FINAL MASTER PLAN

Mesa Street – SH 20 Traffic Engineering and Planning Study

El Paso, TX

CSJ: 0001-02-059

August 14, 2018

This Page Intentionally Left Blank

TABLE OF CONTENTS

EXECUTIVE SUMMARY ..... **ES-I**

INTRODUCTION **1**

EXISTING CONDITIONS **3**

- **Geometric and Operational Profile** **3**
- **Speed Profile** **4**
- **Volume Profile** **4**
- **Traffic Analysis** **5**
- **Critical Intersections** **24**
- **Crash Analysis** **25**
- **Constraints Mapping** **27**

TRAFFIC ANALYSIS AND METHODOLOGY **28**

- **2020 No-Build Scenario** **28**
  - *CRITICAL INTERSECTIONS* *28*
- **2020 Short-Term Recommendations Build Alternative** **32**
  - *CRITICAL INTERSECTIONS* *32*
- **Mid-Term Recommendations** **46**
- **2040 No-Build Scenario** **47**
  - *CRITICAL INTERSECTIONS* *47*
- **2040 Long-Term Recommendations Build Alternative** **51**
  - *CRITICAL INTERSECTIONS* *51*

SH 20 / MESA STREET BUILD ALTERNATIVE RECOMMENDATIONS **66**

- **Intersections** **66**
  - *TURN BAY LENGTHENING* *66*
  - *FLASHING YELLOW ARROWS* *70*
  - *NEAR-SIDE SIGNAL HEADS* *70*
  - *TRAFFIC SIGNAL CONTROLLERS* *70*
  - *TRAFFIC SIGNAL CABINETS* *71*
  - *RIGHT-TURN OVERLAPS* *71*
  - *SIGNAGE* *72*
  - *INNOVATIVE INTERSECTIONS* *72*
- **Corridor** **76**
  - *MEDIAN MAINTENANCE VEHICLE PARKING* *76*
- **Pedestrian and Bicycle** **78**

This Page Intentionally Left Blank

Exclusive Pedestrian Phases *80*
Pedestrian Hybrid Beacon *80*
Transit **80**
Transit Connectivity *81*
Sun Metro Bus Queue Jumping Lanes *81*
Sun Metro Bus Pull-Out Lanes *82*
ITS (Intelligent Transportation System) **83**
Bluetooth for Traffic Surveillance *83*
Microwave Vehicle Detectors *84*
Video Imaging Vehicle Detection System (VIVDS) *84*
Closed Circuit Television (CCTV) *84*
Fiber Connections *85*
Emergency Vehicle Preemption *85*
Speed Feedback Signs *85*
Dynamic Lane Reversal *85*
Arterial Dynamic Message Signs *85*
Vehicle to Infrastructure (V2I) Communications *86*
Smart Corridor *86*
DRAINAGE **87**
UTILITIES **87**
RIGHT-OF-WAY ACQUISITION AND RIGHT-OF-WAY ENCROACHMENT LOCATIONS **87**
SH 20 / MESA STREET DIAGRAMMATICS OF BUILD ALTERNATIVE RECOMMENDATIONS **88**
SH 20 / MESA STREET PRELIMINARY COST ESTIMATES FOR BUILD ALTERNATIVE RECOMMENDATIONS **88**
ADDITIONAL SH 20 / MESA STREET STUDY DATA **89**
ADDITIONAL CONCEPTS EVALUATED **90**
SH 20 / MESA STREET STUDY (PUBLIC & STAKEHOLDER) COORDINATION **90**

