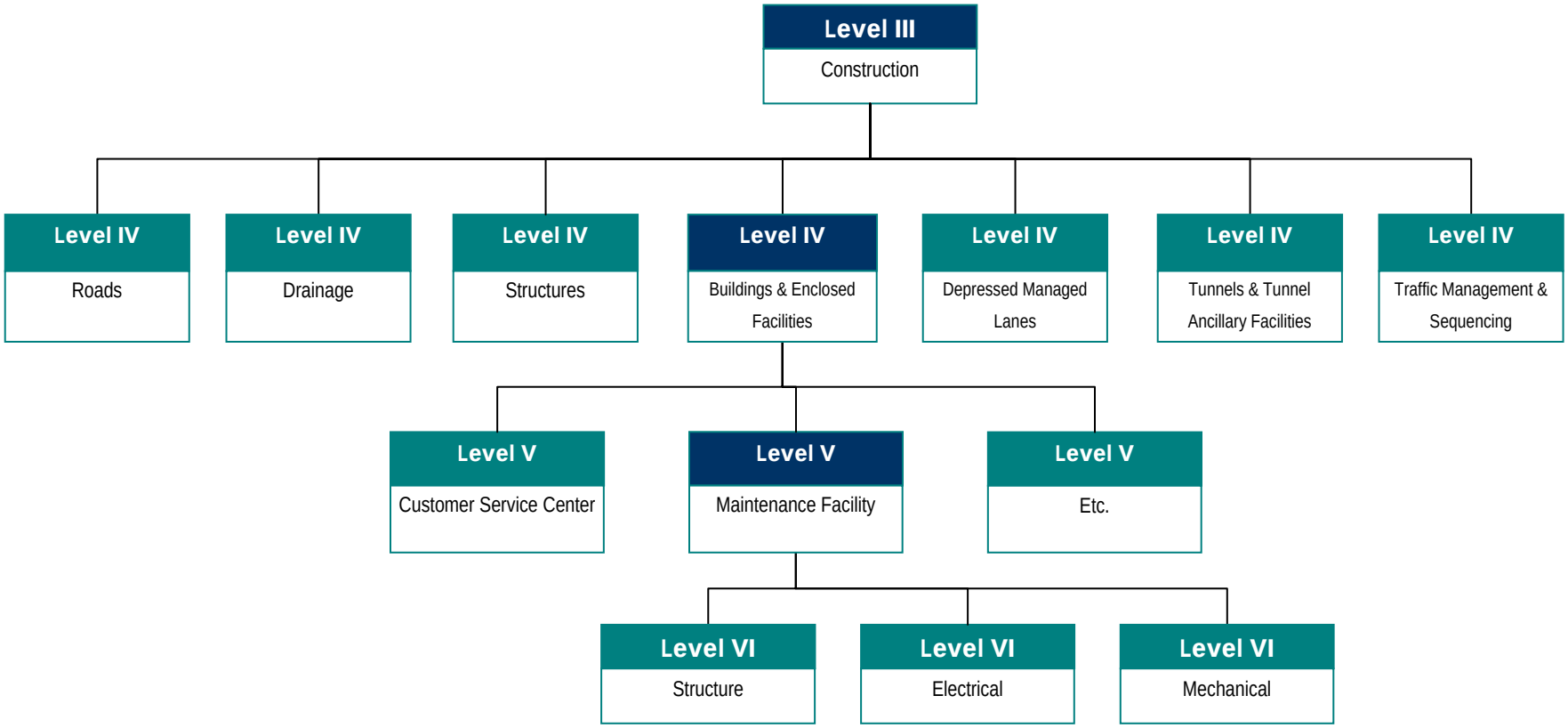

Level III
Property Acquisition
Level IV
Parcel #1
Level IV
Parcel #2
Level IV
Parcel #3
Level IV
Parcel #4
Level IV
Parcel #5
Level IV
Etc.
Level III
Utility Relocation
Level IV
Utility Company 1
Level IV
Utility Company 2
Level IV
Utility Company 3
Level IV
Utility Company 4
Level IV
Utility Company 5
Level IV
Etc.
Level V
Line 1
Level V
Line 2 - Phase 3 Step 1
Level V
Line 3
Level V
Etc.


Level III
Design
Level IV
Roads
Level IV
Drainage
Level IV
Structures
Level IV
Buildings & Enclosed Facilities
Level IV
Depressed Managed Lanes
Level IV
Tunnels & Tunnel Ancillary Facilities
Level IV
Traffic Management & Sequencing
Level V
Level V
Phase 2 Step 3
Nbnd General Purpose Lanes
Sta xx+xxx to Sta xx+xxx
Level V
Phase 2 Step 3
Westbound Managed Lns
Sta xx+xxx to Sta xx+xxx
Level V
Ramp 1
Sta xx+xxx to Sta xx+xxx
Level V
Phase 3 Step 1
Midway Rd
Sta xx+xxx to Sta xx+xxx
Level V
Etc.


Level III
Level IV
Roads
Level IV
Drainage
Level IV
Structures
Level IV
Buildings & Enclosed Facilities
Level IV
Depressed Managed Lanes
Level IV
Tunnels & Tunnel Ancillary Facilities
Level IV
Traffic Management & Sequencing
Level V
Level V
Phase 2 Step 3
Nbnd General Purpose Lanes
Sta xx+xxx to Sta xx+xxx
Level V
Phase 2 Step 3
Westbound Managed Lns
Sta xx+xxx to Sta xx+xxx
Level V
Ramp 1
Sta xx+xxx to Sta xx+xxx
Level V
Phase 3 Step 1
Midway Rd
Sta xx+xxx to Sta xx+xxx
Level V
Etc.
Level VI
Earthwork
Level VI
Subgrade
Level VI
Pavement Structure
Level VI
Illumination
Level VI
Signs & Signals
Level VI
Tolling Infrastructure
Level VI
ITS
Level VI
Pavement Markings
Level VI
Etc.


Level III
Construction
Level IV
Roads
Level IV
Drainage
Level IV
Structures
Level IV
Buildings & Enclosed Facilities
Level IV
Depressed Managed Lanes
Level IV
Tunnels & Tunnel Ancillary Facilities
Level IV
Traffic Management & Sequencing
Level V
Storm Sewer Line 1
Level V
Storm Sewer Line 2
Level V
Storm Sewer Line etc.
Level V
Box Culvert 1
Level V
Pipe Culvert 2
Level V
Culvert etc.
Level V
Etc.
Level VI
Phase 1 Step 1
Level VI
Phase 1 Step 2
Level VI
Phase 2 Step 2
Level VI
Phase 2 Step 4
Level VI
Phase 3 Step 1
Level VI
Phase 1 Step 1
Level VI
Phase 1 Step 2
Level VI
Phase 2 Step 2
Level VI
Phase 3 Step 1


Level III
Level IV
Roads
Level IV
Drainage
Level IV
Structures
Level IV
Buildings & Enclosed Facilities
Level IV
Depressed Managed Lanes
Level IV
Tunnels & Tunnel Ancillary Facilities
Level IV
Traffic Management & Sequencing
Level V
Preston Overpass
Level V
Joe Ratcliff Walkway
Level V
Cantilever Rdwy
Sta xx+xxx to Sta xx+xxx
Level V
IH 35 E SB Elevated Connector
Level V
Marsh Lane Overpass
Level V
Retaining Wall 1
Level V
Noise Wall 3
Level V
Etc.
Level VI
Level VI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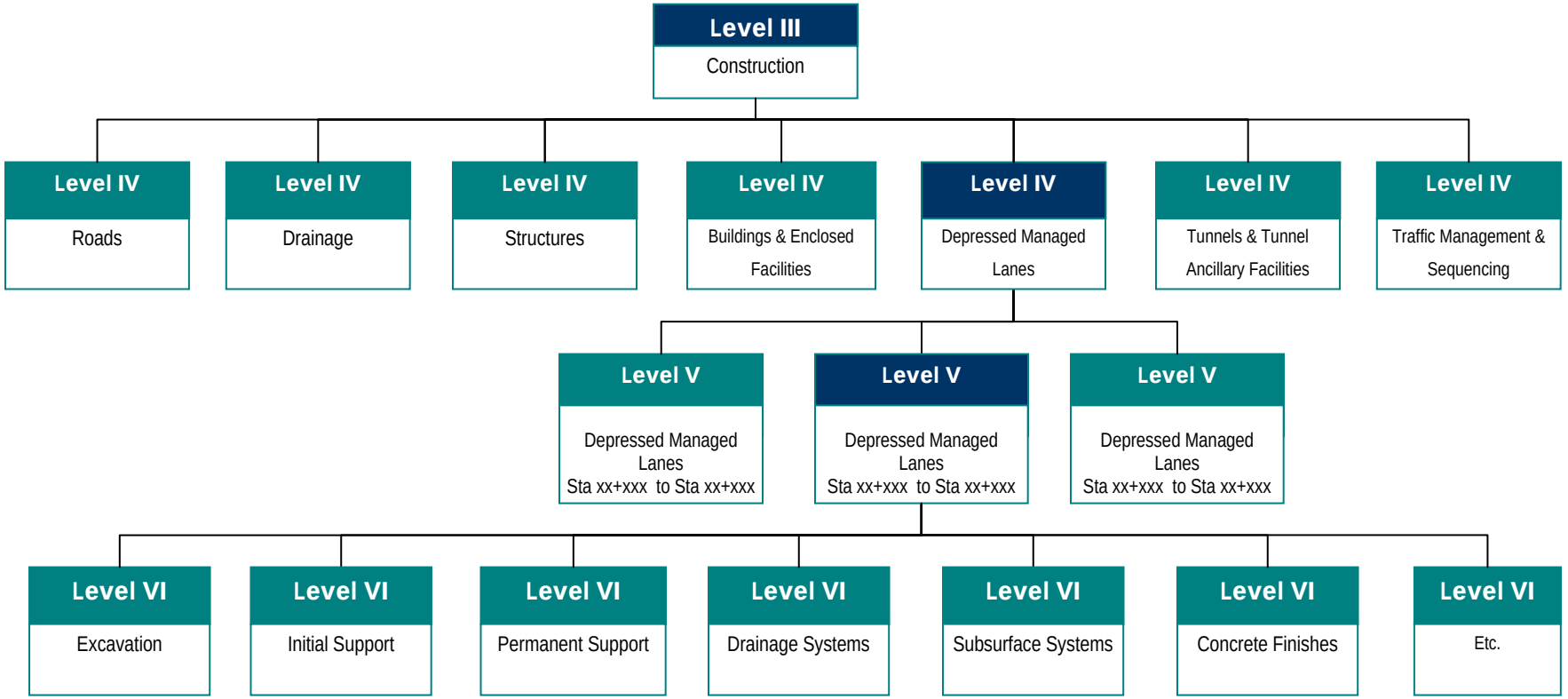
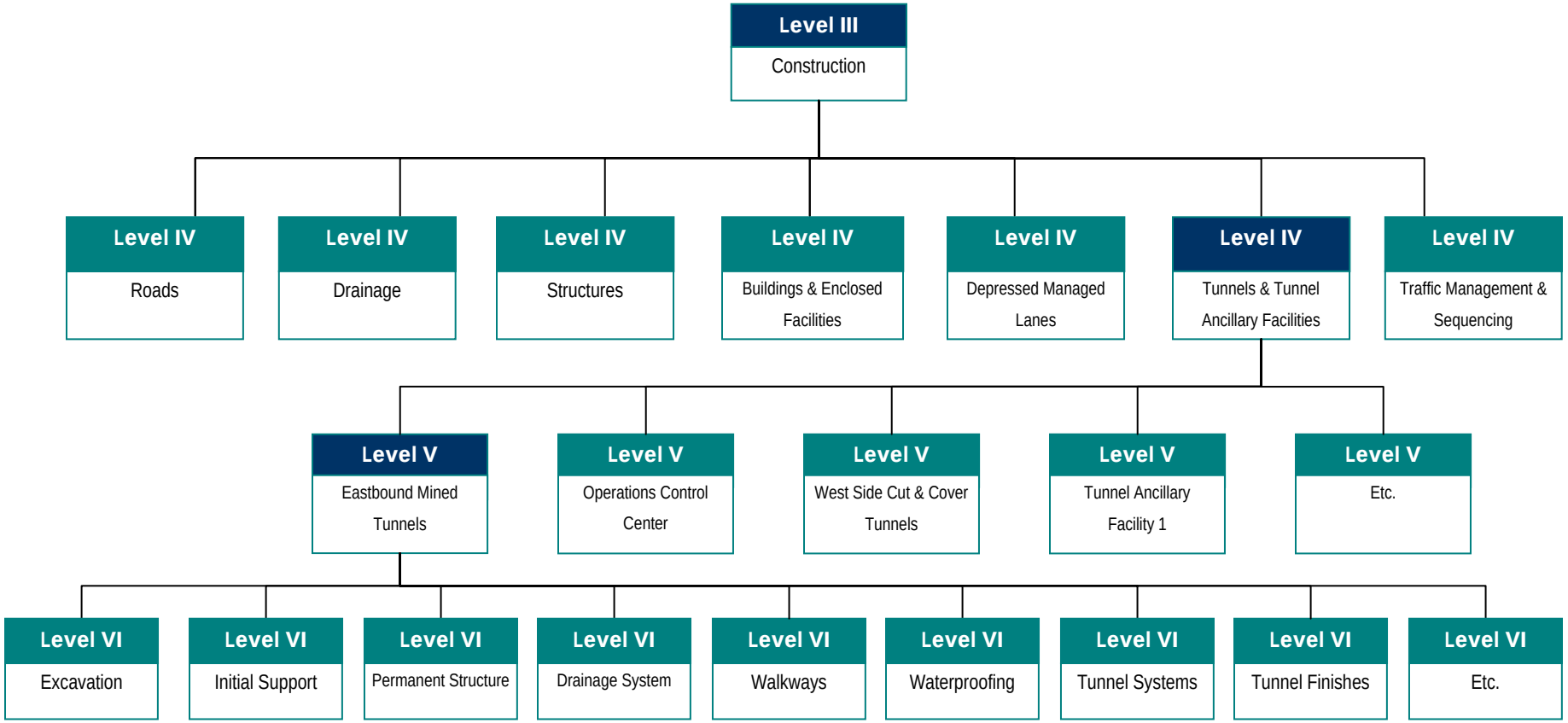
Construction
Level IV
Roads
Level IV
Drainage
Level IV
Structures
Level IV
Buildings & Enclosed Facilities
Level IV
Depressed Managed Lanes
Level IV
Tunnels & Tunnel Ancillary Facilities
Level IV
Traffic Management & Sequencing
Level V
Customer Service Center
Level V
Maintenance Facility
Level V
Etc.
Level VI
Structure
Level VI
Electrical
Level VI
Mechanical


Level III
Construction
Level IV
Roads
Level IV
Drainage
Level IV
Structures
Level IV
Buildings & Enclosed Facilities
Level IV
Depressed Managed Lanes
Level IV
Tunnels & Tunnel Ancillary Facilities
Level IV
Traffic Management & Sequencing
Level V
Depressed Managed Lanes
Sta xx+xxx to Sta xx+xxx
Level V
Depressed Managed Lanes
Sta xx+xxx to Sta xx+xxx
Level V
Depressed Managed Lanes
Sta xx+xxx to Sta xx+xxx
Level VI
Excavation
Level VI
Initial Support
Level VI
Permanent Support
Level VI
Drainage Systems
Level VI
Subsurface Systems
Level VI
Concrete Finishes
Level VI
Etc.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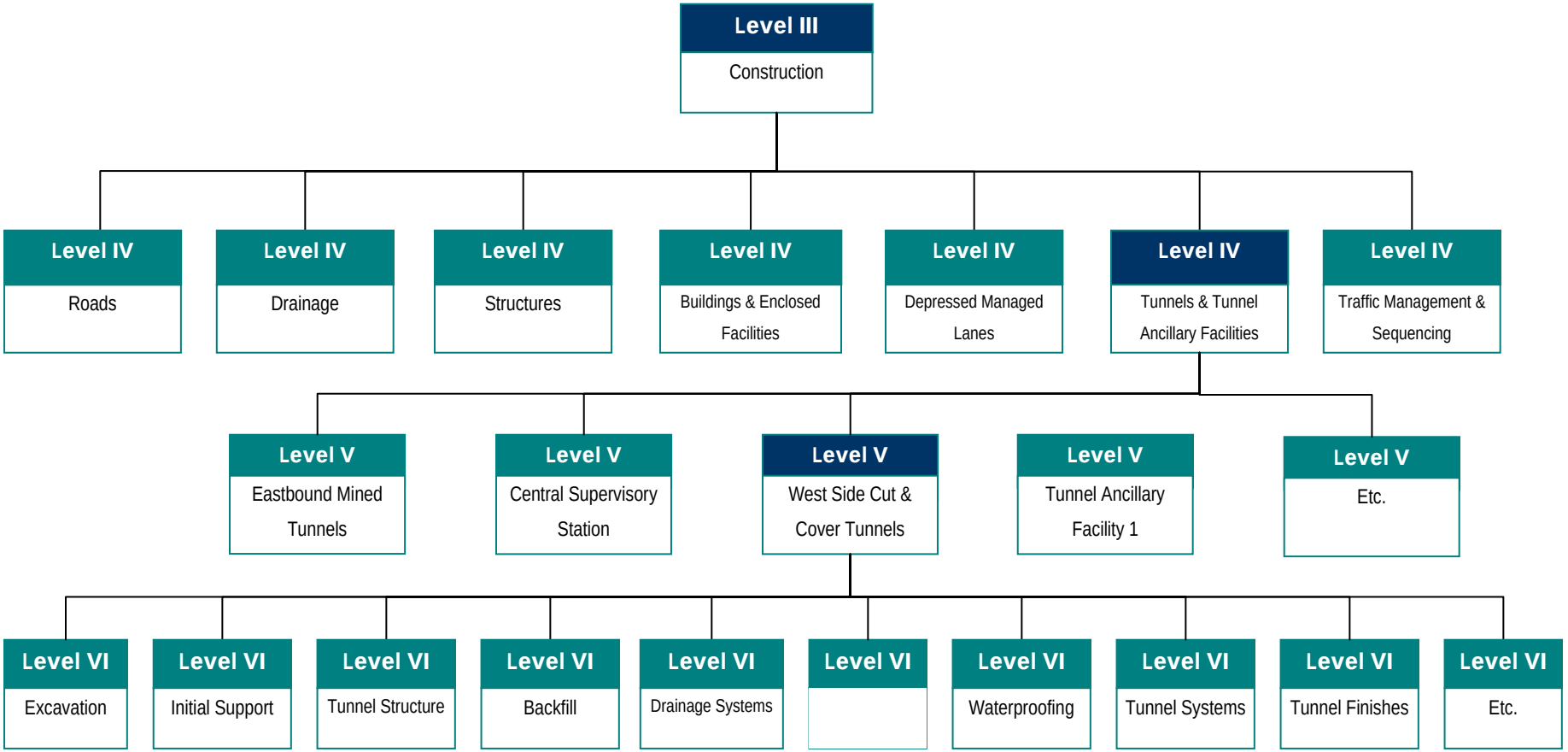
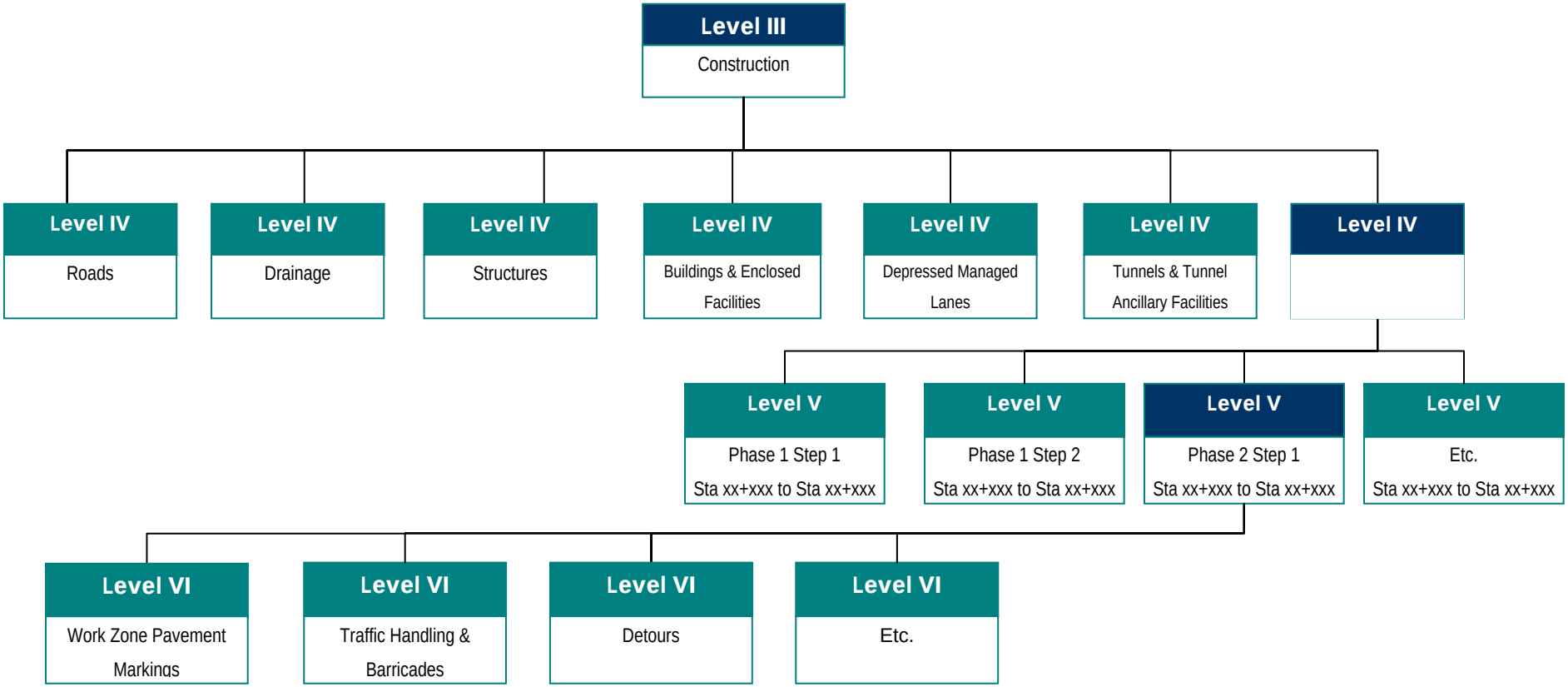
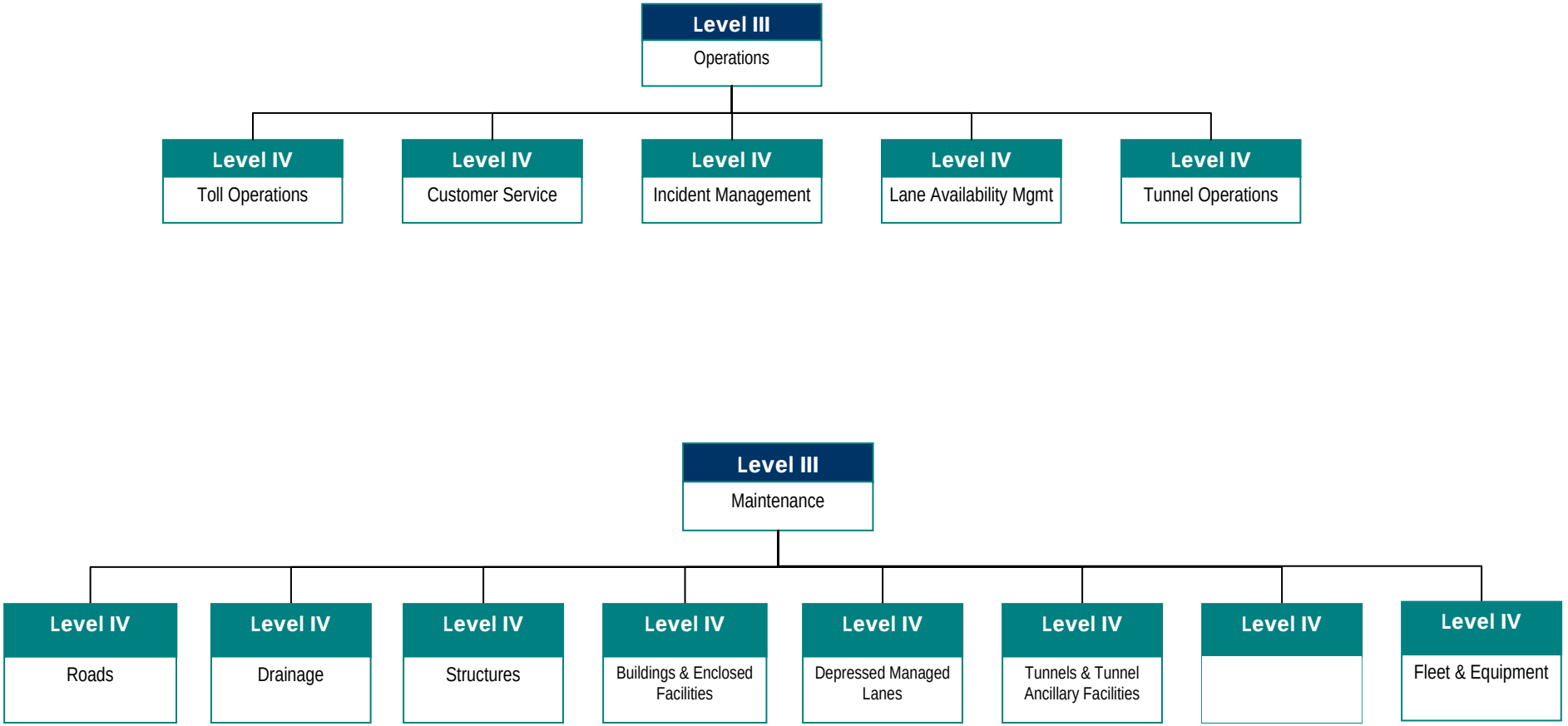
Construction
Level IV
Roads
Level IV
Drainage
Level IV
Structures
Level IV
Buildings & Enclosed Facilities
Level IV
Depressed Managed Lanes
Level IV
Tunnels & Tunnel Ancillary Facilities
Level IV
Traffic Management & Sequencing
Level V
Eastbound Mined Tunnels
Level V
Operations Control Center
Level V
West Side Cut & Cover Tunnels
Level V
Tunnel Ancillary Facility 1
Level V
Etc.
Level VI
Excavation
Level VI
Initial Support
Level VI
Permanent Structure
Level VI
Drainage System
Level VI
Walkways
Level VI
Waterproofing
Level VI
Tunnel Systems
Level VI
Tunnel Finishes
Level VI
Etc.


Level III
Construction
Level IV
Roads
Level IV
Drainage
Level IV
Structures
Level IV
Buildings & Enclosed Facilities
Level IV
Depressed Managed Lanes
Level IV
Tunnels & Tunnel Ancillary Facilities
Level IV
Traffic Management & Sequencing
Level V
Eastbound Mined Tunnels
Level V
Central Supervisory Station
Level V
West Side Cut & Cover Tunnels
Level V
Tunnel Ancillary Facility 1
Level V
Etc.
Level VI
Excavation
Level VI
Initial Support
Level VI
Tunnel Structure
Level VI
Backfill
Level VI
Drainage Systems
Level VI
Level VI
Waterproofing
Level VI
Tunnel Systems
Level VI
Tunnel Finishes
Level VI
Etc.


Level III
Construction
Level IV
Roads
Level IV
Drainage
Level IV
Structures
Level IV
Buildings & Enclosed Facilities
Level IV
Depressed Managed Lanes
Level IV
Tunnels & Tunnel Ancillary Facilities
Level IV
Level V
Phase 1 Step 1
Sta xx+xxx to Sta xx+xxx
Level V
Phase 1 Step 2
Sta xx+xxx to Sta xx+xxx
Level V
Phase 2 Step 1
Sta xx+xxx to Sta xx+xxx
Level V
Etc.
Sta xx+xxx to Sta xx+xxx
Level VI
Work Zone Pavement Markings
Level VI
Traffic Handling & Barricades
Level VI
Detours
Level VI
Etc.


Level III
Operations
Level IV
Toll Operations
Level IV
Customer Service
Level IV
Incident Management
Level IV
Lane Availability Mgmt
Level IV
Tunnel Operations
Level III
Maintenance
Level IV
Roads
Level IV
Drainage
Level IV
Structures
Level IV
Buildings & Enclosed Facilities
Level IV
Depressed Managed Lanes
Level IV
Tunnels & Tunnel Ancillary Facilities
Level IV
Level IV
Fleet & Equipment

Texas Department of Transportation

IH 635 Managed Lanes Project
Technical Provisions

Attachment 02-2A

Schedule of Values Example

A sample presentation of the Schedule of Values is shown below.

Payment Activity ID No.	Activity Description	Quantity / Units	Unit Price - $	Scheduled Value - $
1.1 IH 635 Section (Level II)		LS	x,xxx,xxx.00	x,xxx,xxx.00
1.1.4 Construction (Level III)		LS	x,xxx,xxx.00	x,xxx,xxx.00
1.1.4.1 Roads (Level IV)		LS	x,xxx,xxx.00	x,xxx,xxx.00
1.1.4.1.01 EBFR Sta xx+xxx to Sta xx+xxx (Level V)		LS	x,xxx,xxx.00	x,xxx,xxx.00
1.1.4.1.01.01 Earthwork (Level VI)		LS	x,xxx,xxx.00	x,xxx,xxx.00
AEBFR1245	EBnd Frtg Rd – Sta 1237+00 to Sta 1358+00 – Earthwork	12400 cy	abc / cy	xxx,xxx.00
1.1.4.1.01.02 Subgrade (Level VI)			xxx,xxx.00	xxx,xxx.00
AEBFR1255	EBnd Frtg Rd – Sta 1237+00 to Sta 1358+00 - Subgrade	14500 sy	def / sy	xxx,xxx.00
1.1.4.6 Tunnel Systems (Level IV)		LS	xxx,xxx.00	xxx,xxx.00
1.1.4.6.03 West Side Cut & Cover Tunnels (Level V)		LS	xxx,xxx.00	xxx,xxx.00
1.1.4.6.03.09 Tunnel Finishes (Level VI)		LS	xxx,xxx.00	xxx,xxx.00
AEBML1245	Install Emergency Egress Tunnel Doors	20 ea	abc / ea	xx,xxx.00
AEBML1255	Build-out Emergency Egress Stairwells	20 ea	def / ea	xx,xxx.00
1.2 IH 635 / IH 35E Interchange (Level II)				
1.2.4 Construction (Level III)		LS	xxx,xxx.00	xxx,xxx.00
1.2.4.1 Roads (Level IV)		LS	xxx,xxx.00	xxx,xxx.00
1.2.4.04Ramp 1 (Level V)		LS	xxx,xxx.00	xxx,xxx.00
1.2.4.04.01 Earthwork (Level VI)		LS	xxx,xxx.00	xxx,xxx.00
BEBR11131	DC Ramp 1 – Earthwork	500 cy	abc / cy	xx,xxx.00
1.2.4.04.03	**Pavement Structure**	LS	xxx,xxx.00	xxx,xxx.00
BWBR20131	DC Ramp 2 – Form & Pour 12” CRCP	1000 sy	ghi / sy	xx,xxx.00
TOTAL Project Construction Costs		LS	xxx,xxx,xxx.00	xxx,xxx,xxx.00

Texas Department of Transportation

IH 635 Managed Lanes Project
Technical Provisions

Attachment 02-3A

Document Data Properties

Attachment 02-3A – Document Data Properties

Document Class – Identifies the associated business discipline of the document

Business Function – Identifies or associates a specific business function or project subdiscipline to a file or document and is utilized only if additional classification is required within a document class.

Document Type – Identifies the project specific document grouping series for the document.

Document Subtype – Identifies the project specific document second level grouping series for the document.

Document Name – Identifies the project specific document name or title for the document type/subtype.

Document Date – Identifies the date in which a document is complete or a work action is complete.

Received Date - Identifies the date the document is received by the retaining organization.

Document Status - Identifies the 'state' of a file or document representing its document life cycle stage.

Highway Segment – Identifies a Highway and/or Segment identifier to each file or document.

Component - Identifies the corridor Components associated with the document or file.

Document Author - Identifies the sender (FROM) for documents such as correspondence/transmittals.

Addressee - Identifies the recipient (TO) for documents such as correspondence/transmittals.

Transmittal Number - Identifies that a document or file is transmitted to or received – identifies the date and to whom the document is going to or coming from.

Meeting Name - Identifies the name of a meeting.

Meeting Date – Identifies the calendar date of a meeting.

Meeting Location – Identifies the location (generally a City) where a meeting is held.

Comment (Document) – Identifies or further describes something unique about the document or file.

Title – Identifies or further defines the document or file for example subject matter or key topics.

Attachment 02-3A – Document Data Properties

Parcel Owner – Identifies the legal owner of a ROW parcel of land or property that is being pursued for or is procured.

Parcel Number – Identifies the unique identification of a ROW parcel of land or piece of property that is being pursued for or is procured.

WBS Element – Identifies the element of the WBS.

Texas Department of Transportation

IH 635 Managed Lanes Project
Technical Provisions

Attachment 05-1A

Utility Bridge Locations for Drainage Facilities

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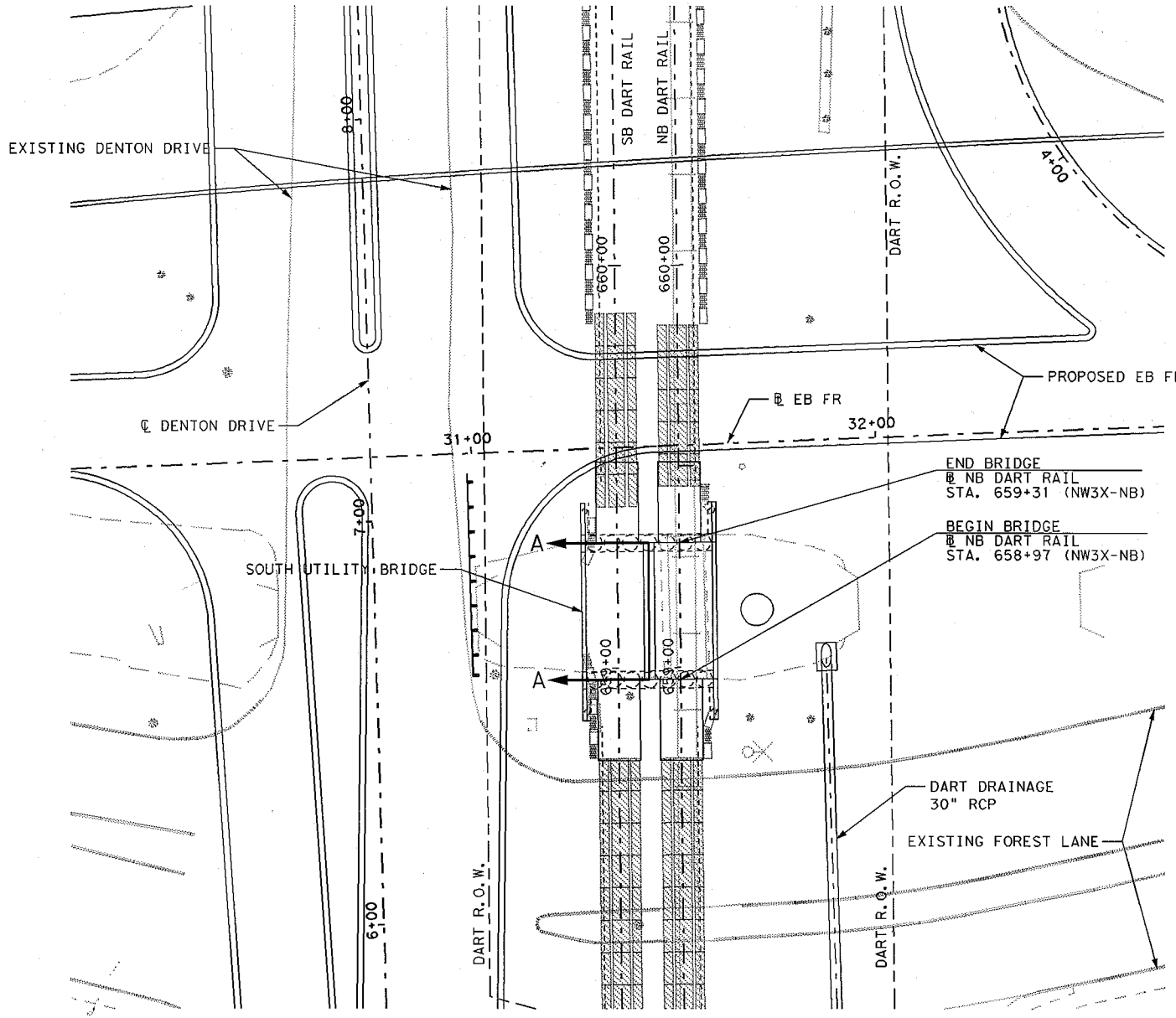
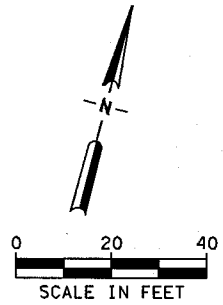




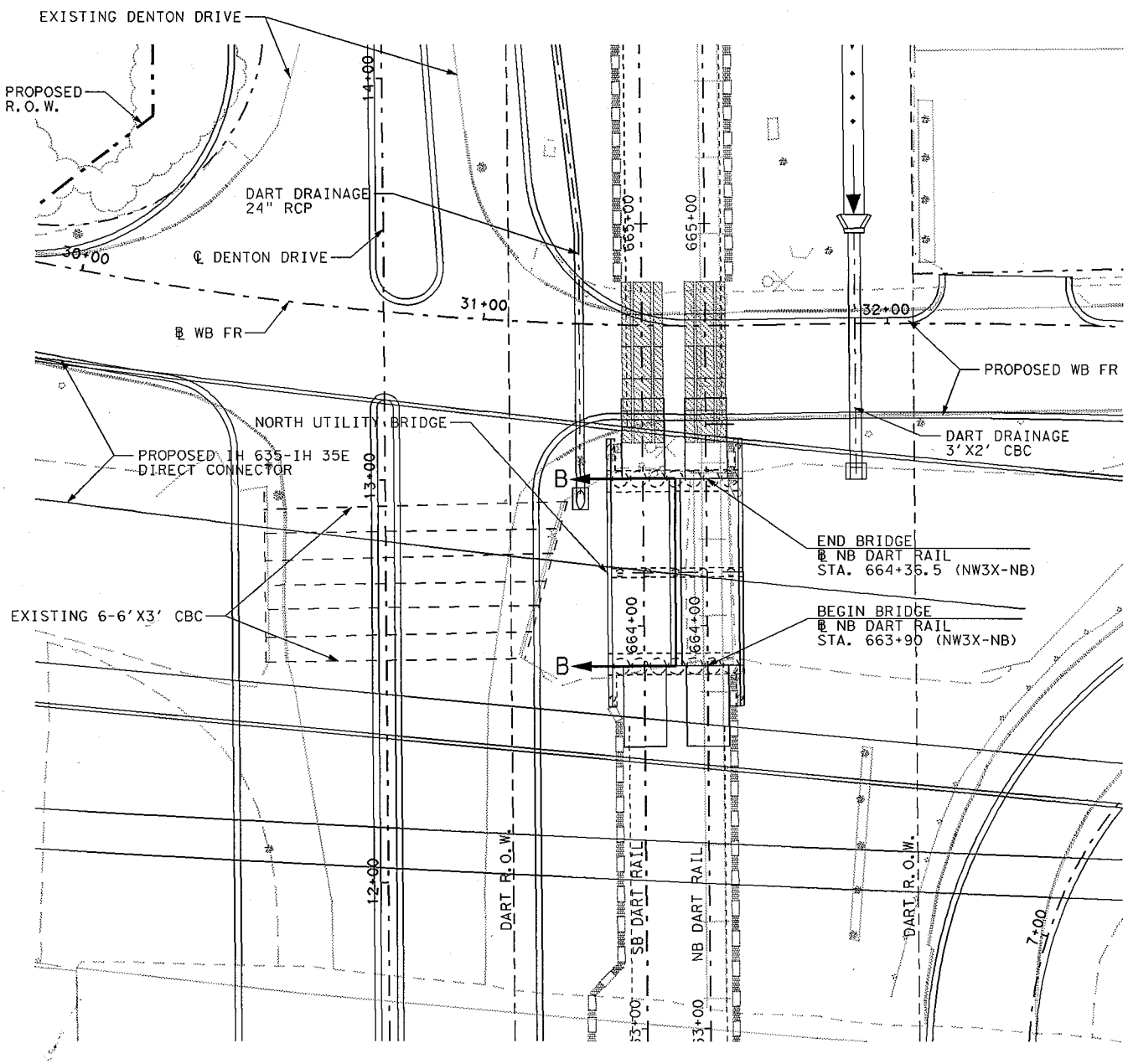
NOTE:

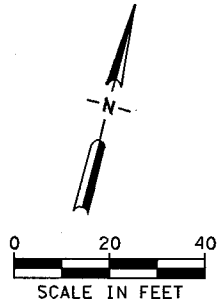
1. FOR SECTION A-A SEE SHEET 3.

Texas Department of Transportation

ATTACHMENT 05-1A

IH 635 MANAGED LANES PROJECT
UTILITY BRIDGE LOCATIONS FOR DRAINAGE FACILITIES





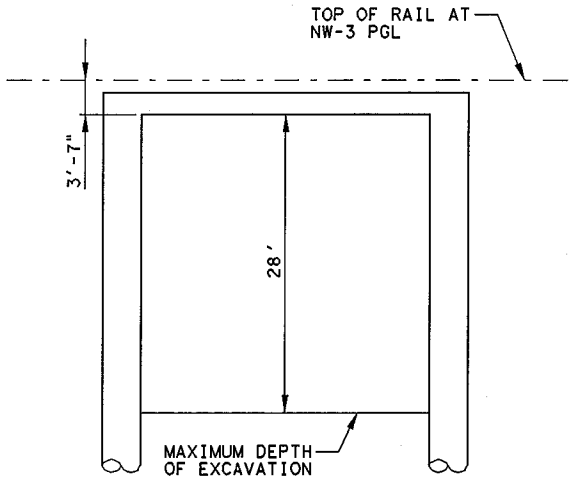
NOTE:

1. FOR SECTION B-B SEE SHEET 3.

Texas Department of Transportation

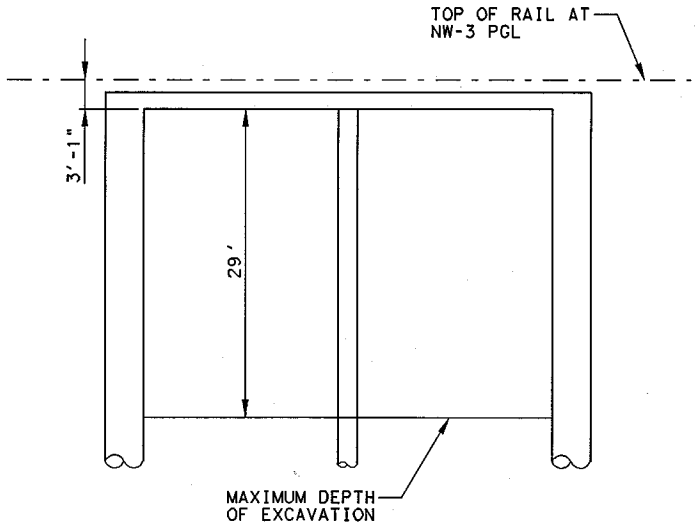
ATTACHMENT 05-1A

IH 635 MANAGED LANES PROJECT UTILITY BRIDGE LOCATIONS FOR DRAINAGE FACILITIES



SOUTH UTILITY BRIDGE
SECTION A-A

N.T.S.



NORTH UTILITY BRIDGE
SECTION B-B

N.T.S.

Texas Department of Transportation

ATTACHMENT 05-1A

IH 635 MANAGED LANES
PROJECT
UTILITY BRIDGE LOCATIONS
FOR DRAINAGE FACILITIES

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Texas Department of Transportation

IH 635 Managed Lanes Project
Technical Provisions

Attachment 07-1A

ROW Parcels

Parcel #	Owner
	CSJ 0196 03 231 From Spur 482 (Story Lane) to IH-635
3AC	EPT Downreit II, Inc.
4AC	Rosebriar Stemmons 3 LP
5AC	Rosebriar Stemmons LP
6	City of Dallas
7	JWV Associates LTD
8	PHCG Investments
9	Viacom Outdoor Inc
10	VCV LLC ATTN: Gene Chupik
11	VCV LLC ATTN: Gene Chupik
13	Sammons Realty Crop.
14	Shadows Corporation
15	Eastgroup Texas Partners Ltd
16	PACCAR Leasing Corporation
17	East Group Properties Lp
18	Weingarten Realty
19	Lit Industrial Texas Limited Partners
20	Summit Electric Supply Co
21	International Boating Center of Dallas, Ltd. Attention: Mr. Casey Freeman
22	Three Stemmons Land Ltd
23	Two Stemmons Land Ltd PS
24	Sarkis J. Kechejian Trust
25	KP Million
26	COMPOSIT BUILDING, INC., A TEXAS CORPORATION
27	Dutt Hospitality, LLC Attention: Mr. Hemant Patel
28	ACFI Traildust LLC
29	Clay E. Cooley
30	Million dollar Saloon Inc
31	Western Properties Three LLC
32	ACFI OSF LLC ACFI Trail Dust LLC
33	Van Four Ltd
34	Walnut Hill I35 Ent. LLC
35	Wallcon Equities 2 Ltd
36	Paul D. Lewis No. 5 Ltd PS
37	Mohammed Sadiq
39	Texas Utilities Electric Company
40	Texas Utilities Electric Company
41	Stemmons Park Ltd c/o Dentt Properties (Rick Dentt)
42 PT 1	First Industrial LP
43	East Group Properties LP

Parcel #	Owner
	CSJ 0196 03 231 From Spur 482 (Story Lane) to IH-635
44	Quoin
45	F & F Stasuma PS
46	Doris S. James
47	Regal Plastics Supply Co.
48	Heste Trust
49	College Park Joint Venture
50	Dennis Jenkins
51	Larry Williams
52	National Advertising Company
53	Doris S. James
54	J. M. Lamb ENT. INC.
55	Paul & Cheryl Heatherington
56	Heste Trust
57	One Fabens Inc.
58	Khaled Chami, Trustee
59	Nasser Investments Inc.
60	Khaled B. Chami
61	11327 Reeder Road Inc
62	11327 Reeder Road Inc
63	John D. Karotkin
64	Larry Craig Clutter/ Robert Eric Cooper
65	Donna C. McDonald
66	Ellen Gimbel et al
67	Makhani Brothers Investments, Inc. Attention: William Roth
68	Chun Investments, LLC Attention: Dr. Richard B.D. Chun
69	Statewide Stations Inc.
70	Exhaust System Spec.
71	Franchise Realty Interstate Corporation
72	K-Cho Investment Inc.
73AC	Fredrick W Bowman
74AC	CDT Properties Inc
75	US Central Plaza Investment LP
76	Texas Utilities Electric Company
78	T J Marshal LTD
79	Levering Enterprise LP
80	Walnut Hill I35 Ent. LLC
81	Jerry Spencer LP

Parcel #	Owner
	CSJ 2374 01 052 Luna to Webb Chapel Valwood to Royal (IH 635/35) Interchange
2AC	TRANSCONTINENTAL REALTY INVESTORS INC.
3AC	PRINCIPAL LIFE INSURANCE COMPANY
5AC	AMERICAN REALTY TRUST INC
6	AMERICAN REALTY TRUST INC
7AC	PROLOGIS TRUST
8	SECURITY CAPITAL INDUSTRIAL TRUST
9	MULTI-PLATE CIRCUITS INC
10	PROLOGIS TRUST
11	MOON VENTURES LTD
12	MOON ACQUISITIONS LTD
13	BALDWIN-HARRIS COMPANY
14 PT1	2610 FOREST LANE LIMITED PARTNERSHIP
15	M6 REMAINDER II LLC
16AC	YPI MERIDIAN PARTNERS LP
17	PAUL YOUNG ASSOCIATES II LP
18	M-SIX VI BUSINESS TRUST
19	THE ARMY AND AIR FORCE EXCHANGE
20	JOHN ROBERT VRIESENGA
21	VIRGINIA WHITE BOWIE
22	DGSE CORPORATION
23	STONE-LEWIS PROPERTIES
24	PWB INTERESTS LTD
25	ML & NB RAY PARTNERS LTD
26	Pit Pros #1 Inc.
27	MBC PARTNERSHIP
28	ANDRE AND SUSAN MONGEON
29	CSFB 1998-PI 2915 LBJ FREEWAY LIMITED PARTNERSHIP
30	JOSEY VILLAGE LTD
31	C P PLAZA LP
32	ONE GRAYSTONE CENTRE LP
33	ARI-TRIWEST PLAZA
34	CINEMARK PARTNER II LTD
35	MOTIVA ENTERPRISES LLC
36	EMKAT LTD
38	BCK PROPERTIES JOINT VENTURE
39	G H JANGDA
40	11590 EMERALD STREET ASSOCIATES
41	B J LANCASTER
42	R A WISK
43	TXU ELECTRIC DELIVERY COMPANY
44	CLINTON L WATSON
45	TXU ELECTRIC DELIVERY COMPANY
47AC	THE CITY OF FARMERS BRANCH TEXAS
48	MRP/VV, LP

Parcel #	Owner
	CSJ 2374 01 052 Luna to Webb Chapel Valwood to Royal (IH 635/35) Interchange
49	AGF VALLEY VIEW LTD
50	ROY LEE AND RUBY MARCOM
51	TAHHAN VALLEY INVESTMENTS LLC
52	RAY HALLFORD
53C	THE CITY OF FARMERS BRANCH, TEXAS

Parcel #	Owner
	CSJ 2374 01 152 Webb Chapel to DNT
1	S & S Grand, Inc
2	Metrocrest Hospital Authority
3	Global Webb LP
4	Millennium state Bank of Texas
5	Alejo E. Sigala and Maria Solis
6	Gloria Silguero
7AC	Taco Bell of America, Inc.
8	Wendy's International Inc.
8AC	Wendy's International, Inc.
9	CNLRS BEP LP
10	State Street Bank & Trust Co. of Connecticut
11	Prescott Interest Midway Plaza, LTD
12	Farmers Branch/ Midway Partners
13	D & H Freed Real Estate, LTD
14	Dallas Texas Union, LTD
15	Consolidated Freed Properties LTD
16	Recreation Equipment, Inc.
17	Robert & Helen Larner Community Property Revocable Trust
18	Elbert Winn
19	RM Partnership I, LTD
20	W.O. Bankston Nissan, Inc.
21	Katherine Ann Smith
22	Duetsche Bank National Trust Company
23	Gailya J. Johnson
24	W.O. Bankston Paint and Body, Inc.