This Page Intentionally Left Blank

LIST OF TABLES

Table 1 - LOS Definitions for Signalized Intersections 5
Table 2 - Existing AM Peak Hour Intersection LOS and Delay 6
Table 3 - Existing PM Peak Hour Intersection LOS and Delay 15
Table 4 - Existing Critical Intersections (AM) 24
Table 5 - Existing Critical Intersections (PM) 24
Table 6 - Crashes by Year for Mesa Street, Stanton Street, and Oregon Street Corridors 25
Table 7 - 2020 No Build Critical Intersections (AM) 28
Table 8 - 2020 No Build Critical Intersections (PM) 28
Table 9 - 2020 Build Critical Intersections (AM) 32
Table 10 - 2020 Build Critical Intersections (PM) 32
Table 11 - 2020 Build AM Peak Hour Intersection LOS and Delay 33
Table 12 - 2020 Build PM Peak Hour Intersection LOS and Delay 38
Table 13 - 2040 No-Build Critical Intersections (AM) 47
Table 14 - 2040 No-Build Critical Intersections (PM) 47
Table 15 - 2040 Build Critical Intersections (AM) 51
Table 16 - 2040 Build Critical Intersections (PM) 51
Table 17 - Travel Time Comparisons 52
Table 18 - 2040 Build AM Peak Hour Intersection LOS and Delay 53
Table 19 - 2040 Build PM Peak Hour Intersection LOS and Delay 58
Table 20 - Intersection Improvements 66
Table 21 - Turn Bay Recommendations 67
Table 22 - Potential Median Maintenance Vehicle Parking Zone Locations 77
Table 23 - Preliminary Cost Estimates for Final Recommendations 89
Table 24 - Public & Stakeholder Coordination 91

LIST OF FIGURES

Figure 1 - Project Study Limits 2
Figure 2 - Spatial Crash Analysis of Mesa Street Corridor 26
Figure 3 - 2020 No-Build LOS (Doniphan Dr to Balboa Rd) 29
Figure 4 - 2020 No-Build LOS (Balboa Rd to Mesita Dr) 30
Figure 5 - 2020 No-Build LOS (Mesita Dr to LP 375) 31
Figure 6 - 2020 Build LOS (Doniphan Dr to Balboa Rd) 43
Figure 7 - 2020 Build LOS (Balboa Rd to Mesita Dr) 44
Figure 8 - 2020 Build LOS (Mesita Dr to LP 375) 45
Figure 9 - 2040 No-Build LOS (Doniphan Dr to Balboa Rd) 48
Figure 10 - 2040 No-Build LOS (Balboa Rd to Mesita Dr) 49
Figure 11 - 2040 No-Build LOS (Mesita Dr to LP 375) 50
Figure 12 - 2040 Build LOS (Doniphan Dr to Balboa Rd) 63
Figure 13 - 2040 Build LOS (Balboa Rd to Mesita Dr) 64
Figure 14 - 2040 Build LOS (Mesita Dr to LP 375) 65
Figure 15 - Median Maintenance Vehicle Parking Zone Concept 77
Figure 16 - Bus Pull-Out Lane Concept 83

This Page Intentionally Left Blank

APPENDIX A

- Diagrammatic of Final Recommendations
- Diagrammatic of Final Major Intersection Recommendations (IH 10 / North Mesa Street, Resler Drive, Sunland Park Drive, Executive Center Boulevard, and Glory Road / Baltimore Avenue)
- Conceptual Renderings of Final Recommendations
- Video VISSIM (Video Simulation) Screen Captures

APPENDIX B

- Bus Stop Pull-out Lane Matrix (Locations & Preliminary Cost Estimate)

APPENDIX C

- White Papers for Short-Term Final Recommendations
- White Papers for Mid-Term Final Recommendations
- White Papers for Long-Term Final Recommendations
- White Paper for Pedestrian Bridge (not currently recommended)

APPENDIX D

- Preliminary Cost Estimate Spreadsheets for Final Recommendations

APPENDIX E

- Existing Utilities Coordination Contact Lists & Mapping

APPENDIX F

- Constraints Maps

APPENDIX G

- February 2018 Public Meeting Exhibit Boards of Draft Recommendations

APPENDIX H

- Measures of Effectiveness Evaluation Matrices / Maps

APPENDIX I

- Corridor Traffic Data

APPENDIX J

- Public & Stakeholder Meeting Summaries

APPENDIX K

- Data Collection and Mobilization Report
- Traffic Projections Methodology Memorandum
- Traffic Operational Analysis Report

This Page Intentionally Left Blank

EXECUTIVE SUMMARY

The **Texas Department of Transportation (TxDOT) El Paso District** has identified the need to improve the capacity, operation, circulation, and safety on Mesa Street [State Highway (SH) 20)] from Doniphan Drive (SH 20) to Loop 375. Located in El Paso County, SH 20 / Mesa Street is experiencing increased traffic and congestion due to the growing population and continuing local development.