Parcel #	Owner
	CSJ 2374 01 150 DNT to Hillcrest Rd.
1	Teachers Insurance and annuity

Parcel #	Owner
	CSJ 2374 01 150 DNT to Hillcrest Rd.
2 AC	TR LBJ Campus Partners LP
3 AC	DBSI Republic LLC
4	MEDHI Bolour Trustee ET AL
5	Hollywood Plaza Associates LLC ET AL
6	Montfort Corner LP
7	McDonalds Corporation
8	Triangle Square, LTD.
9	Primary Properties Corporation
10	Preston National Bank
11	Merit 99 Office Portfolio, LP
12	Macerich Valley View, LTD
13	CNL Retirement CRSI Valley View Dallas
14	Betty Everett Family LP
15	Sears Roebuck and Company
16	M L Hart, TR.
17	Dallas Purling 635, LTD.
18	Preston Valley (North) JV
19	HPD North Dallas, LTD.
20	Motiva Enterpriser, LLC.
21	V V S Properties, LTD.
22	Tetco Store LP
23	North Dallas Bank & Trust
24	Carol McCutchin Properties, LTD.
25	Carol McCutchin Properties, LTD.
26	Tuesday Morning, Inc.
27	Dallas/Ft.Worth Financial Corp.
28	Transwestern Concourse Office Park, LP
29	Conni Shults & I.V. Johnson
30	Anna M. Curry
31	Kah Holdings
32	Michael M & Jeanan Griffin
33	King of Glory Lutheran Church
34	CAAWA Investments Properties LLC
35	David Albert & John M. Davies
36	Micheal abtahi
37	Knoche LP
38	Robert A. & Mirna Weathers Lynch
39	BAAR, Inc
40	LBJ / Hillcrest Oaks. LP
41	US State Street Bank and Trust Company
42	John D. Vezina
43	Brinker Int'l Payroll Corp.
44	Sunrise Hillcrest Senior Living LLC
45	David Albert and Ginette M Albert

Parcel #	Owner
	CSJ 2374 01 148 Hillcrest Rd. to Merit Dr.
1	12380 Hillcrest Road Investors LP
2	Muscovy Limited Partnership
3	Watermark Community Church
4	DA Residential Two LP
5	Westdale LJ Partners LTD
6	Houston RE Income Properties XVIII LTD
7	PCRI Property LP
8	Park Central Joint Venture

Parcel #	Owner
	CSJ 2374 01 142 IH 635 at Webb Chapel Rd.
1	Motiva Enterprises
2	Exxon Mobil Foundation
3	Metrocrest Hospital Authority

Texas Department of Transportation

IH 635 Managed Lanes Project
Technical Provisions

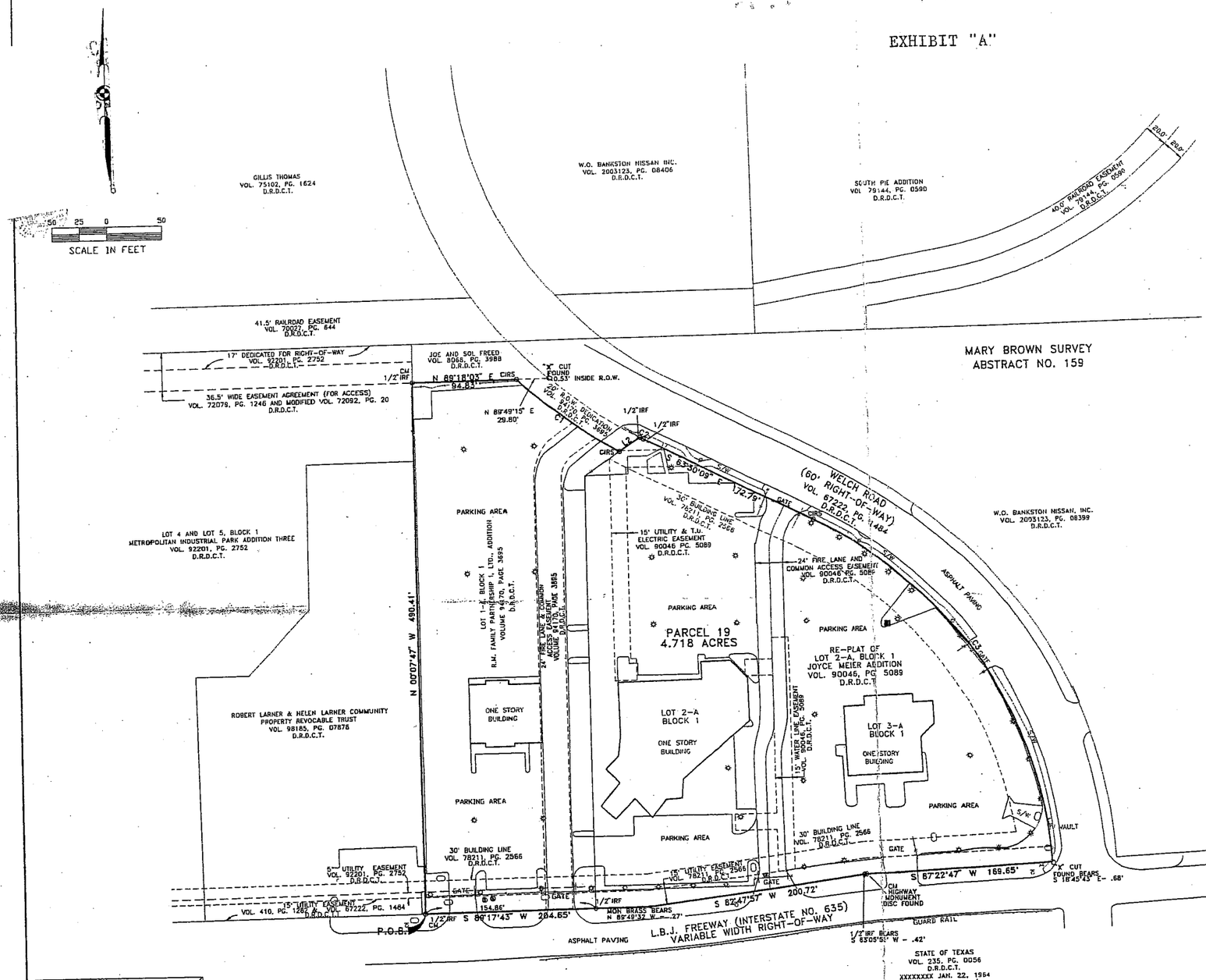
Attachment 07-2A

Property Descriptions and Locations


©NCTCOG
Mcewen Rd
Lbj Fwy
635
635
635
Welch Rd
Exit 22B
Lbj Fwy
Thunder Rd
http://www.dfwmaps.com
0
127ft

Parcel 19 / 2374-01-152
9118-01-038

EXHIBIT "A"



CURVE	RADIUS	DELTA ANGLE	CHORD BEARING	CHORD LENGTH	ARC LENGTH
C1	433.07'	15°19'00"	S 53°50'52" E	115.43'	115.77'
C2	413.07'	00°30'27"	S 63°14'55" E	3.66'	3.66'
C3	378.76'	60°54'56"	S 33°02'41" E	383.99'	402.69'

LINE	BEARING	DISTANCE
L2	N 56°32'48" E	22.82'

LEGEND		
	CM	CONTROL MONUMENT
	IRF	IRON ROD FOUND
	CIRS	5/8" IRON ROD WITH YELLOW PLASTIC CAP STAMPED CARTER BURGESS SET
	PP	POWER POLE
	CO	CLEAN OUT
	WM	WATER METER
	SIGN	SIGN
	MW	MONITOR WELL
	SS MH	SAN SEWER MANHOLE
	EV	ELECTRIC VAULT
	TV	TELEPHONE VAULT

PARCEL 19
PROPERTY DESCRIPTION

BEING A 4.718 ACRE TRACT OF LAND SITUATED IN THE MARY BROWN SURVEY, ABSTRACT NO. 159, DALLAS COUNTY, TEXAS, AND BEING ALL OF LOT 1-A, BLOCK 1 OF THE R.M. FAMILY PARTNERSHIP I, LTD., ADDITION AS RECORDED IN VOLUME 94170, PAGE 3695, DEED RECORDS DALLAS COUNTY, TEXAS (D.R.D.C.T.) AND ALL OF A RE-PLAT OF LOT 2-A, BLOCK 1 OF THE JOYCE MEIER ADDITION AS RECORDED IN VOLUME 90046, PAGE 5089, D.R.D.C.T. BASIS OF BEARING IS REFERENCED TO THE TEXAS COORDINATE SYSTEM, NAD 83, NORTH CENTRAL ZONE, BASED ON THE TEXAS DEPARTMENT OF TRANSPORTATION GEODETIC MONUMENTS. SAID 4.718 ACRE TRACT OF LAND BEING MORE PARTICULARLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

BEGINNING AT A 1/2" IRON ROD FOUND FOR THE SOUTHWEST CORNER OF SAID R.M. FAMILY PARTNERSHIP I, LTD., ADDITION AND THE COMMON SOUTHEAST CORNER OF A TRACT OF LAND DESCRIBED IN DEED TO ROBERT LARNER & HELEN LARNER, COMMUNITY PROPERTY REVOCABLE TRUST, RECORDED IN VOLUME 98185, PAGE 7878, D.R.D.C.T., SAID POINT ALSO BEING IN THE NORTH RIGHT-OF-WAY (R.O.W.) LINE OF L.B.J. FREEWAY (INTERSTATE NO. 635 A VARIABLE WIDTH R.O.W.);

THENCE, N 00°07'47" W, ALONG THE WEST LINE OF SAID R.M. FAMILY PARTNERSHIP I, LTD., ADDITION AND THE COMMON EAST LINE OF SAID LARNER COMMUNITY TRACT, A DISTANCE OF 490.41 FEET TO A 1/2" IRON ROD FOUND FOR THE NORTHWEST CORNER OF SAID R.M. FAMILY PARTNERSHIP I, LTD., ADDITION AND THE COMMON SOUTHWEST CORNER OF A TRACT OF LAND DESCRIBED IN DEED TO JOE AND SOL FREED, RECORDED IN VOLUME 88068, PAGE 3988, D.R.D.C.T.;

**THENCE, N 89°18'03" E, ALONG THE NORTH LINE OF SAID R.M. FAMILY PARTNERSHIP I, LTD., ADDITION AND THE COMMON SOUTH LINE OF SAID FREED TRACT, A DISTANCE OF 94.83 FEET TO A 5/8" IRON ROD WITH YELLOW PLASTIC CAP STAMPED "CARTER BURGESS SET IN THE SOUTHWESTERLY LINE OF A 20 FOOT R.O.W. DEDICATION, SAID POINT BEING N 89°49'15" E, A DISTANCE OF 29.80 FEET FROM AN "X" CUT FOUND IN THE SOUTHWESTERLY R.O.W. LINE OF WELCH ROAD (A 60 FOOT R.O.W.);

**THENCE ALONG THE SOUTHWESTERLY LINE OF SAID 20 FOOT R.O.W. DEDICATION ALONG A CURVE TO THE LEFT HAVING A RADIUS OF 433.07 FEET, A DELTA ANGLE OF 15°19'00", A CHORD BEARING OF S 53°50'52" E, AND A CHORD LENGTH OF 115.43 FEET, AND AN ARC LENGTH OF 115.77 FEET TO A 5/8" IRON ROD WITH YELLOW PLASTIC CAP STAMPED "CARTER BURGESS SET IN THE EAST LINE OF SAID R.M. FAMILY PARTNERSHIP I, LTD., ADDITION AND THE COMMON WEST LINE OF SAID JOYCE MEIER ADDITION;

THENCE, N 56°32'48" E, ALONG SAID COMMON LINE A DISTANCE OF 22.82 FEET TO A 1/2" IRON ROD FOUND FOR THE NORTHEAST CORNER OF SAID R.M. FAMILY PARTNERSHIP I, LTD., ADDITION AND THE COMMON NORTHWEST CORNER OF SAID JOYCE MEIER ADDITION, SAID POINT ALSO BEING IN THE SOUTHWESTERLY R.O.W. LINE OF SAID WELCH ROAD;

THENCE ALONG THE NORTH LINE OF SAID JOYCE MEIER ADDITION AND THE COMMON SOUTHWESTERLY R.O.W. LINE OF SAID WELCH ROAD THE FOLLOWING THREE (3) CALLS:

ALONG A CURVE TO THE LEFT HAVING A RADIUS OF 413.07 FEET, A DELTA ANGLE OF 0°30'27", A CHORD BEARING OF S 63°14'55" E, AND A CHORD LENGTH OF 3.66 FEET, AND AN ARC LENGTH OF 3.66 FEET TO A 1/2" IRON ROD FOUND FOR CORNER;

**S 63°30'09" E, A DISTANCE OF 172.79 FEET TO A 5/8" IRON ROD WITH YELLOW PLASTIC CAP STAMPED "CARTER BURGESS" SET FOR CORNER;

ALONG A CURVE TO THE RIGHT HAVING A RADIUS OF 378.76 FEET, A DELTA ANGLE OF 60°54'56", A CHORD BEARING OF S 33°02'41" E, AND A CHORD LENGTH OF 383.99 FEET, AND AN ARC LENGTH OF 402.69 FEET, TO A POINT FOR THE SOUTHEAST CORNER OF SAID JOYCE MEIER ADDITION SAID POINT ALSO BEING THE INTERSECTION OF THE WEST R.O.W. LINE OF SAID WELCH ROAD AND THE NORTH R.O.W. LINE OF SAID L.B.J. FREEWAY, FROM WHICH A "X" CUT FOUND BEARS S 18°45'43" E, A DISTANCE OF 0.68 FEET;

THENCE ALONG THE SOUTH LINE OF SAID JOYCE MEIER ADDITION, THE COMMON SOUTH LINE OF SAID R.M. FAMILY PARTNERSHIP I, LTD., ADDITION AND THE NORTH R.O.W. LINE OF L.B.J. FREEWAY THE FOLLOWING THREE (3) CALLS:

S 67°22'47" W, A DISTANCE OF 169.65 FEET TO A ALUMINUM HIGHWAY MONUMENT DISC FOUND FOR CORNER FROM WHICH A 1/2" IRON ROD FOUND BEARS S 63°05'56" W, A DISTANCE OF 0.42 FEET;

S 82°47'57" W, A DISTANCE OF 200.72 FEET TO A POINT FOR CORNER FROM WHICH A BRASS HIGHWAY MONUMENT DISC FOUND BEARS N 89°49'32" W, A DISTANCE OF 0.27 FEET;

S 89°17'43" W, A DISTANCE OF 204.65 FEET TO THE POINT OF BEGINNING, AND CONTAINING 4.718 ACRES OF LAND, MORE OR LESS.

**THE MONUMENT DESCRIBED AND SET IN THIS CALL, IF DESTROYED DURING CONSTRUCTION, MAY BE REPLACED WITH A TxDOT TYPE II RIGHT-OF-WAY MARKER UPON THE COMPLETION OF THE HIGHWAY CONSTRUCTION PROJECT UNDER THE SUPERVISION OF A REGISTERED PROFESSIONAL LAND SURVEYOR, EITHER EMPLOYED OR RETAINED BY TxDOT.

NOTES:

1. ALL CORNERS ARE MONUMENTED WITH A 5/8" IRON ROD CAPPED "CARTER BURGESS", UNLESS OTHERWISE NOTED.
2. THE SUBJECT PROPERTY FALLS WITHIN ZONE "X", DETERMINED TO BE OUTSIDE OF THE 500-YEAR FLOODPLAIN. FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP, COMMUNITY MAP NUMBER 48113C0190 J, DATED AUGUST 23, 2001.
3. BASIS OF BEARING IS REFERENCED TO THE TEXAS COORDINATE SYSTEM, NAD 83, NORTH CENTRAL ZONE, BASED ON THE TEXAS DEPARTMENT OF TRANSPORTATION GEODETIC

SURVEYORS CERTIFICATE

I, WILLIAM C. BODEN, REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF TEXAS, DO HEREBY CERTIFY THAT THE MAP SHOWN HEREON ACCURATELY REPRESENTS THE DESCRIBED PROPERTY AS DETERMINED BY A SURVEY, MADE ON THE GROUND UNDER MY DIRECTION AND SUPERVISION AND 5/8" IRON RODS CAPPED "CARTER & BURGESS" HAVE BEEN SET AT ALL BOUNDARY CORNERS, UNLESS OTHERWISE NOTED. THE MONUMENTS OR MARKS SET, OR FOUND, ARE SUFFICIENT TO ENABLE RETRACEMENT.

WILLIAM C. BODEN
REGISTERED PROFESSIONAL LAND SURVEYOR
TEXAS REGISTRATION NO. 1932

NOVEMBER 18, 2003
DATED

STATE OF TEXAS REGISTERED WILLIAM C. BODEN 1932 PROFESSIONAL LAND SURVEYOR

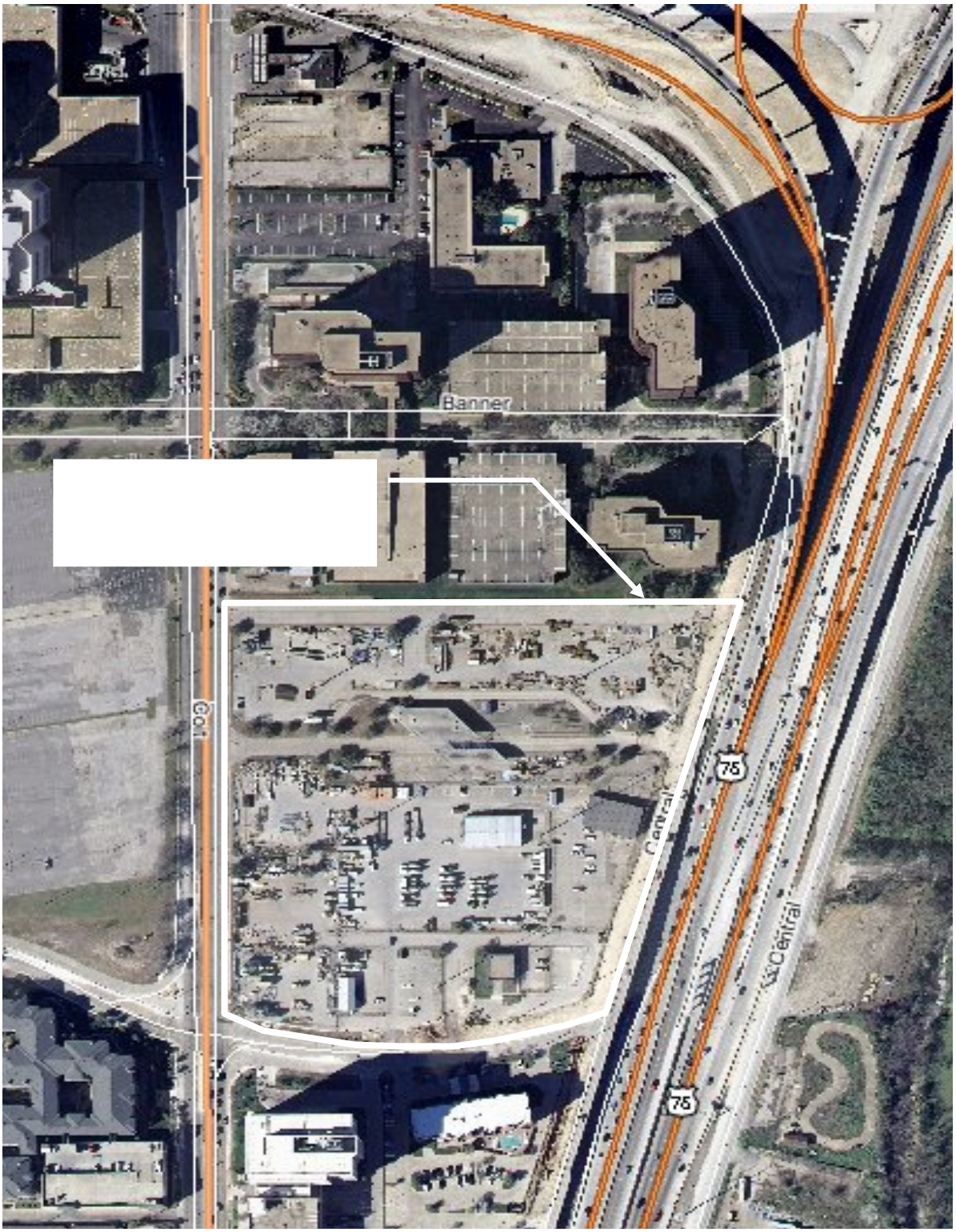
-- NOTICE --

PROJECT NO.	021B0701	DATE	REVISIONS
DRAWN BY	J.FLORES		
APPROVED BY	B.BODEN		
DATE	10/02/03		

BOUNDARY SURVEY
4.718 ACRES
OUT OF THE
MARY BROWN SURVEY, ABSTRACT NO. 159
IN THE CITY OF FARMERS BRANCH, DALLAS COUNTY, TEXAS

Carter::Burgess
CARTER & BURGESS, INC.
7950 ELMBROOK DRIVE, SUITE 250
DALLAS, TX 75247-4961
(214) 638-0145

FILE: 01-664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75
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State Department of Highways and Public Transportation
Form D-15-11 (Whole Taking)
Page 1 of 4
Rev. 7-75

DEED RECORD

9018-9-18
Parcel 1

DEED
CONTROLLED ACCESS HIGHWAY FACILITY

8852 0 2 9.00 DEED 03/05/79

THE STATE OF TEXAS §
§
COUNTY OF DALLAS §

WHEREAS, the State Highway and Public Transportation Commission has been authorized under House Bill 179, Acts of the 55th Legislature, Regular Session, 1957 (Article 6674w-1, et seq., Vernon's Annotated Civil Statutes of Texas) to purchase land and such other property rights deemed necessary for the purposes of facilitating the construction, maintenance and operation of Controlled Access Highways; and,

WHEREAS, the purchase of the hereinafter described premises has been deemed necessary by the State Highway and Public Transportation Commission for the purposes of facilitating the construction, maintenance and operation of a Controlled Access Highway facility;

NOW, THEREFORE, KNOW ALL MEN BY THESE PRESENTS:

That, WDS, Inc., a Delaware Corporation, acting by and through its duly authorized officer,

of the County of Oklahoma, Oklahoma State of ~~Texas~~, hereinafter referred to as Grantors, whether one or more, for and in consideration of the sum of Two Million, Five Hundred Thousand and no/100---------- ($2,500,000.00) Dollars to Grantors in hand paid by the State of Texas, acting by and through the State Highway and Public Transportation Commission, receipt of which is hereby acknowledged, and for which no lien is retained, either expressed or implied, have this day Sold, and by these presents do Grant, Bargain, Sell and Convey unto the State of Texas, all that certain tract or parcel of land lying and being situated in the County of Dallas, State of Texas, more particularly described as follows, to wit:

Situated in Dallas City Block No. 7754, and in the M. J. Sanchez Survey, Abstract No. 1272, Dallas County, Texas.

BEING 485,296 square feet (11.141 acres) tract of land, more or less, and being all of the said tract of land which was conveyed to Texas Auto Warehousers, Inc., a Delaware corporation, by deed dated March 3, 1954 recorded in Volume 4187, Page 614, Deed Records of Dallas County, Texas and further conveyed by Agreement of Merger to Auto Warehousers, Inc., dated April 19, 1963 recorded in Volume 881, Page 0316, Deed Records in Dallas County, Texas, said 485,296 square feet tract of land being more particularly described as follows;

Returned W.T.

74041 2130

BEGINNING at the southeast corner of said 485,296 square feet tract of land, said point being in the existing West right of way line of U. S. 75 and bears South 16°21'26" West a distance of 317.78 feet from the northeast corner of Arno Goetz tract acquired by deed dated May 28, 1975 recorded in Volume 75107, Page 2648, Deed Records of said county;

(1) THENCE South 81°37'47" West for a distance of 642.99 feet for a corner;

(2) THENCE North 0°20'56" East for a distance 956.47 feet for a corner;

(3) THENCE South 89°18'13" East for a distance of 490.00 feet for a corner;

(4) THENCE South 0°23'36" West for a distance of 675.13 feet for a corner;

(5) THENCE North 81°14'02" East for a distance of 210.20 feet to a point in the existing West right of way line of U. S. 75;

(6) THENCE South 16°21'26" West along the said existing right of way line a distance of 222.84 feet to the place of beginning.

SAVE and EXCEPT, HOWEVER, it is expressly understood and agreed that Grantors are retaining title to the following improvements located on the above described property, to wit:

NONE

Grantors covenant and agree to remove the above described improvements from said land by xxxxx xx, 19 xx, subject, however, to such extensions of time as may be granted by the State in writing; and if, for any reason, Grantors fail or refuse to remove same within said period of time prescribed, then, without any further consideration, the title to all or any part of such improvements not so removed shall pass to and vest in the State of Texas forever.

Grantors reserve all of the oil, gas and sulphur in and under the land herein conveyed but waive all rights of ingress and egress to the surface thereof for the purpose of exploring, developing, mining or drilling for same; however, nothing in this reservation shall affect the title and rights of the State to take and use all other minerals and materials thereon, therein and thereunder.

TO HAVE AND TO HOLD the above described premises herein conveyed together with all and singular the rights and appurtenances thereto in anywise belonging, unto the State of Texas and its assigns forever; and Grantors do hereby bind ourselves, our heirs, executors, administrators, successors and assigns, to Warrant and Forever Defend all and singular the said premises herein conveyed unto the State of Texas and its assigns against every person whomsoever lawfully claiming or to claim the same or any part thereof.

IN WITNESS WHEREOF, this instrument is executed on this the 20th day of February, 19 79.

ATTEST: J. Tom Ramsey
Assistant Secretary

HDS, Inc.
By: Roy E. Townsdin
Roy E. Townsdin, President

SINGLE ACKNOWLEDGMENT

THE STATE OF TEXAS }
County of ..... }

Before me, ..., a notary public in and for said County and State, on this day personally appeared ....., known to me (or proved to me on the oath of ....., a credible witness) to be the person ..... whose name ..... subscribed to the foregoing instrument and acknowledged to me that ....he ... executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office, this the ..... day of ..... 19 ....

Notary Public in and for ..... County, Texas.

70041 2122

State Department of Highways
and Public Transportation
Form D-15-11 (Whole Taking)
Page 1 of 4
Rev. 7-75

DEED RECORD

Parcel 2
9018-9-18

DEED
CONTROLLED ACCESS HIGHWAY FACILITY

A 9.00 DEED
6797 0 2 06/06/79

THE STATE OF TEXAS §
§
COUNTY OF DALLAS §

WHEREAS, the State Highway and Public Transportation Commission has been authorized under House Bill 179, Acts of the 55th Legislature, Regular Session, 1957 (Article 6674w-1, et seq., Vernon's Annotated Civil Statutes of Texas) to purchase land and such other property rights deemed necessary for the purposes of facilitating the construction, maintenance and operation of Controlled Access Highways; and,

WHEREAS, the purchase of the hereinafter described premises has been deemed necessary by the State Highway and Public Transportation Commission for the purposes of facilitating the construction, maintenance and operation of a Controlled Access Highway facility;

NOW, THEREFORE, KNOW ALL MEN BY THESE PRESENTS:

That, ARNO GOETZ, not joined by my wife as this property represents no part of my business or residential homestead,

of the County of Dallas, State of Texas, hereinafter referred to as Grantors, whether one or more, for and in consideration of the sum of Three Hundred Seventy Thousand and no/100---------- ($370,000.00) Dollars to Grantors in hand paid by the State of Texas, acting by and through the State Highway and Public Transportation Commission, receipt of which is hereby acknowledged, and for which no lien is retained, either expressed or implied, have this day Sold, and by these presents do Grant, Bargain, Sell and Convey unto the State of Texas, all that certain tract or parcel of land lying and being situated in the County of Dallas, State of Texas, more particularly described as follows, to wit:

Situated in Dallas City Block No. 7754, Dallas County, Texas.

BEING 26,144 square feet (0.600 acre) tract of land, more or less, and being all of the said tract of land which was conveyed to Arno Goetz by deed dated May 28, 1975, recorded in Volume 75107, Page 2648, Deed Records of Dallas County, Texas, said 26,144 square feet tract of land being more particularly described as follows:

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BEGINNING at the southeast corner of said 26,144 square feet tract of land, said point being in the existing West right of way line of U. S. 75 and bears North 16°21'26" East a distance of 222.84 feet from the southeast corner of 3.101 acre tract which was conveyed to Texas Auto Warehousers, Inc., by Deed recorded in Volume 4187, Page 614, Deed Records of said county;

(1) THENCE South 81°14'02" West for a distance of 210.20 feet for a corner;

(2) THENCE North 0°23'36" East for a distance of 146.47 feet for a corner;

(3) THENCE South 84°17'28" East for a distance of 234.64 feet to a point in the existing West right of way line of U. S. 75;

(4) THENCE South 16°21'26" West along the said existing right of way line a distance of 94.94 feet to the place of beginning.

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SAVE and EXCEPT, HOWEVER, it is expressly understood and agreed that Grantors are retaining title to the following improvements located on the above described property, to wit:

NONE

Grantors covenant and agree to remove the above described improvements from said land by xxxxx xx, 19 xx, subject, however, to such extensions of time as may be granted by the State in writing; and if, for any reason, Grantors fail or refuse to remove same within said period of time prescribed, then, without any further consideration, the title to all or any part of such improvements not so removed shall pass to and vest in the State of Texas forever.

Grantors reserve all of the oil, gas and sulphur in and under the land herein conveyed but waive all rights of ingress and egress to the surface thereof for the purpose of exploring, developing, mining or drilling for same; however, nothing in this reservation shall affect the title and rights of the State to take and use all other minerals and materials thereon, therein and thereunder.

TO HAVE AND TO HOLD the above described premises herein conveyed together with all and singular the rights and appurtenances thereto in anywise belonging, unto the State of Texas and its assigns forever; and Grantors do hereby bind ourselves, our heirs, executors, administrators, successors and assigns, to Warrant and Forever Defend all and singular the said premises herein conveyed unto the State of Texas and its assigns against every person whomsoever lawfully claiming or to claim the same or any part thereof.

IN WITNESS WHEREOF, this instrument is executed on this the 16th day of May, 19 79.

Arno Goetz

SINGLE ACKNOWLEDGMENT

THE STATE OF TEXAS
County of DALLAS

Before me, the undersigned authority, a notary public in and for said County and State, on this day personally appeared Arno Goetz, known to me (or proved to me on the oath of ... credible witness) to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that he executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office, this the 16th day of May 19 79

Notary Public in and for Dallas County, Texas.

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Resolution of Directors

to

Terminate Lease, Adjust
Rent and Pay Rent/Damages

WHEREAS, the State of Texas through the State Department of Highways and Public Transportation determined it is in the best interest of the public to acquire subject property located at 12505 North Central Expressway, more specifically described by attached Exhibit A; and

WHEREAS, the State of Texas public use will require existing structures be demolished and removed from the property described by Exhibit A; and

WHEREAS, the above actions required Warrex Computer Corporation to move from the property and the State is proceeding to acquire fee title interest thereto;

THEREFORE, Be It Resolved, That Warrex Computer Corporation terminate its lease of subject property, adjust the rental and other payments may be due fee owner; and, that JAMES H SMITH President of Warrex Computer Corporation be authorized to negotiate these issues and make payments to the fee owner in terms and amounts which, in his opinion, are in the best interest of Warrex Computer Corporation.

This is to certify that the Board of Directors of Warrex Computer Corporation met in a properly called session on Jan 11 '79 and, after, required formality, unanimously approved the Resolution set forth above as an act of the corporation.

Certified this 30th day of May, 1979.

James H Smith
President

attest: [signature]
Secretary

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RETURN TO:

John G. Keller, Dist. Engr.
State Department of Highways and Public Transportation
P. O. Box 3067
Dallas, Texas 75221

STATE OF TEXAS COUNTY OF
I hereby certify that this instrument was filed on the date and time stamped hereon by me and was duly recorded in the volume and page of the named records of Dallas County, Texas as stamped hereon by me.

JUN 6 1979

L.E. Murdock
COUNTY CLERK, Dallas County, Texas

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'79 JUN 5 PM 2:48

COUNTY CLERK
DALLAS COUNTY

L.E. Murdock
Deputy

STW GF 202654 Rec W/D $11.00

State Department of Highways
and Public Transportation
Form D-15-11 (Whole Taking)
Page 1 of 4
Rev. 7-75

DEED RECORD

DEED
CONTROLLED ACCESS HIGHWAY FACILITY

I 635-6(191)454
9018-9-18
Parcel 3

THE STATE OF TEXAS }
}
COUNTY OF DALLAS }

3976 11.00 DEED 04/04/80

WHEREAS, the State Highway and Public Transportation Commission has been authorized under House Bill 179, Acts of the 55th Legislature, Regular Session, 1957 (Article 6674w-1, et seq., Vernon's Annotated Civil Statutes of Texas) to purchase land and such other property rights deemed necessary for the purposes of facilitating the construction, maintenance and operation of Controlled Access Highways; and,

WHEREAS, the purchase of the hereinafter described premises has been deemed necessary by the State Highway and Public Transportation Commission for the purposes of facilitating the construction, maintenance and operation of a Controlled Access Highway facility;

NOW, THEREFORE, KNOW ALL MEN BY THESE PRESENTS:

That, DALLAS CERAMIC COMPANY, a Texas Corporation,

of the County of Dallas, State of Texas, hereinafter referred to as Grantors, whether one or more, for and in consideration of the sum of Five Hundred Five Thousand and no/100---------- ($505,000.00) Dollars to Grantors in hand paid by the State of Texas, acting by and through the State Highway and Public Transportation Commission, receipt of which is hereby acknowledged, and for which no lien is retained, either expressed or implied, have this day Sold, and by these presents do Grant, Bargain, Sell and Convey unto the State of Texas, all that certain tract or parcel of land lying and being situated in the County of Dallas, State of Texas, more particularly described as follows, to wit:

Situated in Dallas City Block No. 7754, Dallas County, Texas.

BEING 34,434 square feet (0.791 acre) tract of land, more or less, and being all of the said tract of land which was conveyed to Dallas Ceramic Company, a Texas corporation, by deed dated January 20, 1959, recorded in Volume 5040, Page 269, Deed Records of Dallas County, Texas, said 34,434 square feet tract of land being more particularly described by metes and bounds as follows:

80068 2104

Received ... 6-80

BEGINNING at the southeast corner of said 34,434 square feet tract of land, said point being in the existing West right of way line of U. S. 75 and bears North 16° 21' 26" East a distance of 317.78 feet from the southeast corner of 3.101 acre tract which was conveyed to Texas Auto Warehousers Inc., by Deed recorded in Volume 4187, Page 614, Deed Records of said county;

(1) THENCE North 84° 17' 28" West for a distance of 234.64 feet for a corner;

(2) THENCE North 0° 23' 36" East for a distance of 124.64 feet for a corner;

(3) THENCE South 89° 10' 03" East for a distance of 274.91 feet to a point in the existing West right of way line of U. S. 75;

(4) THENCE South 16° 21' 26" West along the said existing right of way line a distance of 150.06 feet to the place of beginning.

80068 2105

SAVE and EXCEPT, HOWEVER, it is expressly understood and agreed that Grantors are retaining title to the following improvements located on the above described property, to wit:

None

Grantors covenant and agree to remove the above described improvements from said land by xxxxx xxx xxx, 19 xx, subject, however, to such extensions of time as may be granted by the State in writing; and if, for any reason, Grantors fail or refuse to remove same within said period of time prescribed, then, without any further consideration, the title to all or any part of such improvements not so removed shall pass to and vest in the State of Texas forever.

Grantors reserve all of the oil, gas and sulphur in and under the land herein conveyed but waive all rights of ingress and egress to the surface thereof for the purpose of exploring, developing, mining or drilling for same; however, nothing in this reservation shall affect the title and rights of the State to take and use all other minerals and materials thereon, therein and thereunder.

TO HAVE AND TO HOLD the above described premises herein conveyed together with all and singular the rights and appurtenances thereto in anywise belonging, unto the State of Texas and its assigns forever; and Grantors do hereby bind ourselves, our heirs, executors, administrators, successors and assigns, to Warrant and Forever Defend all and singular the said premises herein conveyed unto the State of Texas and its assigns against every person whomsoever lawfully claiming or to claim the same or any part thereof.

IN WITNESS WHEREOF, this instrument is executed on this the 26th day of February, 19 80.

ATTEST:

DALLAS CERAMIC COMPANY

By: Charles C. Nies
Charles C. Nies
Vice President-Finance

SINGLE ACKNOWLEDGMENT

THE STATE OF TEXAS }
County of ..... }

Before me, ..., a notary public in and for said County and State, on this day personally appeared .....

....., known to me (or proved to me on the oath of ....., a credible witness) to be the person ..... whose name ..... subscribed to the foregoing instrument and acknowledged to me that ....he.... executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office, this the 26 day of February 19 80

.....
Notary Public in and for Dallas County, Texas.

VOL

80068 2106

STW GF 202655 Rec W/D .$7.00

State Department of Highways
and Public Transportation
Form D-15-11 (Whole Taking)
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9018-9-18
Parcel 4

DEED
CONTROLLED ACCESS HIGHWAY FACILITY

A

7201 0 2 10/11/79 7.00 DEED

THE STATE OF TEXAS X
X
COUNTY OF DALLAS X

WHEREAS, the State Highway and Public Transportation Commission has been authorized under House Bill 179, Acts of the 55th Legislature, Regular Session, 1957 (Article 6674w-1, et seq., Vernon's Annotated Civil Statutes of Texas) to purchase land and such other property rights deemed necessary for the purposes of facilitating the construction, maintenance and operation of Controlled Access Highways; and,

WHEREAS, the purchase of the hereinafter described premises has been deemed necessary by the State Highway and Public Transportation Commission for the purposes of facilitating the construction, maintenance and operation of a Controlled Access Highway facility;

NOW, THEREFORE, KNOW ALL MEN BY THESE PRESENTS:

That, JOSE MILMO, not joined by my wife as this property constitutes no part of my business or residential homestead

City of Monterrey, State of Nuevo Leon, Republic of Mexico, hereinafter referred to as Grantors, whether one or more, for and in consideration of the sum of Seven Hundred Thousand and no/100---------- ($ 700,000.00) Dollars to Grantors in hand paid by the State of Texas, acting by and through the State Highway and Public Transportation Commission, receipt of which is hereby acknowledged, and for which no lien is retained, either expressed or implied, have this day Sold, and by these presents do Grant, Bargain, Sell and Convey unto the State of Texas, all that certain tract or parcel of land lying and being situated in the County of Dallas, State of Texas, more particularly described as follows, to wit:

Situated in Dallas City Block No. 7754, Dallas County, Texas.

BEING 134,543 square feet (3.089 acres) tract of land, more or less, and being all of the said tract of land which was conveyed to Jose Milmo by deed dated September 3, 1973 recorded in Volume 73218, Page 1115, Deed Records of Dallas County, Texas, said 134,543 square feet tract of land being more particularly described as follows:

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Reviewed
by 9-7-79

BEGINNING at the southeast corner of said 134,543 square feet tract of land, said point being in the existing West right of way line of U. S. 75 and bears North 16° 21' 26" East a distance of 467.84 feet from the southeast corner of 3.101 acres tract which was conveyed to Texas Auto Warehousers, Inc., by deed recorded in Volume 4187, Page 614, Deed Records of said county;

(1) THENCE North 89° 10' 03" West for a distance of 274.91 feet for a corner;

(2) THENCE North 0° 23' 36" East for a distance of 404.02 feet for a corner;

(3) THENCE South 89° 18' 13" East for a distance of 390.49 feet to a point in the existing West right of way line of U. S. 75;

(4) THENCE South 16° 21' 26" West along the said existing right of way line a distance of 420.27 feet to the place of beginning.

SAVE and EXCEPT, HOWEVER, it is expressly understood and agreed that Grantors are retaining title to the following improvements located on the above described property, to wit:

NONE

Grantors covenant and agree to remove the above described improvements from said land by xxxxx xx, 19 xx, subject, however, to such extensions of time as may be granted by the State in writing; and if, for any reason, Grantors fail or refuse to remove same within said period of time prescribed, then, without any further consideration, the title to all or any part of such improvements not so removed shall pass to and vest in the State of Texas forever.

Grantors reserve all of the oil, gas and sulphur in and under the land herein conveyed but waive all rights of ingress and egress to the surface thereof for the purpose of exploring, developing, mining or drilling for same; however, nothing in this reservation shall affect the title and rights of the State to take and use all other minerals and materials thereon, therein and thereunder.

TO HAVE AND TO HOLD the above described premises herein conveyed together with all and singular the rights and appurtenances thereto in anywise belonging, unto the State of Texas and its assigns forever; and Grantors do hereby bind ourselves, our heirs, executors, administrators, successors and assigns, to Warrant and Forever Defend all and singular the said premises herein conveyed unto the State of Texas and its assigns against every person whomsoever lawfully claiming or to claim the same or any part thereof.

IN WITNESS WHEREOF, this instrument is executed on this the 3 day of August, 1979.

X José Milmo
Jose Milmo

SINGLE ACKNOWLEDGMENT

THE STATE OF TEXAS
County of Dallas

Before me, the undersigned authority, a notary public in and for said County and State, on this day personally appeared Jose Milmo, known to me (~~or proved to me on the oath of~~, ~~or credible witness~~) to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that he executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office, this the 3rd day of August 1979.

Francine K. Culbertson
Notary Public in and for Dallas County, Texas.

79199 0156

STW GF 202655 Rec QCD $9.00

State Department of Highways
and Public Transportation
Form D-15-30
Page 1 of 4
Rev. 7-75

DEED RECORD

Parcel 4
9018-9-18

QUITCLAIM

STATE OF TEXAS

COUNTY OF DALLAS

7199 0 9.00 DEED
2 10/11/79

KNOW ALL MEN BY THESE PRESENTS:

That DALLAS CERAMIC COMPANY

of the County of Dallas, State of Texas, hereinafter referred to as Grantors, whether one or more, for and in consideration of the sum of Nine Hundred Thirty and No/100---------- ($ 930.00) Dollars, and other good and valuable consideration to Grantors in hand paid by the State of Texas, acting by and through the State Highway and Public Transportation Commission, the receipt of which is hereby acknowledged, and for which no lien is retained, either expressed or implied, have quitclaimed, and do by these presents Bargain, Sell, Release and forever Quitclaim unto the State of Texas all of Grantors' right, title, interest, claim and demand in and to that certain tract or parcel of land, situated in the County of Dallas, State of Texas, and being more particularly described as follows, to wit:

Situated in Dallas City Block No. 7754, Dallas County, Texas.

BEING 134,543 square feet (3.089 acres) tract of land, more or less, and being all of the said tract of land which was conveyed to Jose Milmo by deed dated September 3, 1973 recorded in Volume 73218, Page 1115, Deed Records of Dallas County, Texas, said 134,543 square feet tract of land being more particularly described as follows:

Reviewed
WT 9-7-79

VOL PAGE

79199 0144

BEGINNING at the southeast corner of said 134,543 square feet tract of land, said point being in the existing West right of way line of U. S. 75 and bears North 16° 21' 26" East a distance of 467.84 feet from the southeast corner of 3.101 acres tract which was conveyed to Texas Auto Warehousers, Inc., by deed recorded in Volume 4187, Page 614, Deed Records of said county;

(1) THENCE North 89° 10' 03" West for a distance of 274.91 feet for a corner;

(2) THENCE North 0° 23' 36" East for a distance of 404.02 feet for a corner;

(3) THENCE South 89° 18' 13" East for a distance of 390.49 feet to a point in the existing West right of way line of U. S. 75;

(4) THENCE South 16° 21' 26" West along the said existing right of way line a distance of 420.27 feet to the place of beginning.

SAVE and EXCEPT, HOWEVER, it is expressly understood and agreed that Grantors are retaining title to the following improvements located on the above described property, to wit:

A. Advertising Sign

Grantors covenant and agree to remove the above described improvements from said land by October 1, 19 79, subject, however, to such extensions of time as may be granted by the State in writing; and if, for any reason, Grantors fail or refuse to remove same within said period of time prescribed, then, without any further consideration, the title to all or any part of such improvements not so removed shall pass to and vest in the State of Texas forever.

VOL. PAGE

79199 0145

TO HAVE AND TO HOLD for said purposes together with all and singular the rights, privileges, and appurtenances thereto in any manner belonging unto the said State of Texas forever.

IN WITNESS WHEREOF, this instrument is executed on this the 3 day of August, 1979.

DALLAS CERAMIC COMPANY

ATTEST By: Charles C. Tise

Secretary Treasurer

SINGLE ACKNOWLEDGMENT

THE STATE OF TEXAS }
County of Dallas }

Before me, Francine P. Culbreath, a notary public in and for said County and State, on this day personally appeared Charles C. Tise, known to me (or proved to me on the oath of ....., a credible witness) to be the person whose name subscribed to the foregoing instrument and acknowledged to me that he executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office, this the 3rd day of August 1979

Francine P. Culbreath

Notary Public in and for Dallas County, Texas.

SINGLE ACKNOWLEDGMENT

THE STATE OF TEXAS }
County of ..... }

Before me, ..., a notary public in and for said County and State, on this day personally appeared .....

....., known to me (or proved to me on the oath of ....., a credible witness) to be the person whose name subscribed to the foregoing instrument and acknowledged to me that he executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office, this the ..... day of ..... 19 .....

.....

Notary Public in and for ..... County, Texas.

79199 0146

STW GF 202655 Rec QCD $7.00

State Department of Highways
and Public Transportation
Form D-15-30
Page 1 of 4
Rev. 7-75

DEED RECORD

Parcel 4
9018-9-18

QUITCLAIM

STATE OF TEXAS

COUNTY OF DALLAS

A

7200 0 7.00 DEED 2 10/11/79

KNOW ALL MEN BY THESE PRESENTS:

That NATIONAL ADVERTISING COMPANY

of the County of Dallas, State of Texas, hereinafter referred to as Grantors, whether one or more, for and in consideration of the sum of Eighteen Thousand, Six Hundred Ninety-Five and no/100---------- ($ 18,695.00) Dollars, and other good and valuable consideration to Grantors in hand paid by the State of Texas, acting by and through the State Highway and Public Transportation Commission, the receipt of which is hereby acknowledged, and for which no lien is retained, either expressed or implied, have quitclaimed, and do by these presents Bargain, Sell, Release and forever Quitclaim unto the State of Texas all of Grantors' right, title, interest, claim and demand in and to that certain tract or parcel of land, situated in the County of Dallas, State of Texas, and being more particularly described as follows, to wit:

Situated in Dallas City Block No. 7754, Dallas County, Texas.

BEING 134,543 square feet (3.089 acres) tract of Land, more or less, and being all of the said tract of land which was conveyed to Jose Milmo by deed dated September 3, 1973 recorded in Volume 73218, Page 1115, Deed Records of Dallas County, Texas, said 134,543 square feet tract of land being more particularly described as follows:

Reviewed
WOT 9-7-79

VOL. PAGE

79199 0150

BEGINNING at the southeast corner of said 134,543 square feet tract of land, said point being in the existing West right of way line of U. S. 75 and bears North 16° 21' 26" East a distance of 467.84 feet from the southeast corner of 3.101 acres tract which was conveyed to Texas Auto Warehousers, Inc., by deed recorded in Volume 4187, Page 614, Deed Records of said county;

(1) THENCE North 89° 10' 03" West for a distance of 274.91 feet for a corner;

(2) THENCE North 0° 23' 36" East for a distance of 404.02 feet for a corner;

(3) THENCE South 89° 18' 13" East for a distance of 390.49 feet to a point in the existing West right of way line of U. S. 75;

(4) THENCE South 16° 21' 26" West along the said existing right of way line a distance of 420.27 feet to the place of beginning.

SAVE and EXCEPT, HOWEVER, it is expressly understood and agreed that Grantors are retaining title to the following improvements located on the above described property, to wit:

B. Advertising Sign

Grantors covenant and agree to remove the above described improvements from said land by October 1, 19 79, subject, however, to such extensions of time as may be granted by the State in writing; and if, for any reason, Grantors fail or refuse to remove same within said period of time prescribed, then, without any further consideration, the title to all or any part of such improvements not so removed shall pass to and vest in the State of Texas forever.

VOL PAGE

79199 0151

TO HAVE AND TO HOLD for said purposes together with all and singular the rights, privileges, and appurtenances thereto in any manner belonging unto the said State of Texas forever.

IN WITNESS WHEREOF, this instrument is executed on this the 27th day of August, 1979.

NATIONAL ADVERTISING COMPANY

By David Harris

SINGLE ACKNOWLEDGMENT

THE STATE OF TEXAS

County of Dallas

Before me, the undersigned authority, a notary public in and for said County and State, on this day personally appeared DAVID HARRIS

known to me (or proved to me on the oath of , a credible witness) to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that he executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office, this the 27th day of August 1979

Notary Public in and for Dallas County, Texas.

SINGLE ACKNOWLEDGMENT

THE STATE OF TEXAS

County of

Before me, , a notary public in and for said County and State, on this day personally appeared

, known to me (or proved to me on the oath of , a credible witness) to be the person whose name subscribed to the foregoing instrument and acknowledged to me that he executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office, this the day of 19

Notary Public in and for County, Texas.

79199 0152

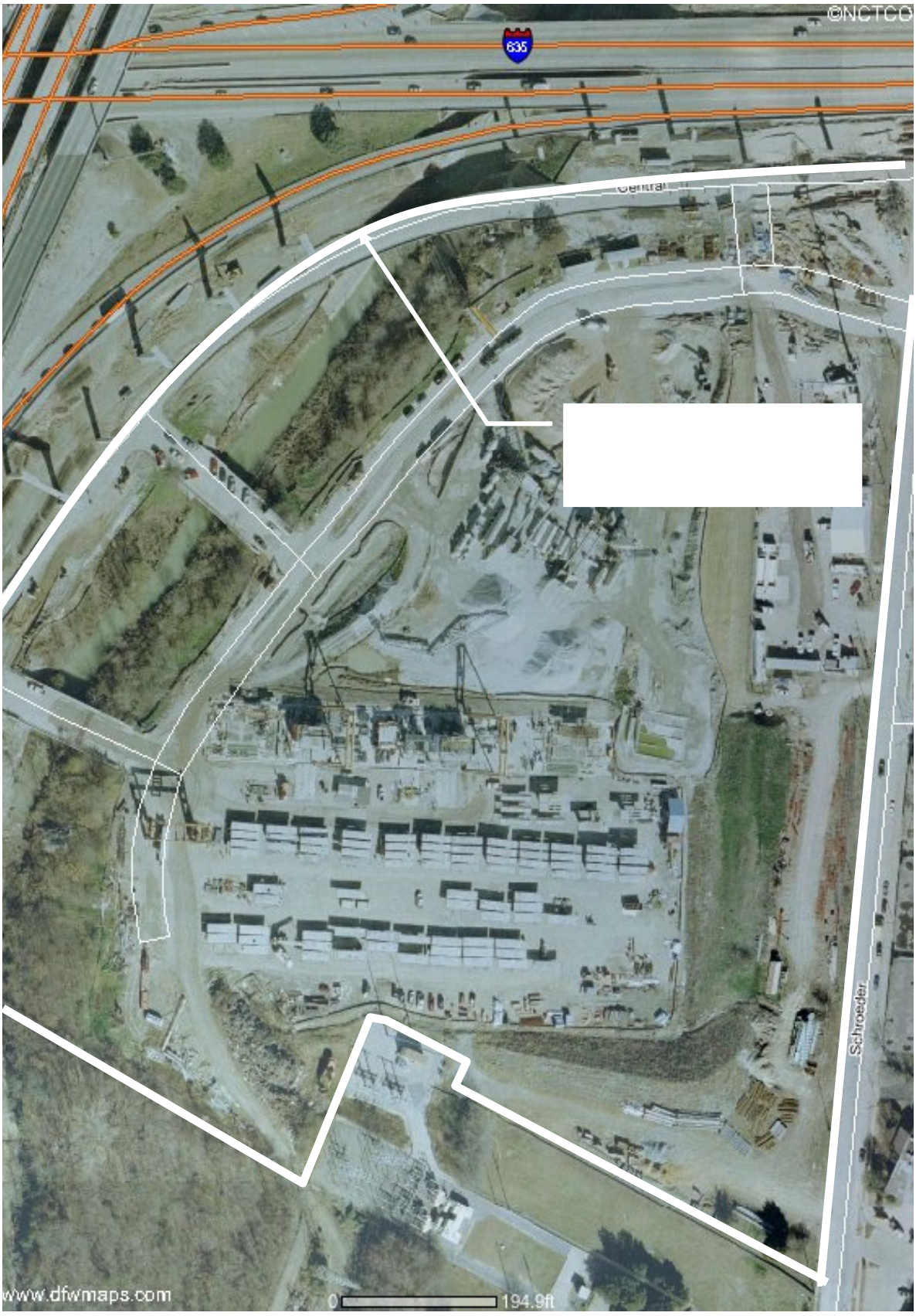
©NCTCOG
635
Schroeder
www.dfwmaps.com
0
194.9ft

EXHIBIT "A"

D-15-11
November 20, 2000

County Dallas
Parcel 33
Highway I.H. 635
PROJECT Limits: From: Crim Drive
To: Pinyon Tree Road

CSJ: 2374-01-103
Acct: 9118-21-07

Legal Land Description for Parcel 33

BEING a 21.210 acre parcel of land situated in the ALEXANDER A. THOMAS SURVEY, Abstract No. 1486, in the City of Dallas, Texas, Block Numbers 7621 and 7624, being all of a called 21.2028 acre tract of land deeded to CLBJ, INC., asrecorded in Volume 93012, Page 1460 of the Deed Records of Dallas County, Texas (DRDCT), and being all of Central 635 Addition, an Addition to the City of Dallas as Recorded inVolume 85008, Page 251, DRDCT. Said 21.210 acre parcel being moreparticularly described by metes and bounds as follows:

BEGINNING at a point, being the intersection of the west right-of-wayline of Schroeder Road (64.00 foot right-of-way at this point), and the south right-of-way line of Interstate 635 (variable width right-of-way), from said point a 5/8" iron rod with an aluminum cap stamped "Texas Department of Transportation" (TXDOT) bears N 86°01' 56" E,a distance of 2.52 feet;

THENCE along the west right-of-way line of said Schroeder Road (64.00foot right-of-way) the following two (2) courses and distances:

1.) S 04°47' 01" W, a distance of 210.42 feet to a 5/8" iron rod with yellow plastic cap stamped "CARTER BURGESS" set, and

2.) S 05°57' 08" W, a distance of 229.17 feet to a 5/8" iron rod with yellow plastic cap stamped "CARTER BURGESS" set, said point being the end of the 64.00 feet right-of way width, and the beginning of variable width right-of-way for said Schroeder Road;

THENCE continuing along the west line of Said Schroeder Road (variable width right-of-way) the following three (3) courses and distances:

3.) S 08°09' 23" W, a distance of 548.46 feet to a point, from saidpoint a 1/2" iron rod found bears N 14°51' 32" W, a distance of 2.47 feet, and

4.) S 65°35' 35" E, a distance of 28.60 feet to a 5/8" iron rod found, and

5.) S 06°00' 58" W, a distance of 297.45 feet to a point, said point being the southeast corner of said 21.2028 acre tract and said Central 635 Addition, same being the northeast corner of Wanda Taylor Addition, an addition to the City of Dallas as recorded in Volume 88071, Page4040, DRDCT, from said point a 5/8" iron rod found bears S 65°32' 39" E, a distance of 1.42 feet;

THENCE leaving said right-of-way line along the south line of said 21.2028 acre tract and

County Dallas
Parcel 33
Highway I.H. 635
PROJECT Limits: From: Crim Drive
To: Pinyon Tree Road

CSJ: 2374-01-103
Acct: 9118-21-07

Legal Land Description for Parcel 33

said Central 635 Addition, being the northline of said Wanda Taylor Addition the following two (2) courses and distances:

6.) N 62°21' 17" W, a distance of 482.80 feet to metal fence corner post found, and

7.) S 06°14 '36" W, a distance of 90.41 feet to an x-cut found in concrete, said point being a southeast corner of said 21.2028 acretract and said Central 635 Addition, being the southwest corner of said Wanda Taylor Addition, and being in the north line ofa called 1.49 acre tract of land deeded to Dallas Power and Light (DP&L), as recorded in Volume 70161, Page 1122, DRDCT;

THENCE continuing along the south line of said 21.2028 acre tract and said Central 635 Addition, being the north line of said DP&L tract the following two (2) courses and distances:

8.) N 62°25 04 " W, a distance of 180.80 feet to a metal fence corner post found, and

9.) S 21°58' 54" W, a distance of 69.43feet to an x-cut in concrete found, said point beirg a southwest corner of said 21.2028 acre tract and said Central 635 Addition, same being the northeast corner of a called 0.35 acre tract of land deeded to DP&L, as recorded in Volume 70161, Page 1118, DRDCT;

10.) THENCE N 61°26' 23" W, along the south line of said 21.2028 acre tract and said Central 635 Addition, being the north line of said DP&L0.35 acre tract a distance of 508.56 feet to a 5/8" iron rod with yellow plastic cap stamped "CARTER BURGESS" set;

11.) THENCE N 6°38' 01" E, along the west line of said 21.2028 acre tract and said Centra 635 Addition, being the east line of said DP&L 0.35 acre tract, passing a northwest corner of said DP&L 0.35 acre tract, same being the southeast corner of a called 005 acre tract of land deeded to Restland Memorial Parkof Dallas, as recorded in Volume 4026, Page 608, DRDCT, continuing along said west line, being the east line of said Restland Memorial tract a total distance of 40.13 feet to a 5/8" iron rod with an aluminum cap stamped "TXDOT" found, said point being a southwest corner of said 21.2028 acre tract and said Central 635 Addition, being the northeast corner of said Restland Memorial tract, and being the southeast corner of a called 0.1913 acre tract of land deeded to TXDOT, as recorded in Volume 99219, Page 949, DRDCT;

EXHIBIT "A"

D-15-11
November 20, 2000

County Dallas
Parcel 33
Highway I.H. 635
PROJECT Limits: From: Crim Drive
To: Pinyon Tree Road

CSJ: 2374-01-103
Acct: 9118-21-07

Legal Land Description for Parcel 33

THENCE along the west and north lines of said 21.2028 acre tract and said Central 635 Addition, being the east and south right-of-way lines for Us Highway 75 (Central Expressway variable width right-of-way) and said Interstate 635 the following seven (7) courses and distances:

12.) S 64°10' 23" E, a distance of 111.27 feet to a 1/2" iron rod found,

13.) N 11°57' 38" E, a distance of 133.29 feet to a brass highway monument found in concrete,

14.) N 24°14' 31" E, a distance of 224.90 feet to a brass highway monument found in concrete,

15.) N 40°15' 41" E, a distance of 450.27 feet to a brass highway monument found in concrete,

16.) N 46°20' 53" E, a distance of 260.02 feet to a brass highway monument found in concrete,

17.) N 82°16' 43" E, a distance of 139.82 feet to a brass highway monument found in concrete,

18.) N 86°17' 33" E, a distance of 352.98 feet to the point of beginning and containing 21.210 acres of land, more of less. Basis of bearing for this description is the Texas Department of Transportation Coordinate System, for US Highway 75, as expanded by Halff Associates, Based on Halff Associates Monuments 402, 403, 404, 405, and 420.

A SURVEY PLAT OF EVEN SURVEY DATE IS ATTACHED TO THIS METES AND BOUNDS DESCRIPTION.

11/21/00
DATE

GORDON K. PERRY
REGISTERED PROFESSIONAL LAND SURVEYOR
TEXAS REGISTRATION NO. 5185

STATE OF TEXAS
REGISTERED
GORDON K. PERRY
5185
PROFESSIONAL
LAND SURVEYOR

I:\SUR\02044601\0008\US75-C~1\SDATA\PAR-33.FNS

Exhibit "C"

County: Dallas
Highway: Interstate Highway No. 635
Project Limits From: Crim Drive
To: Pinyon Tree Road
CSJ: 2374-21-103
ACC: 9118-21-07

D-15-13
December 24, 1996

ACCESS CLAUSE FOR PARCEL 33

(To be inserted under last paragraph on page 1 of 3 on D-15-13)

the beginning of the fifteenth call and a point North 86 degrees 17 minutes 41 seconds East a distance of 32.136 meters [105.43 feet] from the beginning of the eighteenth call of the foregoing property description.

CITY OF DALLAS BLOCK 7749

CITY OF DALLAS BLOCK A/7749

CITY OF DALLAS BLOCK 7749

CITY OF DALLAS BLOCK 7325

U.S. 75

HWY MON

CIRS

½" IRF

CUT PART

HAMILTON PARK

M. J. SANCHES SURVEY
ABST. NO. 1272

N17° 40' 47"E
69.357m
(227.55')

N20° 32' 17"E
22.165m
(72.72')

N45° 09' 37"W
114.090m
(374.31')

N47° 17' 19"W
7.897m
(25.91')

N73° 39' 21"W
49.512m
(162.44')

N07° 59' 23"E
40.999m
(134.51')

DETAIL B

DETAIL A

N24° 14' 31"E
168.550m
(552.90')

N11° 57' 38"E
40.627m(133.29')

N40° 15' 41"E
137.243m(450.27')

N61° 26' 23"W
115.009m (377.36')

S61° 20' 14"E 365.374 (1198.73')

"X" CUT FND

S21° 58' 54"W
21.162m(69.43')

N62° 25' 04"W
55.108m(180.80')

S06° 14' 36"W
27.557m(90.41')

X" CUR FND

FND METAL FEN COR

CITY OF DALLAS BLOCK A/7624

CENTRAL 635 ADDITION
LOT 1
BLOCK A/7624

N82° 16' 43"E
42.617m (139.82')

N87° 17' 33"E
107.589m (352.98')

HWY MON BEARS
N85° 44' 53"E
2.52'

S05° 57' 08"W
69.851m (229.17')

S04° 47' 01"W
64.136m (210.42')

CLBJ. INC.
DEED
VOL. PG.
20.269 AC.
NO REMAINDER

CLBJ. INC.
DEED
VOL. PG.
21.210 AC.
NO REMAINDER

A. A. THOMAS SURVEY
ABST. NO. 1486

ALEXANDER A. THOMAS SURVEY
ABST. NO. 1486

F. W. DUNAWAY SURVEY
ABST. NO. 403

W. CARUTAL SURVEY
ABST. NO. 365

I. H. 635

WILLOWDELL DR.

N45° 44' 17"W 255.575m (838.50')

S21° 12' 43"W
127.416m
(418.03')

HERCULES DR.

TOWNS

FIELDS ESTATES ADDITION

½" IRF BEARS
S27° 33 51 W
2 04'

½" IRF BEARS
N25° 13 51'E
2 77

½" IRF BEARS
S03° 20 31 E
2 48

½" IRF

⅝" IRF BEARS
S66° 05' 19"E
1.42'

⅝" IRF

½" IRF BEARS
N15° 24 11 W
2 47'

S06° 01' 06"W
33.653m
(110.41')

S06° 00' 58"W
90.663m
(297.45')

S65° 35' 35"E
8.717m(28.60')

S08° 09' 23"W 167.171m (548.46')

SCHROEDER RD.

CAMPANELLA DR.

BUNCHE DR.

DALLAS POWER & LIGHT CO.

WANDA TAYLOR ADDITION
LOT 1, BLOCK A/7621

N62° 21' 17"W 147.158m(482.80')

R= 427.550m
(1402.72')
Δ= 15° 11' 37"
L= 113.377m
(371.97')
CH=113.044m
(370.88')
CH-B= S13° 36' 54"W

GRAPHIC SCALE
0' 50' 100 200'

DETAIL A
N. T. S.

N06° 38' 01"E
12.232m(40.13')

S64° 10' 23"E
33.915m
(111.27')

US 75
EXISTING RIGHT
OF WAY

DETAIL B
N. T. S.

N18° 22' 35"E
23.006m(75.48')

PART 1

PART 2

S73° 18' 06"E
33.467m(109.80')

30.693m
(100.70')
N73° 16' 23"W

26.484m
(86.89')
S73° 30' 23"E

N08° 37' 43"E
17.243m(56.57')

N19° 46' 10"E
1.320m(4.33')

FED. AID PROJ. NO.	STATE	FEDERAL AID PROJECT NO	HIGHWAY NO.
6	TEXAS		IH 635
STATE DISTRICT NO.	COUNTY	CONTROL NO. / SECTION NO. / JOB NO.	SHEET NO.
18	DALLAS	2374 / 01 / 103	7A

0118-21-07

Texas Department of Transportation

IH 635 Managed Lanes Project
Technical Provisions

Attachment 11-1A

Interstate Access Justification Report

INTERSTATE HIGHWAY (I) 635 (LBJ)

FROM: LUNA ROAD
TO: MERIT DRIVE
DALLAS COUNTY, TEXAS

ACCESS JUSTIFICATION

I 635 CORRIDOR WEST SECTION UPDATE

CSJ: 2374-07-046 & 2374-01-068

Texas Department of Transportation

LBJMP MOBILITY PARTNERS

January, 2007

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Reasonable Alternatives 1
Safety and Operation 2
Proposed Access 15
Consistency with Local and Regional Plans 15
Comprehensive Interstate Network 15
Coordination 15
Planning and Environmental Requirements 15
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Appendix B: NCTCOG Managed Lane Policy (September 2006)

INTERSTATE HIGHWAY I 635 (LBJ)
From LUNA ROAD to MERIT DRIVE
(DALLAS COUNTY, TEXAS)

ACCESS JUSTIFICATION
I 635 CORRIDOR WEST SECTION UPDATE

Introduction

The Interstate 635 (LBJ) Corridor is located in north Dallas County extending from SH121 to Interstate 20. The West Section Corridor extends from Luna Road, west of I 35E to Merit Drive, west of US 75. Municipalities located along this corridor include the cities of Dallas and Farmers Branch. The west section of I 635 was completed in the 1970's and the growth in population and employment resulted in a traffic demand that greatly exceeded predictions. The roadway is also in need of substantial rehabilitation.

The intent of this report is to address and update the eight requirements of the Federal Highway Administration (FHWA) for revised access points to the existing Interstate System. The original Interstate Access Justification (IAJ) Report for the west section is dated August 22, 2003 is attached as Appendix A. This report will address the changes in access to I 635 and analyze the impact to the highway based on the revisions to the previous schematic.

It should be noted that this is a highly congested corridor. The funding of the project depends on the traffic in the congested General Purpose Lanes diverting into the Managed Lanes and paying a Toll for this swifter more dependable trip. The revisions to the approved schematic (Exhibit 3 of Attachment A) are required to allow for a more cost effective construction solution for the corridor by allowing for a no tunnel option. This study will update the 2003 IAJ Report using the same assumptions for the modifications.

Existing Roadway Network

The Texas Department of Transportation (TxDOT), Dallas District, has produced a schematic design to improve traffic flow and safety for the west section of I 635. The existing General Purpose Lanes (4 in each direction) will be reconstructed. The temporary High Occupancy Vehicle (HOV) Lane (1 in each direction) at grade will be replaced with Managed HOV Lanes (3 in each direction) in a below grade section. The general purpose lanes operation will improve; but it will continue to operate at a low Level-of-Service (LOS). This schematic design is currently being updated to adjust several elements. The NEPA process for this project has been completed. The west corridor received the Finding of No Significant Impact (FONSI) on April 29, 2004. The West Section is being Re-Evaluated to accommodate revised limits of open cut, cut and cover, and mined construction methods. A public meeting to receive comments on these revisions was held on November 16, 2006.

The attached diagram (Exhibit 1) shows the revisions to the Ramps for the Managed HOV Lanes (ML), General Purpose (GP) Lanes, and Frontage Roads (FR).

Reasonable Alternatives

Currently, the I 635 west corridor contains a single temporary High Occupancy Vehicle (HOV) lane in each direction. The proposed managed lane improvements will replace the interim HOV lanes with three Managed HOV Lanes in each direction. Dynamic pricing will be used to influence the traffic demand in the Managed Lanes. Pricing will be adjusted to maintain free flow (50 mph) in the Managed Lanes. HOV vehicles will be given a price reduction in the peak periods. Public transportation providers traveling in the Managed HOV Lanes will not be required to pay a toll at any time. The General Purpose Lanes and Frontage Roads will allow for the traffic mix that exists in the current conditions.

Other mobility improvements are also being implemented in the I 635 corridor.

- Dallas County, Area Cities, and TxDOT are constructing intersection improvements, widening roadways, and implementing signal progression enhancements.
- Dallas Area Rapid Transit (DART) is implementing Employer Trip Reduction programs and other Transportation System Management programs.
- DART has also identified the need for a Transit Rail extension under the corridor between US 75 and the Dallas North Tollway.
- DART will also use the Managed HOV Lanes for an Express Bus Service.

The No-build alternative would not be acceptable to the community.

Safety and Operation

The proposed West Section schematic has the following configuration, which is consistent with the previous schematic that was approved:

- Continuous Frontage Roads;
- 8 General Purpose Lanes;
- 4 Managed HOV Lanes (2 in each direction) from Luna Road to I 35;
- 6 Managed HOV Lanes (3 in each direction) from I 35 E to east of Preston;
- 4 Managed HOV Lanes (2 in each direction) from east of Preston through the I 635/US 75 interchange.

The previously approved IAJ Report based on the original schematic for the West Section of the LBJ corridor can be found in Appendix A. The diagrammatic representation of the revised ramp configuration of the West Section is shown in Exhibit 1. The projected Average Daily Traffic (ADT) in the year 2020 and number of lanes in the West Section of the corridor is also shown in Exhibit 1. A similar diagrammatic representation of the existing conditions is shown in Appendix A (Exhibit 2).

The proposed access locations from Luna Road to Merit Drive. are summarized in the following table (Table 1) in reference to Exhibit 1. The table also illustrates the difference in the ramp configurations between the revised schematic, the original approved schematic and the existing conditions. As the table suggests, in the revised schematic configuration, the majority of the revisions to the previous schematic involve movement of ramps upstream or downstream by a few feet to a few hundred feet.

The revised schematic also calls for minor revisions to ramps along the I 35 E corridor just north of the I 635 / I 35E interchange.

Table 1: Existing, Original and Revised General Purpose Lane Access Locations [1,2]

Existing		Approved Schematic		Revised Schematic		Comment [3]
East Bound I 635 Traffic						
Ramp	Type	Ramp	Type	Ramp	Type	
		Fr EB GP to FR (Ramp W-E)	Off	Fr EB GP to FR (Ramp W-E)	Off	No Change
		Fr EB GP to ML (Ramp W-ML)	Off	Fr EB GP to ML (Ramp W-ML)	Off	No Change
Fr Luna to EB GP	On	Fr Luna to EB GP (Ramp L-E (1))	On	Fr Luna to EB GP (Ramp L-E (1))	On	No Change
		Fr Luna/FR to EB GP (Ramp L-E (2))	On	Fr Luna/FR to EB GP (Ramp L-E (2))	On	No Change
I 635 / I 35E Interchange						
Access Point on I 635		Access Point on I 635		Access Point on I 635		
Fr EB GP to NB I 35E	Off	Fr EB GP to DC (Conn W-N/S)	Off	Fr EB GP to DC (Conn W-N/S)	Off	No Change
Fr EB GP to SB I 35E	Off					
Fr SB I 35E to EB GP	On	Fr DC to EB GP (Conn N/S-E)	On	Fr DC to EB GP (Conn N/S-E)	On	Ramp moved +-90' to the West Insignificant Change
Fr NB I 35E to EB GP	On					
Fr WB GP to NB I 35E	Off	Fr WB GP to DC (Conn E-N/S)	Off	Fr WB GP to DC (Conn E-N/S)	Off	No Change
Fr WB GP to SB I 35E	Off					
Fr NB I 35E to WB GP	On	Fr DC to WB GP (Conn N/S –W)	On	Fr DC to WB GP (Conn N/S –W)	On	No Change
Fr SB I 35E to WB GP	On					
Access Point on I 35E						
Fr WB GP to SB I 35E	On	Fr EB/WB I 635 to SB I 35E (Conn E/W-S)	On	Fr EB/WB I 635 to SB I 35E (Conn E/W-S)	On	No Change
Fr EB GP to SB I 35E	On					
Fr NB I 35E to EB GP	Off	Fr NB I 35E to EB/WB I 635 (Conn S-E/W)	Off	Fr NB I 35E to EB/WB I 635 (Conn S-E/W)	Off	No Change
Fr NB I 35E to WB GP	Off					
Fr WB GP to NB I 35E	On	Fr EB/WB I 635 to NB I 35E (Conn E/W-N)	On	Fr EB/WB I 635 to NB I 35E (Conn E/W-N)	On	GP-Gore moved 300' to the South No impact on operation
Fr EB GP to NB I 35E	On					
Fr SB I 35E to EB GP	Off	Fr SB I 35E to EB/WB I 635 (Conn N-E/W)	Off	Fr SB I 35E to EB/WB I 635 (Conn N-E/W)	Off	No Change
Fr SB I 35E to WB GP	Off					

Existing		Approved Schematic		Revised Schematic		Comment (3)
East Bound I 635 Traffic (continued)						
Fr Anaheim to EB GP	On					
Fr EB GP to Josey	Off	Fr EB GP to Josey/Webb Chapel (Ramp W-J/WC)	Off	Fr EB GP to Josey/Webb Chapel (Ramp W-J/WC)	Off	GP Gore - Moved 1180' to East, FR Gore - Moved 820' East No impact on operation
Fr EB GP to Webb Chapel	Off					
Fr Josey/Webb Chapel to EB GP	On	Fr EB GP to Marsh (Ramp W-M)	Off	Fr EB GP to Marsh (Ramp W-M)	Off	GP Gore - Moved 460' to West, FR Gore- Moved 330' to West No impact on operation
		Fr EB ML to GP (Ramp ML-E(1))	On	Fr EB ML to GP (Ramp ML-E(1))	On	Ramp moved 8200' East Significant change, Reanalyzed for impact on operation[a]
Fr EB GP to Marsh	Off	Fr Josey/Webb Chapel to EB GP (Ramp J/WC-E)	On	Fr Josey/Webb Chapel to EB GP (Ramp J/WC-E)	On	GP Gore – Moved 20' to the West FR Gore – Moved 340' to the West No impact on operation
From Marsh to EB GP	On	Fr EB GP to Midway (Ramp W-MW)	Off	Fr EB GP to Midway (Ramp W-MW)	Off	GP Gore – Moved 1270' to the East FR Gore – Moved 1500' to the East Significant change, Analyzed as a weaving section with ramp M-E[b]
Fr EB GP to Midway	Off	Fr Marsh to EB GP (Ramp M-E)	On	Fr Marsh to EB GP (Ramp M-E)	On	GP Gore – Moved 3090' to the West FR Gore – Moved 3450' to the West Significant change, Analyzed as a weaving section with ramp W-MW[b]
From Midway to EB GP	On	Fr Midway to EB GP (Ramp MW-E)	On	Fr Midway to EB GP (Ramp MW-E)	On	GP Gore - No change FR Gore - Moved 160' to West No impact on operation
		Fr EB GP to FR (Ramp W-PKWY)	Off	Fr EB GP to FR (Ramp W-PKWY)	Off	GP Gore - Moved 30' to the East FR Gore - Moved 100' to the East No impact on operation
I 635/DNT Interchange						
Fr EB GP to SB DNT	Off	Fr EB GP to DC (Conn W-N/S DNT)	Off	Fr EB GP to DC (Conn W-N/S DNT)	Off	No Change
Fr EB GP to NB DNT	Off					
Fr SB DNT to EB GP	On	Fr SB DNT to EB GP (Ramp NDNT-E)	On	Fr SB DNT to EB GP (Ramp NDNT-E)	On	No Change
Fr NB DNT to EB GP	On	Fr NB DNT to EB GP (Conn SDNT-E)	On	Fr NB DNT to EB GP (Conn SDNT-E)	On	No Change
Fr WB GP to NB DNT	Off	Fr WB GP to NB DNT (Conn E-NDNT)	Off	Fr WB GP to NB DNT (Conn E-NDNT)	Off	No Change
Fr WB GP to SB DNT	Off	Fr WB GP to SB DNT (Conn E-SDNT)	Off	Fr WB GP to SB DNT (Conn E-SDNT)	Off	No Change
Fr NB DNT to WB GP	On	Fr NB DNT to WB GP (Conn SDNT-W)	On	Fr NB DNT to WB GP (Conn SDNT-W)	On	No Change

Existing		Approved Schematic		Revised Schematic		Comment [3]
Fr SB DNT to WB GP	On	Fr SB DNT to WB GP (Conn NDNT-W)	On	Fr SB DNT to WB GP (Conn NDNT-W)	On	No Change
East Bound I 635 Traffic (continued)						
Fr EB FR to EB GP	On					
Fr EB GP to Preston	Off	Fr EB GP to Preston (Ramp W-PR)	Off	Fr EB GP to Preston (Ramp W-PR)	Off	GP Gore - No Change FR Gore - Moved 230' to the East No impact on operation
Fr Montfort to EB GP	On					
Fr EB GP to Hillcrest	Off	Fr EB GP to Hillcrest (Ramp W-HC)	Off	Fr EB GP to Hillcrest (Ramp W-HC)	Off	GP Gore - No Change FR Gore – Moved +-10' to the East No impact on operation
		Fr EB ML to GP (Ramp ML-E(2))	On	Fr EB ML to GP (Ramp ML-E(2))	On	GP Gore - No Change ML Gore – Moved 270' to the East No impact on operation
Fr Preston to EB GP	On	Fr Preston to EB GP (Ramp PR-E)	On	Fr Preston to EB GP (Ramp PR-E)	On	GP Gore - No Change FR Gore – Moved 180' to the West No impact on operation
Fr Hillcrest to EB GP	On	Fr Hillcrest to EB GP (Ramp HC-E)	On	Fr Hillcrest to EB GP (Ramp HC-E)	On	
Fr EB GP to Coit	Off	Fr EB GP to Coit (Ramp W-CT)	Off	Fr EB GP to Coit (Ramp W-CT)	Off	No Change
West Bound I 635 Traffic						
Fr Coit to WB GP	On	Fr Coit to WB GP (Ramp CT-W)	On	Fr Coit to WB GP (Ramp CT-W)	On	No Change
Fr WB GP to Hillcrest	Off					
Fr WB GP to Preston	Off	Fr WB GP to Preston (Ramp E-PR)	Off	Fr WB GP to Preston (Ramp E-PR)	Off	GP Gore - Moved 70' to the West FR Gore - No Change No impact on operation
		Fr WB GP to ML (Ramp E-ML)	Off	Fr WB GP to ML (Ramp E-ML(1))	Off	GP Gore – No Change FR Gore - Moved 300' to the West No impact on operation
From Hillcrest to WB GP	On	Fr Hillcrest to WB GP (Ramp HC-W)	On	Fr Hillcrest to WB GP (Ramp HC-W)	On	No Change
WB Fr WB GP to Montfort	Off					
Fr Preston to WB GP	On	Fr Preston to WB GP (Ramp PR-W)	On	Fr Preston to WB GP (Ramp PR-W)	On	GP Gore – No Change FR Gore - Moved 70' to the East No impact on operation
Fr WB GP to FR	Off	Fr WB GP to FR (Conn E-PKWY)	Off	Fr WB GP to FR (Conn E-PKWY)	Off	GP Gore - Moved 40' to the West FR Gore - No Change No impact on operation
Fr WB GP to Midway	Off	Fr WB GP to Midway (Ramp E-MW)	Off	Fr WB GP to Midway (Ramp E-MW)	Off	GP Gore – No Change FR Gore - Moved 90' to the East No impact on operation

Existing		Approved Schematic		Revised Schematic		Comment [3]
Fr Midway to WB GP	On	Fr WB GP to Marsh (Ramp E-M)	Off	Fr WB GP to Marsh (Ramp E-M)	Off	GP Gore – No Change FR Gore - Moved 210' to the East No impact on operation
		Fr WB ML to GP (Ramp ML-W (1))	On			Ramp modified to WB ML to FR, No impact on GP[c]
				Fr WB GP to ML (Ramp E-ML(2))	Off	Ramp analysis performed based on the new location[d]
Fr WB GP to Marsh	Off	Fr Midway to WB GP (Ramp MW-W)	On	Fr Midway to WB GP (Ramp MW-W)	On	GP Gore – Moved 460' to the East FR Gore – Moved 820' to the East No impact on operation
Fr WB GP to Josey/ Webb Chapel	Off	Fr WB GP to Josey/Webb Chapel (Ramp E-J/WC)	Off	Fr WB GP to Josey/Webb Chapel (Ramp E-J/WC)	Off	GP Gore – No Change FR Gore - Moved 120' to the West No impact on operation
Fr Marsh to WB GP	On	Fr Marsh to WB GP (Ramp M-W)	On	Fr Marsh to WB GP (Ramp M-W)	On	Ramp moved +-40' No impact on operation
Fr Webb Chapel to WB GP	On	Fr Josey/Webb Chapel to WB GP(Ramp J/WC-W)	On	Fr Josey/Webb Chapel to WB GP(Ramp J/WC-W)	On	
Fr Josey to WB GP	On					
Fr WB GP to Luna	Off					
		Fr WB GP to FR/Luna (Ramp E-L(2))	Off	Fr WB GP to FR/Luna (Ramp E-L(2))	Off	No Change
Fr WB GP to Luna	Off	Fr WB GP to Luna (Ramp E-L(1))	Off	Fr WB GP to Luna (Ramp E-L(1))	Off	No Change
		Fr ML to WB GP (Ramp ML-W(2))	On	Fr ML to WB GP (Ramp ML-W(2))	On	No Change
		Fr WB FR to WB GP (Ramp E-W)	On	Fr WB FR to WB GP (Ramp E-W)	On	No Change
Access Point on I 35E						
				Fr Frontage Road to NB I 35E (Ramp FR-N)	On	This ramp provides access from the frontage road to NB I 35E for traffic south of Valley View Lane in addition to the existing on ramp from Valley View Lane. This replaces ramp FR to existing WB/NB DC for Harry Hines [e]. Analyzed as a weaving section with Ramp S-VW.
Fr NB I 35E GP to Valwood Pkwy (Ramp S-VW)	Off	Fr NB I 35E GP to Valwood Pkwy (Ramp S-VW)	Off	Fr NB I 35E GP to Valwood Pkwy (Ramp S-VW)	Off	FR Gore – Moves 570 ' to the North GP Gore - Moves 990 ' to the South Analyzed as a weaving section with Ramp FR-N
Fr Valley View Lane to NB I 35E GP (Ramp VV-N)	On	Fr Valley View Lane to NB I 35E GP (Ramp VV-N)	On	Fr Valley View Lane to NB I 35E GP (Ramp VV-N)	On	FR Gore – Moves 780 ' to the North GP Gore - Moves 50 ' to the South No impact on operation

Notes for Table 1:

(1) Abbreviations:
The following abbreviations apply to the whole document.
Fr: From
EB: Eastbound
WB: Westbound
NB: Northbound
SB: Southbound
PKWY: Parkway
DNT: Dallas North Tollway
GP: General Purpose Lanes
ML: Managed HOV Lanes
FR: Frontage Roads

(2) Ramp name convention:
For off-ramp, the first letter shows "from" what direction (West, East, South or North) and the second letter denotes "to" which cross street. For example, ramp W-MW indicates the ("from" west) EB off-ramp "to" Midway Road. For on-ramp, the first letter shows "from" which cross street and the second letter denotes "to" what direction. For example, ramp MW-E indicates "from" Midway
Road "to" east (EB general purpose lanes). See Exhibit 1 and 2 for Ramp names.

(3) The 'Comments' column summarizes changes in the ramp access location in the Revised Schematic in relation to the Original Schematic

The major changes in the schematic, identified in the table above with letter notes are summarized below:

[a] The EB on ramp from the Managed HOV Lanes to the General Purpose Lane (W-ML(1)) east of the I 35E interchange has been moved downstream by 8200 ft in the revised schematic. The merge was analyzed based on the new schematic configuration.

[b] The eastbound off ramp to Midway (W-MW) and the eastbound on ramp from Marsh (M-E) have been reversed from the approved schematic. This configuration is consistent with the existing conditions. However, in the existing condition the distance between the on-ramp and the off-ramp is approximately 3000 ft (higher than the threshold of 2500 ft prescribed by HCM for a weaving section to be analyzed), the distance is only approximately 1350 ft in the revised schematic. Therefore, this section was analyzed for weaving condition.

[c] The westbound on ramp from the Managed HOV Lanes to the General Purpose Lanes (ML-W(1)), west of the off ramp to Midway (E-MW) in the approved schematic, has been eliminated. The traffic from the Managed HOV Lane, in the revised schematic will now exit to the frontage road directly. Therefore, this ramp does not have to be analyzed for the new schematic.

[d] Based on the old schematic, access was provided to the Managed HOV Lanes from the frontage road in the westbound direction from Midway. This ramp has been eliminated. In the revised schematic, access is provided to the Managed HOV Lane from the General Purpose Lanes. This ramp was analyzed for operational characteristics.

[e] In the revised schematic a new on ramp from the frontage road to northbound I 35E (FR-N) is added just south of Valley View Lane. This ramp provides additional access to northbound I 35E on top of the existing on ramp from Valley View Lane.

The traffic volumes were modified based on the revised schematic. But, the basic distribution of traffic across various ramps was kept consistent with the 2003 IAJ report. Based on this methodology, revised volumes were estimated on the General Purpose Lanes and reconfigured ramps.

Eastbound traffic: Due to the reconfiguration of the on ramp from the Managed HOV Lanes to the General Purpose Lanes (ML-E(1)), the volume on the General Purpose Lanes was estimated to increase by a small amount between the beginning of the Managed HOV Lanes west of I 35E interchange and to the relocated on ramp from the Managed HOV Lanes. Analysis was performed at all the ramp merge and diverge locations based on the revised volumes.

Westbound traffic: Using the methodology described above, the westbound traffic was determined for the revised schematic. It was found that the General Purpose Lane volumes will not change except at the locations where ramp gores have significantly moved or the functionality of a ramp has changed.

The projected year 2020 average daily traffic volumes on I 635 General Purpose Lanes, Managed Lanes and ramps are from TxDOT's Transportation Planning and Programming (TP&P) Division are shown in Exhibit 1. The projected average daily traffic volumes have been converted to the peak hour traffic volume by applying a "K" factor to it. A K-Factor of 0.08 was used for this study. The 2003 IAJ report on the I 635 corridor have indicated a K-factor of 0.078 (refer to Appendix A).
The I 635 corridor is located in a highly urbanized area and is the major east-west thoroughfare serving the North Dallas Metropolitan Area. In highly urbanized areas, the peak hour is spread out to most of the day. Therefore, heavy traffic is not restricted to one "peak hour", but rather for a longer "peak period". Past studies have indicated a K-factor of around 0.06 for the peak period (refer to 'Operational Analysis' section of Appendix A) which represents around a 15-hour period in a day.

In the previous study, the operational analysis was first performed using a K-Factor of 0.08, which represents the absolute worst case hour of the day. At locations where there is a breakdown (LOS=F) during the "peak hour", further analysis was performed for the "peak period" using a K-Factor of 0.06 as an alternative analysis. And if the traffic will continue to show failure, then the 2020 traffic numbers developed by the 'LBJ Traffic & Revenue Study' were applied to the level of service check calculation and capacity check. This same methodology was used in the 2003 report.

For weaving analysis, the assumptions made in the 2003 IAJ report have been adopted for this study too. It is assumed that a small volume of traffic would take the on ramp followed by off ramp (ramp to ramp weaving traffic). This percentage is assumed to be half the percentage of exiting traffic in the weaving area. Since HCM procedures are specified for only a maximum of five lane weaving sections, for six-lane weaving (5 upstream lanes plus 1 auxiliary lane) scenarios a factor of 4/5 was applied to the General Purpose Lanes upstream of the weaving segment to reduce the volume to the equivalent of a five-lane section in the weaving area.

In the original study, the ingress and egress locations were classified into 3 categories (See Appendix A, Pg.8).

- Category 1: Ramps that provide access to the General Purpose Lane (including General Purpose Lane/Managed Lane access) that do not exist today. Table 2 lists all the ramps that belong to this category based on the original schematic and the revised schematic.
- Category 2: Access at reconfigured interchanges. The I 635/I 35E and I 635/DNT interchanges fall into this category. The ramps that belong to Category 2 can be found in Appendix A (Table 3, Pg. 8). The configuration of these ramps does not change in the revised schematic.
- Category 3: Eliminated or reversed ramp access. In the revised analysis, this category will include ramps whose gores have moved significantly to warrant further analysis. Table 3 lists the ramps in this category.

Table 2: Category 1 – Added Ramps

Ramps		Notes
Revised Schematic	Original Schematic	
1. EB W-E	1. EB W-E	GP/FR Access
2. EB L-E (2)	2. EB L-E (2)	GP/FR Access
3. EB W-PKWY	3. EB W-PKWY	GP/FR Access
4. WB E-L(2)	4. EB E-L(2)	GP/FR Access
5. WB E-W	5. EB E-W	GP/FR Access
6. EB W-ML	6. EB W-ML	GP/ML Access
7. EB ML-E(1)	7. EB ML-E(1)	GP/ML Access
8. EB ML-E(2)	8. EB ML-E(2)	GP/ML Access
9. WB E-ML(1)	9. WB E-ML	GP/ML Access
10. WB E-ML(2)	10. WB ML-W(1)	GP/ML Access
11. WB ML-W(1)	11. WB ML-W(2)	GP/ML Access

Table 3: Category 3 – Eliminated/Revised Ramps

Ramps		Notes[1]
Revised Schematic	Original Schematic	
1. EB from Anaheim to GP	1. EB from Anaheim to GP	No change
2. EB from GP to Webb Chapel	2. EB from GP to Webb Chapel	No change
3. EB from Montfort to GP	3. EB from Montfort to GP	No change
4. WB from GP to Hillcrest	4. WB from GP to Hillcrest	No change
5. WB from GP to Montfort	5. WB from GP to Montfort	No change
6. WB from Webb Chapel to GP	6. WB from Webb Chapel to GP	No change
7. WB from GP to FR	7. WB from GP to FR	No change
8a. EB W-M	8a. EB W-M	No change
8b. EB J/WC-E	8b. EB J/WC-E	
9a. EB M-E	9a. EB W-MW	Pair reversed order (on-ramp followed by off-ramp) Consistent with existing configuration.
9b. EB W-MW	9b. EB M-E	
10. WB E-M	10. WB E-M	No change
11. WB MW-W	11. WB MW-W	

[1] Summarizes the change in the revised schematic in relation to the original schematic. Details of the change in comparison to the existing configuration can be found in Appendix A (Table 4, Pg.9).

Operational Analysis

Category 1: The operation analyses of General Purpose Lanes that are affected because of the revised schematic configuration have been performed in accordance with the procedures outlined in the 2000 Highway Capacity Manual (HCM), using Highway Capacity Software (HCS). The level of service of Category 1 ramps are shown in Table 4. The freeway analysis evaluates the LOS of freeway segments due to the addition of traffic volume by proposed access ramps. The operational LOS of ramp-freeway junctions was studied in the ramp analysis. The weaving analysis considers the weaving operation between proposed on ramps followed by off ramps.

Table 4: Category 1 – Added Ramps LOS

Ramp	Level of Service			Notes
	Freeway	Weaving	Ramp	
W-E	Appendix A			-
L-E (2)	C	No Weaving	B	The operation of this ramp is not affected adversely because of the revised schematic design.
W-PKWY	Appendix A			-
E-L(2)	Appendix A			-
E-W	Appendix A			-
W-ML	D	No Weaving	F E[I]	The operation of this ramp is not affected adversely due to the revised schematic.
ML-E(1)	F E[II]	No Weaving	F C[II]	
ML -E(2)	Appendix A			-
E- ML	Appendix A			-
ML -W(1)	Ramp access to Frontage from ML	Ramp access to Frontage from ML	Ramp access to Frontage from ML	Ramp access to Frontage from ML
ML -W(2)	Appendix A			-
E- ML(2) [III]	F D[III]	No Weaving	F D[III]	This is a modified ramp that provides access to the ML from the General Purpose Lane. This ramp previously provided access from the Frontage Road to the ML.

[I] By using the 2020 Traffic & Revenue Study traffic volume and applying the "peak period" K-Factor of 0.06, the LOS of the ramp diverge condition will improve.

[II] The peak hour LOS=F is because of insufficient capacity on 4 General Purpose Lanes to handle the 2020 peak hour flow of 12,496vph that is converted from the 156,200vpd by a factor of K=0.08. But, by using the 2020 Traffic & Revenue Study traffic number and applying the "peak period" K-Factor of 0.06, the LOS will improve.

Notes for table 4 continued:
[III] This is a reconfigured ramp. In the original schematic, the ramp provided connection from the Frontage Road to the Managed HOV Lanes. In the revised schematic the ramp connects the General Purpose Lane to the Managed HOV Lane. The peak hour LOS=F is because of insufficient capacity of 4 General Purpose Lanes for the 2020 peak hour flow of 9,248vph that was converted from the 115,600vpd by a factor of K=0.08. But, by using the 2020 Traffic & Revenue Study traffic number and applying the "peak period" K-Factor of 0.06, the LOS will improve to "D".

Category 2: The level of service of Category 2 ramps are shown in Table 5. The revised schematic is consistent with the configuration of the I 635/I 35E interchange and the I 635/DNT interchange in the original schematic. There is insignificant movement of some of the ramp locations (Table 1). The projected volume on I 635 General Purpose Lanes at certain locations have changed due to the reconfiguration of ramp access at other locations. New analyses at affected General Purpose Lanes, taking the revised volumes into account, are summarized in Table 5. Table 5 shows that the proposed changes to the schematic have minimal to no impact on Category 2 ramps.

Table 5: Category 2 – Reconfigured Ramps LOS

Revised Schematic	Original Schematic	Notes
I 635/I 35 Interchange		
1. Conn W-N/S a) Weaving with ramp L-E(1) Major Diverge Area 88900vpd x 0.08 = 7112vph 7112vph/ (PHF0.9xFhv0.96) =8231 pc/h Average Density D = 0.0109 x 8231/6 = 14.9 Eq. 25-12 LOS = B Exhibit (25-4) Depart leg-4 LN Freeway 53400vpd x 0.08 = 4272vph 4272vph/ (PHF0.90xFhv0.96) =4944 pc/h < 9000 pc/h from Exhibit 25-14 b) Consolidated one exit point	Refer to Appendix A (Page 14)	The LOS does not change from the previous Study
2. Conn N/S-E a) Major Merge Area Approach leg-3 LN Freeway 46400vpd x 0.08 = 3712vph 3712vph/ (PHF0.90xFhv0.96) =4296 pc/h < 6750 pc/h from Exhibit 25-7 Approach Leg-3 LN Conn b) Same as Original Schematic Consolidated one exit point	Refer to Appendix A (Page 15)	Operation of the ramp is not affected by the changes.

3. Conn E-N/S Same as Original Schematic	Refer to Appendix A (Page 15)	--
4. Conn N/S-W Same as Original Schematic	Refer to Appendix A (Page 16)	--
5. Conn S-E/W Same as Original Schematic	Refer to Appendix A (Page 16)	--
6. Conn E/W-N Same as Original Schematic	Refer to Appendix A (Page 17)	--
7. Conn N-E/W Same as Original Schematic	Refer to Appendix A (Page 17)	--
8. Conn E/W-N Same as Original Schematic	Refer to Appendix A (Page 18)	--
Revised Schematic	**Original Schematic**	**Notes**
I 635/DNT Interchange		
1. Conn W-N/S DNT Same as Original Schematic	Refer to Appendix A (Page 19)	--
2. Conn NDNT-E Same as Original Schematic	Refer to Appendix A (Page 19)	--
3. Conn SDNT-E Same as Original Schematic	Refer to Appendix A (Page 19)	--
4. Conn E-NDNT Same as Original Schematic	Refer to Appendix A (Page 19)	--
5. Conn E-SDNT Same as Original Schematic	Refer to Appendix A (Page 19)	--
6. Conn SDNT-W Same as Original Schematic	Refer to Appendix A (Page 20)	--
7. Conn NDNT-W Same as Original Schematic	Refer to Appendix A (Page 20)	--

Category 3: The revised schematic maintains the functionality of most of the ramps in the original schematic. In addition the changes that have been addressed in the previous sections, two other major changes include the following: a).The eastbound off ramp to Midway (W-MW) and the eastbound on ramp from Marsh (M-E) are reversed. This will result in the new configuration being consistent with the existing configuration. The distance between the ramps is 1350 ft and falls within the 2500 ft threshold distance for weaving analysis as prescribed by HCM. In the 2003 IAJ report, weaving analysis was conducted for the section between the on ramp from Josey Lane/Webb Chapel (J/WC-E)

and the off ramp to Midway Road (W-MW). The Ramp reversal eliminated the weaving section that occurred in the original schematic as can be seen from Exhibit 1. b) The distance of the weaving section between the WB on ramp from Midway (MW-W) and WB off ramp to Josey/Webb Chapel increases from 2200 ft to 2600 ft (approx.).
The results of the analysis for the above conditions are shown below in Table 6. The original analysis still applies for the other ramps and details of those analyses can be found in Appendix A (Pg. 22-23).