As a means to address the various SH 20 / Mesa Street travel-related concerns, TxDOT performed a SH 20/Mesa Street Traffic Engineering and Planning Study which evaluated and recommended multi-modal transportation improvements and upgrades to the SH 20 / Mesa Street corridor to support TxDOT's overriding goal of enhancing the safety, congestion relief and transportation reliability along the facility. Therefore, this SH 20 / Mesa Street Master Plan summarizes and presents the Study-recommended Short-, Mid-, and Long-term improvements and upgrades to SH 20 / Mesa Street. The Short-term recommendations are forecasted to be implemented within the next five years and require no additional right-of-way (ROW), are typically low (construction) cost, and can be readily implemented. Mid-term recommendations would be implemented within the next five to ten years and may require ROW acquisition, are typically higher cost, and would take longer to implement. Long-term recommendations would be implemented within the next ten to twenty years due to the required ROW acquisition, extensive design work involved, utility adjustment impacts, higher costs, and longer implementation time.

The studied alternatives and concepts to address the SH 20 / Mesa Street safety, mobility, and traffic operations focused the Short-term (year 2020) and the Long-term (year 2040) travel demand and traffic volume projections along the corridor. Traffic volumes along the corridor are overall projected to increase by more than 25% within the next 20 years. This increase in traffic will cause some of the existing intersection operations to fail and increase travel delays in the corridor. The No-Build or do-nothing alternative (option) was evaluated and compared to various Build alternatives in order to determine an optimum overall solution. The Study analyzed existing conditions and identified critical intersections in the Short-term and Long-term. An initial existing conditions analysis determined there were three (3) intersections operating at a Level of Service (LOS) E or F in the AM (6:30AM - 9:00AM) peak hour, and two (2) intersections in the PM (3:30PM - 6:30PM) peak hour operating at LOS E or F which are each described in this Master Plan.

From a traffic operations standpoint, the Study determined the SH 20 / Mesa Street travel times and traffic flow are governed by the signalized Mesa Street intersections and not by the number of lanes between the intersections. These intersection bottlenecks occur due to the signalized intersections not being able to process the traffic volume demand and being overcapacity. Therefore, more efficient intersection performance will overall increase SH 20 / Mesa Street's operations and efficiency. Delay increases in the future will result from projected traffic volume increases, and the intersections operating either at LOS E or F will increase from three (3) to ten (10) intersections in the AM peak hour for the year 2040, and from two (2) to fourteen (14) intersections in the PM peak hour for the year 2040 when compared to existing. With the intersection improvements, grade separations, signal timing updates, and other mitigations recommended by the Study's Build concepts, the intersections operating at LOS E or F will reduce from ten (10) to one (1) intersection in the AM peak hour, and from fourteen (14) to two (2) intersections in the PM peak hour for the year 2040 when compared to existing (year 2040 No-Build) intersections.

The plan of action (recommended conceptual Build Alternatives) presented in this Master Plan, and summarized on the Short-, Mid-, and Long-term White Paper summaries located in **Appendix C (White Papers)** are based on the Study's various transportation analyses involving the Alternatives, safety evaluations, and feedback received from the Study's six (6) public meetings, three (3) Agency Working

Group meetings, agency workshops, and individual stakeholder meetings organized and conducted by the Study Team. Each White Paper addresses a specific Short-, Mid-, and Long-term recommended and cost-estimated corridor element to improve and upgrade SH 20 / Mesa Street. These elements were addressed and evaluated during the course of the Study according to five (5) distinct SH 20 / Mesa Street corridor, operational categories:

- Intersections;
- Corridor (between intersections and includes median maintenance vehicle parking zones);
- Pedestrian & Bicycle;
- Transit (includes bus pull-out lanes); and
- Intelligent Transportation System (ITS).

To view the specific corridor location of each recommended Short-, Mid-, and Long-term SH 20 / Mesa Street (mapped) element improvement, reference **Appendix A (Diagrammatic of Final Recommendations, etc.)**.

INTRODUCTION

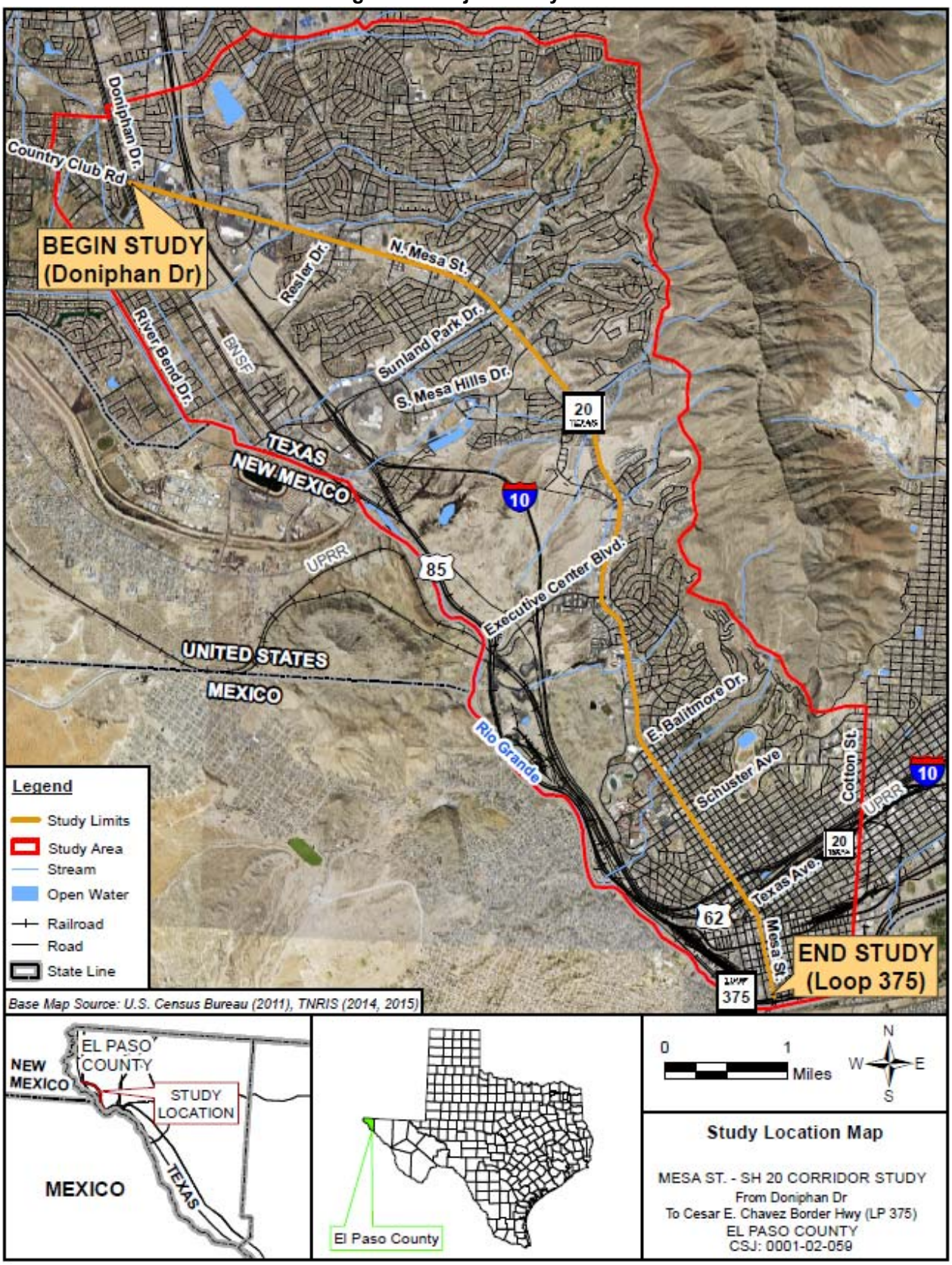
The Texas Department of Transportation (TxDOT) El Paso District has identified the need to improve capacity, operation, circulation, and safety on SH 20 / Mesa Street from Doniphan Drive (SH 20) to Loop 375 (see **Figure 1 - Project Study Limits**).