Table 6: Category 3 – Eliminated/Reversed/Modified Ramps LOS

Revised Schematic	Original Schematic	Notes
8a and 8b. EB off-ramp to Marsh (Ramp W-M) followed by EB on-ramp from Webb Chapel (Ramp J/WC-E). No weaving between J/WC-E and W-MW.	8a and 8b. EB off-ramp to Marsh (Ramp W-M) followed by EB on-ramp from Webb Chapel (Ramp J/WC-E). Weaving between J/WC-E and W-MW.	No analysis required for the new configuration since there is no weaving section.
9a and 9b. EB on-ramp from Marsh (Ramp M-E) followed by EB off-ramp to Midway (W-MW). Weaving Analysis LOS = F (E^{l})	9a and 9b. Reversed ramps EB off-ramp to Midway (Ramp W-MW) followed by EB on-ramp from Marsh (Ramp M-E)	Weaving between M-E and W-MW with a weaving distance of 1350 ft.
10a and 10b. Reversed ramps WB off-ramp to Marsh (Ramp E-M) followed by WB on-ramp from Midway (Ramp MW-W). Weaving between WB on-ramp from Midway (MW-W) and WB off-ramp to Josey/Webb Chapel (E-J/WC).	10a and 10b. Reversed ramps WB off-ramp to Marsh (Ramp E-M) followed by WB on-ramp from Midway (Ramp MW-W). Weaving between WB on-ramp from Midway (MW-W) and WB off-ramp to Josey/Webb Chapel (E-J/WC).	The weaving distance between the ingress/egress ramps is 2650 ft in the revised schematic compared to 2200 ft in the original schematic. 2500 ft is the maximum distance for which weaving analysis needs to be conducted according to the HCM. Therefore, no analysis was considered necessary for the operation between the ramps in the revised schematic.

[l] By using the 2020 Traffic & Revenue Study traffic volume, applying the "peak period" K-Factor of 0.06 and Peak Hour Factor of 0.95 the LOS of the weaving operation will improve to acceptable condition.

I 35 E

A new on ramp from the Frontage Road to northbound I 35E General Purpose Lanes is added in the revised schematic. This ramp forms a weaving segment with the off ramp to Valwood Parkway (Ramp S-VW). Therefore, it was analyzed for weaving operation and freeway capacity. The results are shown in Table 7.

Table 7: Ramp analysis for I 35E - LOS

Ramp	Level of Service			Notes
	Freeway	Weaving	Ramp	
FR-N	D	E	-	This ramp was analyzed for weaving operation with Ramp S-VW. This is a five lane weaving segment of 2010 ft length.

Proposed Access

The proposed design provides for traffic movement onto corridor and connects only with public roadways and the frontage road system. The proposed access additions are required to support the Managed HOV Lane system, tolling of the managed lanes and the rebuilding of the Interstate System as part of this project. A continuous frontage road system will increase capacity and improve mobility.

Consistency with Local and Regional Land Use

A Major Investment Study (MIS) was completed for the entire corridor in 1996. The Metropolitan Planning Organization (MPO) for this region is the North Central Texas Council of Governments (NCTCOG). This proposal considered and is consistent with local and regional land use and transportation plans. The revised corridor is also consistent with the policies and goals set forth by the North Central Texas Council of Governments in the Mobility 2025 Plan. The proposal is also consistent with NCTCOG 2030 plan adopted January 2007. The NCTCOG approved a Managed Lane policy on Sept. 14, 2006 specifically for this corridor (see Appendix B).

The City of Dallas Bond Plan and DART programs include funding and support of this project.

Comprehensive Interstate Network

This project will reconstruct the Interstate and Frontage Road network in the process of constructing the Managed HOV Lanes to create a seamless roadway network.

Coordination

This request is not generated by new or expanded development. This request is being generated by the Texas Department of Transportation's intent to reconstruct and improve the efficiency and safety of the corridor. The additional Managed HOV Lanes are also critical to maintain the capacity required in the corridor.

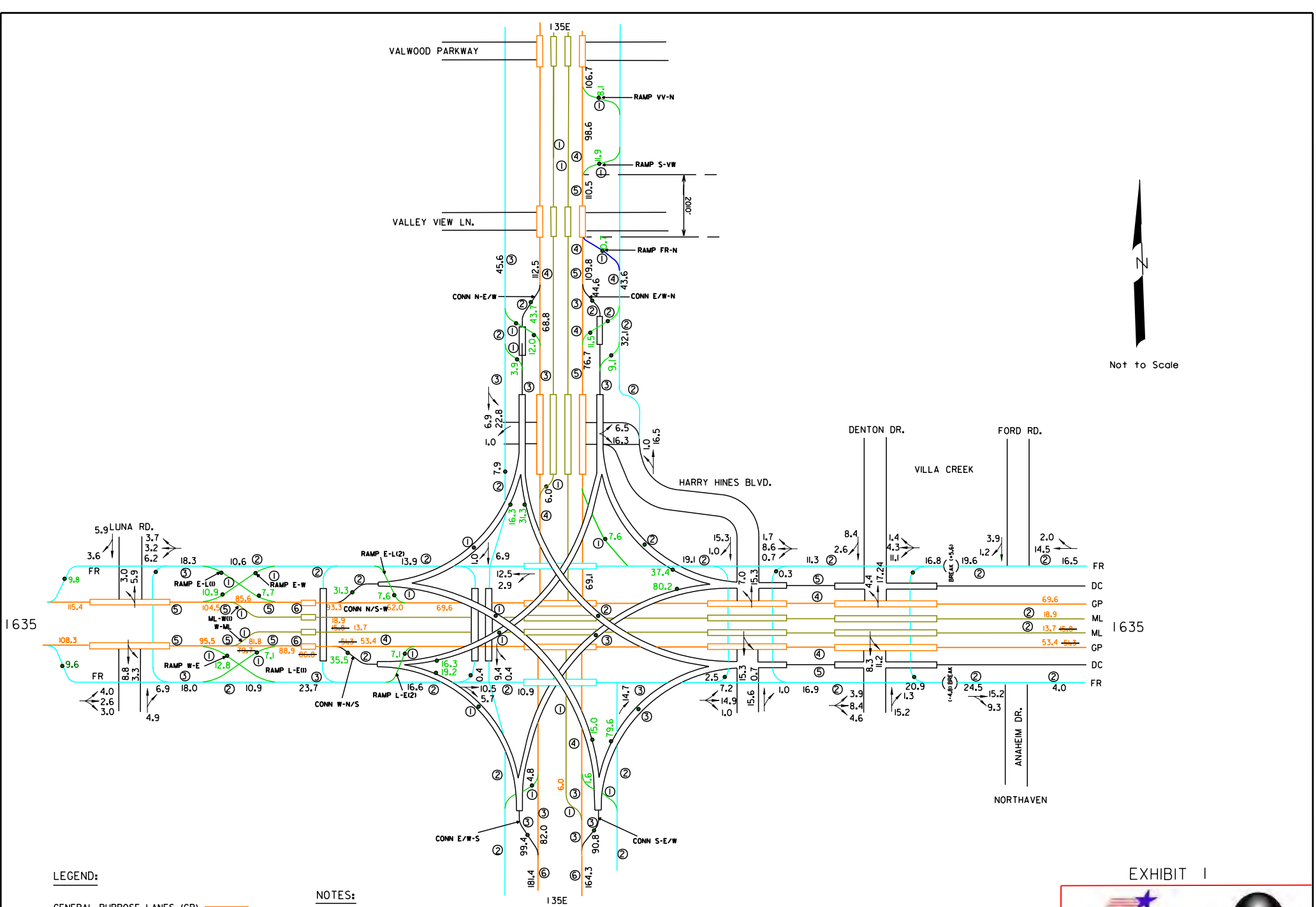
Planning and Environmental Requirements

The FONSI Re-Evaluation process for this project is being conducted and the revised design schematic is currently under review by the Austin office of TxDOT.

Conclusions

The North Dallas Metropolitan Area will benefit from the additional capacity the Managed HOV Lanes provide for the I 635 area. The additional access is required to rebuild the Interstate System and add the Managed HOV Lanes. This improvement will provide for congestion relief on the existing main lanes. The Managed HOV Lanes will provide for a dependable time saving trip for those willing to use them. Those remaining in the

General Purpose Lanes they will benefit from reduced congestion compared to the current conditions, however some congestion must remain for the Managed HOV Lanes to be economically viable. The revisions to the project will provide for a more cost effective solution to the rebuilding of the corridor.



LEGEND:

- GENERAL PURPOSE LANES (GP)
- MANAGED HOV LANES (ML)
- FRONTAGE ROADS (FR)
- BYPASS FRONTAGE ROADS
- RAMPS
- DIRECT CONNECT RAMPS (DC)
- ELIMINATED/RELOCATED RAMPS
- REVISED RAMP LOCATION

NOTES:

1. CROSS STREET ARE SHOWN PERPENDICULAR
2. MANAGED LANES ARE DIAGRAMMATICALLY LOCATED FOR ACCESS/ EGRESS PURPOSES
3. TRAFFIC NUMBER (ADT) = *1000
4. ⓝ NUMBER OF LANES
5. XXX.X ORIGINAL VOLUME (LATER REVISED)
6. XXX.X REVISED VOLUME
7. FOR RAMP NAMES REFER TO REPORT

EXHIBIT I

2020 DAILY TRAFFIC PROJECTIONS
TP&P PROJECTIONS
SHEET I OF 4

I 635 (LBJ) CORRIDOR WEST SECTION

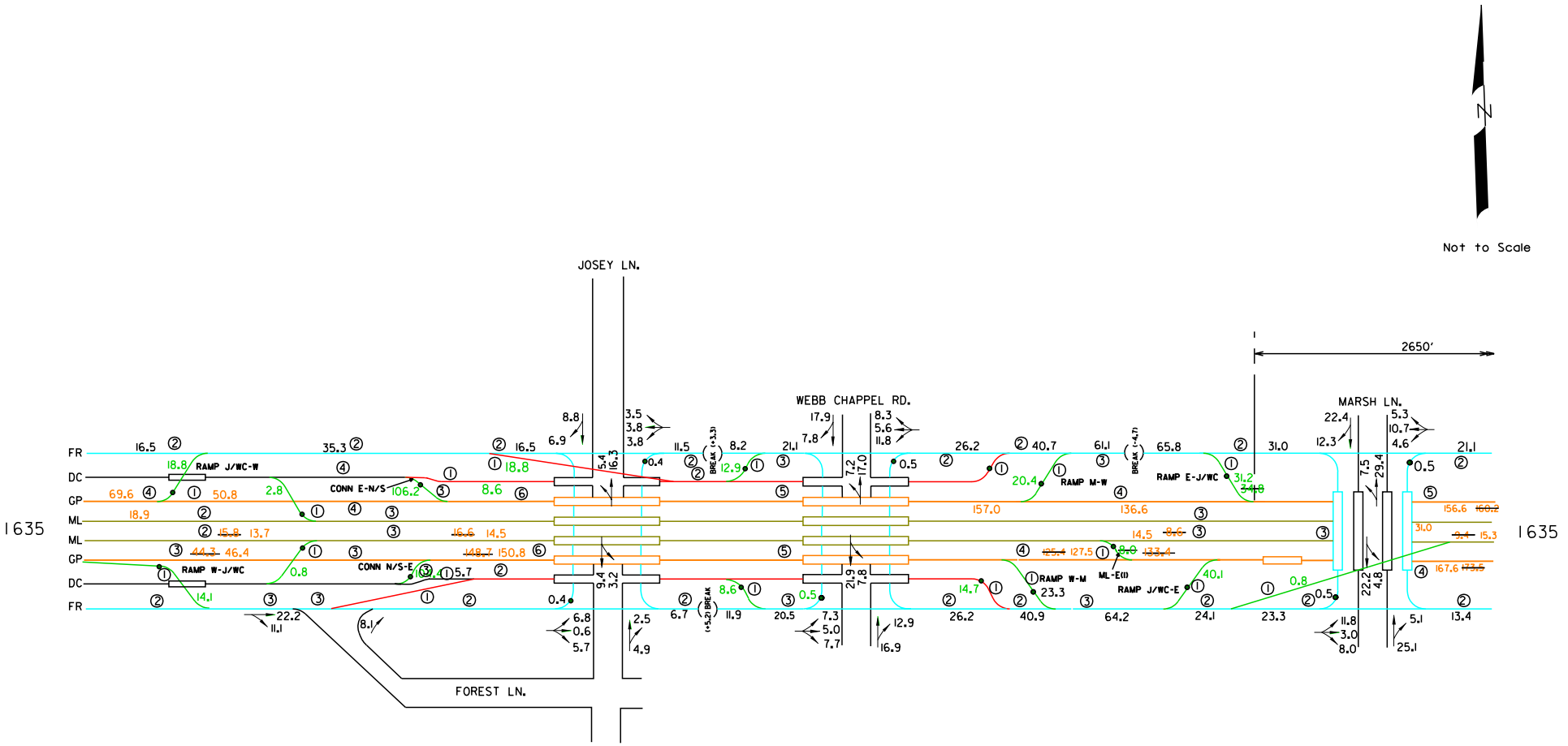


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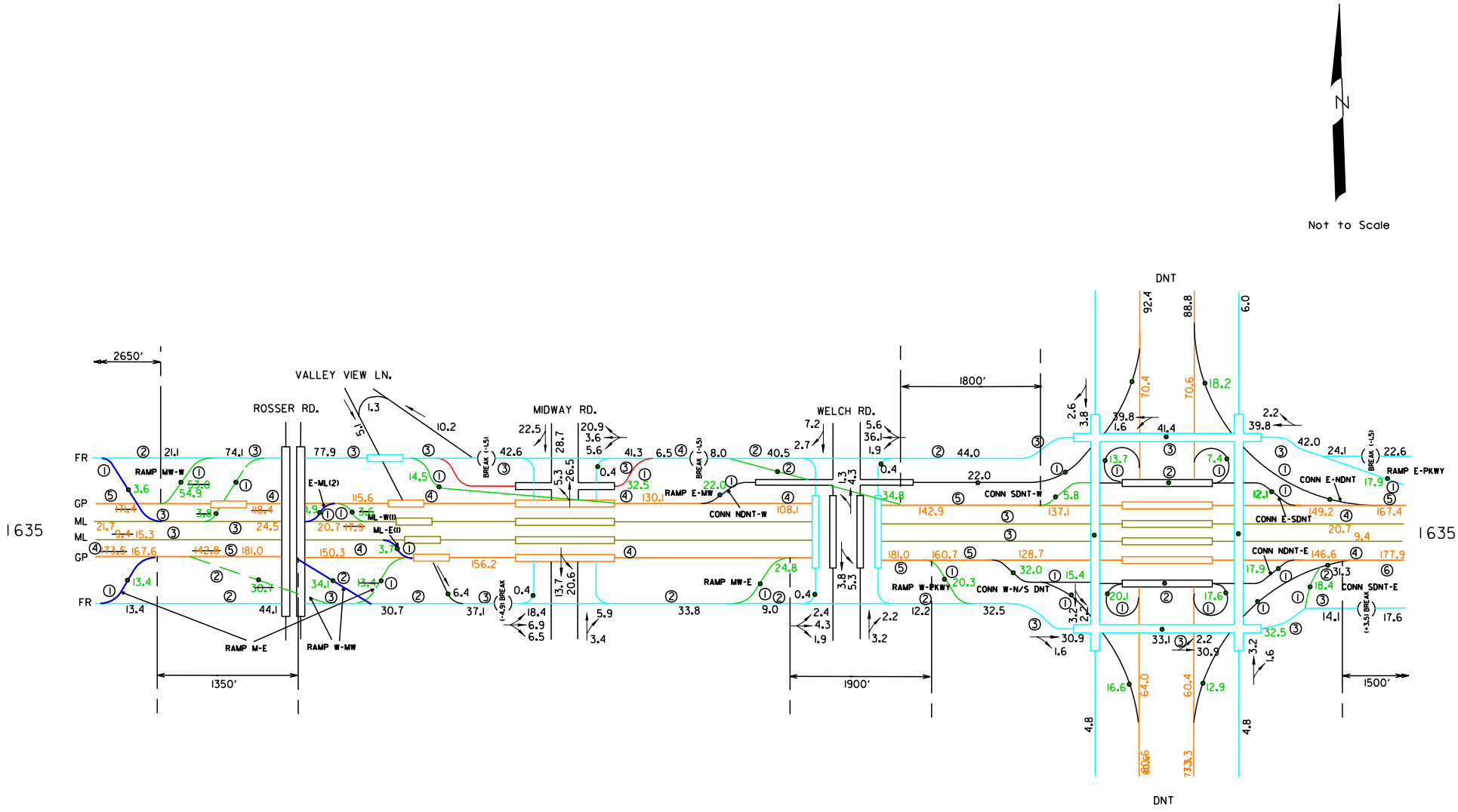
EXHIBIT 1

2020 DAILY TRAFFIC PROJECTIONS
TP&P PROJECTIONS
SHEET 2 OF 4

1635 (LBJ) CORRIDOR WEST SECTION



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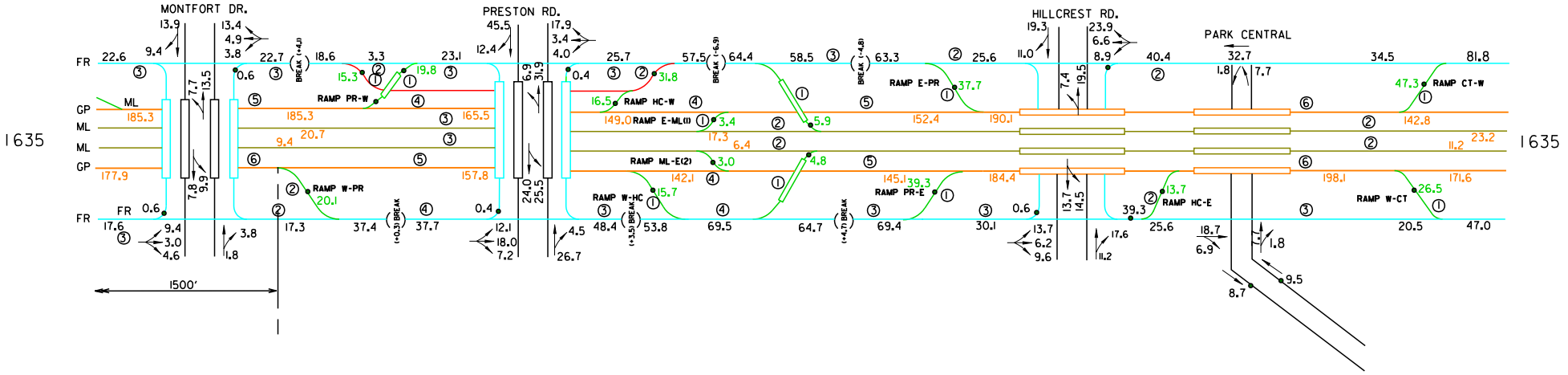
2020 DAILY TRAFFIC PROJECTIONS
TP&P PROJECTIONS
SHEET 3 OF 4

1635 (LBJ) CORRIDOR WEST SECTION



Not to Scale

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2020 DAILY TRAFFIC PROJECTIONS
TP&P PROJECTIONS
SHEET 4 OF 4

I635 (LBJ) CORRIDOR WEST SECTION

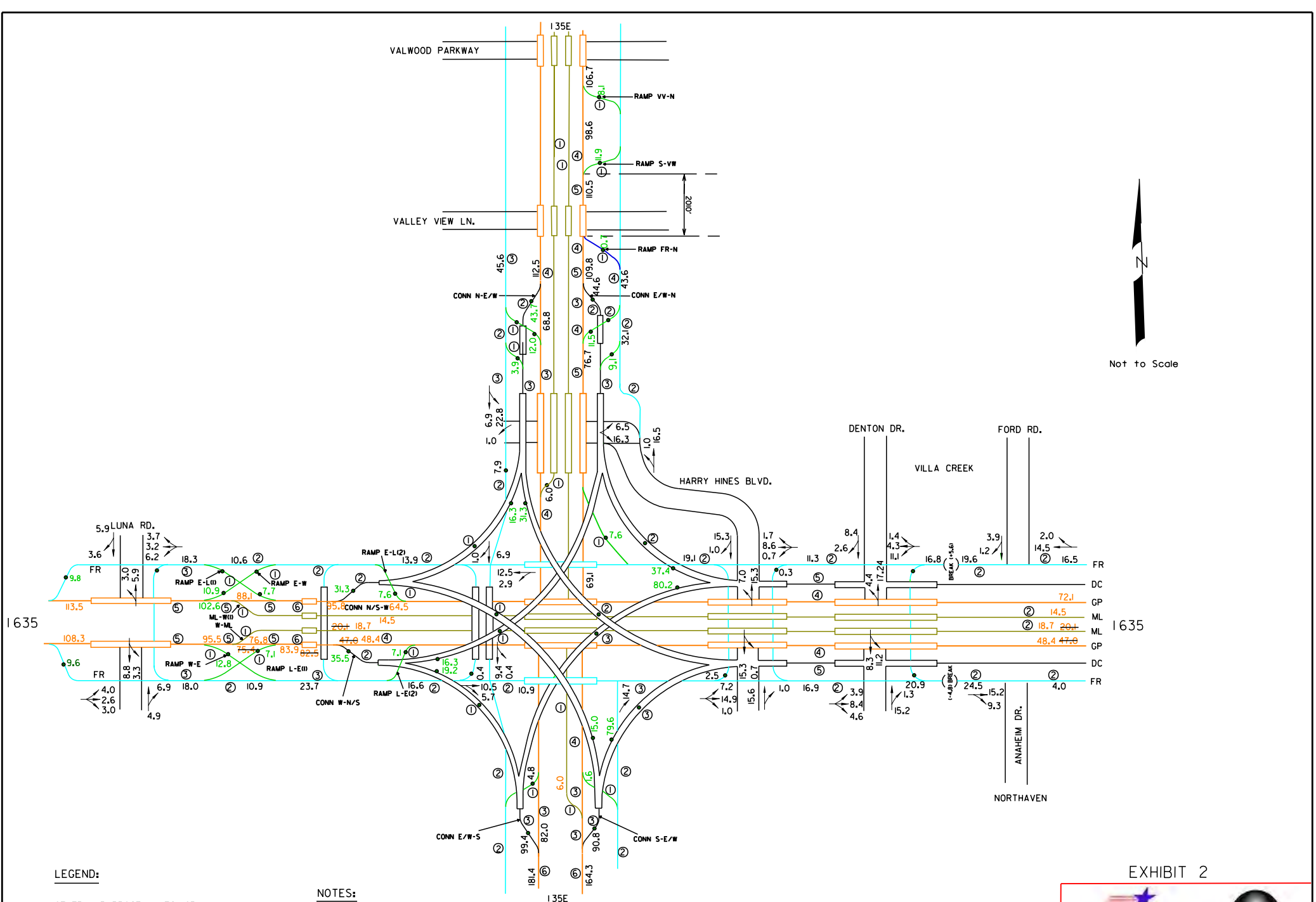

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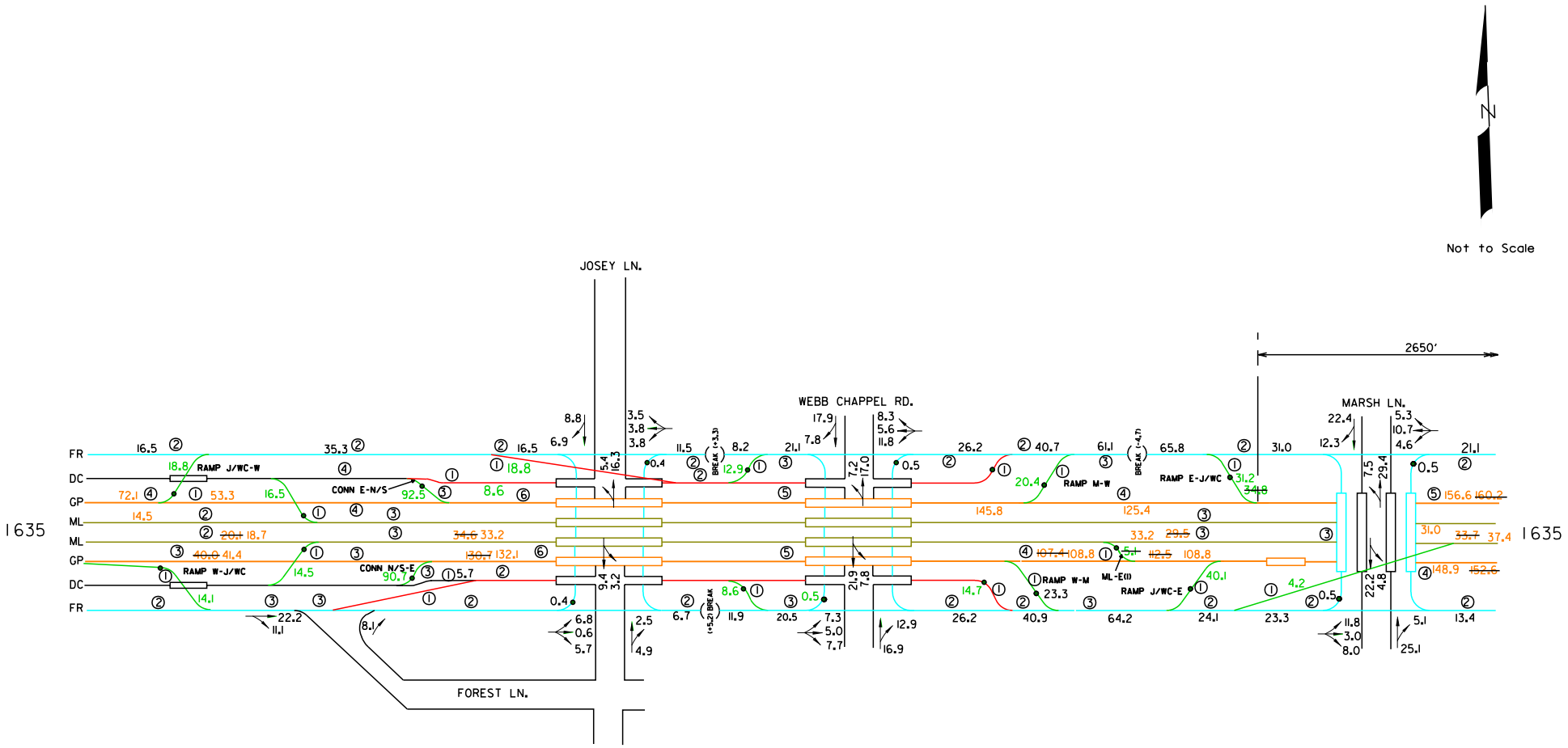
EXHIBIT 2

2020 DAILY TRAFFIC PROJECTIONS
TRAFFIC AND REVENUE STUDY-WSA
SHEET 1 OF 4

I635 (LBJ) CORRIDOR WEST SECTION



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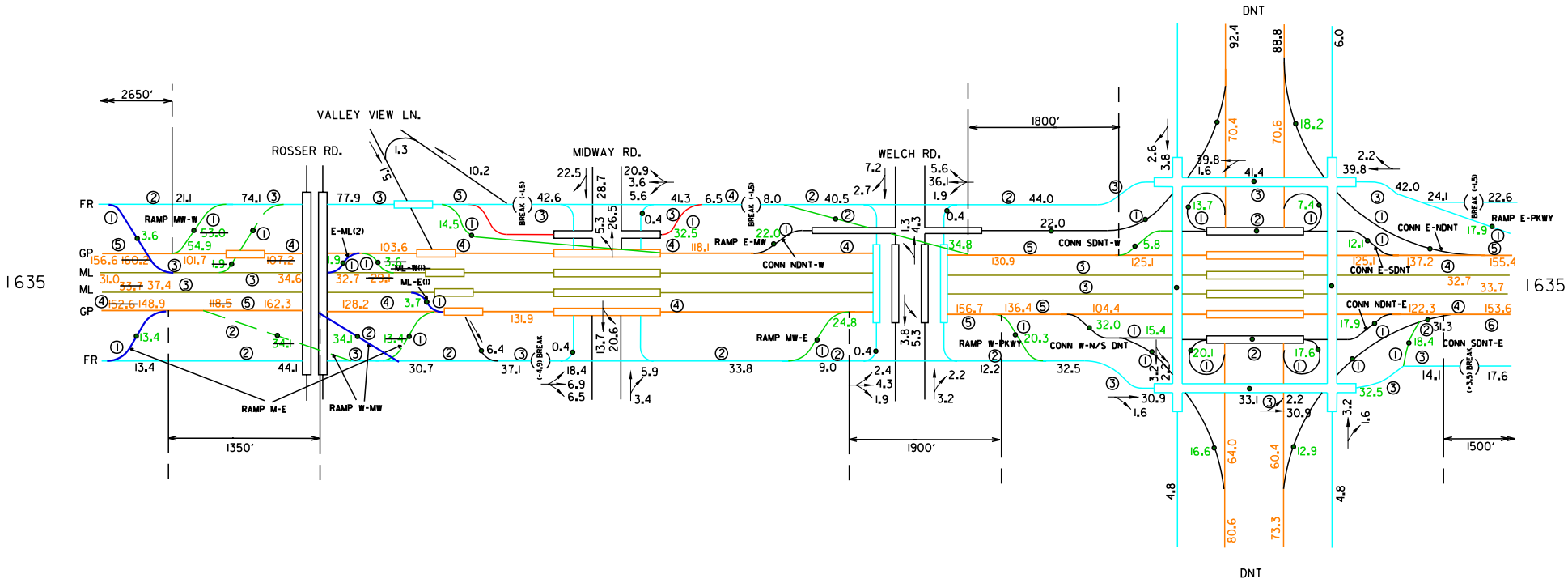
TRAFFIC AND REVENUE STUDY-WSA
SHEET 2 OF 4

I635 (LBJ) CORRIDOR WEST SECTION



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2020 DAILY TRAFFIC PROJECTIONS
TRAFFIC AND REVENUE STUDY-WSA
SHEET 3 OF 4

1635 (LBJ) CORRIDOR WEST SECTION

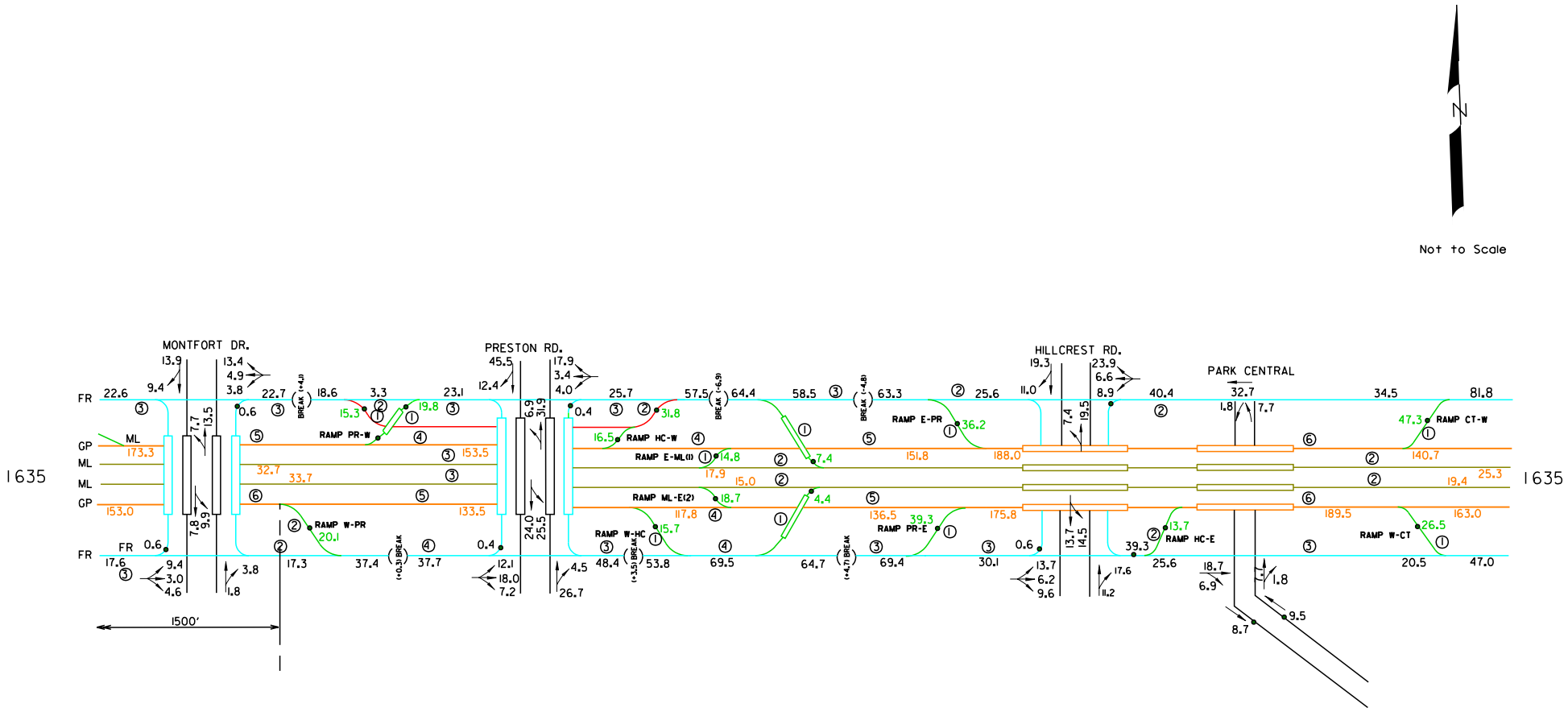

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EXHIBIT 2

2020 DAILY TRAFFIC PROJECTIONS
TRAFFIC & REVENUE STUDY - WSA
SHEET 4 OF 4

I635 (LBJ) CORRIDOR WEST SECTION

Appendix

Appendix A

ACCESS JUSTIFICATION
I 635 CORRIDOR WEST SECTION
(August 22, 2003)

INTERSTATE HIGHWAY (IH) 635

FROM: LUNA ROAD
TO: PARK CENTRAL BLVD
DALLAS COUNTY

CSJ: 2374-07-046 & 2374-01-068

ACCESS JUSTIFICATION
IH 635 CORRIDOR WEST SECTION

August 22, 2003

Texas Department of Transportation

Dallas District LBJ Project Office

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ACCESS JUSTIFICATION
LBJ Corridor West Section

Introduction

The IH 635 (LBJ Freeway) corridor is located in the Dallas/Fort Worth metropolitan area. The corridor is approximately 21 miles in length extending from Luna Road, west of IH 35E, to US 80, in the City of Mesquite. Its width extends from Beltline Road to the North and Loop 12 to the south. Municipalities located along this corridor include the cities of Farmers Branch, Dallas, Garland and Mesquite.

The LBJ freeway corridor encompasses one of the most highly developed commercial and residential areas in North Texas. The completion of LBJ freeway in the 1970's resulted in significant population and employment growth in the region. This growth in conjunction with the opening of DFW International Airport led to traffic demand that greatly exceeded predictions.

The LBJ freeway serves a variety of trip purposes. It serves long distance trips accessing other regional facilities such as IH 35E, Dallas North Tollway (DNT), US 75, IH 30 and US 80. The residential and commercial developments within the region serve as origins and destinations for shorter and local trips. The combination of these users has resulted in significant congestion for many hours each day. Predicted development and travel demand growth for the area indicate that the problem will continue to worsen.

The corridor is divided into 4 sections. The West section is from Luna Road to Park Central Boulevard. The Dallas High Five section is from Park Central Boulevard to West of Greenville Ave. The East section is from East of Greenville Ave including the Greenville Ave underpass to North of Town East Boulevard. The Mesquite section is from North of Town East Boulevard to US 80. Exhibit 1 depicts the general area.

The Dallas High Five is currently under construction. The Mesquite section access justification has been separately performed and approved by the FHWA and TxDOT's Design Division. The Public Hearing for Mesquite Section was held on May 7, 2002 and a Category Exclusion (CatEx) was obtained on September 6, 2002. The NEPA process for the Mesquite Section has been completed. In addition, the Mesquite Section phase I construction has started and the phase II PS&E is in process.

The Public Hearing for the East Section was held on October 10, 2002 and a Finding of No Significant Impact (FONSI) was obtained on January 30, 2003. The NEPA process for the East Section has also been completed. In addition, the East Section access justification had been submitted to FHWA as separate report and

was approved on December 24, 2002.

The West Section is in its final stages of the NEPA process. The design schematic has been approved. The Environmental Assessment (EA) has obtained a "Satisfaction for Further Processing" status from FHWA. The West Section Public Hearing was held in June 5, 2003. The final "IH 635 West Section Public Hearing Documentation Package" has been submitted to FHWA via TxDOT Environmental Affairs Division to seek FONSI.

This report covers the access justification for the West Section of LBJ freeway corridor. It describes the existing facility, its relation to the regional transportation and land use plan, other alternatives evaluated, and the design and operational characteristics of the proposed ramps.

Existing Roadway Network

The LBJ Freeway generally consists of eight mainlanes except at interchanges. One-way service roads are generally two and three lanes wide and are not continuous. Right-of-way (ROW) width varies from 330' to 450' depending on the existence of service roads, interchange design and drainage requirements.

Within the West section, there are two major crossing facilities, IH 35E and the Dallas North Tollway (DNT). In addition, there are 15 cross street intersections. Access situations vary from full access to no access from the LBJ freeway. Interim HOV lanes also exist in the West Section. Exhibit 2 demonstrates the detailed access situation at each cross street, and the IH 35E and DNT interchanges. The average daily traffic (ADT) in the year 1997 and number of lanes on the West Section existing roadway network are also shown in the Exhibit 2.

Transportation and Land Use Plans

The North Central Texas Council of Government (NCTCOG), the metropolitan planning organization (MPO) for this region, is responsible for preparing financially constrained regional transportation plans. A Major Investment Study (MIS) was completed for the entire corridor in 1996. The LBJ freeway has been a major factor in commercial development. In 1995, total employment for Dallas County was approximately 1.44 million. The LBJ corridor study boundaries contained nearly 80% of the total employment in Dallas County. The results of this study have been included in each of the region's Mobility plans since that time.

The proposed action is consistent with the area's financially constrained Metropolitan Transportation Plan, Mobility 2025 Plan Update.

Regional Traffic Needs

The dramatic population growth and the variety of trip purposes served within the LBJ corridor led to travel demands that far exceeded original projections for the freeway. The average daily traffic for LBJ freeway has continued to increase each year from 100,000 vehicle per day (vpd) in 1976 to 230,000 vpd in 1994 to a projected volume of over 400,000 vpd in 2020. The extremely high traffic volumes result in significant congestion for many hours each day. The high travel demand for the freeway has forced traffic to spread out beyond the normal peak hours and creating congested conditions for most of the day. For example, the Texas Transportation Institute (TTI) of Texas A&M University made traffic counts at two EB IH 635 mainlane locations east of IH 35E on February 1, 2001 (Friday). The 15-hour (6AM to 9PM) traffic volumes are 59,087 vehicles with the highest hourly volume of 5,310 (4PM to 5PM) and lowest hourly volume of 2,838 (10AM to 11AM).

Transportation improvements implemented on and near LBJ freeway have not been able to satisfy the ever-increasing travel demand in the area or reduce congestion on the facility. Predicted development and travel demand growth for the area indicate that the problem will continue to worsen in the foreseeable future. The current and projected travel demand clearly warrants a need for improvements.

Reasonable Alternatives

The following reasonable alternatives were evaluated to determine if they meet the traffic demand in the corridor.

- Programmed Improvements (no-build)
- Transportation System Management (TSM)
- Transportation Demand Management (TDM)

It was concluded after the evaluation that these alternatives could not help much in meeting the traffic demand. The following is a discussion of each alternative.

Programmed Improvements (no-build): Programmed improvements are projects that are included in the regional transportation plan, Mobility 2025 plan, and have funding programmed for their construction. The local parallel streets that can be used as partial relief routes are Forest Lane to the south and Spring Valley to the north. These streets are currently serving at full capacities with their own congestion problems during peak hours. In addition, the President George Bush Turnpike (PGBT) is a toll road and is more than 4 miles to the north of LBJ freeway. Although the PGBT is offering a reasonable alternative to some current LBJ travelers, it is already experiencing peaking conditions that would not encourage greater diversion from LBJ.

Thus, without the extensive reconstruction and improvements of the LBJ freeway, the future traffic demand cannot be adequately accommodated.

TSM Strategies: TSM strategies improve the flow of traffic through improvements to the transportation network and include traffic signal timing improvements, signing improvements and intersection geometry improvements. NCTCOG, TxDOT and the surrounding cities have identified and been working on various intersection improvement projects. These improvements will mostly benefit and smoothen the local/off-system traffic flow. Their impacts on the LBJ freeway mainlanes are negligible.

TDM Strategies: TDM strategies reduce or manage traffic demand. They include strategies such as Employer Trip Reduction (ETR) program, telecommuting, flexible work hours and ride sharing. The private corporations and public entities along the LBJ corridor have already implemented various such programs. In addition, non-work related trips such as dropping children off at daycare or school, shopping, lunch, along with the geographic diversification of land uses create the dependency on the private automobile. The Dallas Area Rapid Transit (DART) lines are basically radial lines in relation to IH 635, see Exhibit 3. DART will relieve radial traffic congestion such as congestion on US 75, DNT and IH 35E, rather than the congestion on IH 635. It is evident that TDM strategies alone cannot help much to improve the congestion significantly.

Connections and Design

The proposed West Section schematic calls for

- continuous frontage roads;
- 8 mainlanes with wider inside shoulders for the future flexibility to expand to 10 mainlanes;
- 4 HOV/HOT lanes (2 in each direction) from Luna Road to west of Josey;
- 6 HOV/HOT lanes (3 in each direction) from west of Josey to east of Preston; and
- 4 HOV/HOT lanes (2 in each direction) from east of Preston through the IH 635/US 75 interchange.

The diagrammatic representation of the West Section is shown in Exhibit 4. The projected average daily traffic (ADT) in the year 2020 and number of lanes on the West Section proposed roadway network are also shown in the Exhibit 4.

The existing and proposed mainlane access locations from Luna Road to Park Central Blvd are summarized in the following table in reference to the Exhibits 2 and 4.

TABLE 1: Existing and Proposed Mainlane Access Locations

Proposed		Existing	
East Bound Traffic			
Ramp	Type	Ramp	Type
Fr EB ML to FR (Ramp W-E)	Off		
Fr EB ML to HOV (Ramp W-HOV)	Off		
Fr Luna to EB ML (Ramp L-E(1))	On	Fr Luna to EB ML	On
Fr Luna/FR to EB ML (Ramp L-E(2))	On		
IH 635/IH 35E Interchange			
Access Point on IH 635		Access Point on IH 635	
Fr EB ML to DC (Conn W-N/S)	Off	Fr EB ML to NB IH 35E	Off
		Fr EB ML to SB IH35E	Off
Fr DC to EB ML (Conn N/S-E)	On	Fr SB IH 35E to EB ML	On
		Fr NB IH 35E to EB ML	On
Fr WB ML to DC (Conn E-N/S)	Off	Fr WB ML to NB IH 35E	Off
		Fr WB ML to SB IH 35E	Off
Fr DC to WB ML (Conn N/S-W)	On	Fr NB IH 35E to WB ML	On
		Fr SB IH 35E to WB ML	On
Access Point on IH 35E		Access Point on IH 35E	
Fr EB/WB IH 635 to SB IH 35E (Conn E/W-S)	On	Fr WB ML to SB IH 35E	On
		Fr EB ML to SB IH 35E	On
Fr NB IH 35E to EB/WB IH 635 (Conn S-E/W)	Off	Fr NB IH 35E to EB ML	Off
		Fr NB IH 35E to WB ML	Off
Fr EB/WB IH 635 to NB IH 35E (Conn E/W-N)	On	Fr WB ML to NB IH 35E	On
		Fr EB ML to NB IH 35E	On
Fr SB IH 35E to EB/WB IH 635 (Conn N-E/W)	Off	Fr SB IH 35E to EB ML	Off
		Fr SB IH 35E to WB ML	Off

Table 1 Continue

East Bound Traffic (continue)			
		Fr Anaheim to EB ML	On
Fr EB ML to Josey/Webb Chapel (Ramp W-J/WC)	Off	Fr EB ML to Josey	Off
		Fr EB ML to Webb Chapel	Off
Fr EB ML to Marsh (Ramp W-M)	Off	Fr Josey/Webb Chapel to EB ML	On
Fr EB HOV to ML (Ramp HOV-E(1))	On		
Fr Josey/Webb Chapel to EB ML (Ramp J/WC-E)	On	Fr EB ML to Marsh	Off
Fr EB ML to Midway (Ramp W-MW)	Off	Fr Marsh to EB ML	On
Fr Marsh to EB ML (Ramp M-E)	On	Fr EB ML to Midway	Off
Fr Midway to EB ML (Ramp MW-E)	On	Fr Midway to EB ML	On

Fr EB ML to FR (Ramp W-PKWY)	Off		
IH 635/DNT Interchange			
Fr EB ML to DC (Conn W-N/S DNT)	Off	Fr EB ML to SB DNT	Off
		Fr EB ML to NB DNT	Off
Fr SB DNT to EB ML (Ramp NDNT-E)	On	Fr SB DNT to EB ML	On
Fr NB DNT to EB ML (Conn SDNT-E)	On	Fr NB DNT to EB ML	On
Fr WB ML to NB DNT (Conn E-NDNT)	Off	Fr WB ML to NB DNT	Off
Fr WB ML to SB DNT (Conn E-SDNT)	Off	Fr WB ML to SB DNT	Off
Fr NB DNT to WB ML (Conn SDNT-W)	On	Fr NB DNT to WB ML	On
Fr SB DNT to WB ML (Conn NDNT-W)	On	Fr SB DNT to WB ML	On
East Bound Traffic (continue)			
		Fr EB FR to EB ML	On
Fr EB ML to Preston (Ramp W-PR)	Off	Fr EB ML to Preston	Off
		Fr Montfort to EB ML	On
Fr EB ML to Hillcrest (Ramp W-HC)	Off	Fr EB ML to Hillcrest	Off
Fr EB HOV to ML (Ramp HOV-E(2))	On		
Fr Preston to EB ML (Ramp PR-E)	On	Fr Preston to EB ML	On
Fr Hillcrest to EB ML (Ramp HC-E)	On	Fr Hillcrest to EB ML	On

Table 1 Continue

Fr EB ML to Coit (Ramp W-CT)	Off	Fr EB ML to Coit	Off
West Bound Traffic			
Fr Coit to WB ML (Ramp CT-W)	On	Fr Coit to WB ML	On
		Fr WB ML to Hillcrest	Off
Fr WB ML to Preston (Ramp E-PR)	Off	Fr WB ML to Preston	Off
Fr WB ML to HOV (Ramp E-HOV)	Off		
Fr Hillcrest to WB ML (Ramp HC-W)	On	Fr Hillcrest to WB ML	On
		WB Fr WB ML to Montfort	Off
Fr Preston to WB ML (Ramp PR-W)	On	Fr Preston to WB ML	On
Fr WB ML to FR (Conn E-PKWY)	Off	Fr WB ML to FR	Off
Fr WB ML to Midway (Ramp E-MW)	Off	Fr WB ML to Midway	Off

Fr WB ML to Marsh (Ramp E-M)	Off	Fr Midway to WB ML	On
Fr WB HOV to ML (Ramp HOV-W(1))	On		
Fr Midway to WB ML (Ramp MW-W)	On	Fr WB ML to Marsh	Off
Fr WB ML to Josey/Webb Chapel (Ramp E-J/WC)	Off	Fr WB ML to Josey/Webb Chapel	Off
Fr Marsh to WB ML (Ramp M-W)	On	Fr Marsh to WB ML	On
Fr Josey/Webb Chapel to WB ML (Ramp J/WC-W)	On	Fr Webb Chapel to WB ML	On
		Fr Josey to WB ML	On
		Fr WB ML to FR	Off
Fr WB ML to FR/Luna (Ramp E-L(2))	Off		
Fr WB ML to Luna (Ramp E-L(1))	Off	Fr WB ML to Luna	Off
Fr HOV to WB ML (Ramp HOV-W(2))	On		
Fr WB FR to WB ML (Ramp E-W)	On		
Summary			
# of EB ML/Cross Street On Ramps	7		9
# of EB ML/Cross Street Off Ramps	8		7
# of EB ML/HOV Access	3		0

Table 1 Continue

# of IH 635/IH 35E Interchange Access	8		16
# of IH 635/DNT Interchange Access	7		8
# of WB ML/Cross Street On Ramps	7		7
# of WB ML/Cross Street Off Ramps	7		9
# of WB ML/HOV Access	3		0

Notes:

(1) Ramp name convention: For off-ramp, the first letter shows "from" what direction (west, east, south or north) and the second letter denotes "to" which cross street. For example, ramp W-MW indicates the ("from" west) EB off-ramp "to" Midway Road. For on-ramp, the first letter shows "from" which cross street and the second letter denotes "to" what direction. For example, ramp MW-E indicates "from" Midway Road "to" east (EB mainlane).