SH 20 / Mesa Street from Doniphan Drive (SH 20) southward to Texas Avenue (SH 20) is a State of Texas roadway operated and maintained by TxDOT, whereas Mesa Street from Texas Avenue (SH 20) southward to Loop 375 is a city street operated and maintained by the City of El Paso. The northern segment of SH 20 / Mesa Street remains a heavily traveled state highway with historic traffic volumes reaching 50,000 vehicles per day (VPD). Eighteen (18) traffic fatalities have occurred over the last seven (7) years along the SH 20 / Mesa Street corridor. The corridor contains various El Paso Independent School District schools and commercial, retail, and residential developments along the northern segment. The University of Texas at El Paso (UTEP) and Medical Center region are generally located in the middle segment of the SH 20 / Mesa Street corridor.

This Master Plan describes the capacity and traffic flow challenges within the corridor, both for existing and future travel conditions, and recommends Short-term, Mid-term, and Long-term multi-modal transportation improvements to improve the SH 20 / Mesa Street specific and overall traffic operations. The Short-term recommendations are forecasted to be implemented within the next five years, Mid-term recommendations within the next five to ten years, and Long-term recommendations within the next ten to twenty years. These improvements were identified based on the results of the Study's various traffic analyses, as well as feedback received from the conduction of six (6) public meetings, agency and stakeholder coordination meetings and workshops, and the assembly of three (3) Agency Working Group meetings specifically conducted for the Study.

This Master Plan presents the existing and projected traffic volumes and operations for the No-build Alternative in comparison to the recommended conceptual Build Alternatives (Short-, Mid-, and Long-term) that address the traffic volume demand projected on SH 20 / Mesa Street for the years 2020 and 2040. The traffic operational analyses utilized to assess the No-build and Build Alternatives included a Measures of Effectiveness (MOEs) screening of alternatives matrix evaluation that included screening criteria such as Level of Service (LOS), delay, travel time and public and agency feedback.

Figure 1 - Project Study Limits



EXISTING CONDITIONS

Geometric and Operational Profile

Mesa Street (SH 20) is a state highway which consists of a divided six-lane roadway between Doniphan Drive (SH 20) and Glory Road / Baltimore Drive. Left-turn lanes are present at most intersections, in combination with mid-block median openings that allow for access to driveways, particularly at large retail centers. SH 20 / Mesa Street from Glory Road / Baltimore Drive to Cincinnati Avenue is a divided four-lane roadway. SH 20 / Mesa Street from Cincinnati Avenue to Franklin Avenue is a four-lane roadway with left-turn lanes present at all intersections. From Franklin Avenue to San Antonio Avenue, Mesa Street is composed of four lanes, undivided, with no left-turn lanes at intersections. Mesa Street from San Antonio Avenue to Loop 375 is an undivided two-lane roadway containing infrequent on-street parallel parking south of Mills Avenue.

At the Mesa Street and Texas Avenue intersection, SH 20 continues east on Texas Avenue (SH 20), while Mesa Street continues southward as a two-lane, undivided cross-section until it terminates at Loop 375 (Cesar E. Chavez Border Highway). The posted speed limit on SH 20 / Mesa Street is 45 mph from Doniphan Drive (SH 20) to Alto Mesa Drive, 40 mph from Alto Mesa Drive to Sunland Park Drive; 45 mph from Sunland Park Drive to Kern Drive, and 35 mph from Kern Drive to Loop 375.

There are also several school zones along the corridor with school zone speed limits posted as listed below:

- Coronado High School – school zone from Pitt Street to halfway to Alto Mesa Drive (30 mph);
- Morehead Middle School – school zone from Double Tree Lane to past Confetti Drive (35 mph);
- Mesita Elementary School – school zone from west of Sun Bowl Drive to Kern Drive (30 mph); and
- St. Patrick's School – school zone from California Avenue to Arizona Avenue (20 mph).

The SH 20 / Mesa Street corridor has fifty-two (52) signalized intersections which constrain the free flow vehicular speed on the SH 20/ Mesa Street travel lanes. Throughout the corridor, a mix of left-turn treatments is used, including protected-permitted, protected-only, permitted, and split left-turn phasing. Flashing yellow arrow left-turns are not currently used. In addition, all intersections have various combinations of pedestrian accommodations that include crosswalks, push buttons, and pedestrian signal heads.

Also, along SH 20 / Mesa Street corridor, four intersections have split-phase operations on the cross-streets at Doniphan Drive, Sunland Park Drive / Shadow Mountain Drive, Bartlett Drive / Remcon Circle, and San Antonio Avenue. These split phases allow for more capacity for cross-street traffic since only one approach is served at a time. However, they create significant reductions in green-band for the through movements along SH 20 / Mesa Street. Possible future changes that would allow for the use of lead-lag left-turn sequences instead of the split-phase operation are discussed later in this Master Plan.

Sun Metro operates the Brio Bus Rapid Transit (BRT) service along the SH 20 / Mesa Street corridor. Brio operates with transit signal priority, which dynamically adjusts the signal timing to prioritize bus operations on the corridor.

All traffic signals along SH 20 / Mesa Street are controlled by Type 170 controllers interconnected to each other with a combination of twisted pair copper communication cable and fiber optic cable. The traffic signals are interconnected with twisted pair copper communication cable from Schuster Avenue to Sunland Park Drive. They are interconnected by fiber optic cable from Sunland Park Drive to Doniphan Drive (SH 20). Communications cable then connects to the TransVista Traffic Management Center through the

existing IH 10 fiber optic cable connection. The connection points are at the intersections of SH 20 / Mesa Street at IH 10, Sunland Park Drive, and Executive Center Boulevard.

Speed Profile

To generate the speed profiles for the SH 20 / Mesa Street corridor, the operating speeds along SH 20 / Mesa Street were measured on February 15 and 16, 2016. Speed profiles are used to determine the average travel speed during the period of interest, in this case the peak hours, for a corridor. The average speed measured during the AM peak hour (6:30AM - 9:00AM) in the northbound and southbound directions was 27.7 mph and 26.7 mph, respectively. Additional operational speeds were measured and observed on December 7, 2016 during the PM (3:30PM - 6:30PM) peak period and December 8, 2016 during the AM peak period along Mesa Street from Texas Avenue (SH 20) to Loop 375. The average speed in the northbound direction was 5.3 mph (during the PM peak period) and 12 mph (during the AM peak period). In the southbound direction, the average speed ranged from 12 mph (during the PM peak period) to 16 mph (during the AM peak period).

The non-school zone posted speed in the corridor ranges from 35 mph to 45 mph. The presence of multiple traffic signals along the corridor presents challenges to improve the operational speed of SH 20 / Mesa Street. And the existence of traffic signals at major intersections preclude free-flow speed and travel time reliability along the entire corridor. The corridor length (approximately 9.8 miles) and the number of existing traffic signals impose limitations of time and space that require driver stops at multiple points along the corridor. For example, intersections at major arterials such as Resler Drive, Sunland Park Drive, Mesa Hills Drive, Executive Center Boulevard, and Sun Bowl Drive require long green times to avoid excessive delay on for these high-volume side streets and in doing so creates SH 20 / Mesa Street queuing at the same (red stop condition) signal.

TxDOT also provided a year 2014 speed summary for the Study which was collected by INRIX for highway facilities located in the El Paso area. INRIX data information was received in January 2016 for Year 2014 and in May 2017 for Year 2015. Given the timing of the delivery of the INRIX data; the Study Team utilized the 2014 INRIX information to evaluate and validate the speed operation of the corridor. The operational speed in both directions never reaches 30 mph during the peak periods, or during the noon period. The average speed measured by INRIX during the AM peak hour in the northbound and southbound direction was 22 mph and 27 mph, respectively. The average speed measured during the PM peak hour in the northbound and southbound direction was 19 mph and 26 mph, respectively.