(2) The existing interim HOV lane in the West Section is not a barrier separated HOV lane from the mainlanes. The access between the mainlane and the HOV is not connected by conventional ramps and thus, the existing mainlane and HOV

access locations are not listed in the above table.

There are three categories of access included in the proposed schematics that need to be justified.

- Category 1: Category 1 access is for any ramps that will provide mainlane on/off access that does not exist today (including mainlane/HOV access).
- Category 2: Category 2 access is for reconfigured interchanges. The proposed IH 635/IH 35E and IH 635/DNT interchanges in the West Section fall into this category, according to the FHWA guidance.
- Category 3: Category 3 access is for eliminated ramp access and reversed ramp access that will be investigated case by case to ensure that no adverse effect exists.

In reference to the Exhibits 2, 4 and Table 1, Table 2 lists ramps that are classified as Category 1 access.

Table 2: Category 1 - Added Ramps

Ramps	Note
1. EB W-E	Mainlanes/FR Access
2. EB L-E(2)	Mainlanes/FR Access
3. EB W-PKWY	Mainlanes/FR Access
4. WB E-L(2)	Mainlanes/FR Access
5. WB E-W	Mainlanes/FR Access
6. EB W-HOV	Mainlanes/HOV Access
7. EB HOV-E(1)	Mainlanes/HOV Access
8. EB HOV-E(2)	Mainlanes/HOV Access
9. WB E-HOV	Mainlanes/HOV Access
10. WB HOV-W(1)	Mainlanes/HOV Access
11. WB HOV-W(2)	Mainlanes/HOV Access

Table 3 shows the reconfigured IH 635/IH 35E interchange connectors and revised access locations on IH 635 of IH 635/DNT interchange. These connectors and access locations are defined as Category 2 access. The access locations on DNT of IH 635/DNT interchange will remain the same and thus, are not listed in the Table 3.

Table 3: Category 2 - Reconfigured Ramps

Direct Connectors	Note
IH 635/IH 35E Interchange	
1. Conn W-N/S	EB IH 635 Exit to NB/SB IH 35E

2. Conn N/S-E	Entrance from NB/SB IH 35E to EB IH 635
3. Conn E-N/S	WB IH 635 Exit to NB/SB IH 35E
4. Conn N/S-W	Entrance from NB/SB IH 35E to WB IH 635
5. Conn S-E/W	NB IH 35E Exit to EB/WB IH 635
6. Conn E/W-S	Entrance from EB/WB IH 635 to SB IH 35E
7. Conn N-E/W	SB IH 35E Exit to EB/WB IH 635
8. Conn E/W-N	Entrance from EB/WB IH 635 to NB IH 35E
IH 635/DNT Interchange	
1. Conn W-N/S DNT	EB IH 635 Exit to NB/SB DNT
2. Conn NDNT-E	Entrance from SB DNT to EB IH 635
3. Conn SDNT-E	Entrance from NB DNT to EB IH 635
4. Conn E-NDNT	WB IH 635 Exit to NB DNT
5. Conn E-SDNT	WB IH 635 Exit to SB DNT
6. Conn SDNT-W	Entrance from NB DNT to WB IH 635
7. Conn NDNT-W	Entrance from SB DNT to WB IH 635

Due to the proposed continuous frontage roads, widened mainlanes, added HOV lanes and reconstruction of all cross street overpasses/underpasses, all the cross street access ramps will be revised from their existing conditions. Table 4 lists all eliminated access and on/off reversed ramps (Category 3 access).

Table 4: Category 3 - Eliminated/Revised Ramps

Ramps	Note
1. EB from Anaheim to ML	Eliminated Access
2. EB from ML to Webb Chapel	Eliminated Access
3. EB from Montfort to ML	Eliminated Access
4. WB from ML to Hillcrest	Eliminated Access
5. WB from ML to Montfort	Eliminated Access
6. WB from Webb Chapel to ML	Eliminated Access
7. WB from ML to FR	Eliminated Access
8a. EB W-M	Pair Reversed on/off Order (off-ramp followed by on-ramp)
8b. EB J/WC-E	
9a. EB W-MW	Pair Reversed on/off Order (off-ramp followed by on-ramp)
9b. EB M-E	
10a. WB E-M	Pair Reversed on/off Order (off-ramp followed by on-ramp)
10b. WB MW-W	

Operational Analysis

The operational analyses of mainlanes that are affected by the above three (3) categories of access ramps have been performed in accordance with the procedures outlined in the 2000 Highway Capacity Manual (HCM), using Highway Capacity Software (HCS). The analysis consists of freeway analysis, weaving analysis, ramp analysis and major merge/diverge analysis, whenever applicable. The projected year 2020 daily traffic volumes on IH 635 mainlanes, HOV/HOT and ramps are from TxDOT Transportation

Planning and Programming (TP&P) Division and shown in Exhibit 4. The average daily traffics (ADTs) have been converted to the busiest one hour (peak hour) traffic volume by a factor of "K" for calculation of the year 2020 peak hour level of service (LOS) to have a general understanding of the "worst" traffic operation conditions during a day. The factor "K" ranges from 0.08 to 0.12 for general urban facilities based on the TxDOT's Roadway Design Manual Chapter 2 Section 2. For IH 635 that serves a highly urbanized and fully developed area, the factor "K" is close to 0.8 (for example, K=0.078 as computed from TTI February 1, 2001 traffic count at east of IH 35E). In addition, the year 1997 daily traffic volumes on IH 635 mainlanes and ramps are also from TxDOT TP&P Division and shown in Exhibit 2. They are used for the computation of the peak hour level of service in the existing conditions.

As discussed in the "Regional Traffic Needs" section, the LBJ corridor is located in and serves a highly urbanized region. The heavy traffic is not limited to only one "peak hour" defined above. It actually spreads out to most of the day. For instance, the average hourly EB two lane traffic volume at east of IH 35E was 3,939vph in a 15-hour span (6AM to 9PM) according to the February 1, 2001 traffic count by TTI. This 15-hour span is defined as "peak period" on the LBJ corridor in this report. The "K" factor used to compute the "peak period" hourly traffic volume from the ADT was calculated as 0.058 in this example. Further detailed data analysis has indicated that there were only 5 hours' K greater than 0.06 (1 hour K=0.08 and 4 hours' K=0.07) within our defined 15-hour "peak period" at this location. From the available field data, we concluded that using a factor of "K=0.08" to compute the LOS would be helpful to have a first glance of the traffic operation conditions in the LBJ corridor. But the results represented the worst scenario - the level of service at the real "peak hour" during the day. In this report, each LOS will first be computed using K=0.08. Special attention will then be given to those LOS=F where further analysis for the "peak period" (K=0.06) is performed by considering the above traffic characteristics on LBJ corridor. The majority actual hour by hour LOS will be equal or better than the calculated LOS using K=0.06 within the defined 15-hour "peak period".

The term "Value Pricing Strategy" would appear in the report extensively and used to analyze the traffic operation. The basic idea of the "Value Pricing Strategy" is to manage the HOV lanes in such a manner that will not either under-use or over-use the HOV lane capacity. The managed HOV lanes are defined as HOV/HOT lanes, i.e., High-Occupancy-Vehicle (Toll) lanes, in this report. The mechanism of the "Value Pricing Strategy" can be simply explained as to encourage the single-occupancy-vehicle (SOV) to use the HOV/HOT lanes when traffic volume on HOV/HOT lanes is below the capacity by lowering the toll price. On the other hand, the SOV will be limited to use the HOV/HOT lanes when traffic flow on HOV/HOT lanes is at capacity by raising the toll price.

The ultimate purpose of the "Value Pricing Strategy" is to balance the traffic demands and capacities on the general mainlanes and HOV/HOT lanes. For example, when the LOS=A or B on the HOV/HOT lanes and LOS=F on the general mainlanes are observed, the toll price would be lowered to divert some traffic to the HOV/HOT lanes. The level of services would probably be "C" on the HOV/HOT lanes and "E" on the general mainlanes in this case. The fundamental difference between the common concept of "toll" road and "Value Pricing Strategy" is that "toll" road concept is to maximize revenue while "Value Pricing Strategy" is to optimize traffic operation. The "Value Pricing Strategy" is a separate research project and is currently under study. The "Value Pricing Strategy" is currently planned to be adopted for the entire LBJ corridor. TxDOT TP&P Division projected year 2020 traffic volumes in the network of IH 635 corridor (Exhibit 4) did not take into consideration of the "Value Pricing Strategy". In order to introduce the "Value Pricing Strategy" into traffic operation analysis in this report, Wilbur Smith Associates had provided the year 2020 HOV/HOT lane traffic demand projection (see Exhibit 5), per TxDOT request, from its existing ongoing Traffic Revenue Study contract with TxDOT.

The operational analysis in this report will use TxDOT TP&P Division projected year 2020 traffic volume (Exhibit 4) as the foundation. The peak hour (K=0.08) level of service or capacity will first be calculated or checked. If the computed level of service would be "F" or capacity check would fail, the traffic operation during a broader "peak period" (K=0.06) defined above would then be investigated. Finally, when all the above fail to show an acceptable traffic condition (LOS=E or better), the year 2020 traffic number by Wilbur Smith Associates, Exhibit 5, will be applied to the level of service calculation and capacity check.

Although the HCS forms the foundation of operational analysis in this report, the traffic at a few mainlane locations have also been "spot checked" by the micro-simulation software CORSIM, with the assistance of Wilbur Smith Associates, to understand the operational characteristics, see Exhibit 6.

For weaving analysis, there would be a small volume of traffic that would take the entrance ramp followed by the exit ramp (ramp to ramp weaving traffic). This percentage is assumed to be half the percentage of exiting traffic in the weaving area. For example, if 20% of the vehicles in the weaving area will exit the freeway, then 10% of the entrance ramp traffic would be exiting the freeway. The HCS can only analyze weaving sections with a maximum of five lanes. For six-lane weaving area (5 upstream lanes plus 1 auxiliary lane) analysis, a factor of 4/5 is applied to the mainlane volume upstream from the weaving area to proportionally project volume to a five lane weaving section.

The level of service of Category 1 ramps is shown in Table 5. The

freeway analysis evaluates the LOS of freeway segment due to the addition of traffic volume by proposed access ramps. The ramp analysis studies the LOS of ramp-freeway junctions due to the addition of the proposed access ramps. The weaving analysis investigates the potential weaving between the proposed access ramp and adjacent ramps.

Table 5: Category 1 Ramp LOS

Ramp	Level of Service			Note
	Freeway	Weaving	Ramp	
W-E	D	No Weaving	E	Due to continuous FR, the ramp provides access to Harry Hines Blvd, Denton Dr. and Ford Rd. where no direct access from EB ML has been provided.
L-E(2)	C	No Weaving	B	This ramp relieves ramp L-E(1) whose major function is to provide access to IH 35E DC.
W-PKWY	F D(I)	F E(I)	F E(I)	This is a revised access to FR and Montfort compared with the existing condition.
E-L(2)	C	No Weaving	C	This ramp relieves ramp E-L(1) whose major function is to provide access from NB&SB IH 35E to FR and Luna Road.
E-W	D	No Weaving	C	Due to continuous FR, the ramp provides access for Harry Hines Blvd., Denton Dr. and Ford Rd. where no direct access to WB ML has been provided.
W-HOV	D	No Weaving	E	This is the EB beginning of HOV.
HOV-E(1)	F E(II)	NO Weaving	F C(II)	This ramp provides HOV access to Midway, Welch, DNT, Montfort and Preston.
HOV-E(2)	E	No Weaving	N/A	One lane addition. Analyze as freeway segment with one more lane. This ramp provides access to Coit and US 75 from EB HOV.

E-HOV	F D[III]	No Weaving	Capa-city Check OK	One lane drop, analyze as Ramp roadway 3400vpd x 0.08 = 272vph 272vph/(PHF0.90xFhv0.96) =315pc/h < 2200 pc/h from Exhibit 25-3
HOV-W(1)	F D[IV]	No Weaving	F C[IV]	Provide access to Josey/Webb Chapel from WB HOV.
HOV-W(2)	D	No Weaving	C	End of HOV.

[I]The peak hour LOS=F is simply because the 5 general mainlanes cannot handle the projected year 2020 peak hour flow of 14,480vph that is converted from the 181,000vpd by a factor of K=0.08. It is noted that the originally projected year 2020 daily traffic of 9,400vpd on the 3-lane HOV/HOT is well below the capacity. Based on the study and modeling by Wilbur Smith Associates, 33,700vpd is projected on the HOV/HOT lanes by the "Value Pricing Strategy". Thus, the LOS would be improved to an acceptable level on the general mainlanes for the "peak period".

[II]The 4 general mainlanes in this area cannot provide the needed capacity for the projected year 2020 peak hour flow of 10,672vph and thus, the peak hour level of service would be "F". The level of service would be improved for the freeway segment and ramp when the "peak period" traffic is analyzed.

[III]The projected peak hour volume of 12,192vph exceeds the capacity of 5 general mainlanes. However, the level of service would be "D" for the "peak period".

[IV]The 9,472vph of the projected year 2020 peak hourly flow cannot be absorbed appropriately by the 4 general mainlanes in the area. But, the LOS would be at a comfortable level for the "peak period".

Based on the level of service calculations, the peak hour traffic would experience "break down" at four (4) newly added ramps/access locations. One (1) is for mainlane/FR access and three (3) are at mainlane/HOV access locations. The sole reason for the "break down" is that the projected year 2020 peak hour traffic volumes in these areas exceed the capacity. However, by successfully applying the "Value Pricing Strategy" and/or looking at a big picture of "peak period" traffic, the LOS would generally be improved to an acceptable level. The benefit of adding these ramps listed in Table 2 far outweighs the disadvantages of not providing these access locations. The proposed access points all connect to public roads and provide for all traffic movements. By providing these ramps, the LBJ corridor network traffic time will be saved, mobility will be improved, and the traffic burden on frontage roads and cross

street intersections will be significantly relieved.

Category 2 access characteristics are summarized in Table 6. IH 635/IH 35E interchange will be totally reconstructed and these access locations must be provided. The operational analysis shows the improvements from the proposed intersection access configuration (sheet 1 of Exhibit 4) over the existing interchange access locations (sheet 1 of Exhibit 2). The IH 635/DNT interchange will only be partially reconstructed. While all the access points on IH 635 will be revised, all the access locations on DNT will remain as is. Therefore, only the access locations on IH 635 will be analyzed in this report.

Table 6: Category 2 Ramp LOS

Proposed	Existing	Note
IH 635/IH 35E Interchange		
Access Points on IH 635		
1. Conn W-N/S a) Weaving with ramp L-E(1) LOS = C Major Diverge Area 86800vpd x 0.08 = 6944vph 6944vph/(PHF0.9xFhv0.96) = 8037 pc/h Average Density D = 0.0109 x 8037/6 = 14.6 Eq.(25-12) LOS = B Exhibit (25-4) Depart leg-4 LN Freeway 51300vpd x 0.08 = 4104vph 4104vph/(PHF0.90xFhv0.96) = 4750 pc/h < 9000 pc/h from Exhibit 25-14 Depart leg-2 LN Conn 35500vpd x 0.08 = 2840vph 2840vph/(PHF0.90xFhv0.96) = 3287 pc/h < 4500 pc/h from Exhibit 25-14 b) Consolidated one exit point	a) Freeway Analysis LOS = C One lane drop, analyze as ramp roadway 10200vpd x 0.08 = 816vph 816vph/(PHF0.90xFhv0.96) =944pc/h < 2200 pc/h from Exhibit 25-3 b) Two consecutive exit points 1,500' apart	EB IH 635 Access NB/SB IH 35E Location.

Table 6 Continue

2. Conn N/S-E a) Major Merge Area Approach leg-3 LN Freeway 44300vpd x 0.08 = 3544vph 3544vph/(PHF0.95xFhv0.96) = 3886 pc/h < 6750 pc/h from Exhibit 25-7 (I) Approach leg-3 LN Conn 104400vpd x .08 = 8352vph 8352vph/(PHF0.95xFhv0.96) =9158 pc/h > 6750 pc/h from Exhibit 25-7 Depart leg - 6 LN Freeway 148700vpd x .08 =11896vph 11896vph/(PHF0.95xFhv.96) =13043 pc/h < 13500 pc/h from Exhibit 25-7 b) Consolidated one entrance point	a) Two lanes are added consecutively from SB IH 35E and NB IH 35E to EB IH 635. Analyze as freeway segment. LOS = F b) Two consecutive entrance (right and left) points 800' apart	NB/SB IH 35E access EB IH 635 location.
3. Conn E-N/S a) Major Diverge Area 157000vpd x 0.08=12560vph 12560vph/(PHF0.9xFhv0.96) = 14537 pc/h Average Density D = 0.0109 x 14537/6 = 26.4 Eq.(25-12) LOS = C Exhibit (25-4) Depart leg-4 LN Freeway 50800vpd x 0.08 = 4064vph 4064vph/(PHF0.90xFhv0.96) = 4704 pc/h < 9000 pc/h from Exhibit 25-14 (II) Depart leg-3 LN Conn 106200vpd x .08 = 8496vph	a) WB ML to NB IH 35E Ramp Analysis LOS = F WB ML to SB IH 35E Major Diverge Area 101000vpd x 0.08=8080vph 8080vph/(PHF0.9xFhv0.96) = 9352 pc/h Average Density D = 0.0109 x 9352/4 = 25.5 Eq.(25-12) LOS = C Exhibit (25-4) Depart leg-3 LN Freeway 50800vpd x 0.08=4064vph 4064vph/(PHF.90xFhv0.96) = 4703 pc/h < 6750 pc/h from Exhibit 25-14	WB IH 635 Access NB/SB IH 35E Location.

8496vph/(PHF0.90xFhv0.96) = 9833 pc/h > 6750 pc/h from Exhibit 25-14 b) Consolidated one exit Point	Depart leg-2 LN Conn 50200vpd x 0.08=4016vph 4016vph/(PHF.90xFhv0.96) = 4648 pc/h > 4500 pc/h from Exhibit 25-14 b) Two consecutive exit (right and left) points 500' apart	

Table 6 Continue

4. Conn N/S-W a) Weaving with ramp E-L(1) LOS = C Major Merge Area Approach leg-4 LN Freeway 62000vpd x 0.08 = 4960vph 4960vph/(PHF0.95xFhv0.96) = 5439 pc/h < 9000 pc/h from Exhibit 25-7 Approach leg-2 LN Conn 31300vpd x .08 = 2504vph 2504vph/(PHF0.95xFhv0.96) =2746 pc/h < 4500 pc/h from Exhibit 25-7 Depart leg - 6 LN Freeway 93300vpd x .08 =7464vph 7464vph/(PHF0.95xFhv.96) =8184 pc/h < 13500 pc/h from Exhibit 25-7 b) Consolidated one entrance point	a) Two lanes are added consecutively from NB IH 35E and SB IH 35E to WB IH 635. Analyze as freeway segment. LOS = C b) Two consecutive entrance points 1,300' apart	NB/SB IH 35E access WB IH635 Location.
Access Points on IH 35E		
5. Conn S-E/W a) Major Diverge Area 164300vpd x 0.08=13144vph 13144vph/(PHF.95xFhv0.96) = 14412 pc/h Average Density D = 0.0109 x 14412/6 = 26.2 Eq.(25-12) LOS = C Exhibit (25-4) Depart leg-3 LN Freeway 73500vpd x 0.08 = 5880vph 5880vph/(PHF0.95xFhv0.96) = 6447 pc/h < 6750 pc/h from Exhibit 25-14 (III) Depart leg-3 LN Conn	a) Major Diverge Area 105200vpd x 0.08=8416vph 8416vph/(PHF.95xFhv0.96) = 9228 pc/h Average Density D = 0.0109 x 9741/5 = 20.1 Eq.(25-12) LOS = C Exhibit (25-4) Depart leg-3 LN Freeway 55400vpd x 0.08=4432vph 4432vph/(PHF.95xFhv0.96) = 4860 pc/h < 6750 pc/h from Exhibit 25-14 Depart leg-2 LN Conn 49800vpd x 0.08=3984vph	NB IH 35E Access EB/WB IH 635 Location.

90800vpd x .08 = 7264vph 7264vph/(PHF0.95xFhv0.96) = 7965 pc/h > 6750 pc/h from Exhibit 25-14 b) Consolidated one exit Point	3984vph/(PHF.95xFhv0.96) = 4368 pc/h < 4500 pc/h from Exhibit 25-14 b) Two consecutive exit (right and left) point 1,100' apart	

Table 6 Continue

6. Conn E/W-N a) Major Merge Area Approach leg-3 LN Freeway 65200vpd x 0.08 = 5216vph 5216vph/(PHF0.95xFhv0.96) = 5719 pc/h < 6750 pc/h from Exhibit 25-7 Approach leg-2 LN Conn 44600vpd x .08 = 3568vph 3568vph/(PHF0.95xFhv0.96) =3912 pc/h < 4500 pc/h from Exhibit 25-7 Depart leg - 5 LN Freeway 109800vpd x .08 = 8784vph 8784vph/(PHF0.95xFhv.96) =9632 pc/h < 11250 pc/h from Exhibit 25-7 b) Consolidated one entrance point	WB IH 635 to NB IH 35E Ramp Analysis LOS = F EB IH 635 to NB IH 35E Ramp Analysis LOS = F	EB/WB IH 635 access NB IH 35E Location.
7. Conn N-E/W a) Major Diverge Area 112500vpd x 0.08=9000vph 9000vph/(PHF0.9xFhv0.96) = 10417 pc/h Average Density D = 0.0109 x 10417/4 = 28.4 Eq.(25-12) LOS = D Exhibit (25-4) Depart leg-3 LN Freeway 68800vpd x 0.08 = 5504vph 5504vph/(PHF0.90xFhv0.96) = 6370 pc/h < 6750 pc/h from Exhibit 25-14 Depart leg-2 LN Conn 43700vpd x 0.08 = 3496vph 3496vph/(PHF0.90xFhv0.96) = 4046 pc/h < 4500 pc/h from Exhibit 25-14 b) Consolidated one exit Point	SB IH 35E to EB IH 635 Ramp Analysis LOS = F SB IH 35E to WB IH 635 Ramp Analysis LOS = F	SB IH 35E Access EB/WB IH 635 Location.

Table 6 Continue

8. Conn E/W-S a) Major Merge Area[IV] Approach leg-3 LN Freeway 82000vpd x 0.08 = 6560vph 6560vph/(PHF0.95xFhv0.96) = 7193 pc/h > 6750 pc/h from Exhibit 25-7 Approach leg-3 LN Conn 99400vpd x 0.08 = 7952vph 7952vph/(PHF0.95xFhv0.96) =8719 pc/h > 6750 pc/h from Exhibit 25-7 Depart leg - 6 LN Freeway 181400vpd x .08 =14512vph 14512vph/(PHF0.95xFhv.96) =15912 pc/h > 13500 pc/h from Exhibit 25-7 b) Consolidated one entrance Point	a) Major Merge Area (SB IH 35E and entrance ramp from WB ML to SB IH 35E) Approach leg-3 LN IH 35E 48100vpd x 0.08 =3848vph 3848/(PHF0.95xFhv0.96) = 4219 pc/h < 6750 pc/h from Exhibit 25-7 Approach leg-2 LN ramp 50200vpd x 0.08 =4016vph 4016/(PHF0.95xFhv0.96) =4404 pc/h < 4500 pc/h from Exhibit 25-7 Depart leg - 5 LN IH 35E 98300vpd x .08 = 7864vph 7864vph/(PHF0.95xFhv.96) =8623 pc/h < 11250 pc/h from Exhibit 25-7 b) Weaving Area (between entrance ramp from EB ML to SB IH 35E and IH 35E exit ramp to Royal Lane) LOS = C Note: Only 250' between the Major Merge Area and Weaving Area.	EB/WB IH 635 access SB IH 35E Location.

Table 6 Continue

IH635/DNT Interchange		
1. Conn W-N/S DNT a) Major Diverge Area 160700vpd x 0.08=12856vph 12856vph/(PHF.97xFhv0.96) = 13806 pc/h Average Density D = 0.0109 x 13806/5 = 30.1 Eq.(25-12) LOS = D Exhibit (25-4) (V)Depart leg-4 LN Freeway 128700vpd x 0.08=10296vph 10296vph/(PHF.97xFhv0.96) = 11057 pc/h > 9000 pc/h from Exhibit 25-14 Depart leg-2 LN Conn 32000vpd x 0.08 = 2560vph 2560vph/(PHF0.97xFhv0.96) = 2749 pc/h < 4500 pc/h from Exhibit 25-14 b) Consolidated one exit point, provide room for new ramp W-PKWY	Weaving between entrance ramp from Midway and exit ramp to SB DNT Weaving Analysis LOS = F	EB IH 635 Access NB/SB DNT location.
2. Conn NDNT-E Same configuration as existing. Ramp Analysis LOS = F (C(VI))	Ramp Analysis LOS = F	SB DNT access EB IH 635 Location.
3. Conn SDNT-E Reconfigured entrance ramp to EB ML from FR such that it merged with Conn SDNT-E first to reduce one access location on the ML. Weaving with ramp W-PR LOS = F (D(VII))	Ramp Analysis LOS = F Three consecutive entrance ramps within 1,800'. Weaving between entrance ramp from FR and exit ramp to Preston LOS = F	NB DNT access EB IH 635 Location.
4. Conn E-NDNT One land drop, analyzed as ramp roadway. 17900vpd x 0.08 =1432vph 1432vph/(PHF0.90xFhv0.96) =1657pc/h < 2200 pc/h from Exhibit 25-3	Ramp Analysis LOS = D	WB IH 635 access NB DNT Location.

Table 6 Continue

5. Conn E-SDNT	Ramp Analysis	WB IH 635

Same configuration as existing Ramp Analysis LOS = F ($E^{(VIII)}$)	LOS = E	access SB DNT Location.
6. Conn SDNT-W Weaving with ramp E-MW LOS = F ($D^{(IX)}$)	Ramp Analysis LOS = C	NB DNT access WB IH 635 Location.
7. Conn NDNT-W Removed entrance point further west and eliminated existing weaving. Ramp Analysis LOS = F ($C^{(X)}$)	Weaving between entrance ramp from SB DNT and exit ramp to Midway LOS = F	SB DNT access WB IH 635 Location.

(I) The projected year 2020 peak hourly flow of 8,352vph would simply be too heavy a burden on the 500' long 3-lane final leg of the 5-lane connector. However, the "Value Pricing Strategy" would put 14,500vpd (not 800vpd as shown in the page 2 of Exhibit 4) to the HOV/HOT lanes from the connector via the HOV/HOT access ramp 500' upstream. The capacity check process would show the "peak period" demand of 5,967 pc/h that is less than the capacity of 6,750 pc/h. It is important to note that for the majority of the connector that is 5-lane and 2000' long, the projected year 2020 peak hour demand of 9,728 pc/h is less than the capacity of 11,250 pc/h.

(II) Similar to the footnote (I) above, the projected year 2020 peak hourly flow of 8,496vph would exceed the capacity of the 1,200' long 3-lane beginning leg of the 5-lane connector. The traffic demand on the connector would be reduced to 92,500vpd from 106,200vpd by the "Value Pricing Strategy". The capacity check would indicate the "peak period" demand of 6,423 pc/h that is less than the capacity of 6,750 pc/h from Exhibit 25-14. It is worth noting that for the 2000' long 5-lane connector downstream, the projected year 2020 peak hour demand of 10,888 pc/h is less than the capacity of 11,250 pc/h.

(III) The projected year 2020 peak hour volume of 7,264vph exceeds the capacity of the 3-lane connector. However, the 6,750 pc/h capacity meets the "peak period" demand of 5,974 pc/h.

(IV) The projected year 2020 peak hour demands of 6,560vph, 7,952vph and 14,512vph on the 3-lane upstream freeway, 3-lane upstream connector and 6-lane downstream freeway exceed the capacity of the major merge area. The "peak period" demands were calculated as 5,395 pc/h, 6,539 pc/h and 11,934 pc/h for the upstream freeway, connector and downstream freeway, respectively. The proposed improvements would be able to handle the demand during "peak period".

(V) The projected year 2020 peak hour volume of 10,296vph exceeds the capacity of the 4-lane mainlane section. The traffic volume in this location would become 104,400vpd down from 128,700vpd

when the "Value Pricing Strategy" was considered. Therefore, the peak hour traffic demand on the mainlane would be reduced to 8,969 pc/h that is less than the capacity of 9,000 pc/h.

(VI) Same as footnote (V) above, the level of service of this ramp would be improved to "C" for the "peak period" if 104,400vpd on the mainlane was used in the HCS computation due to the "Value Pricing Strategy".

(VII) Same logic applies to this ramp. The LOS would be improved to "D" for the "peak period" when 33,700vpd (not 9,400vpd shown in the page 3 of Exhibit 4) was projected to HOV/HOT lanes by the "Value Pricing Strategy".

(VIII) The LOS would be improved to "E" for the "peak period" when the mainlane demand is reduced from 149,200vpd shown in page 3 of Exhibit 4 to 137,200vpd under the "Value Pricing Strategy".

(IX) This connector is immediate downstream to the connector in footnote (VIII) above. The LOS would be improved to "D" for the "peak period" when 32,700vpd (not 20,700vpd in the page 3 of Exhibit 4)) could be diverted to HOV/HOT lanes by the "Value Pricing Strategy".

(X) Although the LOS=F for the peak hour, the LOS would be generally "C" for the "peak period".

Consolidating the existing dual points access situation into the proposed single point access for the IH 635/IH 35E interchange will eliminate the existing two closely spaced consecutive exit and entrance access locations. Although the traffic conditions at the interchange area would be generally improved as the Table 6 shows, the peak hour traffic demand in the year 2020 will still exceed the capacity for those traveling between the downtown Dallas business district and LBJ business corridor (from WB IH 635 to SB IH 35E and from NB IH 35E to EB IH 635). In order to improve the traffic operation in general during the "peak period", it will be very critical to correctly apply the "Value Pricing Strategy" to maximize the HOV/HOT usage.

For IH 635/DNT interchange, no dramatic access location revisions have been called for as that for IH 635/IH 35E interchange. The access ramps on DNT would remain the same, and only the access points on IH 635 to/from DNT are revised and analyzed in this report. The existing EB two exit ramps to SB & NB DNT have been consolidated into one exit ramp. In addition, an existing entrance ramp from FR to EB mainlane has been merged with the NB DNT to EB mainlane ramp to reduce another access point on IH 635 mainlane. Finally, the existing entrance ramp from SB DNT to WB IH 635 mainlane has been extended further west. This eliminates the heavy weaving between the entrance ramp and the exit ramp to Midway that exists today. As the Table 6 demonstrates, the

traffic operations at the DNT area would be enhanced. Considering the projected year 2020 near 350,000vpd demand on the IH 635 mainlanes in the IH 635/DNT interchange area, the fundamental solution to improve the level of service will be to use the 6-lane HOV/HOT efficiently by the "Value Pricing Strategy".

Category 3 access is summarized in the table 7. Seven ramps that exist today have been eliminated in the proposed schematic.

Table 7: Category 3 Ramp LOS

Proposed	Existing
1. Eliminate direct entrance Ramp from Anaheim to EB IH 635 Freeway Analysis LOS = C	Direct entrance from Anaheim. Ramp Analysis LOS = F
2. Eliminate direct exit ramp From EB IH 635 to Webb Chapel Freeway Analysis LOS = E Heavy weaving with IH 35E DC if this ramp is not eliminated.	Direct exit ramp to Webb Chapel. Ramp Analysis LOS = F
3. Eliminate direct entrance Ramp from Montfort to EB IH 635 Freeway Analysis LOS = F (E, D) (I)	Direct entrance ramp from Montfort. Ramp Analysis LOS = F

Table 7 Continue

4. Eliminate direct exit ramp From WB IH 635 to Hillcrest Access to Hillcrest has been moved further east and has been constructed with Dallas High Five project. Freeway Analysis LOS = F ($E^{(II)}$)	Weaving between on-ramp from Coit to WB IH 635 and off-ramp From WB IH 635 to Hillcrest. LOS = F
5. Eliminate direct exit ramp From WB IH 635 to Montfort Freeway Analysis LOS = F ($E^{(III)}$)	Direct exit to Montfort Ramp Analysis LOS = F
6. Eliminate direct entrance Ramp from Webb Chapel to WB IH 635 Freeway Analysis	Direct entrance ramp from Webb Chapel Ramp Analysis LOS = F

LOS = F (E[IV]) Heavy weaving with DC to IH 35E if this ramp is not eliminated.	
7. Eliminate direct exit ramp from WB IH 635 to FR Eliminate weaving with the on ramp from Josey/Webb Chaple to WB IH 635 Freeway Analysis LOS = C	Weaving between on-ramp from Josey to WB IH 635 and off-ramp from WB IH 635 to FR. LOS = F
8a & 8b. Reversed ramps EB off-ramp to Marsh (Ramp W-M) followed by EB on-ramp from Webb Chapel (Ramp J/WC-E). Weaving between J/WC-E and W-MW LOS = F (E[V])	EB on-ramp from Webb Chapel followed by EB off-ramp to Marsh. Freeway Analysis LOS = F
9a & 9b. Reversed ramps EB off-ramp to Midway (Ramp W-MW) followed by EB on-ramp from Marsh (Ramp M-E). Weaving analysis as (8a & 8b) above.	EB on-ramp from Marsh followed by EB off-ramp to Midway. Freeway Analysis LOS = F
10a & 10b. Reversed ramps WB off-ramp to Marsh (Ramp E-M) followed by WB on-ramp from Midway (Ramp MW-W). Weaving between WB on ramp from Midway (MW-W) and WB off ramp to Josey/Webb Chapel (E-J/WC). LOS = F (E[VI])	WB on-ramp from Midway followed by WB off-ramp to Marsh. Freeway Analysis LOS = F

[I]LOF=F is simply because the 5 general mainlanes cannot handle the projected year 2020 peak hour flow, 12,624vph, in this area. The level of service would be improved to "E" for the general "peak period". Furthermore, the level of service would be enhanced to "D" if "Value Pricing Strategy" was considered and LOS was computed using revised HOV/HOT traffic numbers by Wilbur Smith Associates.

[II]The 6 general mainlanes cannot provide the needed capacity for the projected year 2020 peak hour traffic volume of 15,208vph. The level of service would be improved to "E" for the general "peak period".

[III]The projected year 2020 peak hour demand of 14,824vph exceeds the capacity of 5 general mainlanes. The level of service would be improved to "E" for the general "peak period".

[IV]The 5 general mainlanes cannot absorb the projected year 2020 peak hour flow of 12,560vph. The level of service would be improved to "E" for the general "peak period".

(v) Based on the study and modeling by Wilbur Smith Associates, 29,500vpd, not firstly assumed 8,600vpd, is projected on the HOV/HOT lanes by the "Value Pricing Strategy". The level of service would be improved to "E" for the general "peak period".

(vi) The projected year 2020 daily traffic volume of 53,000vpd is too heavy a burden for a 1-lane entrance ramp (Ramp MW-W). The level of service would be "F" no matter what "strategy" is adopted under the current schematic. The following schematic revision is proposed to improve the traffic operation.
Schematic Revision:

1. Revise the 1-lane entrance ramp (Ramp MW-W) into a 2-lane ramp.
2. Add one WB general mainlane between the Ramp MW-W and Ramp M-W. This will make it a 6-lane section between Ramp MW-W and Ramp E-J/WC and a 5-lane section between Ramp E-J/WC and Ramp M-W.

Therefore, the level of service was calculated as "E" for the general "peak period" using 31,000vpd on the HOV/HOT lanes projected by the Wilbur Smith Associates with the "Value Pricing Strategy". It is understood that it is not easy to carry out the proposed schematic revision due to the unknown ROW and displacement impact. This particular issue should be kept in mind for the future designers.

By eliminating access locations on the IH 635 mainlanes, the proposed schematic would generally improve the traffic operation conditions over the existing configurations, as Table 7 indicated. These improvements were obtained even without considering the potential benefit of the "Value Pricing Strategy". Once the "Value Pricing Strategy" is used to encourage more traffic to the HOV/HOT lanes and balance the traffic demands and capacities on the general mainlanes and HOV/HOT lanes, such as footnote (I) of Table 7 showed, the level of service would be further improved.

There are three pairs (6 ramps) of mainlane on/off ramp configurations that have been revised from an existing "Diamond" type to the proposed "X" type design, i.e., revising the existing "on" ramp followed by "off" ramp configuration to the proposed "off" ramp followed by "on" ramp configuration. For example, the existing EB mainlane between Webb Chapel Road and Marsh Lane showed the "on" ramp from Webb Chapel Road followed by the "off" ramp to Marsh Lane (see sheet 2 of Exhibit 2). The proposed design calls for the "off" ramp to Marsh Lane followed by the "on" ramp from Webb Chapel Road (see sheet 2 of Exhibit 4). The general design concepts to support the reconfigurations are listed below.

1. The traffic on the proposed "X" type "off" ramp will have a higher speed (e.g., 55 MPH, since it is farther away from the destined intersection) than that on the existing "Diamond"

type "off" ramp (e.g., 35 MPH, since it is closer to the destined intersection). Therefore, the proposed "X" type design will remove traffic from the mainlane to the frontage road more efficiently than the existing "Diamond" type design. In addition, the proposed "X" type design will provide better queuing at the intersection signal, preventing traffic from queuing onto the exit ramp during peak traffic conditions.

2. The proposed "X" type design forces the local traffic to stay on the frontage road longer (entering the mainlane further downstream) and removes traffic from the mainlane to frontage road earlier than that of the existing "Diamond" type design, and thus, improve the mainlane traffic flow.
3. For the five-lane mainlane portions of the LBJ West Section, the weaving created by the proposed "X" type design for upstream and downstream ramps is limited to the outside two lanes. By removing traffic from the mainlane to frontage road earlier and injecting traffic from frontage road to mainlane later, the inside three mainlanes will have a better traffic operation condition.

Finally, real-time traffic operation has been simulated by CORSIM at selected IH 635 west section mainlane locations for K=0.08 (peak hour), K=0.07 and K=0.06 (peak period). The speed, level of service, traffic demanded and processed are tabulated in Exhibit 6. Although the CORSIM simulation and HCS computation lead to similar results, the peak hour LOS simulated by CORSIM is generally better than those listed in the IH 635 West Section Environmental Assessment document and those calculated in this report. This is because the LOS computation in the EA document did not take into consideration of the "Value Pricing Strategy" and the CORSIM only "processed" part of the traffic "demand" while the "full" traffic volume was used in the LOS calculation by HCS in this report. In addition, both the CORSIM simulation and HCS computation revealed the worst area in the IH 635 west section, i.e., in the vicinity of Ramp E-J/WC. The LOS would be "F" and schematic revision is discussed in this report, see footnote (VI) of Table 7.

Conclusion

Both sides of IH 635 west section have been fully developed. The Right of Way (ROW) is severely constrained and it is impractical to provide more general mainlanes. This is the compelling reason that a majority of the proposed HOV/HOT lanes will be in the tunnel or in a cut-and-cover box underneath the frontage road. A Value Engineering Study that was held in 1999 thoroughly investigated all avenues (moving, eliminating or braiding ramps, adding auxiliary lanes, etc.) to balance the traffic operation and demand, and to geometrically fit the area and satisfy the adjacent property/home owner's request (such as no elevated roadway in LBJ corridor). The study and other planning process

had resulted in the current schematic layout that had been approved by both TxDOT and FHWA. There is only limited leverage in this report to recommend any revisions of the approved schematic.

Although adding an additional general mainlane is practically not feasible at this time, a wider than usual concrete inside shoulder has been proposed in the schematic. It has provided the potential in the future that the mainlanes would be re-striped with one more lanes in each direction with reduced inside shoulder. As a result, the level of services computed in this report would be further improved. A design exception will be needed for such re-striping.

"Peak period" is an important concept introduced in this report. Considering the reality that the existing and future peak hour level of service would be "F" almost in the entire IH 635 west section, the level of service in "peak period" provides us a different angle to see a broader "picture" of traffic operation. However, It should be clearly understood that by showing a better "peak period" (K=0.06) LOS does not mean the worst peak hour (K=0.08) LOS not exist. Furthermore, a deeper investigation by a sample data analysis of TTI February 1, 2001 traffic count at east of IH 35E indicated that there were only 5 hours' K greater than 0.06 (1 hour K=0.08 and 4 hours' K=0.07) within the defined 15-hour "peak period". The "peak period" broader "picture" demonstrated that the majority actual hour by hour LOS would be equal or better than the calculated LOS using K=0.06 within the defined 15-hour "peak period".

In addition to the "peak period" concept, the "Value Pricing Strategy" is another tool introduced in this report to analyze the traffic operation. For such a highly congested (today and future), full commercially developed IH 635 west section with adding more general mainlanes almost impossible, the calculated level of service cannot be improved from "F" to "E" or better in numerous sections without considering the "Value Pricing Strategy" as a factor in the access justification analysis. The TxDOT ongoing Traffic Revenue Study with the Wilbur Smith Associates clearly indicates that the "Value Pricing Strategy" would certainly divert more vehicles from the general mainlanes to the HOV/HOT lanes. The operational analysis demonstrated the importance of the "Value Pricing Strategy".

HCS is an efficient tool to study the traffic operation characteristics in a big corridor. The micro-simulation model such as CORSIM would provide more detailed information and let the planners "visualize" the congestion. However, to establish and fine-tune the model would need a huge amount of effort for a big corridor.

The proposed new ramp access points (Category 1 Access) provide direct connections to the IH 635 mainlanes from major local cross streets and HOV/HOT lanes, and relieve the traffic on adjacent ramps. There are a few cases where the projected year 2020 mainlane peak hour LOS would be "F". But this is not due to the addition of these new ramps. It is because the projected year 2020 peak hour traffic volume exceeds the mainlane capacity in the area. On the other hand without these ramps, vehicles will have to use the next or previous ramps to get to and leave from the cross streets. This will increase the congestion at these intersections that already exists today.

For the reconfigured IH 635/IH 35E interchange (Category 2 Access), the existing 16 dual-point "on" and "off" access connectors have been revised to an 8 single-point "on" and "off" access connectors. The LOS has been significantly improved at the interchange area.

For the revised access locations on IH 635 mainlanes of IH 635/DNT interchange (Category 2 Access), the traffic operation for both EB and WB IH 635 mainlanes has been enhanced, as discussed in the "Operational Analysis" section.

Seven existing ramps have been eliminated in the proposed schematic, so do the seven LOS=F ramp-freeway junctions for the LBJ freeway at peak hour. However, due to the projected heavy mainlane traffic volume in the year 2020, further eliminating a few more ramps would not help the peak hour mainlane level of service much. In addition, there is so much congestion in the parallel facilities and latent demand along the corridor.

Three pairs of ramps (six ramps) have been reversed. They have been converted from the existing "Diamond" configuration to proposed "X" configuration. In addition to the advantages discussed in the "Operational Analysis" section for Category 3 access, a specific schematic revision has been recommended for the future designer to consider to improve the traffic operation conditions in WB IH 635 mainlanes at Midway, Webb Chapel area.

The proposed new access ramps and revised access points meet the current standards for Federal-aid projects on the Interstate System as required in the revision of the FHWA policy statement issued in the Federal Register on February 11, 1998.