Volume Profile

Traffic (vehicle), bike and pedestrian counts were collected at each signalized intersection along the corridor from March 28, 2016 to April 12, 2016 and on November 29, 2016 **(see Appendix K - Data Collection and Mobilization Report)**. These counts indicated the SH 20 / Mesa Street traffic volume in both directions is balanced between Doniphan Drive (SH 20) and Executive Center Boulevard. And the southbound direction traffic is higher from Executive Center Boulevard to Main Street. The section from Shadow Mountain Drive to Executive Center Boulevard carries the highest traffic volume in the SH 20 / Mesa Street Study area. The traffic volume in 2016 was influenced to some degree by the on-going construction on IH 10, the Border West Highway, and construction of the City's Streetcar route along Stanton Street both north of downtown and within the downtown region.

The vehicle classification distribution along SH 20 / Mesa Street is based on the 2016 traffic counts. The light vehicle traffic ranges from 99 percent of the total vehicle volume composition on Doniphan Drive (SH 20) to 95 percent on Paisano Drive (US 62). Along the SH 20 / Mesa Street corridor, medium and heavy vehicles represent less than 5.0 percent and less than 1.0 percent of the overall volume, respectively.

Traffic Analysis

The Highway Capacity Manual (HCM) 6th Edition uses Level of Service (LOS) to describe the quality of traffic flow. LOS criteria for signalized and stop controlled intersections are based on the average control delay per vehicle. LOSs range from A (very little delay) to F (long delays and congestion). Control delay includes deceleration and acceleration delay, queue move-up time, and stopped delay. The LOS thresholds are presented in **Table 1**.

For example, if the average control delay for vehicles at a signalized intersection is fifty-five seconds or less, the intersection is defined as operating at a LOS "D" or better. LOS "D" describes conditions where congestion is observed with many vehicles stopping and individual cycle failures are noticeable. Control delay of 55-80 seconds represents LOS "E". Control delay values greater than 80 seconds represent LOS "F". For this Study, the criterion for acceptable LOS is a LOS "D" or better.

Table 1 - LOS Definitions for Signalized Intersections

Level of Service	Average Total Delay (sec / veh)
A	≤10
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

A traffic analysis was performed to evaluate the LOS of each SH 20 / Mesa Street intersection using the HCM methodologies. Existing traffic signal timing was obtained from the City of El Paso and was considered in calculating the resultant LOS. Certain intersections along Stanton Street were omitted due to the Streetcar construction which did not allow for counts to be taken at those locations. The traffic analysis was performed for a typical weekday for the AM and PM peak hours for the years 2016 (existing), 2020 (short-term), and 2040 (long-term). The traffic volumes developed for the years 2020 and 2040 were based on historical growth rates, traffic counts, and the Travel Demand Model for the area.

A detailed description of how the future traffic volumes were developed is located in a separate summary document produced by the Study and located in **Appendix K (Traffic Projections Methodology Memorandum)**. This traffic analysis did not consider crashes or construction activities along SH 20 / Mesa Street or IH 10. Crashes or construction activities along IH 10 shift or detour traffic to the SH 20 / Mesa Street corridor that in turn cause the corridor intersections to operate at LOS E or LOS F. Detailed information is also available in **Appendix K (Data Collection and Mobilization Report)**.

The Study determined the SH 20 / Mesa Street travel times and traffic flow are governed by the signalized SH 20 / Mesa Street intersections and not by the number of lanes between the intersections. These intersection bottlenecks occur due to the signalized intersections not being able to process the traffic volume demand and being overcapacity. Therefore, more efficient intersection performance will overall increase SH 20 / Mesa Street's operations and efficiency. Intersection delay and LOS results for existing conditions are presented in **Table 2** and **Table 3** for the AM and PM peak hours, respectively.