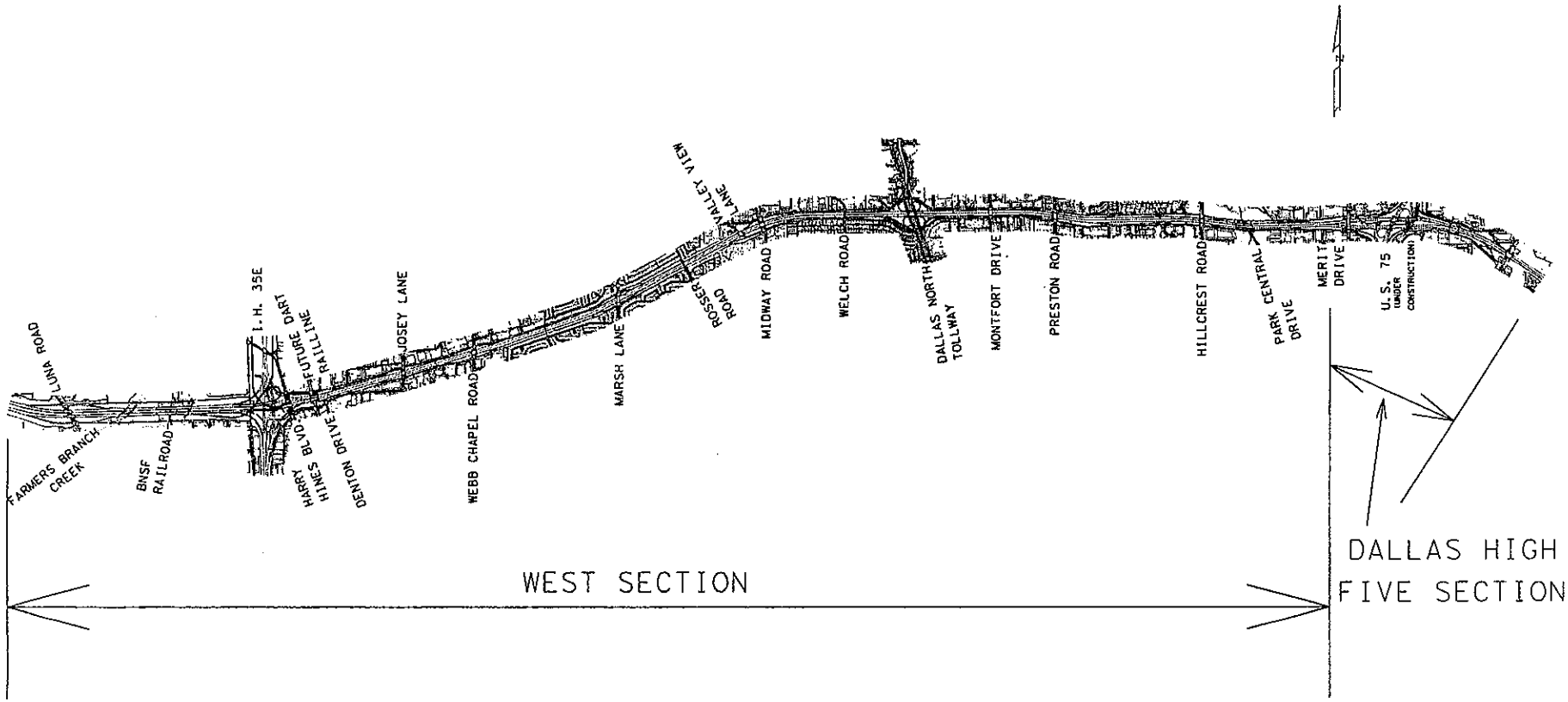

EXHIBIT 1

30

IH 635 CORRIDOR LAYOUT

6 | ½ | TEXAS | 1B | IH 635

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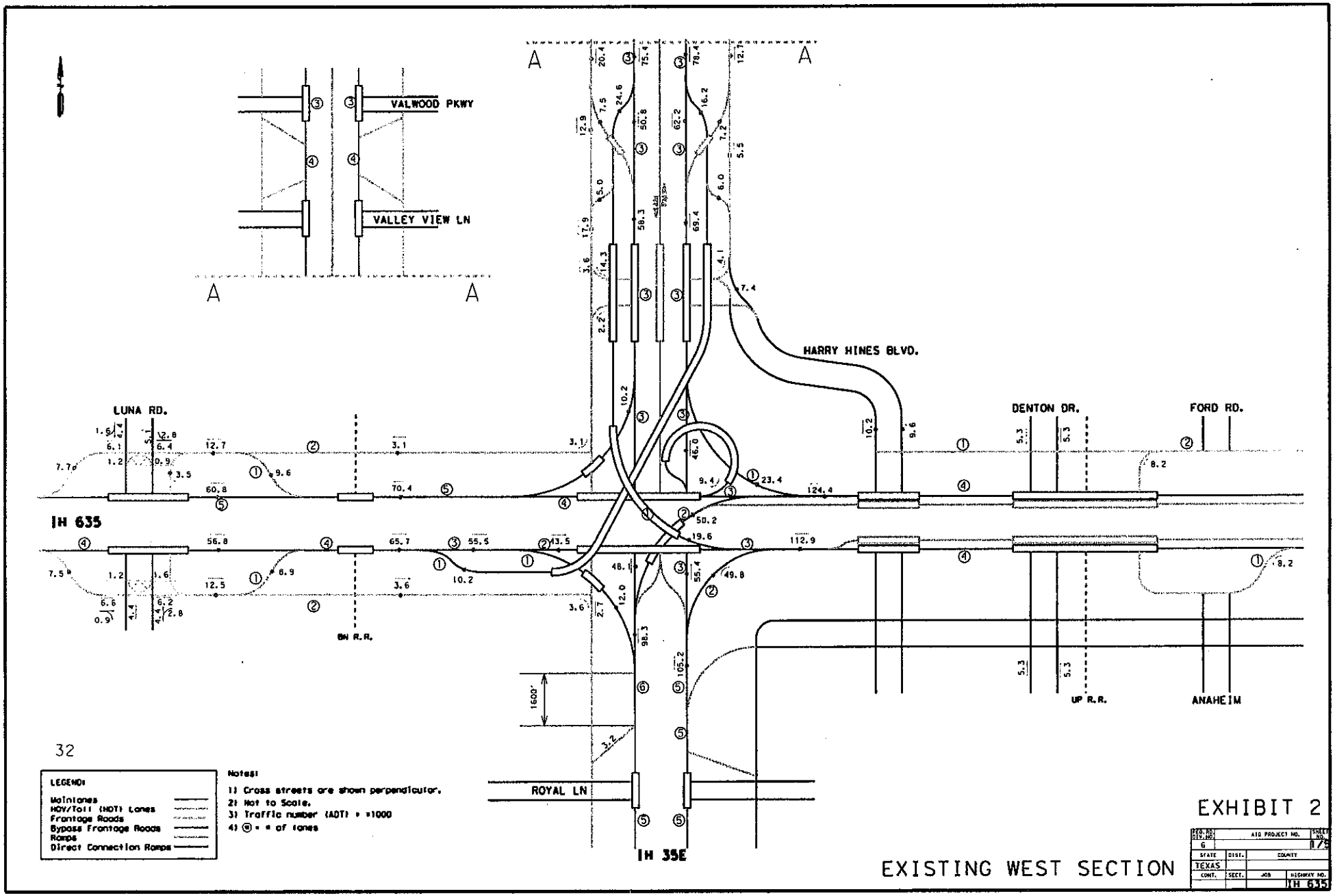

32

EXISTING WEST SECTION

EXHIBIT 2

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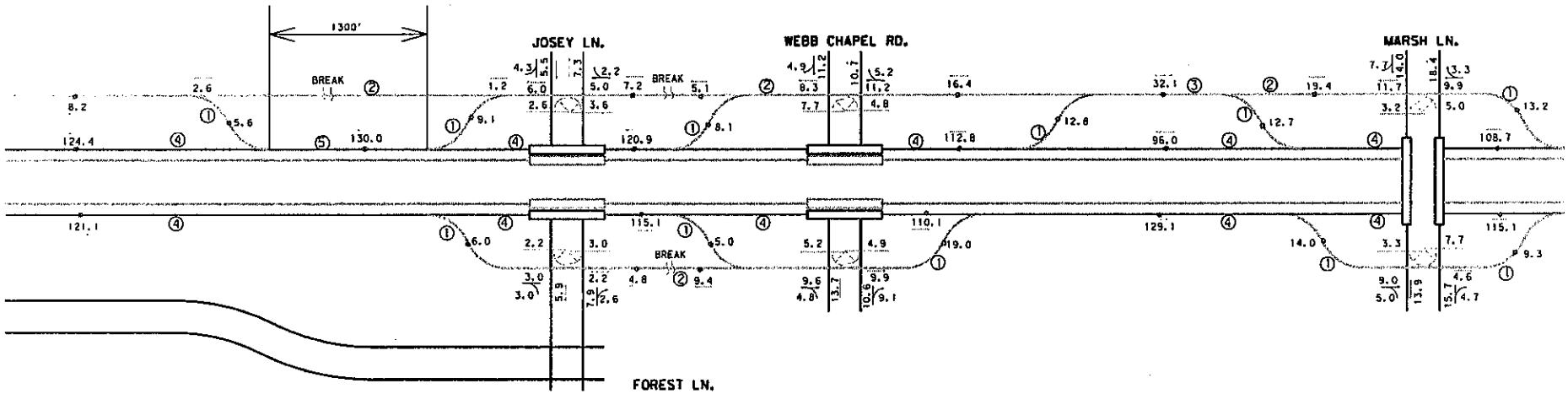
G		1/5
STATE		
TEXAS		
CONT.	SECT.	JOB

HIGHWAY NO. IH 635



33

LEGEND:
- Mainlanes
- HOV/Toll (HOT) Lanes
- Frontage Roads
- Bypass Frontage Roads
- Ramps
- Direct Connection Ramps

Notes:
1) Cross streets are shown perpendicular.
2) Not to Scale.
3) Traffic number (ADT) = *1000
4) ⓝ = # of lanes

EXHIBIT 2

EXISTING WEST SECTION

FED. RD. DIV. NO.	AID PROJECT NO.	SHEET NO.
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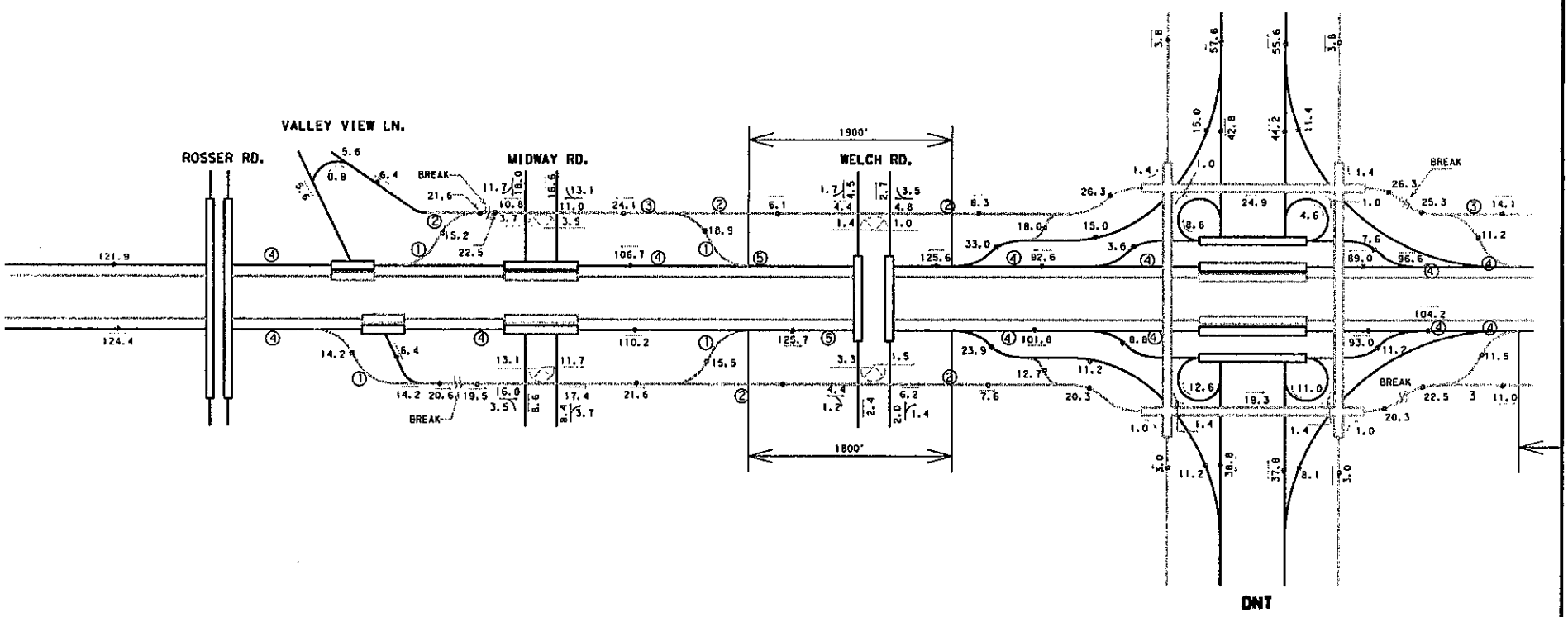
STATE	DIST.	COUNTY
TEXAS		
CONT.	SECT.	JOB	HIGHWAY NO.
			IH 635



34

LEGEND:
- Mainlanes
- HOV/Toll (HOT) Lanes
- Frontage Roads
- Bypass Frontage Roads
- Ramps
- Direct Connection Ramps

Notes:
1) Cross streets are shown perpendicular.
2) Not to Scale.
3) Traffic number (ADT) = *1000
4) ⓝ = # of lanes

EXHIBIT 2

EXISTING WEST SECTION

FED. ROAD DIV. NO.		AID PROJECT NO.		SHEET NO.
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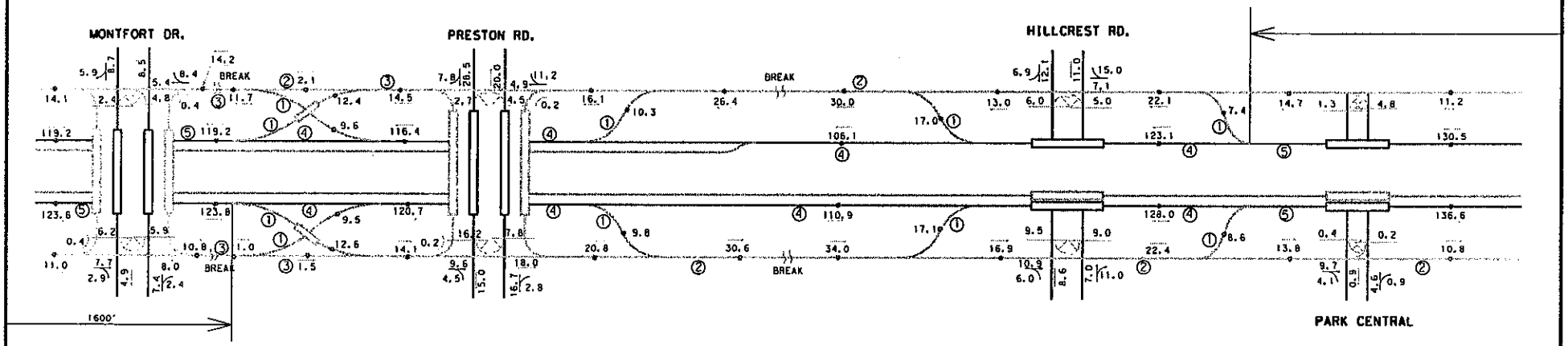
STATE	DIST.	COUNTY		
TEXAS				
CONT.	SECT.	JOB	HIGHWAY NO.	



35

LEGEND:
- Mainlanes
- HOV/Toll (HOT) Lanes
- Frontage Roads
- Bypass Frontage Roads
- Ramps
- Direct Connection Ramps

Notes:
1) Cross streets are shown perpendicular.
2) Not to Scale.
3) Traffic number (ADT) = #1000
4) (#) = # of lanes

EXHIBIT 2

EXISTING WEST SECTION

FED. RD. DIV. NO.	AID PROJECT NO.	SHEET NO.
6		4/5
STATE	DIST.	COUNTY
TEXAS		
CONT.	SECT.	JOB	HIGHWAY NO.
			IH 635

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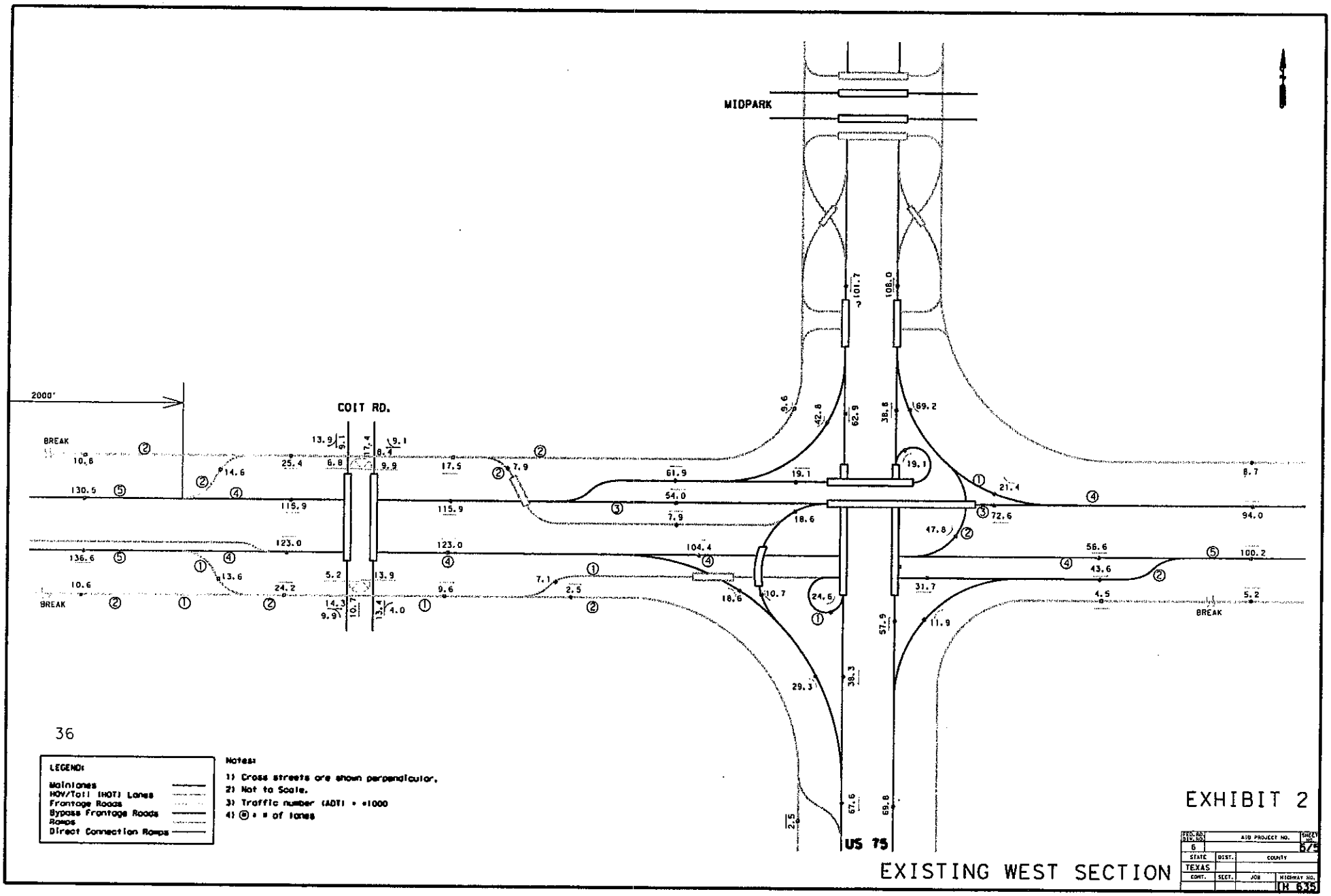

36

EXISTING WEST SECTION

EXHIBIT 2

FED. RD. DIV. NO.		ASD PROJECT NO.	SHEET NO.
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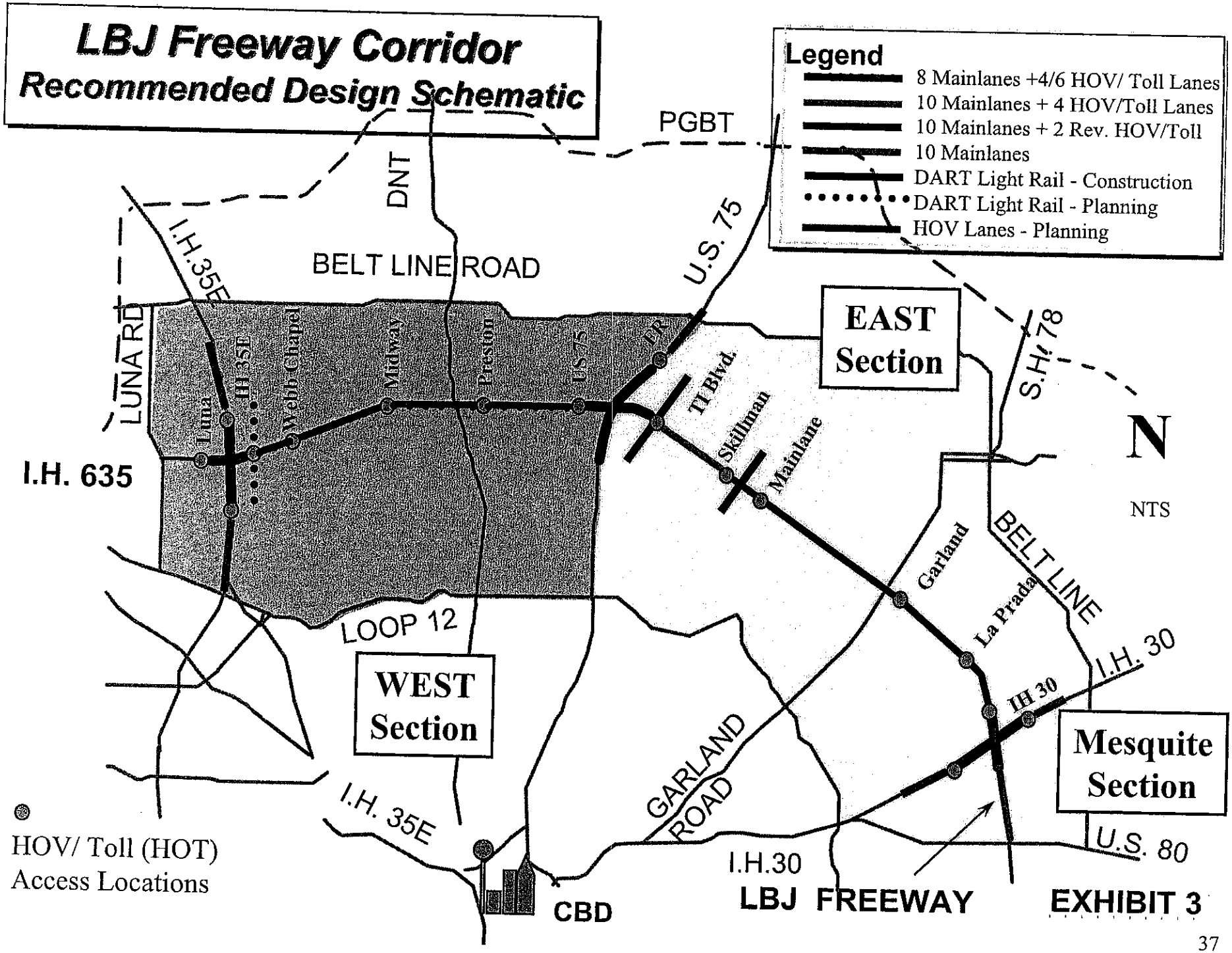
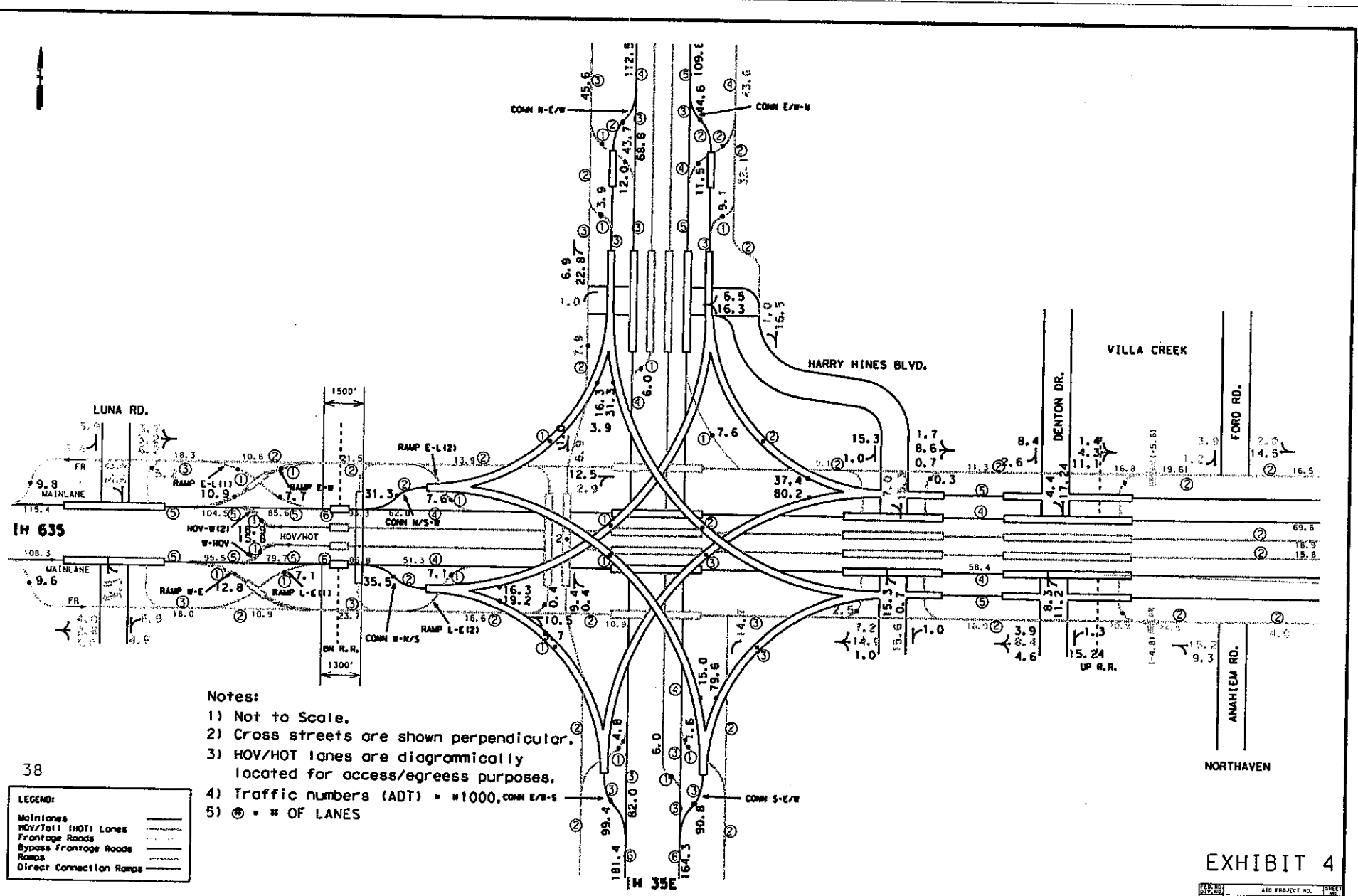
STATE	DIST.	COUNTY	
TEXAS			
CONT.	SECT.	JOB	HIGHWAY NO.
			IH 635

LBJ Freeway Corridor
Recommended Design Schematic





Notes:

1) Not to Scale.
2) Cross streets are shown perpendicular.
3) HOV/HOT lanes are diagrammically located for access/egreess purposes.
4) Traffic numbers (ADT) = #1000, CONN E/W-S
5) (#) = # OF LANES

38

LEGEND:

- Mainlanes
- HOV/Toll (HOT) Lanes
- Frontage Roads
- Bypass Frontage Roads
- Ramps
- Direct Connection Ramps

EXHIBIT 4

PROPOSED WEST SECTION

FED. RD. DIV. NO.	AID PROJECT NO.	SHEET NO.
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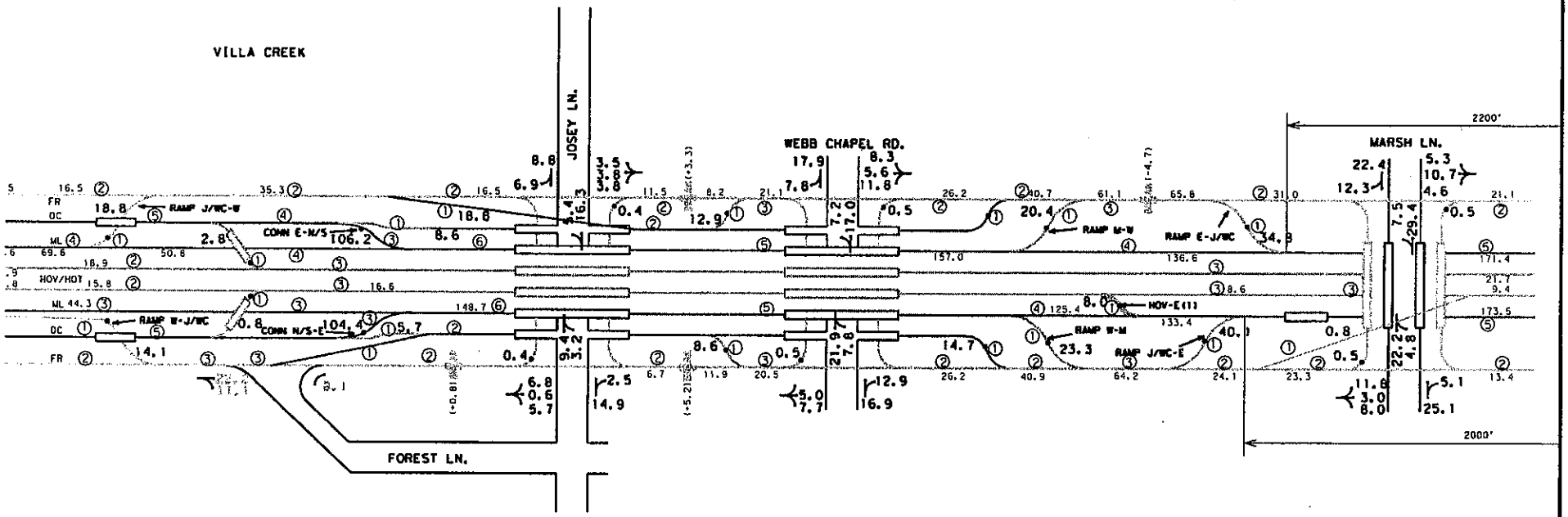
STATE	DIST.	COUNTY
TEXAS		
CONT.	SECT.	JOB / HIGHWAY NO.
		IH 635



39

LEGEND:
- Mainlanes
- HOV/Toll (HOT) Lanes
- Frontage Roads
- Bypass Frontage Roads
- Ramps
- Direct Connection Ramps

Notes:
1) Not to Scale.
2) Cross streets are shown perpendicular.
3) HOV/HOT lanes are diagrammically located for access/egreess purposes.
4) Traffic numbers (ADT) = #1000.
5) ⑯ = # OF LANES

EXHIBIT 4

PROPOSED WEST SECTION

FED. RD. DIV. NO.		AID PROJECT NO.	SHEET NO.
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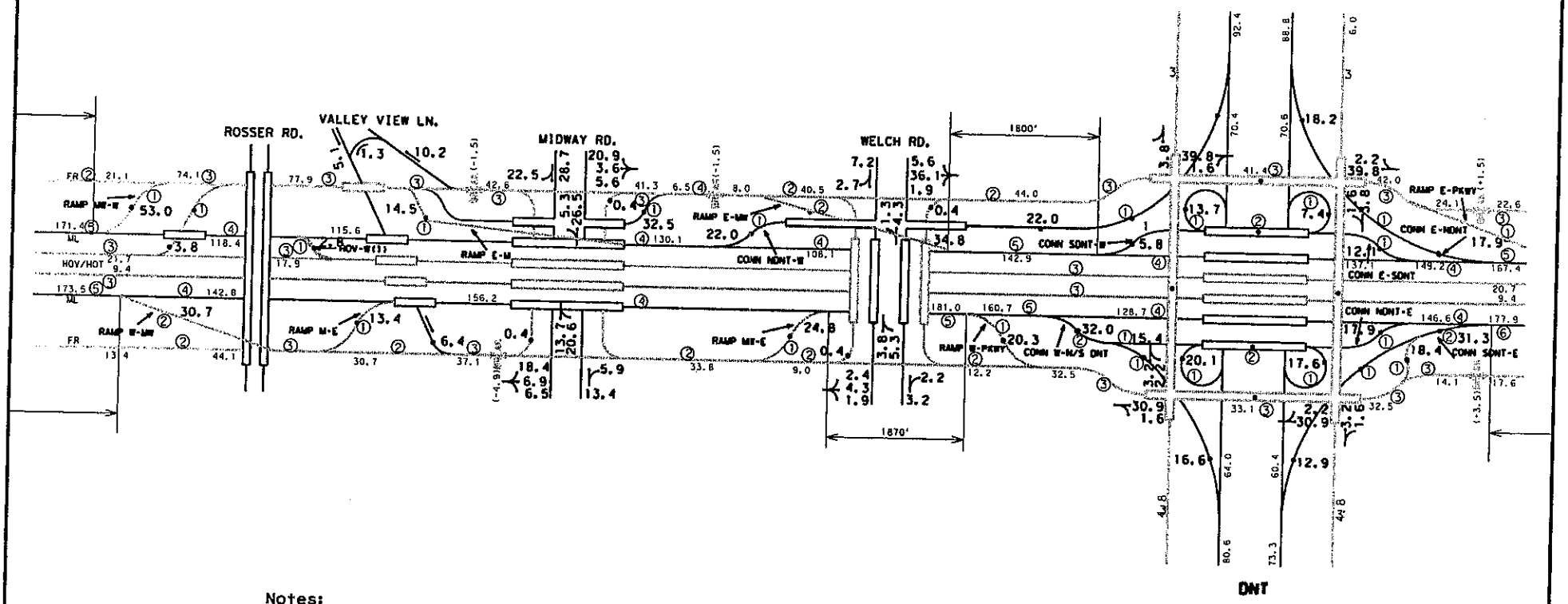
STATE	DIST.	COUNTY	
TEXAS			
CONT.	SECT.	JOB	HIGHWAY NO.
			IH 635



40

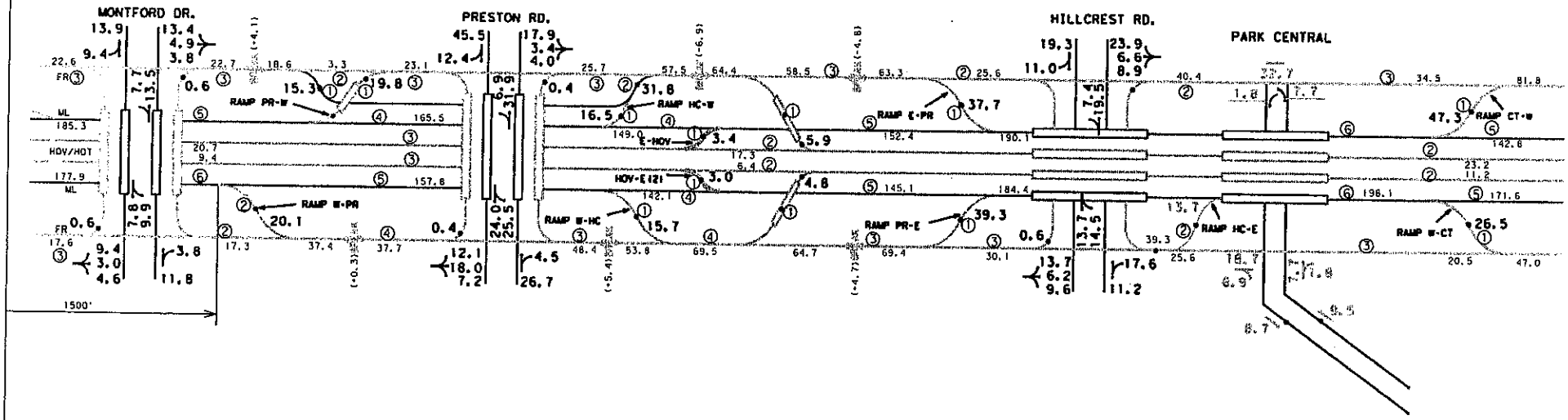
LEGEND:
- Mainlanes Mainlanes
- HOV/Toll (HOT) Lanes
- Frontage Roads
- Bypass Frontage Roads
- Ramps
- Direct Connection Ramps

Notes:
1) Not to Scale.
2) Cross streets are shown perpendicular.
3) HOV/HOT lanes are diagrammically located for access/egreess purposes.
4) Traffic numbers (ADT) = #1000.
5) (#) = # OF LANES

EXHIBIT 4

PROPOSED WEST SECTION

FED. RD. DIV. NO.		AID PROJECT NO.	SHEET NO.
6			37
STATE	DIST.	COUNTY	
TEXAS			
CONT.	SECT.	JOB	HIGHWAY NO.
			IH 635



41

LEGEND:

- Mainlanes
- HOV/Toll (HOT) Lanes
- Frontage Roads
- Bypass Frontage Roads
- Ramps
- Direct Connection Ramps

Notes:

1) Not to Scale.
2) Cross streets are shown perpendicular.
3) HOV/HOT lanes are diagrammically located for access/egreess purposes.
4) Traffic numbers (ADT) = #1000.
5) Ⓝ = # OF LANES

EXHIBIT 4

PROPOSED WEST SECTION

FED.RD. DIV.NO.		AID PROJECT NO.	SHEET NO.
6			4/4
STATE	DIST.	COUNTY	
TEXAS			
CONT.	SECT.	JOB	HIGHWAY NO.
			IH 635

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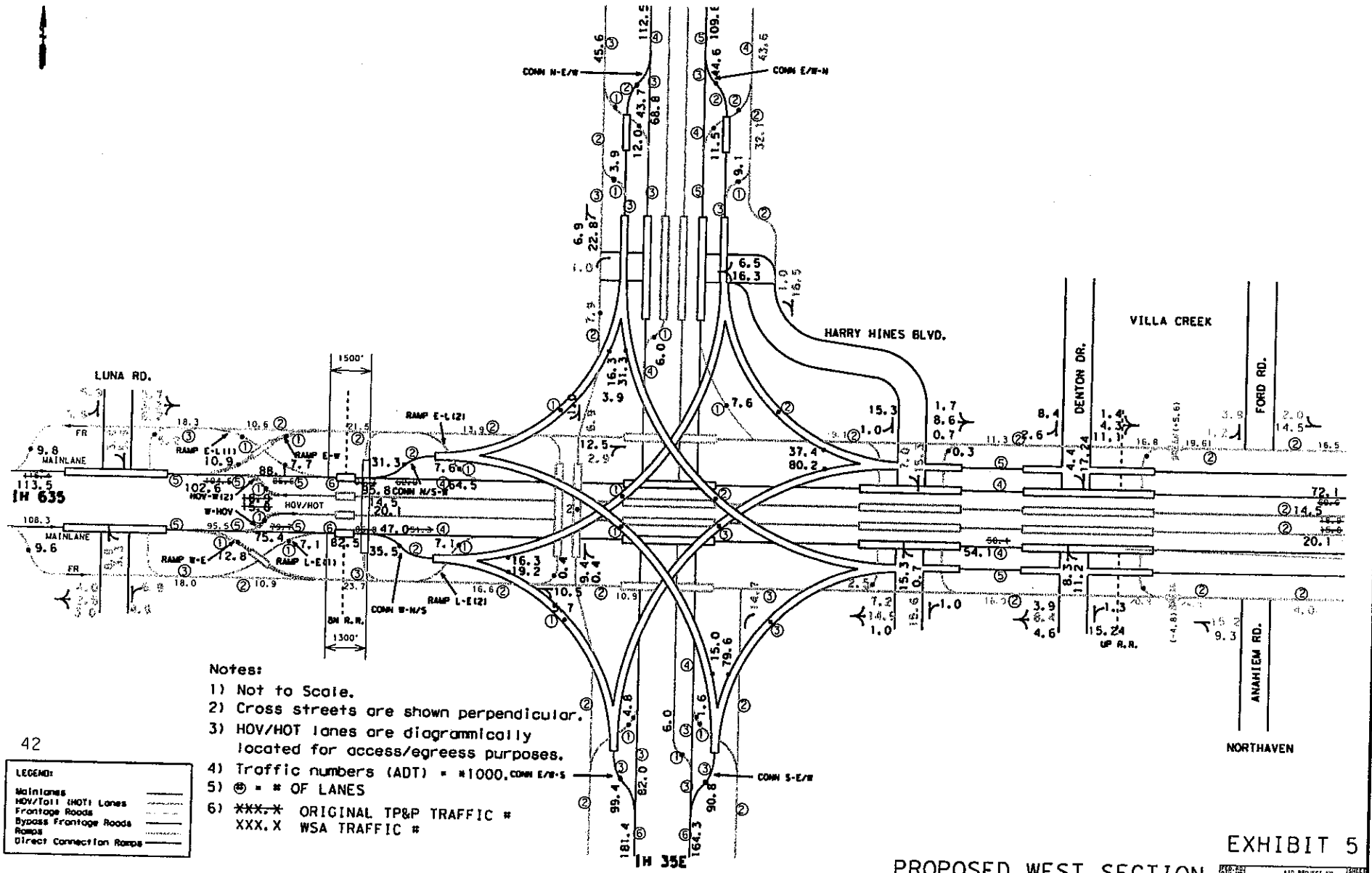


Notes:

1) Not to Scale.
2) Cross streets are shown perpendicular.
3) HOV/HOT lanes are diagrammically located for access/egress purposes.
4) Traffic numbers (ADT) = *1000.
5) (#) = # OF LANES
6) ~~XXX.X~~ ORIGINAL TP&P TRAFFIC #
   XXX.X WSA TRAFFIC #

42

LEGEND:

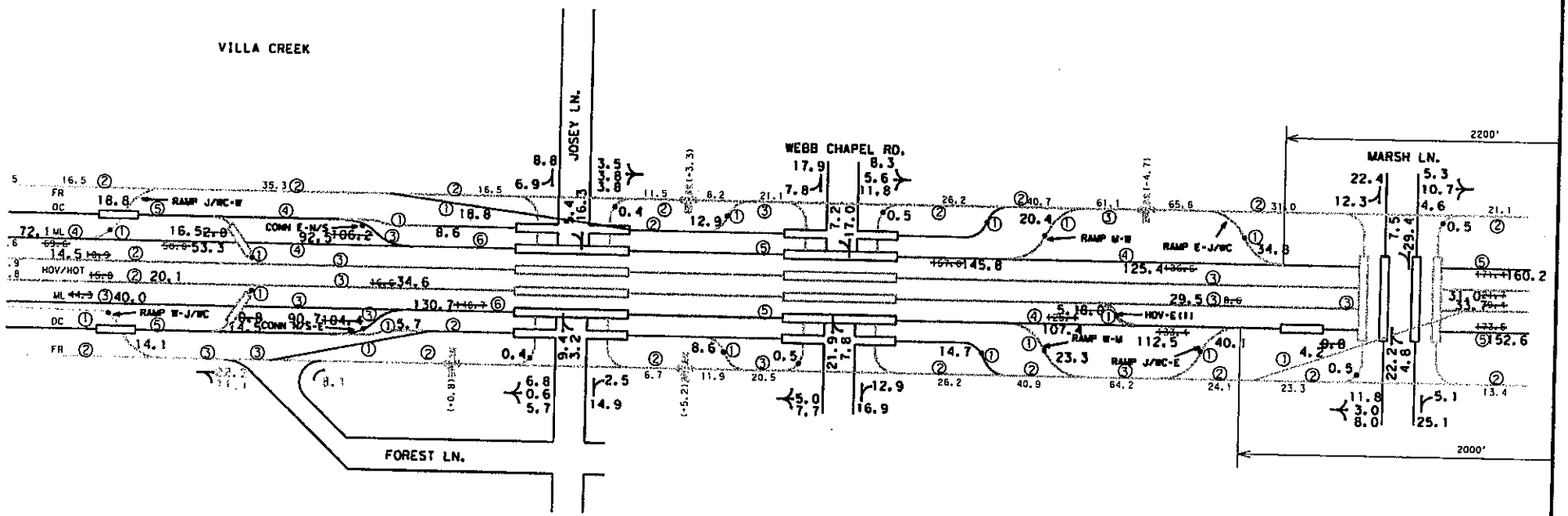
- Mainlanes
- HOV/Toll (HOT) Lanes
- Frontage Roads
- Bypass Frontage Roads
- Ramps
- Direct Connection Ramps

EXHIBIT 5

PROPOSED WEST SECTION

(TRAFFIC # BY WSA)

DIST.	COUNTY	AID PROJECT NO.	SHEET NO.
6			174
STATE	DIST.	COUNTY	
TEXAS			
CONT.	SECT.	JOB	HIGHWAY NO.
			IH 635



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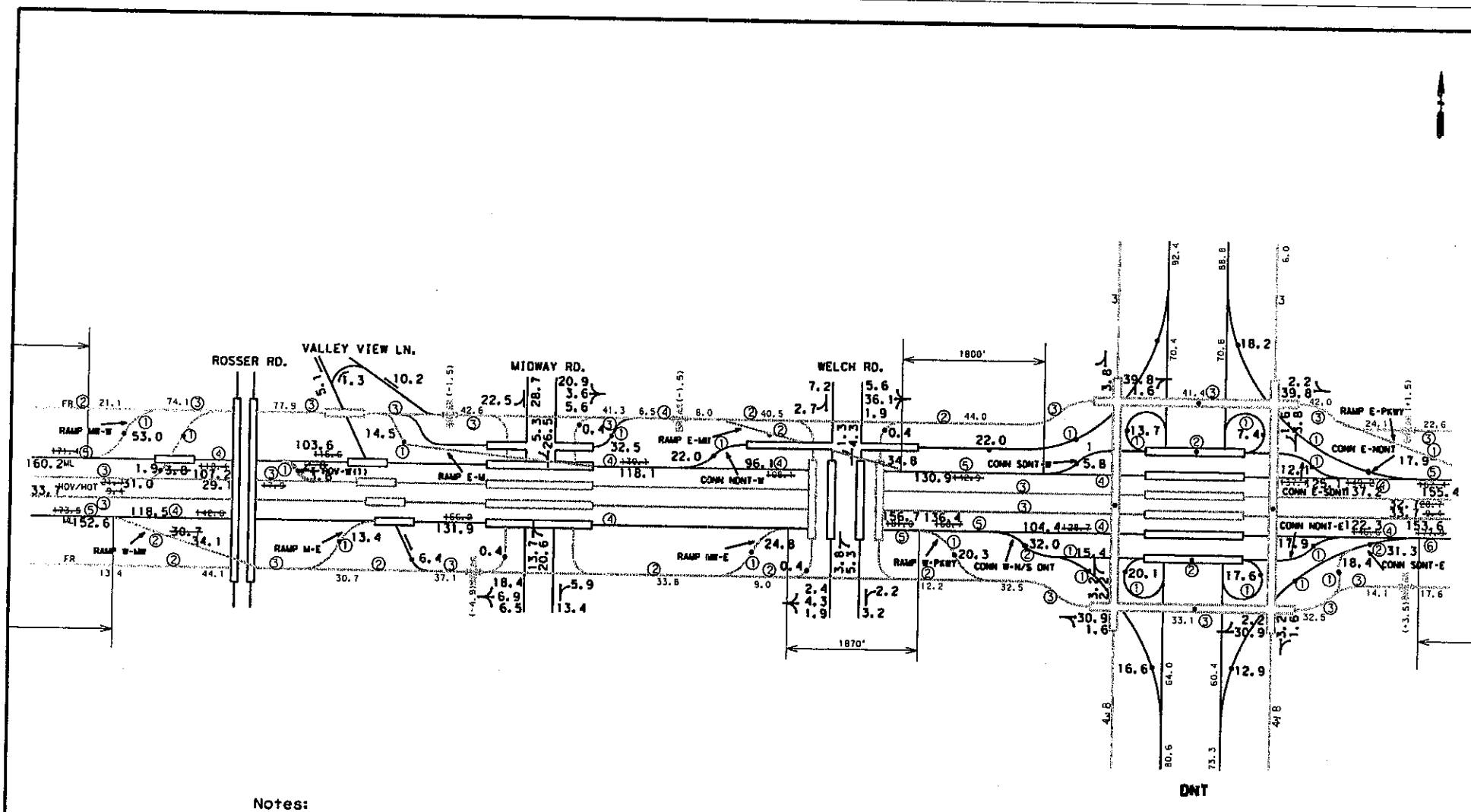
LEGEND:
- Mainlanes
- HOV/Toll (HOT) Lanes
- Frontage Roads
- Bypass Frontage Roads
- Ramps
- Direct Connection Ramps

Notes:
1) Not to Scale.
2) Cross streets are shown perpendicular.
3) HOV/HOT lanes are diagrammically located for access/egreess purposes.
4) Traffic numbers (ADT) = *1000.
5) ⑥ = # OF LANES
6) ~~XXX.X~~ ORIGINAL TP&P TRAFFIC #
   XXX.X WSA TRAFFIC #

EXHIBIT 5

PROPOSED WEST SECTION
(TRAFFIC # BY WSA)

DIST.	COUNTY	ADD PROJECT NO.	SHEET NO.
6			274
STATE	DIST.	COUNTY	
TEXAS			
CONT.	SECT.	JOB	HIGHWAY NO.
			IH 635



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LEGEND:

- Mainlanes Mainlanes
- HOV/Toll (HOT) Lanes
- Frontage Roads
- Bypass Frontage Roads
- Ramps
- Direct Connection Ramps

Notes:

1) Not to Scale.
2) Cross streets are shown perpendicular.
3) HOV/HOT lanes are diagrammically located for access/egress purposes.
4) Traffic numbers (ADT) = #1000.
5) Ⓝ = # OF LANES
6) ~~XXX.X~~ ORIGINAL TP&P TRAFFIC #
   XXX.X WSA TRAFFIC #

EXHIBIT 5

PROPOSED WEST SECTION
(TRAFFIC # BY WSA)

FED.RD. DIV.NO.	AID PROJECT NO.	SHEET NO.
6		174
STATE: TEXAS	DIST.	COUNTY
CONT.	SECT.	JOB	HIGHWAY NO. IH 635

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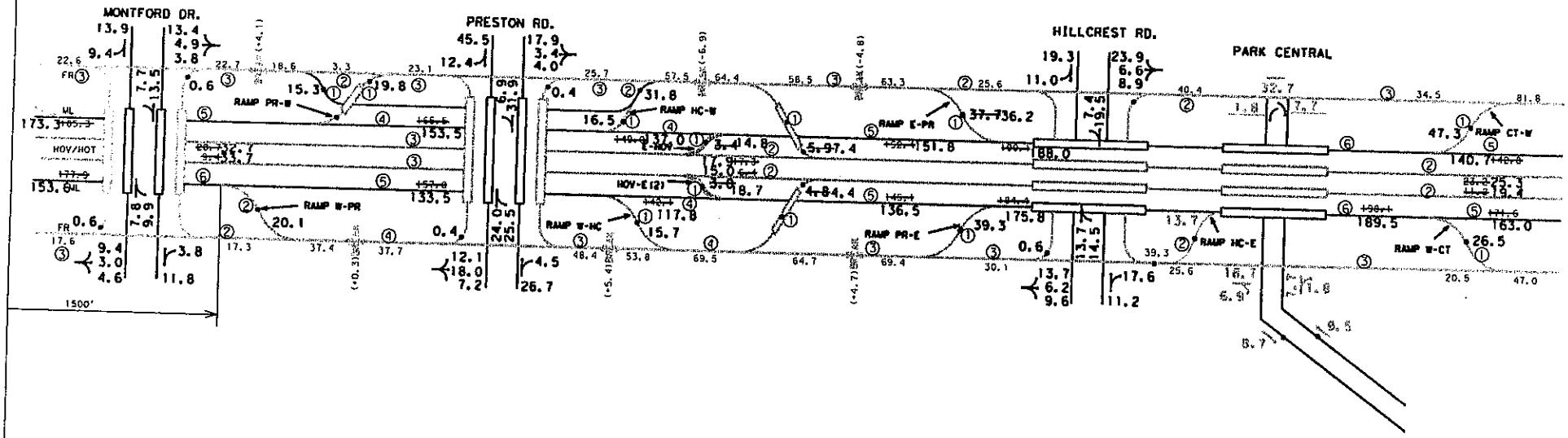

45

LEGEND:
- Mainlanes
- HOV/Toll (HOT) Lanes
- Frontage Roads
- Bypass Frontage Roads
- Ramps
- Direct Connection Ramps

Notes:

1) Not to Scale.
2) Cross streets are shown perpendicular.
3) HOV/HOT lanes are diagrammically located for access/egreess purposes.
4) Traffic numbers (ADT) = *1000.
5) ⑥ = # OF LANES
6) ~~XXX.X~~ ORIGINAL TP&P TRAFFIC #
   XXX.X WSA TRAFFIC #

EXHIBIT 5

PROPOSED WEST SECTION
(TRAFFIC # BY WSA)

FED. RD. DIV. NO.		AIS PROJECT NO.	SHEET NO.
6			4/4
STATE	DIST.	COUNTY	
TEXAS			
CONT.	SECT.	JOB	HIGHWAY NO.
			IH 635

Appendix B

NCTCOG

MANAGED LANE POLICY

MANAGED LANE POLICIES

1. A fixed-fee schedule will be applied during the first six months of operation; dynamic pricing will be applied thereafter.

2. The toll rate will be set up to $0.75 per mile during the fixed-schedule phase. The established rate will be evaluated and adjusted, if warranted, with Regional Transportation Council (RTC) approval.

3. Toll rates will be updated monthly during the fixed-schedule phase.

4. Market-based tolls will be applied during the dynamic-pricing phase.

5. Transit vehicles will not be charged a toll.

6. Single-occupant vehicles will pay the full rate.

7. Trucks will pay a higher rate, and no trucks will be permitted in the LBJ tunnel.

MANAGED LANE POLICIES (continued)

8. High-occupancy vehicles of two or more occupant and vanpools will pay the full rate in the off-peak period.

9. High-occupancy vehicles of two or more occupants will receive a 50 percent discount during the peak period.* This discount will phase out after the air quality attainment maintenance period. RTC-sponsored public vanpools are permitted to add peak-period tolls as eligible expenses. Therefore, the Comprehensive Development Agreement (CDA) firm will be responsible for the high-occupancy vehicle discount and the Regional Transportation Council will be responsible for the vanpool discount.

10. The toll rate will be established to maintain a minimum average corridor speed of 50 miles per hour.

*6 hours per weekday: 6:30 a.m. - 9:00 a.m. and 3:00 p.m. - 6:30 p.m.

MANAGED LANE POLICIES (continued)

11. During the dynamic-pricing phase, travelers will receive rebates if the average speed drops below 35 mph. Rebates will not apply if speed reduction is out of the control of the operator.

12. Motorcycles qualify as high-occupancy vehicles.

13. No discounts will be given for "Green Vehicles."

14. No scheduled inflation adjustments will be applied over time.

15. Every managed lane corridor will operate under the same policy.

16. There will be no change to the Regional Transportation Council Excess Revenue Policy.

MANAGED LANE POLICIES (continued)

17. The Regional Transportation Council requests that local governments and transportation authorities assign representatives to the Comprehensive Development Agreement procurement process.

18. The duration of the Comprehensive Development Agreement should maximize potential revenue.

19. Tolls will remain on the managed lanes after the Comprehensive Development Agreement duration.

RTC Approved – May 11, 2006
RTC Modified – September 14, 2006

Texas Department of Transportation

IH 635 Managed Lanes Project
Technical Provisions

Attachment 12-1A

Drainage Criteria Manual

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CHAPTER 1 - INTRODUCTION

1.1 PURPOSE

The purpose of this drainage manual is to establish design procedures necessary for the control of storm water runoff for the IH 635 Freeway improvements from Luna Road to US 80 (referred to in this manual as IH 635 corridor). Also included is IH 35E from Royal Lane to Valwood Parkway. The design factors, formulas, graphs, and procedures are intended for use as engineering guides in the solution of drainage problems involving determination of the quantity, rate of flow and conveyance of storm water. The procedures defined herein should be applied by experienced professional drainage Engineers who are ultimately responsible for the design of drainage systems within the IH 635 corridor.

1.2 SCOPE

This manual presents various applications of accepted principles of surface drainage engineering and is a working supplement to the information obtained from standard drainage handbooks and other publications on drainage.

The design criteria presented herein for the IH 635 corridor drainage systems are primarily based on the Texas Department of Transportation's (TxDOT) Hydraulic Design Manual, March 2004. However, additional drainage design guidelines from the cities of Dallas, Farmer's Branch, Garland, and Mesquite were referenced during the development of this manual.

The intent of this manual is to provide clear, concise and uniform principles, guidelines and criteria for use by drainage Engineers designing the storm drainage systems along the IH 635 corridor from Luna Road to US 80. The information provided in this manual has been adjusted to reflect the conditions that generally exist along the Project corridor and is meant to clarify and supplement the TxDOT Hydraulic Design Manual.

Methods of design other than indicated herein may be considered in special cases where experience clearly indicates they are preferable. However, there should be no extensive variations from the practices established herein without express approval from TxDOT.

1.3 DESIGN CRITERIA SUMMARY

A brief summary of the drainage design criteria is provided in Table 1.3.1. For detailed discussions and additional criteria refer to the following chapters.

Table 1.3.1 Design Criteria

Description	General Purpose Lanes	Managed Lanes	Direct Connectors
Method for Determining Peak Runoff			
Less than 200 acres	Rational Method	Rational Method	Rational Method
Greater than 200 acres	Natural Resources Conservation Service Runoff Curve Number Method	Natural Resources Conservation Service Runoff Curve Number Method	Natural Resources Conservation Service Runoff Curve Number Method
Culvert Crossings			
Design Storm	Minor: 50-year	Minor: 50-year	Minor: 50-year
	Major: 100-year	Major: 100-year	Major: 100-year
Check Storm	100-year	100-year	100-year
Headwater Control[1]	< Or = Existing Headwater Elevation	< Or = Existing Headwater Elevation	< Or = Existing Headwater Elevation
Maximum Outlet Velocity	Lined:12 fps	Lined - 12 fps	Lined - 12 fps
	Vegetated clay: 8 fps	Vegetated clay: 8 fps	Vegetated clay: 8 fps
	Vegetated sand: 6 fps	Vegetated sand: 6 fps	Vegetated sand: 6 fps
Minimum Outlet Velocity	Lined: 2.5 fps	Lined: 2.5 fps	Lined: 2.5 fps
	Vegetated: 2 fps	Vegetated: 2 fps	Vegetated: 2 fps
Storm Sewers and Inlets			
Design Storm	50-year	50-year	50-year
Check Storm	100-year	100-year	100-year
Design Storm Allowable Ponding Width	No encroachment into the travel lanes	2 feet of encroachment into the travel lanes	2 feet of encroachment into the travel lanes
Check Storm Allowable Ponding Width	One lane free of encroachment	One lane free of encroachment	One lane free of encroachment
Pipe Material	Concrete	Concrete	Concrete
Minimum Pipe Size	Laterals: 18 inch	Laterals: 18 inch	Laterals: 18 inch
	Trunklines: 24 inch	Trunklines: 24 inch	Trunklines: 24 inch
Minimum Pipe Velocity	2 fps	2 fps	2 fps
Maximum Pipe Velocity	12 fps	12 fps	12 fps

Table 1.3.1 Cont.

Description	Ramps	By-Passes	Elevated Collectors
Method for Determining Peak Runoff			
Less than 200 acres	Rational Method	Rational Method	Rational Method
Greater than 200 acres	Natural Resources Conservation Service Runoff Curve Number Method	Natural Resources Conservation Service Runoff Curve Number Method	Natural Resources Conservation Service Runoff Curve Number Method
Culvert Crossings			
Design Storm	Minor: 50-year	Minor: 50-year	Minor: 50-year
	Major: 100-year	Major: 100-year	Major: 100-year
Check Storm	100-year	100-year	100-year
Headwater Control[1]	< Or = Existing Headwater Elevation	< Or = Existing Headwater Elevation	< Or = Existing Headwater Elevation
Maximum Outlet Velocity	Lined:12 fps	Lined - 12 fps	Lined - 12 fps
	Vegetated clay: 8 fps	Vegetated clay: 8 fps	Vegetated clay: 8 fps
	Vegetated sand: 6 fps	Vegetated sand: 6 fps	Vegetated sand: 6 fps
Minimum Outlet Velocity	Lined: 2.5 fps	Lined: 2.5 fps	Lined: 2.5 fps
	Vegetated: 2 fps	Vegetated: 2 fps	Vegetated: 2 fps
Storm Sewers and Inlets			
Design Storm	50-year	50-year	50-year
Check Storm	100-year	100-year	100-year
Design Storm Allowable Ponding Width	2 feet of encroachment into the travel lanes	2 feet of encroachment into the travel lanes	2 feet of encroachment into the travel lanes
Check Storm Allowable Ponding Width	One lane free of encroachment	One lane free of encroachment	One lane free of encroachment
Pipe Material	Concrete	Concrete	Concrete
Minimum Pipe Size	Laterals: 18 inch	Laterals: 18 inch	Laterals: 18 inch
	Trunklines: 24 inch	Trunklines: 24 inch	Trunklines: 24 inch
Minimum Pipe Velocity	2 fps	2 fps	2 fps
Maximum Pipe Velocity	12 fps	12 fps	12 fps

Table 1.3.1 Cont.

Description	Frontage Roads	Cross Streets
Method for Determining Peak Runoff		
Less than 200 ac	Rational Method	Rational Method
Greater than 200 ac	Natural Resources Conservation Service Runoff Curve Number Method	Natural Resources Conservation Service Runoff Curve Number Method
Culvert Crossings		
Design Storm	Minor: 50-year	Minor: 50-year
	Major: 100-year	Major: 100-year
Check Storm	100-year	100-year
Headwater Control[1]	< Or = Existing Headwater Elevation	< Or = Existing Headwater Elevation
Maximum Outlet Velocity	Lined - 12 fps	Lined - 12 fps
	Vegetated clay: 8 fps	Vegetated clay: 8 fps
	Vegetated sandy: 6 fps	Vegetated sandy: 6 fps
Minimum Outlet Velocity	Lined: 2.5 fps	Lined: 2.5 fps
	Vegetated: 2 fps	Vegetated: 2 fps
Storm Sewers and Inlets		
Design Storm,[2]	25-year	25-year
	Depressed: 50-year	Depressed: 50-year
Check Storm,	50-year	50-year
	Depressed: 100-ear	Depressed: 100-year
Design Storm Allowable Ponding Width	One-lane for a 2-lane frontage road One-and-a-half lanes for a 3-lane frontage road	One lane open to traffic in each direction
Check Storm Allowable Ponding Width	50-year – no overtopping of curb	50-year – no overtopping of curb
Pipe Material	Concrete	Concrete
Minimum Pipe Size	Laterals: 18 inch	Laterals: 18 inch
	Trunklines: 24 inch	Trunklines: 24 inch
Minimum Pipe Velocity	2 fps	2 fps
Maximum Pipe Velocity	12 fps	12 fps

Notes:
1. This applies to cross structures. Refer to Chapter 7. The same headwater controls that apply to storm sewer apply to internal culverts. For internal drainage hydraulic grade line requirements, refer to Chapter 6.
2. For frontage roads and side streets along IH-35E south of Royal Lane, the 10-year design frequency applies. In all cases for depressed sections, design will be for the 50-year event. For further discussion, refer to Chapter 6.2.

CHAPTER 2 - POLICY AND GUIDELINES

An objective of TxDOT is to construct and maintain facilities that minimize the potential for flooding impacts to the surrounding area. The TxDOT Drainage Policy as stated in Chapter 2 of the TxDOT Hydraulic Design Manual shall govern the design of drainage facilities within the IH 635 corridor. All criteria in this manual have been developed to support this policy. Variances from any of the criteria or policy in this manual must receive prior approval from TxDOT.

TxDOT and the design Engineer shall work together in the preparation of the construction plans for projects within the IH 635 corridor. Throughout the preparation process TxDOT shall review the progress of the design in pre-determined intervals as defined in this manual. Submittals shall be made to TxDOT in the form of half-size sets of construction plans that are eleven inches tall by seventeen inches wide. For all but the final submittal, the construction plans shall have the preliminary seal of the project Engineer that is licensed in the state of Texas. An Engineer licensed in the state of Texas shall seal the final set of construction plans and any bound reports.

The review process is subdivided into four distinct steps, representing levels of completeness. They are: 35 percent complete, 65 percent complete, 95 percent complete, and 100 percent complete. A description of major drainage-related elements required at each step is explained in Chapter 3, Section 4. Refer to TxDOT's PS&E Preparation Manual for additional information.

For improvements at crossings that affect Federal Emergency Management Agency (FEMA) flood hazard areas, the guidelines explained in Chapter 2 of TxDOT's Hydraulic Design Manual should be followed. No rise in water surface for the 100-year storm will be permitted; therefore, Conditional Letters of Map Revision (CLOMR's) will not be necessary. It will be left up to the local community to submit to the FEMA a Letter of Map Revision (LOMR) request. TxDOT will provide the cities with the certified as-built plans for the proposed Project.

Improvements along the IH 635 corridor may impact jurisdictional waters of the United States. The agency responsible for regulating such impacts is the U.S. Army Corps of Engineers (USACE). Applications shall be submitted to the USACE detailing impacts to the waters of the United States and adjacent wetlands, according to the guidelines prescribed by the USACE.

The Engineer shall prepare exhibits that clearly demonstrate proposed work in waters of the U.S. and adjacent wetlands. Any measures to mitigate the impacts to the waters of the United States shall be reviewed and approved by TxDOT. The design Engineer shall prepare other permits or applications that may apply along the IH 635 corridor.

CHAPTER 3 - DATA COLLECTION, EVALUATION, AND DOCUMENTATION

3.1 GENERAL

The purpose of this chapter is to clarify documentation and data collection procedures for the IH 635 corridor. Because drainage improvements along the IH 635 corridor may be designed by several Engineers, it is imperative that a clear procedure for documentation is followed. This will ensure that information is adequately relayed and a uniform design within the corridor is achieved. Chapters 3 and 4 of TxDOT's Hydraulic Design Manual discuss the standard documentation and data collection procedures. The following chapter clarifies specific aspects of those procedures as they apply to the IH 635 corridor for the following design elements:

1. Hydraulic reports
2. Drainage plans preparation
3. Submittals

3.2 HYDRAULIC REPORTS

All data gathered and used in analysis and design should be included in hydraulic reports. For each major hydraulic crossing as defined in Table 4.2.1 the following information shall be included when available:

1. Stream/Structure location
2. Site description
3. Maps
    a. Local zoning maps
    b. Flood insurance studies
    c. USGS quadrangle maps
    d. Aerial photos
    e. Soil maps
4. Field survey information
    a. Existing hydraulic facilities
    b. Existing controls
    c. Profiles of existing roadway
5. Ground level photographs
6. Flood history
7. Flood insurance studies (FIS by FEMA)

8. Geotechnical information
    a. Soil properties
    b. Stream stability
    c. Existing erosion/scour problems
    d. Historic scour data from bridge inspection records for existing bridges and other crossings on the same and nearby streams.
    e. Boring logs where available
9. Drainage area maps
    a. Scale
    b. North arrow
    c. Delineated areas and size
    d. Runoff coefficients/Runoff Curve Numbers (RCN)
    e. Slopes
    f. Contours
10. Hydrologic methods and programs
11. Hydrologic calculations
12. Flood frequency analysis
    a. Peak discharges for design and check events
    b. Runoff hydrographs for design and check events
13. Hydraulic method or program used
14. Channel data
    a. Cross sections
        i. Location
        ii. Subdivisions and “n” values
    b. Thalweg profiles
    c. Flow controls
    d. Design criteria and assumptions
15. Structure data
    a. Size and configuration
    b. Abutment protection for bridges
    c. Stream bank stabilization
    d. Allowable headwater and outlet velocities for design and check events
    e. Magnitude and frequency of overtopping event

f. Scour calculations and estimated scour envelope for bridges

16. Hydraulic computations including stage-discharge data
17. Water surface elevations for the design and check events including headwater elevations at structures
18. Average velocities for design and check events
19. Analysis of existing conditions for comparison
    a. Velocities through existing structures
    b. Water surface elevations
    c. Erosion and sedimentation problems
20. Channel improvements/easements
21. Outlet protection/control

3.3 DRAINAGE PLANS PREPARATION

The drainage construction plans for the IH 635 corridor shall include the following sheets and information:

1. Drainage Area Maps
    a. Overall/Offsite drainage area maps
        i. Scale
        ii. North arrow
        iii. Centerline of IH 635
        iv. Cross structure drainage designation and size
        v. Drainage boundary for major divides
        vi. Contours with elevation label at a readable increment (when available)
        vii. Runoff direction arrows
        viii. Drainage area sizes
        ix. Design flows
    b. Roadway/Onsite drainage area maps
        i. Scale
        ii. North arrow
        iii. Centerline of IH 635
        iv. Existing topography
        v. Inlets and cross structures visible

vi. Runoff direction arrows
vii. Drainage area label/identification

2. Major culvert hydraulic computation sheets
    a. Culvert size and length
    b. Method of hydraulic analysis
    c. Design and check storm flow
    d. Design and check storm headwater and tailwater elevations
    e. Design and check storm velocities
        i. Through proposed structure
        ii. Through existing structure
    f. Culvert flowlines upstream and downstream
    g. Allowable and existing headwater elevations
3. Storm sewer hydraulic calculation sheets (refer to Tables 6.10.1 through 6.10.5) for required information
    a. Runoff computations
    b. Inlet configuration
    c. Inlet computations
    d. Storm sewer configuration
    e. Storm sewer computations
4. Culvert layout sheets
    a. North arrow
    b. Vertical and horizontal scales
    c. Plan view
        i. Proposed contours and grading
        ii. Existing contours, grading, or features to match at R.O.W.
        iii. Proposed roadway linework
        iv. Roadway centerline/baseline callouts and stationing
        v. Right-of-way and drainage easement linework and callouts
        vi. Culvert size and length (normal length and skew length, if applicable)
        vii. Culvert, headwall, inlet, storm sewer linework
        viii. Culvert stationing
        ix. Callouts for headwalls and junctions on culvert
    d. Profile view

i. Culvert profile facing the direction of increasing roadway stationing
ii. Culvert stationing
iii. Culvert elevation callouts at grade breaks and junctions
iv. Linework and callouts for pipes/culverts tying to cross structure
v. Centerline slopes upstream and downstream of structure
vi. Proposed flows for the design and check events
vii. Proposed headwater and tailwater elevations for the design and check events
viii. Proposed velocities for the design and check events
ix. Proposed and existing ground along the centerline of the culvert
x. Applicable culvert and end treatment/headwall standard details reference

5. Storm sewer plan and profile sheets
    a. Plan view
        i. Scale
        ii. North arrow
        iii. Topography
        iv. Proposed roadway linework
        v. Callouts for the reference roadway centerlines/baselines
        vi. Culvert, storm sewer trunk line and lateral, inlet, and ditch centerline linework
        vii. Node identification - headwall, inlet, bend, and junction designations
        viii. Pipe/link designations, pay lengths, and diameter/size
        ix. Utilities in critical locations
    b. Profile view
        i. Scale
        ii. Link profile linework
        iii. Callouts for headwalls, inlets, junctions, bends, and grade breaks
            1. Flowline elevations
            2. Type of node
            3. Reference roadway station/offset
            4. Top of pavement/grade or lip of gutter where applicable
            5. Depth of inlet/manhole
        iv. Callouts for pipe/link pay length, diameter/size, and slope

v. Trench excavation protection limits and length
vi. Hydraulic grade line for design event
vii. Existing ground and proposed (finished) grade along centerline of link

6. Special ditch grading
    a. Ditch designation – shown on storm sewer plan view
    b. Table summarizing ditch design – on separate special ditch grading summary sheet
        i. Reference roadway station, offset and elevation for beginning, end, grade breaks, and shape changes
        ii. Ditch flowline elevations
        iii. Ditch bottom width
    c. Ditch typical sections shown on roadway typical sections or on special ditch grading summary sheets
7. Drainage details and standard details

3.4 SUBMITTALS

Documentation review stages shall be as follows:

1. 35 Percent Submittal – Preliminary Design
    a. 11” x 17” half-size bond with preliminary seal
    b. Preliminary hydraulic report for effective review
    c. Overall drainage area maps essentially complete for final review
    d. Major creek crossings
        i. Final hydrologic and hydraulic calculations
        ii. Water surface elevations
        iii. Bridge layouts essentially complete for final review
        iv. Culvert plan and profile sheets with final layouts and sizes
        v. Utility locations in critical locations
    e. Minor culvert crossings – design substantially complete for effective review
        i. Final hydrologic calculations
        ii. Preliminary hydraulic calculations
        iii. Culvert layout
        iv. Preliminary size and profile

v. Preliminary water surface elevations

f. Preliminary box culvert supplement sheet if applicable

2. 65 Percent Submittal – Plans Adequate
   a. 11” x 17” half-size bond with preliminary seal
   b. Incorporated TxDOT comments from 35% submittal
   c. Preliminary storm sewer design
      i. Trunk line layout and preliminary size
      ii. Preliminary trunk line profile
      iii. Known inlet locations
      iv. Sample inlet drainage area map
      v. Outfall location, description, and tailwater information
      vi. Utility locations in critical locations
   d. Minor culvert design complete
      i. Final hydraulic calculations
      ii. Final culvert plan and profile sheets
   e. Provide plans and reports for review by adjacent cities
   f. Provide plans adequate for utility adjustments
3. 95 Percent Submittal – District Review
   a. 11” x 17” half-size bond with preliminary seal
   b. Incorporated TxDOT comments from 65% submittal
   c. Final storm sewer design
      i. Final inlet locations and inlet drainage area maps
      ii. Final hydrologic and hydraulic calculations
      iii. Final storm sewer plan and profiles sheets – trunk lines and laterals
   d. Final bridge design and construction plans
4. 100 Percent Submittal – Final Mylars
   a. 11” x 17 “ half-size sealed mylar
   b. Incorporated TxDOT comments from 95% submittal
   c. Final drainage construction plans and detail sheets
   d. TxDOT standard details
5. As-Built Plans
   a. 11” x 17” half-size sealed mylar
   b. Incorporated TxDOT approved field changes of 100% submittal

CHAPTER 4 - HYDROLOGY

4.1 GENERAL

The requirements regarding the computations of runoff from the watersheds located along the IH 635 corridor are based primarily on the TxDOT's Hydraulic Design Manual, Chapter 5. The information contained herein offers clarification to that manual and specifies some site-specific requirements related to the IH 635 corridor.

For the purposes of the IH 635 corridor, all computed existing and design discharges will be based on the assumption that the offsite contributing watershed is completely developed. In other words, only fully-urbanized discharges will be used to size proposed improvements. Sufficient documentation such as zoning maps, as-builts, site plans, etc., must be provided to support the computation of both the existing and fully-developed runoff discharges.

4.2 DESIGN FREQUENCY

The frequency of a storm refers to the probability that, in any given year, a certain magnitude of rainfall event will occur or be exceeded. Table 4.2.1 summarizes the frequencies that are to be used for the various drainage structures within the IH 635 corridor. Table 4.2.1 also specifies the criteria that are to be used for both design storms and check storms. The design and check storm conditions as they relate to the roadway facilities are given in Chapter 6, 7 and 8.

Table 4.2.1 Design Frequencies

Hydraulic Crossings	Design Storm	Check Storm
Major Bridge Crossings		
- Farmers Branch	100-year	
- Farmers Branch Tributary	100-year	
Major Culvert Crossings		
- Cooks Branch	100-year	
- Long Branch	100-year	
- Audelia	100-year	
- Jackson	100-year	
- Dixon	100-year	
Other major culverts (DA > 200 ac)	100-year	
Minor culvert crossings (DA < 200 ac)	50-year	100-year
Storm Drainage		
Frontage road and cross streets	25- and 50*-Year	50- and 100-Year
Mainlanes/General Purpose, ramps, collector/distributor and Managed HOV	50-Year	100-Year

*Depressed Section

4.3 FREQUENCIES OF COINCIDENTAL OCCURRENCES

Coincidental Occurrence was applied in the hydrologic design for the IH 635 corridor. Coincidental Occurrences refer to the varying amount of time it takes for different size drainage basins to reach peak flow. A smaller basin with a relatively quick time of concentration is going to achieve its peak discharge before a larger basin with a longer time of concentration. Therefore, when the smaller basin's peak flow is achieved the larger basin has only reached a fraction of its peak flow. The percent of the larger basin's peak flow that is reached depends on the ratio of drainage areas for the two basins. Table 4.3.1 lists the possible frequency combinations in the IH 635 corridor. Refer to Section 6.2 for further guidance involving coincidental occurrences.

Table 4.3.1 Frequency Combinations

Area Ratio	Storm Drain Frequency		
Receiving Stream Area to Storm Drain Area	25-Year	50-Year	100-Year
1,000:1	5	5	10
100:1	10	10	25
10:1	10	25	50
1:1	25	50	100

4.4 TIME OF CONCENTRATION

The computation of the time of concentration will be based on TxDOT's Hydraulic Design Manual for urbanized areas which subdivides the flow path into three categories: overland flow (sheet flow), shallow concentrated flow (gutter flow), and conduit and/or open channel flow. Typically, the overland or sheet flow consists of water flow over plane surfaces before it collects as shallow concentrated flow. Because only fully urbanized conditions will be considered for the IH 635 corridor, the shallow concentrated flow is most often carried through the gutter to an inlet and then into a storm sewer pipe or to a discharge point at a creek or channel. The runoff continues in the pipe and/or creek until it reaches IH 635 corridor or the design point.

The overland flow and shallow concentrated flow can be computed by using Figure 5-4 of the TxDOT Hydraulic Design Manual. The overland flow length shall not be greater than 200 feet for urban watersheds and 400 feet for all other watersheds.

Conduit flow and open channel flow can be computed from basic hydraulic principles. The velocity for open channels shall be computed using full bank flow conditions (channel full with no flow in the overbanks) for a typical stream cross-section. If no detailed information or as-built plans are available, the United States Geographical Maps (USGS) may be used. Conduit flow velocity shall be computed at uniform depth based on the computed discharge.

Actual time of concentration shall be computed, input into storm drain analysis, and accumulated along system, even if less than 10 minutes. Actual time is not used until accumulated total exceeds 10 minutes.

If the computed discharge is unknown, the velocity shall be computed using the full capacity of the pipe. The minimum time of concentration shall be 10 minutes.

4.5 RATIONAL METHOD

The Rational Method shall be used for drainage areas that are less than 200 acres. The TxDOT Hydraulic Design Manual provides a specific description of the theory and assumptions for the Rational Method. Table 4.5.1 summarizes various runoff coefficients that are to be used for the IH 635 corridor.

Table 4.5.1 Runoff Coefficients (C) for Urban Watersheds for 2-year, 5-year, and 10-year Frequencies

Type of Drainage Area	Runoff Coefficients (C)
Business	
• Downtown areas	0.90
• Neighborhood areas	0.80
Residential	
• Single-family development	0.60
• Multi-family development	0.85
Industrial	0.90
Parks, cemeteries, open grass areas	0.35
Yards	0.40
Streets	
• Asphalt	0.95
• Concrete	0.95

The runoff coefficients listed in Table 4.5.1 apply to storm events of 2, 5, and 10-year frequencies. Higher frequency storms require modifying the runoff coefficient because infiltration and other abstractions have a proportionally smaller effect on runoff. In order to

adjust the runoff coefficients in Table 4.5.1 to represent higher frequency events, multiply them by the factor C_f as indicated in Table 4.5.2. In no cases should the product of C and C_f exceed 1.00.

Table 4.5.2 Runoff Coefficient Adjustment Factors for Rational Method

Recurrence Intervals (years)	C_f
25	1.10
50	1.20
100	1.25

The Rational formula then becomes:

$$Q = CC_f IA$$

Where,

Q = Design frequency discharge (cfs)
C = Runoff coefficient from Table 4.5.1
C_f = Correction factor for 25, 50, and 100-year frequencies from Table 4.5.2
I = Design Storm Rainfall Intensity (in/hr)
A = Drainage Area (acres)

Each city within the IH 635 corridor has determined the rainfall intensity for various storm events. The values determined by the Cities are published in their respective drainage manuals. A comparison made between the intensities published in these manuals and those computed using TxDOT's criteria revealed that the Cities' 100-year intensities were generally lower than the 25-year intensities computed by TxDOT's criteria for times of concentration less than 20 minutes. Therefore, the rainfall intensity to be used for the IH 635 corridor is based on the following equation from the TxDOT manual:

$$I = \frac{b}{(t_c + d)^e}$$

Where,

I = Rainfall intensity (in/hr)
t_c = Time of concentration (min)
e, b, d = coefficients for specific frequencies that are based on rainfall frequency-duration data contained in the National Weather Service Technical Paper 40 (TP 40) for each county in Texas. See Table 4.5.3.

Table 4.5.3 Intensity Coefficients for Dallas County

Design Storm	Coefficients		
	e	b	d
2-Year	0.791	54	8.3
5-Year	0.782	68	8.7
10-Year	0.777	78	8.7
25-Year	0.774	90	8.7
50-Year	0.771	101	8.7
100-Year	0.762	106	8.3

4.6 NRCS RUNOFF CURVE NUMBER METHOD

The Natual Resources Conservation Services Runoff Curve Number Method (NRCS RCN Method) with a TY II 15-minute rainfall distribution shall be used to compute runoff for drainage areas greater than 200 acres. A detailed discussion of the NRCS RCN methodology can be found in Chapter 5, Section 7 of the TxDOT Hydraulic Design Manual. Within the IH 635 corridor, HEC-1, HEC-HMS, or other TxDOT approved software may be used to compute the runoff and a dimensionless unit hydrograph. With any modeling software, the computational interval shall not exceed one-third of the shortest lag time of any basin in the model. Refer to Chapter 5, Section 8 of the TxDOT Hydraulic Design Manual for a detailed discussion of the NRCS Type II unit hydrograph.

Table 4.6.1 summarizes the curve numbers that are to be used for the IH 635 corridor. This table is based on values from the TxDOT Hydraulic Design Manual, and includes only those categories that represent development within the IH 635 corridor.

Table 4.6.1 Runoff Curve Numbers for Urban Areas

Cover Type and Hydrologic Condition	Average Percent Impervious Area	A	B	C	D
Open space (lawns, parks, golf courses, cemeteries, etc.)		68	79	86	89
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
• Paved; curbs and storm drains (excluding right-of-way)		98	98	98	98
• Paved; open ditches (including right-of-way)		83	89	92	93
• Gravel (including right-of-way)		76	85	89	91
• Dirt (including right-of-way)		72	82	87	89
Urban districts:					
• Commercial and business	85	89	92	94	95
• Industrial	72	81	88	91	93
Residential districts:					
• Town houses and apartments	65	77	85	90	92
• Residential lots	38	61	75	83	87

Notes: Values are for average runoff condition, and $I_a = 0.2S$. The average percent impervious area shown was used to develop the composite RCNs. Other assumptions are: impervious areas are directly connected to the drainage system, impervious areas have a RCN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition.

4.7 FLOOD HYDROGRAPH ROUTING METHODS

A detailed description of Flood Hydrograph Routing techniques can be found in Chapter 5, Section 9 of the TxDOT Hydraulic Design Manual. Along streams that have detailed studies, the routing techniques should not be modified. However, for watersheds that have no existing study, HEC-1, HEC-HMS, or other TxDOT approved software may be used for flood hydrograph routing computation. The Modified Puls Method is to be used for channel routing. This will require development of a storage-discharge relationship from the hydraulic model (HEC-2 or HEC-RAS). Where there are detention ponds, a storage-elevation-discharge relationship is to be determined.

CHAPTER 5 - HYDRAULIC CROSSINGS

5.1 GENERAL

A detailed discussion of hydraulic principles and theory can be found in Chapter 6 of the TxDOT Hydraulic Design Manual. The following guidelines apply to open channels, including creeks, ditches, and channels along the IH 635 corridor. The analysis for these open channels within the IH 635 corridor shall be performed using HEC-RAS. See Section 6.8 for additional Roadside Ditch Criteria.

5.2 SURVEY

Cross-section information used in the hydraulic modeling of open channels shall be based on surveyed information. The cross sections shall be spaced no greater than 500 feet apart, and shall provide enough detail to sufficiently define the channel geometry as illustrated by Figure 5.2.1.

Existing bridges and culverts shall be modeled using the field survey information. The upstream and downstream limits of the hydraulic model for a culvert or bridge crossing shall extend 1,000-feet or to the nearest hydraulic control point which may include structure crossings or any point in the channel that controls the water surface elevation.

5.3 ROUGHNESS COEFFICIENTS

The roughness coefficients used for the hydraulic models shall be defined so that they vary horizontally along the cross section depending on the type of land cover. Table 5.3.1 lists typical values of roughness coefficients. Cross-sections should be subdivided to have a minimum 3 subsections, left overbank, channel, and right overbank. Typically, these 3 subsections will be adequate to define the section.

Figure 5.2.1 Typical Surveyed Cross Section with Five Points in the Channel

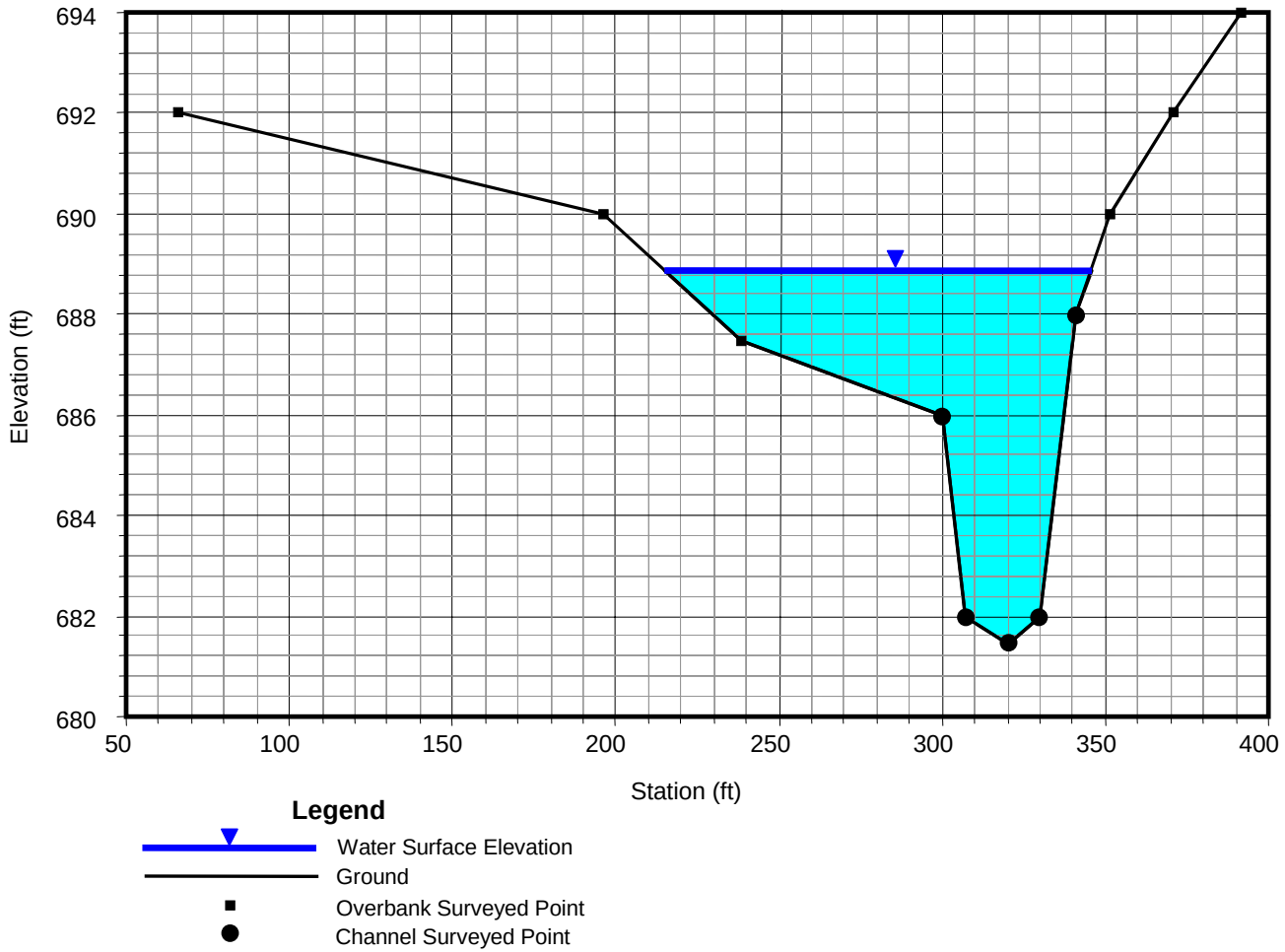


Table 5.3.1 Manning's "n" Values

Channel Description	"n" value
Channel Roughness Coefficients:	
Well Defined Natural Channel	
Rock bottom	0.035
Dirt lined with light vegetation	0.040
Moderate vegetation on banks	0.060
Heavy vegetation on banks	0.070

Channel Description	"n" value
Irregular Channel with Meanders and Pools	
Rock bottom	0.047
Dirt lined with light vegetation	0.052
Moderate vegetation on banks	0.072
Heavy vegetation on banks	0.080
Lined Channel	
Concrete-lined channel	0.020
Grouted riprap	0.035
Ungrouted riprap	0.040
Gabion mattress	0.033
Geotextile fabric with established vegetation	0.043
Maintained grass-lined channel	0.035
Non-maintained grass-lined channel	0.060
Overbank Roughness Coefficients:	
Undeveloped Overbank	
Short grass, no brush	0.050
Tall grass, no brush	0.060
Grass with moderate tree cover	0.080
Grass with heavy tree cover	0.120
Developed Overbanks	
Residential	0.150
Developed commercial or industrial	0.100
Parks, manicured open space	0.035

5.4 REQUIREMENTS

The study of existing open channels within the IH 635 corridor involves the study of both existing and proposed improvements using fully-developed conditions. In addition to complying with the USACE's requirements and TxDOT's requirements, the following guidelines must be met:

- There shall be no rise in water surface elevation between the existing conditions and the proposed conditions for the design storm. Existing conditions are defined as fully-developed offsite design flows and existing onsite (within existing right-of-way) through the existing structure and over the road, if applicable. Proposed conditions are based on fully-developed design flows through the proposed structure.
- The proposed conditions shall not increase the design storm channel velocity above the amount specified in Table 5.5.1.
- The study limits for major crossings shall extend either 1,000 feet upstream and downstream or to the next control structure, whichever is closer.

Valley storage shall be considered on those streams that are part of the Certificate Development Corridor (CDC) program.

5.5 CHANNELS

Chapter 7 of the TxDOT Hydraulic Design Manual discusses in detail the analysis and design of proposed channel improvements. In addition to the guidelines listed here, other requirements that involve state and federal agencies must be met for permits as they apply to any proposed improvements. This includes, but is not limited to, the following:

- Federal Emergency Management Agency National Flood Insurance Program (FEMA NFIP)
- U.S. Corps of Engineers (USACE) Section 404 permit
- Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System permit requirements
- TPDES permit for industrial activity (construction)
- EPA Endangered Species Act provisions
- Texas Commission of Environmental Quality (TCEQ) 401 Permit

Table 5.5.1 Types of Channel Lining

Type of Channel Lining	Maximum Velocity	Minimum Side Slopes (Hor.: Vert.)	Desired Shape	Minimum Velocity
Grouted riprap	12 feet/sec	3:1	Trapezoidal	2.5 feet/sec
Rock riprap	12 feet/sec	3:1	Trapezoidal	2.5 feet/sec
Gabion	12 feet/sec	N/A	N/A	2.5 feet/sec
Vegetated clay channels	8 feet/sec	3:1	Trapezoidal	2 feet/sec *
Vegetated sandy channels	6 feet/sec	3:1	Trapezoidal	2 feet/sec *****

* The minimum velocities apply to proposed channels. Any modifications to existing channels shall match the existing channel as close as possible.

Proposed channel improvements shall be lined with native material such as grasses, crushed rock, and earth where possible. In such a case, the side slopes shall be no steeper than 3 to 1. Other lining material may be necessary to accommodate hydraulic, aesthetic, economics, safety, and environment. Table 5.5.1 summarizes the requirements for various types of channel lining that are to be used in the IH 635 corridor.

5.6 STREAM ANALYSIS

For a detailed discussion of stream morphology and channel analysis refer to Chapter 7 of the TxDOT Hydraulic Design Manual. This manual also discusses environmental mitigation alternatives and stream stabilization measures that should be reviewed during the design of any channel improvements in the IH 635 corridor.

CHAPTER 6 - STORM DRAINAGE SYSTEMS

6.1 GENERAL

The drainage systems shall include all drainage and erosion control appurtenances such as:

- curb inlets
- grate inlets
- manholes
- junction boxes
- headwalls
- ditches
- underdrains
- safety end treatments
- storm sewer pipes
- box or pipe culverts
- lined channels

Drainage shall be designed to:

- Ensure the proper collection and disposal of storm runoff disrupted or generated by the Project and its associated construction.
- Ensure the continuing service of all drainage systems during Project construction.
- Provide protection from erosion of all slopes and ditches in the IH 635 corridor and on adjacent property.
- Maintain clear roadways for the design storm.
- Provide subgrade drainage, where required.

6.2 DESIGN FREQUENCIES

All inlet and storm drain design and check frequencies are listed in Table 4.2.1.

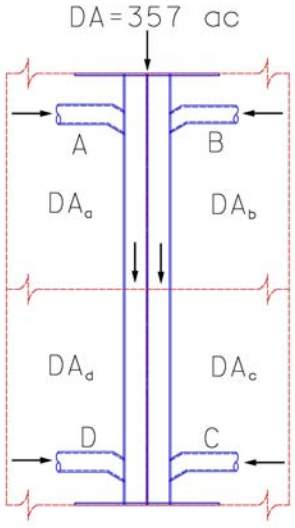
Depressed and at-grade mainlane/general purpose lane, ramp, and Managed HOV lane storm inlets and conduit shall be designed as given here and Table 4.2.1. These criteria with the ponding and the Hydraulic Grade Line (HGL) requirements given in Sections 6.4 through 6.7 meet the Federal Highway Administration (FHWA) and TxDOT's criteria for depressed sections.

The FHWA defines depressed sections as pavement areas on interstate highways where ponded water can only be removed through the storm conduit. The TxDOT Dallas district's policy adds mainlanes/general purpose lanes, direct connectors, ramps, Managed HOV lanes and frontage roads bounded by barrier or retaining wall to the "depressed" category. Because the majority of the IH 635 corridor falls within these two descriptions, all mainlane/general purpose lane, direct connector, ramp, and Managed HOV lane storm drain will be designed at the same frequency.

When a depressed frontage road section ties to a non-depressed frontage road section trunk line, the trunk line downstream of the junction shall be designed to maintain the 50-year HGL at critical elevations. All laterals that tie to this trunk line will be designed for full flow at the 25-year storm event. Figures 6.2.1 and 6.2.2 show examples of the proper design event for various locations. Critical elevations are given in Sections 6.5 and 6.7.

When a storm drain system ties to a cross structure of a larger drainage basin, coincidental occurrence may be applied to determine the storm drain's beginning HGL. The following example references the Table 4.3.1 in Chapter 4, Section 3.

Trunk line design for the 25-year event tying to a cross culvert.



Cross Structure Drainage A = 357 acres

Total Storm Drain Area = (DA_a+DA_b+DA_c+DA_d) = 18.7 acres

Ratio 357/18.7 = 19.1

Go to Table 4.3.1

Ratio 10:1 (round to the nearest ratio in table)

25-year design

Main stream = 10 year

Use the cross structure's 10-year water surface elevation as the starting tailwater elevation for each trunk line.

An acceptable alternative to the above method would be to evaluate the flood hydrograph in the outfall channel and base the tailwater elevation on the water level in the outfall at the time of the peak discharge from the trunk line.

Figure 6.2.1 Depressed and Non-Depressed Frequencies

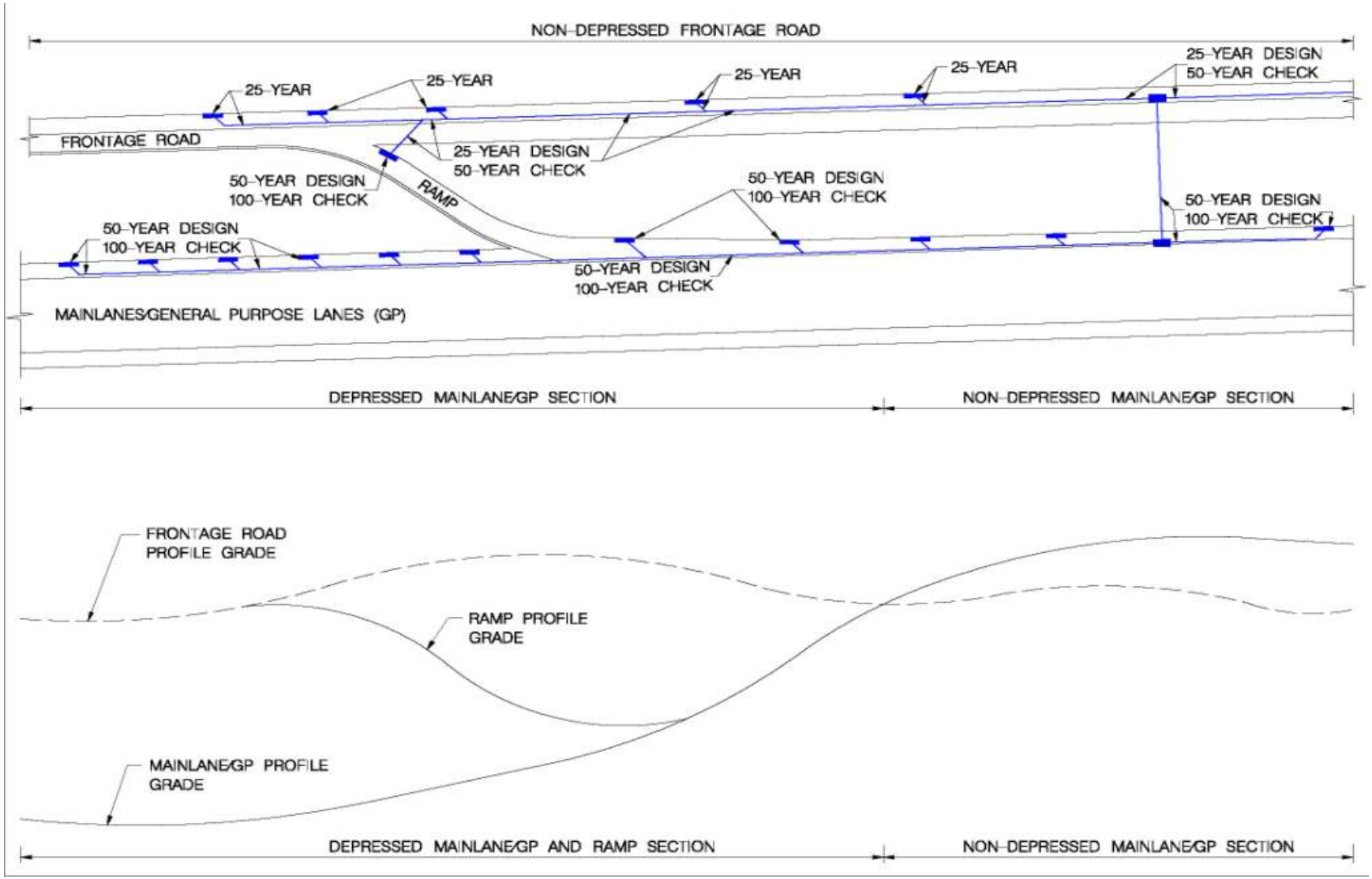
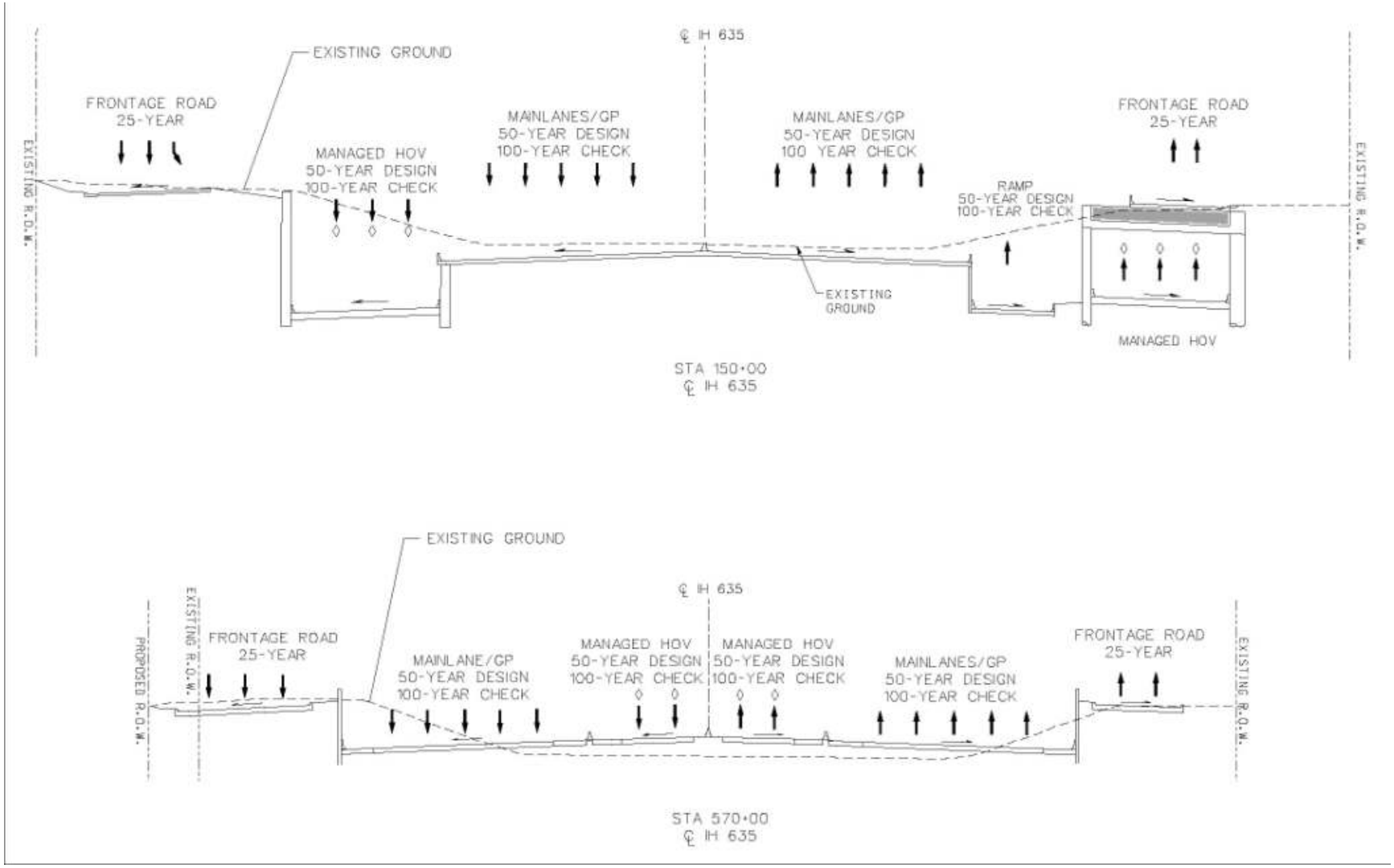


Figure 6.2.2 Depressed Sections



6.3 RUNOFF CALCULATIONS

Storm drain design should maintain the pre-project drainage boundaries when possible to avoid diverting runoff flows from one major watershed to another.

The time of concentration in storm drainage design consists of the time required for water to flow from the most distant point of the drainage area to the inlet and the travel time of the flow within the storm drain pipe. For the IH 635 corridor, the minimum time of concentration shall be 10-minutes. (Refer to Chapter 4, Section 5 for additional information.)

Refer to Chapter 4, Sections 5 and 6 for appropriate runoff calculation methods.

6.4 PAVEMENT DRAINAGE

Table 6.4.1 summarizes the allowable ponding widths.

Table 6.4.1 Allowable Ponding Widths

Location	Design Events	Check Event
Mainlanes/General Purpose Lanes	No encroachment into the travel lanes.	One lane free of encroachment
Managed HOV lanes, ramps, direct connectors and collector distributors	2-feet encroachment into the travel lanes.	One lane free of encroachment
Frontage roads	One-lane for a 2-lane frontage road. One-and-a-half lanes for a 3-lane frontage road.	50-year – no overtopping of curb 50-year – no overtopping of curb
Cross streets	One lane open to traffic in each direction.	50-year – no overtopping of curb
Note: Isolated instances of ponding width greater than those shown in the table may be allowed based on the Engineer's judgment and approval of TxDOT.		

For the design frequency, the allowable ponding width shall not be exceeded, nor shall the depth of flow exceed the curb height on curbed roadways. During the 100-year flood event, one-lane should be free of encroachment on the mainlanes/general purpose lanes, direct connectors and ramps to allow for emergency vehicle access.

Gutter flow and ponding spread should be calculated using the methods given in Chapter 10 Section 4 of the TxDOT Hydraulic Design Manual. Appropriate Manning's "n" values are 0.015 for concrete gutter with asphalt pavement and 0.016 for concrete pavement. For ponding at

approaches to sag locations, the longitudinal slopes used to evaluate ponding widths should be one-half of the tangent grades.

6.5 STORM DRAIN INLETS

Inlet types to be used in the IH 635 corridor are listed in Table 6.5.1. These refer to TxDOT Dallas District Standard Details.

Inlet runoff interception calculations should be based on equations and methods listed in Chapter 10, Section 5 of the TxDOT Hydraulic Design Manual.

Inlet input information for inlet capacity calculations are listed in Table 6.5.2 and Table 6.5.3.

Table 6.5.1 Inlet Types

Inlet Type	Standard Detail Sheet Name	General Location
Curb inlet	Curb Inlet TY I	Frontage roads, cross streets
Grate inlet	Drop Inlet TY C, Drop Inlet TY C & G	Gore areas, separation ditches, swales behind retaining walls
	Drop Inlet TY E & F	Mainlanes/General Purpose lanes, gore areas
Combination inlet	Curb and Grate Inlet TY II	Frontage roads, cross streets (where needed)[a]
Barrier inlet	Curb & Grate Inlet TY III Curb & Grate Inlet TY V	Mainlanes/General Purpose Lanes, Managed HOV lanes, ramps
Slotted drain[b]	Roadway Drain Details[c] (Slotted Drain) SD	Mainlanes/General Purpose Lanes against median barrier (where needed)[d], at entrances to tunnel sections

[a] If a Curb Inlet TY I is not sufficient to meet ponding and interception requirements
[b] Statewide Standard
[c] If other inlet types are not sufficient to meet ponding and interception requirements
[d] Not to be used at sag points and at locations where there are flexible joints in the roadway structure

Table 6.5.2 Curb Inlet Input

Dallas District Standard Detail Sheet Name	Curb Length	Gutter Depression	Depression Width	Inlet Opening Height	Critical Elevation	Maximum Ponded Depth
Curb Inlet TY I[a]	5', 10', 15'	3"	2'	4"	1.0' below gutter depression	Satisfies ponding requirements & < curb height
Curb & Grate Inlet TY II[a]	5', 10', 15'[b]	3"	3'	4"	1.0' below gutter depression	Satisfies ponding requirements & < curb height
Curb & Grate Inlet TY III	5'[b]	3"	3'	4"	1.0' below gutter depression	Satisfies ponding requirements
Curb & Grate Inlet TY V[a]	5', 10', 15'[b]	3"	3'	3"	1.0' below gutter depression	Satisfies ponding requirements

[a] Starting Curb length is 5' and larger lengths increase in 5' increments.
[b] Where the grate and curb opening overlap, the capacity of the greater of the two will be used.

Grate inlets should be aligned so that grate bars are parallel to the gutter flow except on side streets where bicycle safety is concerned and as stated above. Figure 6.5.1 shows typical grate inlet orientation.

All on-grade inlets, slotted drains excluded, shall be designed to intercept a minimum of 65% of the approaching flow of the design event, but inlets shall be designed to be cost effective. Carryover shall be limited upstream of intersections, driveways, superelevation transitions, bridges, and downstream of exit and entrance ramps so that no more than 0.10 cfs shall be allowed to concentrate and flow across travel lanes. If this is not possible, the potential for hydroplaning shall be checked based on guidelines listed in Chapter 10, Section 4 of the TxDOT Hydraulic Design Manual. At Dallas Area Rapid Transit (DART) light rail crossings, inlets shall be coordinated with the street profile so that no runoff enters the trackway.

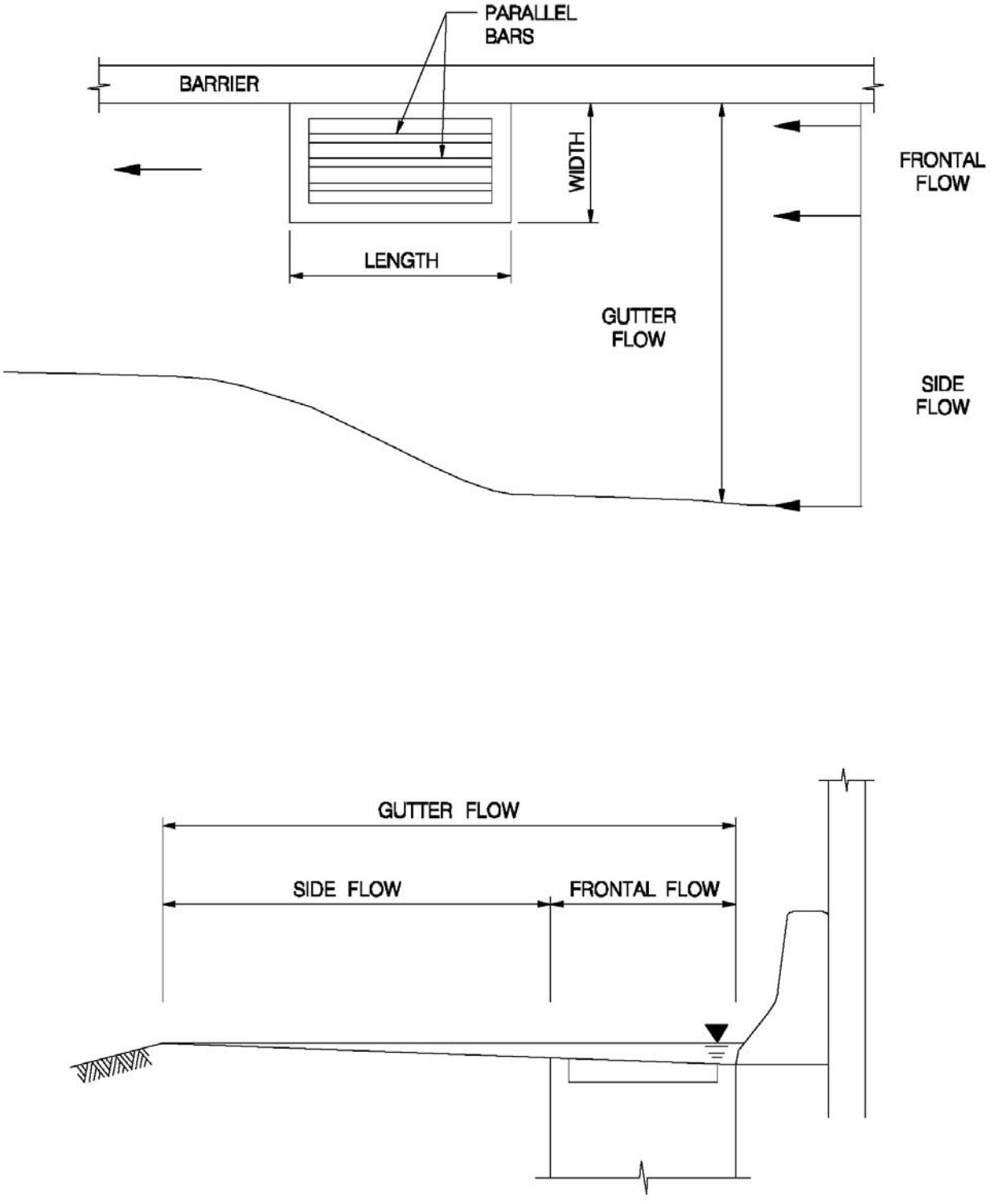
Table 6.5.3 Grate Inlet Input

Dallas District Standard Detail Sheet Name	Critical Elevation	Grate Type	Maximum Ponded Depth	Number of Grates	Grate Width	Grate Length	Effective Grate Area In Sag	Effective Grate Perimeter in Sag - 3-sided	Effective Grate Perimeter in Sag - 4-sided	Safety Reduction Factor in Sag
Drop Inlet TY C	1.0' below top of grate	Parallel	1' of freeboard[a]	1	2'	2.38'	3.14 ft^2	3.14'	8.25'	50%
				2	2'	4.73'	6.38 ft^2	6.38'	13.04'	50%
				3	2'	7.08'	9.59 ft^2	9.59'	17.75'	50%
Drop Inlet TY C & G*	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
Drop Inlet TY E & F	1.0' below top of grate	Parallel	1' of freeboard[a]	1	2.5'	1.22'	3.36 ft^2		7.54'	50%
				2	5.43'	1.22'	6.72 ft^2		11.54'	50%
				3	8.35'	1.22'	10.07 ft^2		15.54'	50%
Curb & Grate Inlet TY II	1.0' below gutter depression	Transverse	Satisfies ponding requirements & < curb height	1	1.52'	2.49'	3.09 ft^2	4.97'	NA	NA
Curb & Grate Inlet TY III	1.0' below gutter depression	Transverse	Satisfies ponding requirements	1	1.52'	2.49'	3.09 ft^2	4.97'	NA	NA
Curb & Grate Inlet TY V	1.0' below gutter depression	Transverse	Satisfies ponding requirements	1	1.52'	2.49'	3.09 ft^2	4.97'	NA	NA
Roadway Drain Details (Slotted Drain) SD	1.0' below drain guide opening	NA	NA	NA	NA	20'	NA	NA	NA	NA

[a] Refer to Figure 6.8.1

[b] Grate used in this detail is the same as the on used in the Drop Inlet TY C standard detail sheet so input is the same.

Figure 6.5.1 Parallel Grate Inlet



6.6 LOCATION OF STORM DRAIN APPURTENANCES / CONDUIT RUNS

Storm conduit and inlets shall be designed so that conflicts with major utilities are avoided.

Geometric controls may determine inlet location in addition to the ponding requirements given in Section 6.4. Examples of such locations are as follows:

- Low points in the gutter grade.
- Immediately upstream of entrance/exit ramp gores, cross walks and street intersection.
- Immediately upgrade of bridges (to prevent pavement runoff from flowing onto bridge decks).
- Immediately downstream of bridges (to intercept bridge deck drainage).
- Immediately upgrade of cross slope reversals.

6.7 CONDUIT SYSTEMS

Table 6.7.1 lists all storm drainage conduit criteria.

Table 6.7.1 Conduit System Design Criteria

Component	Design Criteria
Pipe class	Class III or greater, D-loads calculated according to Chapter 14 in the TxDOT Hydraulic Design Manual
Diameters	Laterals - minimum of 18" reinforced concrete pipe (RCP) Trunk lines - minimum of 24" RCP Standard sizes - 18", 24", 36", etc. in 6" increments Maximum pipe size - 60" then use reinforced concrete box Minimum box culvert height - 3'
Cover	Pavement - top of pipe clears pavement base structure Non-Pavement - a minimum of 1-ft from top of pipe to finished grade
Roughness coefficient "n"	Concrete pipe - 0.013 Concrete box - 0.012
Manhole spacing	24" - 300' 36" - 375' 42"-54" - 450' 60" - 900'
Bends	15, 30, 45, and 60 degree angles 90 degree angle if unavoidable
Lateral tie-ins	One lateral junction - 45 and 60 degree wyes Two or more lateral junction - A manhole or junction box unless the trunkline is more than twice the diameter of the largest ajoining lateral
Velocities	Minimum - 2 fps Maximum - 12 fps
Conduit flow	Design event - non-pressure flow Check event - see Hydraulic Grade Line
Hydraulic grade line	Design: Inlets - meet critical elevation requirements listed in Tables 6.5.2 and 6.5.3 Mahholes - a minimum of 1.0' below the top of the manhole cover Check: Frontage road and side streets - 50-year HGL below top of curb. Mainlanes, ramps, HOV, collector/distributor, depressed frontage roads - 100-year HGL allows for one travel lane to be free of encroachment

6.8 ROADSIDE CHANNELS

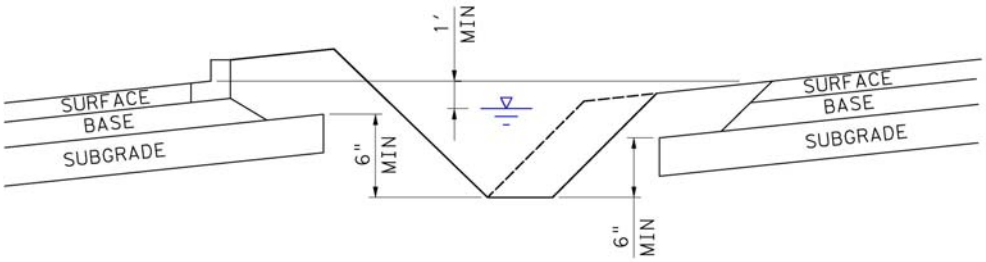
For the IH 635 corridor, roadside channels are those open channels, which convey runoff within the proposed right-of-way. Design shall meet criteria given in Section 5.5 and in Chapter 7, Section 3 of the TxDOT Hydraulic Design Manual. A summary of additional design requirements is listed in Table 6.8.1. Where possible, ditches parallel to DART light rail shall meet DART drainage design criteria.

Table 6.8.1 Roadway Channel Design Criteria

Component	Design Criteria
Minimum longitudinal slope	0.50%
Maximum side slope	Within clear zone[a] Mainlanes/General Purpose and Ramps – 6:1 Frontage Roads – 4:1 Outside of clear zone Mainlanes/General Purpose and Ramps – 4:1 Frontage Roads – 3:1 Backslope Trapezoidal bottom – 4:1 V-shaped bottom – 3:1
Water surface elevation	Design event – 1-foot below pavement surface[b]
Depth	Minimum of 6 inches below subgrade crown[b]

[a] Maximum side slopes without positive protection.
[b] Refer to Figure 6.8.1 for further explanation.

Figure 6.8.1 Roadside Channels



6.9 HEAD LOSSES

Hydraulic grade line losses associated with junctions, manholes, wyes, bends and pipe size changes will be calculated as shown in Table 6.9.1.

Table 6.9.1 Headloss Coefficients

Inlet on mainline		0.50	$(V_2^2/2g) – (K*V_1^2/2g)$
Inlet on mainline with branch lateral		0.25	$(V_2^2/2g) – (K*V_1^2/2g)$
Manhole on mainline with:	90° 60° 45° 30° 15°	0.25 0.35 0.50 0.60 0.90	$(V_2^2/2g) – (K*V_1^2/2g)$
Wye connection or cut in:	60° 45°	0.60 0.75	$(V_2^2/2g) – (K*V_1^2/2g)$
Inlet or manhole at beginning of line		1.25	$K*V_2^2/2g$
Bends:	90° 60° 45° 30° 15°	0.70 0.56 0.47 0.35 0.19	$K*V_2^2/2g$
Conduit connection to cross culvert		N/A	Headloss negligible

V_1 is upstream velocity and V_2 is downstream velocity.

6.10 OUTPUT

Drainage design calculations may be done with Winstorm, Geopak Drainage or other TxDOT approved methods. Required output is shown in Tables 6.9.1 through 6.9.5.

Table 6.10.1 Example Drainage Area Output

DRAINAGE AREA	PAVEMENT C = 0.95 (AC)	COMMERCIAL		INDUSTRIAL C = 0.85 (AC)	RESIDENTIAL		OPEN AREA		TOTAL AREA (AC)	COMPOSITE C VALUE	Tc ACTUAL (MIN)	Tc USED (MIN)	INTENSITY 25 yr (IN/HR)	DISCHARGE 25 yr (CFS)	INTENSITY 50 yr (IN/HR)	DISCHARGE 50 yr (CFS)	INTENSITY 100 yr (IN/HR)	DISCHARGE 100 yr (CFS)
		DOWNTOWN C = 0.90 (AC)	NEIGHBRHD. C = 0.70 (AC)		MULTI C = 0.75 (AC)	SINGLE C = 0.50 (AC)	GRASS C = 0.40 (AC)	PARKS C = 0.30 (AC)										
1-A1	0.24	0.12	0.00	0.62	0.00	0.00	0.05	0.00	1.03	0.86	7.15	10.00	9.33	9.09	10.56	11.22	11.57	12.81
1-A3	0.16	0.45	0.00	0.00	0.00	0.00	0.08	0.00	0.69	0.85	5.27	10.00	9.33	6.02	10.56	7.43	11.57	8.48
2-A1	0.06	0.00	0.23	0.00	0.45	0.70	0.04	0.10	1.58	0.60	9.62	10.00	9.33	9.73	10.56	12.01	11.57	13.71
2-B1	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39	0.95	7.06	10.00	9.33	13.55	10.56	16.73	11.57	19.10

Table 6.10.2 Example Inlet Configuration Output

Inlet ID	Inlet Description	Inlet Station	Inlet Offset (ft)	Inlet Ref Chain	Inlet Elev (ft)	Inlet Type	Profile Type	Spread X-sect Slope 1 (%)	Spread X-sect Width 1 (ft)	Curb Length (ft)	Curb Depression (ft)	Curb Height (ft)	Curb Depression Width (%)	Grate Type	Grate Length (ft)	Grate Width (ft)	Grate Area (sf)	Grate Perimeter (sf)	Grate Area Reduction	Grate Perimeter Reduction	Remarks
1-A1	Curb Inlet Ty C w/ 1 ext (10')	910+00	0.00	EBFR	658.54	Curb	On Grade	3.06	38.00	10	0.33	0.50	2.00	n/a	n/a	n/a	n/a	n/a	n/a	n/a	CURB INLET
1-A3	Curb Inlet Ty C w/ 1 ext (10')	912+00	0.00	EBFR	653.51	Curb	On Grade	2.77	40.00	10	0.33	0.50	2.00	n/a	n/a	n/a	n/a	n/a	n/a	n/a	CURB INLET
2-A1	Inlet Ty C-1	913+15	5' RT	EBFR	642.21	Grate	Sag	16.61	6.00	n/a	n/a	n/a	n/a	Parallel 1 1/8	2.48	4.96	4.87	9.44	0.5	0.5	DITCH GRATE INLET
2-B1	Inlet Ty C-1	915+00	69.17 LT	CL-IH635	635.54	Grate	On Grade	2.54	52.00	n/a	n/a	n/a	n/a	Parallel 1 1/8	2.48	4.96	4.87	6.95	n/a	n/a	GRATE INLET

Table 6.10.3 Example Inlet Hydraulics Output

1-A1	Curb	On Grade	910+00	EBFR	9.09	2.33	0.00		0.00	10.00	9.60	6.51	0.17	3.45	6.51	0.06	0.015	
1-A3	Curb	On Grade	912+00	EBFR	6.02	3.20	0.00	1-A1	0.00	10.00	9.95	8.26	0.22	1.83	8.26	0.10	0.015	
2-A1	Grate	Sag	913+15	EBFR	9.73	23.01	0.00		0.00	n/a	n/a	0.00	0.01	n/a	0.00	0.00	0.016	
2-B1	Grate	On Grade	915+00	CL-IH635	13.55	9.45	0.00		0.00	n/a	n/a	0.77	0.18	n/a	0.77	0.00	0.016	

Table 6.10.4 Example Link Configuration Output
Hydraulic Data: Proposed Storm Sewer (50-Year Frequency)

Link/Run No.	From Node	To Node	Drainage Area No.	Total DA	Weighted C-Value	Cumulative Tc (min)	Intensity (in/hr)	Design Q (cfs)	Conduit Size	Number of Barrels	Flowline U.S. (ft)	Flowline D.S. (ft)	Hydraulic Length (ft)	Slope (%)	Manning's n-value
IH 635 Eastbound Frontage Road Trunk Line (West of DNT)															
1	DP1	DP2	EF DP 1	2.45	0.915	10.00	10.56	23.72	30" RCP	1	626.35	623.02	664.73	0.50	0.013
2	DP2	DP3	EF DP 1-2	5.76	0.842	10.00	10.56	51.20	36" RCP	1	622.52	615.33	1037.64	0.69	0.013
3	DP3	DP4	EF DP 1-3	6.92	0.868	10.00	10.56	63.46	36" RCP	1	615.33	606.42	810.48	1.10	0.013
4	DP4	DP5	EF DP 1-4	17.88	0.845	10.00	10.56	159.62	4'X4' BC	1	605.42	600.56	441.36	1.10	0.012
5	DP5	DP6	EF DP 1-5	45.41	0.939	12.88	9.46	403.29	6'X6' BC	1	598.56	593.11	1010.63	0.54	0.012
6	DP6	DP6A	EF DP 1-6	60.85	0.951	14.22	9.03	522.27	6'X6' BC	1	593.11	589.75	589.63	0.57	0.012

Table 6.10.5. Example Link Hydraulics Output

Hydraulic Data: Proposed Storm Sewer (50-Year Frequency)

Link/Run No.	From Node	To Node	Critical Elevation (ft)	HGL U.S. (ft)	HGL D.S. (ft)	Friction Slope (%)	Depth Uniform (ft)	Depth Actual (ft/s)	Velocity Uniform (ft)	Velocity Actual (ft/s)	Q (cfs)	Capacity (cfs)	Junction Loss (ft)	Remarks
1	DP1	DP2	631.40	629.22	627.00	0.334	1.72	2.50	6.59	4.83	23.72	29.01	0.000	
2	DP2	DP3	629.80	627.00	620.48	0.589	2.27	3.00	8.91	7.24	51.19	55.52	0.408	
3	DP3	DP4	627.10	620.48	612.52	0.905	2.24	3.00	11.22	8.98	63.46	69.96	0.626	
4	DP4	DP5	616.60	612.52	608.88	0.649	2.78	4.00	14.35	9.98	159.61	207.81	0.773	
5	DP5	DP6	611.70	608.88	603.09	0.477	4.88	6.00	13.79	11.20	403.29	429.26	0.975	
6	DP6	DP6A	619.60	603.09	596.74	0.799	5.91	6.00	14.74	14.51	522.27	441.04	1.635	

CHAPTER 7 - CULVERTS

7.1 GENERAL

Culvert design shall be based on procedures outlined in Chapter 8 of TxDOT's Hydraulic Design Manual. The guidelines included here are intended to supplement that manual. Downstream tailwater shall be calculated as stated in Chapter 7 of TxDOT's Hydraulic Design Manual. Refer to Table 5.3.1 for Channel roughness coefficients to be used in IH 635 corridor.

Chapter 8, Section 2 of the TxDOT Hydraulic Manual discusses design considerations for culverts and Chapter 8, Section 3 discusses design procedure. The following discussion clarifies these sections as they relate specifically to the IH 635 corridor.

7.2 RUNOFF CALCULATIONS

Refer to Chapter 6 for appropriate runoff calculation methodology.

Major crossings or crossings with an upstream drainage area greater than 200 acres shall be designed based on the 100-year storm frequency. Minor crossings with upstream contributing drainage areas less than 200 acres shall be designed based on the 50-year storm frequency. For minor culvert crossings, the 100-year storm frequency shall be used as a check of the performance of the culvert. See section 7.5 for check criteria.

7.3 TAILWATER DETERMINATION

The tailwater refers to the water surface elevation downstream of the culvert crossing. The tailwater is used as starting conditions for the computation of the hydraulic grade line through the culvert. Within the IH 635 corridor there are two types of tailwater conditions and they include culverts that tie into a downstream channel and culverts that tie into a closed storm drain system.

7.3.1 Culverts That Tie Into a Downstream Channel

The tailwater for instances where the culvert discharges into a channel shall be computed based on standard backwater procedures as prescribed in Chapter 7 of the TxDOT Hydraulic Design Manual. Cross sections shall be obtained downstream to the first downstream control point or 1000-feet whichever is shorter. The procedure for obtaining

cross sections and creating hydraulic models is discussed in Chapter 5. Where the culvert is located along a major creek crossing, HEC-RAS or HEC-2 hydraulic models shall be used to determine the tailwater and to design the culvert. When two culverts along the same channel are separated by 1,000-foot or less, the downstream culvert must be included in the backwater computations.

7.3.2 Culverts That Tie Into a Closed System

The hydraulic grade line of the appropriate design frequency for the downstream drainage system shall be used as a tailwater for the proposed culvert. The frequency for the hydraulic grade line shall be the same frequency that is being used to size the culvert.

7.4 HYDRAULIC COEFFICIENTS

The Manning's roughness coefficient that is to be used for concrete boxes is 0.012. For concrete pipe the roughness coefficient is 0.013. Metal or plastic culverts shall not be used for culvert crossings within the IH 635 corridor.

The entrance loss coefficient is based on the culvert entrance geometry. Table 7.4.1 defines the entrance loss coefficients to be used for the various entrance types allowed within the IH 635 corridor. The exit loss coefficient shall be 1.0.

Table 7.4.1 Entrance Loss Coefficients

Type of Structure/Design of Entrance	Coefficient C_e
Pipe, Concrete	
Headwall or headwall and wingwalls	0.5
Straight wingwalls or pipe cut (mitered) to match embankment side slope	0.7
Box, Reinforced Concrete	
Beveled edges on three sides	0.20
45° flared wingwalls	0.40
180° parallel wingalls	0.50
Straight wingwalls (extension of sides)	0.70

7.5 HEADWATER

The headwater is the depth of the upstream water surface measured from the invert at the culvert entrance. Refer to Chapter 8 of TxDOT's Hydraulic Design Manual for headwater computation procedure. The design of the culvert shall begin by establishing the headwater and the upstream water surface elevations resulting from the existing culvert passing the

fully-urbanized discharges as defined in Sections 4.1 and 5.4. The flow used for culvert design shall include the runoff from all drainage areas contributing flow to the culvert. For culverts within the IH 635 corridor, the total flow will be assumed to enter the upstream culvert entrance.

Once the existing water surface elevations are set, the proposed culvert must be designed so that the design storm's headwater is no greater than the existing water surface elevation at the location of the proposed culvert entrance. The check storm shall be used to ensure the headwater does not encroach onto the IH 635 mainlanes/general purpose lanes. In addition, the headwater elevation for the check storm must not be greater than the elevation of the culverts drainage divides.

The hydraulic grade line for the culverts will be a straight line interpolation between the proposed headwater and tailwater unless a hydraulic jump or hydraulic drop occurs inside the box.

7.6 CULVERT SECTIONS

For the IH 635 corridor only concrete box culverts or concrete pipe culverts will be allowed for cross drainage. The smallest pipe diameter allowed is 24-inches. The shortest concrete box culvert height that is allowed is three-feet. The culverts span to height ratio must be no less than 1:1/2 as site conditions allow. When multiple box culverts are necessary they may be placed at various elevations to best match the natural or pipe channel section as shown in Figure 7.6.1.

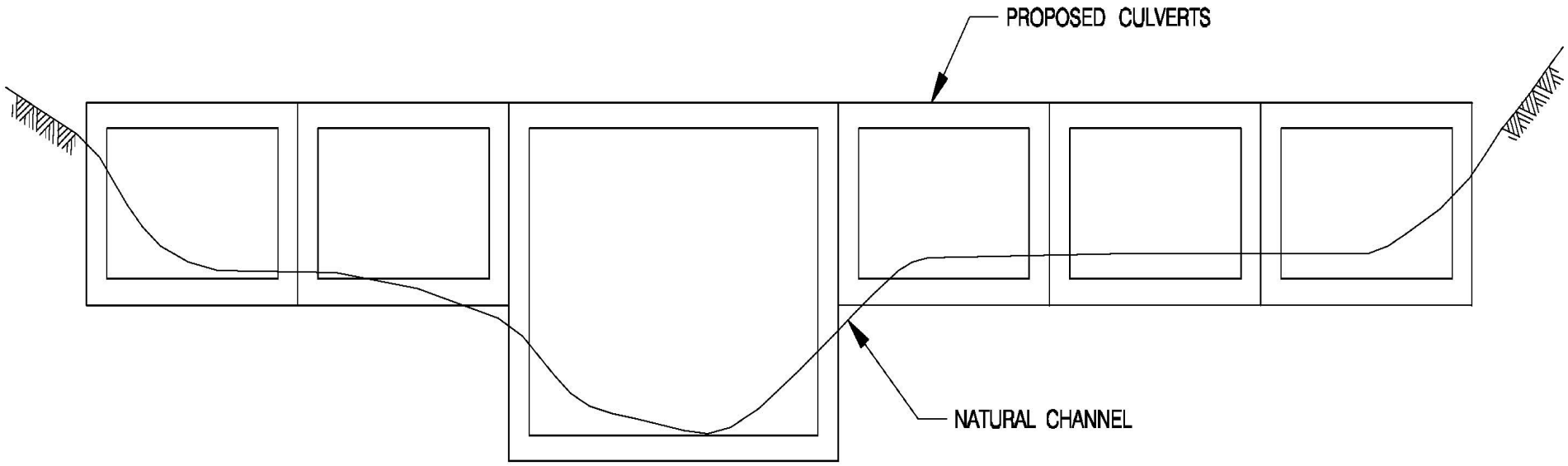
For the IH 635 corridor, all culverts not tying to closed systems must have headwalls. Wingwalls shall project from the headwall at angles allowed by TxDOT standard details for headwalls and wingwalls. The edges of the culvert entrance shall be beveled as shown in TxDOT standard details for box culverts.

7.7 CULVERT VELOCITY

Modifications to the existing culvert shall not raise the velocities greater than the erosive limits for either the design storm or the check storm. The erosive limits are specified in Table 5.5.1 of this manual. If the proposed design causes a rise in the channel velocity

greater than erosive limits, the proposed design must be modified to lower the velocity or the channel must be armored.

Figure 7.6.1 Multiple Box Culvert Placement



Armoring the channel experiencing high velocities may consist of materials shown in Table 5.5.1 such as gabions or rock rip-rap. The armoring shall be extended downstream or upstream to a point where the channel velocities are not erosive. Methods of reducing the proposed velocities are discussed in Chapter 8, Section 5 of TxDOT's Hydraulic Design Manual.

7.8 OUTPUT

There are a number of different tools to analyze culvert systems including: HEC-RAS, HY8, Culvert Master, etc. For the IH 635 corridor, regardless of the analytical tool used to design the culvert, the following data must be provided:

- Number and size of culvert structure
- Lowest top of curb above the culvert
- Upstream and downstream flowline (for each barrel, if necessary)
- Tailwater used for the design and check storm
- Headwater calculated for the design and check storms
- Length of box
- Slope of box
- Discharge for the design storm and check storm

CHAPTER 8 - BRIDGES

8.1 GENERAL

There are four hydraulically designed bridges in the IH 635 corridor. They are the crossings over Farmer's Branch Creek, its tributary, Cooks Branch, and the Lower Long Branch Creek of Duck Creek. These bridge crossings shall be designed based on methods provided in Chapter 9 of TxDOT's Hydraulic Design Manual. Chapter 9, Section 3 covers design considerations and Sections 4 through 6 cover design procedures. The information provided here supplements these sections as they apply to the IH 635 corridor.

8.2 RUNOFF CALCULATIONS

Refer to Chapter 4 for the appropriate runoff calculation methods. All bridge crossings are considered major creek crossings and shall be designed for the ultimate 100-year storm frequency as described in Section 5.4.

8.3 BRIDGE SECTIONS

Bridges shall span the creek so that no bents are located within the main channel when possible. Bents and headers shall be oriented so that they are parallel to the stream lines at the 100-year flow with standard skew angles to the floodplain such as 15°, 30°, 45°, etc. where possible. For skewed stream crossings where the skew angle is greater than 20°, the effective area of opening shall be reduced. Documentation shall be provided in the hydraulic report in the event that bridge or culvert skew is considered.

8.4 HYDRAULIC OPERATION

Because all hydraulically designed bridges are located at major creek crossings, HEC-2 or HEC-RAS hydraulic models shall be used to design the openings and determine tailwater and headwater. Farmer's Branch Creek and its tributary are in HEC-RAS, while Cooks Branch and Upper Long Branch will remain in HEC-2. The limits of analysis and cross section update requirements are given in Section 5.2. Manning's "n" values are given in Table 5.3.1.

Headwater shall be determined with methods listed in Chapter 9 Section 4 of TxDOT's Hydraulic Design Manual. The design storm headwater elevation must not be greater than the bridge's drainage divide elevation. Bridge low chord elevations shall be designed for a minimum of 2-feet above the 50-year water surface elevation and a desirable freeboard of 1-foot above the 100-year water surface elevation. The 100-year headwater shall not encroach onto

the IH 635 mainlanes/general purpose lanes. Bridges shall be designed to maintain their integrity during a 500-year event.

Maximum velocities for various types of channel lining are given in Section 5.5 in Table 5.5.1. Where velocities greater than these exist, the channel shall be protected.

8.5 BRIDGE SCOUR

Refer to "Evaluating Scour at Bridges" (HEC 18, 2001) for detailed scour discussion and analysis procedures.

Refer to FHWA IH-97-030, "Bridge Scour and Stream Instability Countermeasures" (HEC-23) for discussion on selection of scour protection measures.

To prevent scour from impacting the stability of the proposed bridges in non-lined channels, the following two methods shall be used to protect the columns and foundations:

- Design the bridge columns and foundations to withstand the maximum total potential scour for the structure. This includes the assumption that all of the material down to the maximum potential scour limit has been removed when determining the point of rigidity. It is also advisable in areas where a layer of highly erosion resistant bedrock, such as shale or limestone, is relatively shallow, to design these foundations as if the soil above the bedrock is removed completely by the scour process.
- Provide scour protection at the base of columns by installing an apron of rock riprap. Rock riprap is preferred over the use of gabions for scour protection. Riprap protection must be combined with a regular maintenance program to repair any scour that does occur at the base of the columns and regular inspection program of columns subject to scour, especially after major flood events. Guidelines based on HEC-23 for use of rock riprap are as follows:

    - The individual rocks should be sized to withstand the expected velocities.
    - The top of the apron should be at the streambed elevation.
    - The thickness of the apron should be a minimum of 3 times the D_{50}, and no shallower than the D_{100}.
    - The maximum size rock should be no greater than 2 times the D_{50}.

- The extent of the riprap apron around the column should be at least 2 times the column dimension measured perpendicular to the flow, measured from the column face. However, the extent of the apron downstream of the column should be no less than 10 feet.

8.6 OUTPUT

In the IH 635 corridor, HEC-RAS will be used for hydraulic modeling, except where an existing HEC-2 hydraulic model is available. With either software, the design models will be provided in the hydraulic report, and a summary of that documentation shall be incorporated into the construction plans as given in Chapter 3.

Scour calculations shall be performed in accordance with HEC-18. The required scour analysis output is shown in Table 8.6.1. An example of the required scour analysis results is shown in Table 8.6.2.

Table 8.6.1 Sample Scour Calculations

IH 635 LBJ FREEWAY
HYDRAULIC ANALYSIS

SCOUR ANALYSIS

NOTES AND SOURCES OF DATA:

MAXIMUM ALLOWABLE SCOUR:

Original Embedment (ft):	-
Existing Scour (ft):	-
Diameter / Section (inches):	-
Total column length (ft):	-
Column length above bracing (ft):	-
Based on bearing stability = 0.5 * Embedment (ft) - Exist. Scour:	-
Based on allowable unsupported length (ft):	-
Column/Drill Shaft = 1.5 x diameter (inches) - Exposed length:	-
Trestle Pile = 2.0 x diameter (inches) - Exposed length:	-
H or Square Pile = 2.0 x section depth (inches) - Exposed length:	-
Timber Pile = 1.0 x diameter (inches) - Exposed length:	-

PIER SCOUR: $Y_s = 2*Y_1*K_1*K_2*K_3*K_4*(a/Y_1)^{0.65}*Fr^{0.43}$

where:

	angle of attack:	-
L = pier length	L (ft):	-
a = pier width	a (ft):	-
K_1 = pier shape correction (chp 4, table 2 in HEC -18)	K1:	-
K_2 = correction for angle of attack (chp 4, table 3 in HEC-18)	K2:	-
K_3 = correction for bed condtion (chapter 4, table 4 in HEC-18)		
K_4 = correction for armoring by bed material size (chp 4, eqn 24 and table 5 in HEC-18)		
Y_1 = depth of flow directly upstream of the pier	Y1 (ft):	-
V_1 = velocity upstream of pier	V1 (fps):	-
$Fr = V_1/(gy)^{0.5}$	Fr:	-
Y_s = pier scour depth	Ys (ft):	-

CHECK FOR LIVE BED SCOUR: $V > V_{cr}$?, $V_{cr} = 11.52\ Y^{1/6}d_{50}^{1/3}$

where:

V = avg. through bridge velocity for subarea	V (fps):	-
Y = avg. flow depth in subarea	Y (ft):	-
d_{50} = median particle size diameter	d50 (ft):	-
V_{cr} = critical velocity for incipient motion	Vcr (ft):	-

LIVE BED CONTRACTION SCOUR: $Y_2/Y_1 = (Q_t/Q_c)^{0.857}(W_1/W_2)^{.069}$

where:

Y_1 = avg. depth of flow in upstream channel	Y_1 (ft):	-
W_1 = bottom width of the upstream main channel	W_1 (ft):	-
W_2 = bottom width of contracted channel	W_2 (ft):	-
Q_c = main channel flow upstream of contraction	Q_c (cfs):	-
Q_t = main channel flow in contracted section	Q_t (cfs):	-
Y_2 = avg. flow depth in contracted section	Y_2 (ft):	-
Y_s = contraction scour = $Y_2 - Y_1$	Y_s (ft):	-

CLEAR WATER CONTRACTION SCOUR: $Y_2 = (Q^2 / 120\ d_{50}^{2/3} W^2)^{3/7}$

where:

Q = flow in the clear water section	Q (cfs):	-
W = width in clear water section less pier widths	W (ft):	-
Y_2 = avg. flow depth in section + c/w scour	Y_2 (ft):	-
Y_s = contraction scour = $Y_2 - Y$	Y_s (ft):	-

SUMMARY OF SCOUR DEPTHS:

Pier scour (ft):	-
Contraction scour (ft):	-
Total (pier + contraction) scour (ft):	-
Maximum allowable scour depth (ft):	-

Table 8.6.2 Scour Results

Contraction Scour Variables and Depths							
Proposed Structure	Y_1 U/S Depth of Flow (ft)	W_1 Bottom Width of Main Channel (ft)	W_2 Bottom Width of Contracted Channel (ft)	Q_c Main Channel Flow U/S of Contraction (cfs)	Q_t Main Channel Flow Contracted Section (cfs)	Y_2 Avg. Flow Depth Contracted Section (ft)	Maximum Computed Potential Contraction Scour (ft)

Pier Scour Variables and Depths									
Proposed Structure	a Pier Width (ft)	K_1 Pier Shape Factor	K_2 Attack Angle Factor	K_3 Bed Condition Factor	K_4 Amoring Factor	Y_1 Hydraulic Depth (ft)	V_1 Velocity (fps)	Fr Froude Number	Maximum Computed Potential Pier Scour (ft)

Texas Department of Transportation

IH 635 Managed Lanes Project
Technical Provisions

Attachment 12-2A

Amendment For The
IH-635 Drainage Criteria Manual, October 2006
(Revised February 2008)

Chapter 1 – Introduction

Section	Subheading	Modification
1.1	Purpose	Retain
1.2	Scope	Delete
1.3	Design Criteria Summary	Retain all text except criteria for pipe material, minimum pipe velocity, and maximum pipe velocity for all roadway types presented in Table 1.3.1.

Chapter 2 – Policy and Guidelines

Delete all text except: "No rise in water surface of the 100-year storm will be permitted, therefore Conditional Letters of Map Revision (CLOMR's) will not be necessary."

Chapter 3 – Data Collection, Evaluation, and Documentation

Section	Subheading	Modification
3.1	General	Delete
3.2	Hydraulic Reports	Retain
3.3	Drainage Plans Preparation	Delete
3.4	Submittals	Delete

Chapter 4 – Hydrology

Section	Subheading	Modification
4.1	General	Delete text in first paragraph. Retain text in second paragraph.
4.2	Design Frequency	Retain
4.3	Frequencies of Coincidental Occurrences	Retain
4.4	Time of Concentration	Replace first sentence in first paragraph with: "The computation of the time of concentration will be based on subdividing the flow path into three categories: overland flow (sheet flow), shallow concentrated flow (gutter flow), and conduit and/or open channel flow. Delete the first sentence in the second paragraph.
4.5	Rational Method	Retain Table 4.5.1, Table 4.5.2, Table 4.5.3 and all text except: "The TxDOT Hydraulic Design Manual provides a specific description of the theory and assumptions for the Rational Method." Replace " Each city within the IH 635 corridor has determined the rainfall intensity for various storm events. The values determined by the Cities are published in their respective drainage manuals. A comparison made between the intensities published in these manuals and those computed using TxDOT's criteria revealed that the Cities' 100-year intensities were generally lower than the 25-year intensities computed by TxDOT's criteria for times of concentration less than 20 minutes. Therefore, the rainfall intensity to be used for the IH 635 corridor is based on the following equation from the TxDOT manual:" with "The rainfall intensity to be used for the IH 635 corridor is based on the following equation:"
4.6	NRCS Runoff Curve Number Method	Retain Table 4.6.1 and replace text with the following: "The Natural Resources Conservation Services Runoff Curve Number Method (NRCS RCN Method) with a TY II 15-minute rainfall distribution shall be used to compute runoff for drainage areas greater than 200 acres. With any modeling software, the computational interval shall not exceed one-third of the shortest lag time of any basin in the model. Table 4.6.1 summarizes the

Section	Subheading	Modification
		curve numbers that are to be used for the IH 635 corridor."
4.7	Flood Hydrograph Routing Methods	Retain all text except: "A detailed description of Flood Hydrograph Routing techniques can be found in Chapter 5, Section 9 of the TxDOT Hydraulic Design Manual and "TxDOT approved."

Chapter 5 – Hydraulic Crossing

Section	Subheading	Modification
5.1	General	Retain all text except: "A detailed discussion of hydraulic principles and theory can be found in Chapter 6 of the TxDOT Hydraulic Design Manual."
5.2	Survey	Retain
5.3	Roughness Coefficients	Retain
5.4	Requirements	Retain all text except: "In addition to complying with the USACE's requirements and TxDOT's requirements".
5.5	Channels	Delete all except Table 5.5.1.
5.6	Stream Analysis	Delete

Chapter 6 – Storm Drainage Systems

Section	Subheading	Modification
6.1	General	Delete
6.2	Design Frequencies	Retain all text except: "Critical elevations are given in Sections 6.5 and 6.7."
6.3	Runoff Calculations	Delete all text except: "Storm drain design should maintain the pre-project drainage boundaries when possible to avoid diverting runoff flows from one major watershed to another."
6.4	Pavement Drainage	Retain Table 6.4.1 and all text except: "Gutter flow and ponding spread should be calculated using the method's given in Chapter 10 Section 4 of the TxDOT Hydraulic Design Manual."
6.5	Storm Drain Inlets	Delete all text except: "Dallas Area Rapid Transit (DART) light rail crossings, inlets shall be coordinated with the street profile so that no runoff enters the trackway."
6.6	Location of Storm Drain Appurtenances / Conduit Runs	Delete
6.7	Conduit Systems	Retain all except delete the text in Table 6.7.1: "Minimum – 2 fps," "Maximum – 12 fps," and "D-loads calculated according to Chapter 14 in the TxDOT Hydraulic Design Manual" and replace the text in Table 6.7.1: "Inlets – meet critical elevation requirements listed in Table 6.5.2 and 6.5.3" with the text: "Curb inlets and combination curb & grate inlets – a minimum of 1.0' below gutter depression. Grate inlets – a minimum of 1.0' below top of grate. Slotted drain – a minimum of 1.0' below guide opening."
6.8	Roadside Channels	Retain Table 6.8.1, Figure 6.8.1, and all text except: "and in Chapter 7, Section 3 of the TxDOT Hydraulic Design Manual."
6.9	Head Losses	Retain
6.10	Output	Delete

Chapter 7 – Culverts

Section	Subheading	Modification
7.1	General	Delete all text except: "Refer to Table 5.3.1 for Channel roughness coefficients to be used in IH 635 corridor." And "The following discussion clarifies these sections as they relate specifically to the IH 635 corridor."
7.2	Runoff Calculations	Retain
7.3	Tailwater Determination	Retain
7.3.1	Culverts That Tie Into a Downstream Channel	Retain all text except first sentence.
7.3.2	Culverts That Tie Into a Closed System	Retain
7.4	Hydraulic Coefficients	Retain
7.5	Headwater	Retain all text except: "Refer to Chapter 8 of TxDOT's Hydraulic Design Manual for headwater computation procedure."
7.6	Culvert Sections	Retain all text except the last 2 sentences in the second paragraph.
7.7	Culvert Velocity	Retain all text except: "Methods of reducing the proposed velocities are discussed in Chapter 8, Section 5 of TxDOT's Hydraulic Design Manual."
7.8	Output	Delete

Chapter 8 – Bridges

Section	Subheading	Modification
8.1	General	Delete all text except the first and second sentence.
8.2	Runoff Calculations	Retain
8.3	Bridge Sections	Retain
8.4	Hydraulic Operation	Retain all text except: "Headwater shall be determined with methods listed in Chapter 9 Section 4 of TxDOT's Hydraulic Design Manual."
8.5	Bridge Scour	Delete
8.6	Output	Replace all text with the following: "In the IH 635 corridor, HEC-RAS will be used for hydraulic modeling, except where an existing HEC-2 hydraulic model is available."

Texas Department of Transportation

IH 635 Managed Lanes Project
Technical Provisions

Attachment 14-1A

Amendment for the TxDOT Traffic Operations Manual, Railroad Operations Volume

AMENDMENTS FOR THE:
TxDOT Traffic Operations Manual – Railroad Operations Volume, February 2000

Manual Notices
Delete

Chapter 1 – Introduction

Section	Subheading	Modification
3	Operations Involving Railroads	Replace text with "The Developer and TxDOT will jointly enter into agreements with railroad companies. The Developer shall be responsible for all costs related to force account work for construction or maintenance requirements during the term of project. Where the Manual refers to actions the state normally takes, Developer shall perform those actions."

Chapter 2 – Railroad Agreements – General

Section	Subheading	Modification
1	Overview	Replace text with "Developer shall be responsible for all costs normally assigned to TxDOT."
2	Railroad Force Account Work	Replace text with "Developer and TxDOT will jointly enter into agreements with railroad companies. The Developer shall be responsible for all costs related to force account work for construction or maintenance requirements during the term of project. Where the Manual refers to actions the state normally takes, Developer shall perform those actions."
3	District Responsibilities	For reference only
3	District Responsibilities	In all subsequent subheadings, where the text includes work to be performed by the District or TRF, Developer shall perform.
4	TRF Responsibilities	Replace all text with the following: "The Developer shall provide all documents, estimates, and other information required by the TxDOT Traffic Operations Division (TRF) to prepare railroad agreements for the project."

Chapter 3 – Highway-Rail Grade Crossing Surfaces (Construction and Reconstruction)

Section	Subheading	Modification
1	Overview	Delete
2	Plan Layout	Replace "District" and "TxDOT" with "Developer". Under **Instruction**, delete "to be performed by TxDOT, TxDOT's contractor".
3	Agreement and Negotiating	Replace references to "Traffic Operations Division", "TRF", and "TxDOT" with the word "Developer". Delete **Construction and Maintenance** except for the 1st sentence. Under **Insurance Claims** delete all except the 1st sentence. Replace the word "contractor with the word "Developer". Delete "Payment Clause", "Solicitations of Bids" clause and "Conditions". Delete "Negotiating" and "After Execution".
4	Project Execution	Replace the words "District", "TxDOT's Contractor" and "TxDOT" with the word "Developer". Delete the section **Completion Letter**.

Chapter 4 – Grade Crossing Replanking Program
Delete

Chapter 5 – Spur Tracks
Delete

Chapter 6 – Warning Signals and Devices
Delete

Chapter 7 – Traffic Signal Preemption
Delete

Chapter 8 – Grade Separation
Delete

Chapter 9 – Drainage Structures and Common Ditches
Delete this Chapter, except for Page 9-2; Overview Policy and Practice.

Chapter 10 – Other Railroad Agreements
Delete this Chapter except for Page 10-2, Letter Agreements, Policy and Practices.

Chapter 11 – Crossing Closure, Relocation, and Consolidation
Delete

Appendix A – Forms
Delete