Table 2 - Existing AM Peak Hour Intersection LOS and Delay

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
1	DONIPHAN & SH 20 (MESA)	EB	EBL	72	82	22.3	30.7	696	C
			EBT	302	442	32.0			
			EBR	0	172	0.0			
		WB	WBL	94	114	26.1	20.9	780	C
			WBT	140	431	28.1			
			WBR	41	235	6.0			
		NB	NBL	#280	170	124.8	291.9	725	F
			NBT	#488	509	343.6			
			NBR	0	46	0.0			
		SB	SBL	383	398	64.7	57.3	1,092	E
			SBT	466	614	53.7			
			SBR	0	80	0.0			
						Overall Intersection	98.4	3,293	F
2	CROSSROADS & SH 20 (MESA)	EB	EBL	m8	29	3.1	9.3	942	A
			EBT	m188	881	9.9			
			EBR	m4	32	2.2			
		WB	WBL	9	112	3.6	2.1	961	A
			WBT	32	807	1.8			
			WBR	0	42	0.0			
		NB	NBL	0	17	0.0	28.2	99	C
			NBT	58	9	63.3			
			NBR	30	73	15.7			
		SB	SBL	0	57	0.0	58.1	156	E
			SBT	66	49	58.1			
			SBR	0	50	0.0			
						Overall Intersection	11.4	2,158	B
3	OSBORNE & SH 20 (MESA)	EB	EBL	m10	2	70.0	5.6	1,085	A
			EBT	79	1015	5.4			
			EBR	0	68	0.0			
		WB	WBL	m184	317	76.5	18.8	1,358	B
			WBT	m86	1040	2.4			
			WBR	0	1	0.0			
		NB	NBL	0	59	0.0	24.3	319	C
			NBT	30	3	77.0			
			NBR	43	257	9.1			
		SB	SBL	0	10	0.0	52.5	39	D
			SBT	51	19	52.5			
			SBR	0	10	0.0			
						Overall Intersection	15.1	2,801	B
4	DESERT SOUTH & SH 20 (MESA)	EB	EBL	0	0	0.0	22.8	1,302	C
			EBT	200	951	28.7			
			EBR	51	351	7.9			
		WB	WBL	203	187	35.9	7.0	1,399	A
			WBT	43	1212	2.0			
			WBR	0	0	0.0			
		SB	SBL	312	493	50.8	235.2	831	F
			SBT	#726	110	310.1			
			SBR	0	228	0.0			
						Overall Intersection	67.7	3,532	E
5	DESERT NORTH & SH 20 (MESA)	EB	EBL	m182	187	42.2	10.6	1,499	B
			EBT	m133	1312	5.4			
			EBR	0	0	0.0			
		WB	WBL	0	0	0.0	36.7	1,257	D
			WBT	285	859	36.7			
			WBR	0	398	0.0			
		NB	NBL	338	493	63.6	38.2	940	D
			NBT	197	123	48.1			
			NBR	0	324	0.3			
						Overall Intersection	26.2	3,696	C

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
6	BARTLETT & SH 20 (MESA)	EB	EBL	101	139	50.5	21.2	1,649	C
			EBT	322	1122	20.3			
			EBR	225	388	10.9			
		WB	WBL	m43	52	44.8	13.1	880	B
			WBT	m260	792	11.0			
			WBR	0	36	0.0			
		NB	NBL	167	214	63.7	66.5	256	E
			NBT	167	28	75.2			
			NBR	0	14	0.0			
		SB	SBL	117	106	67.2	22.8	320	C
			SBT	93	31	67.7			
			SBR	0	183	0.3			
						Overall Intersection	23.0	3,105	C
7	REMCON & SH 20 (MESA)	EB	EBL	60	28	39.7	2.6	1,074	A
			EBT	38	1008	1.8			
			EBR	0	38	0.1			
		WB	WBL	94	153	61.4	15.7	1,083	B
			WBT	116	840	7.2			
			WBR	0	90	0.0			
		NB	NBL	#137	66	129.0	42.2	191	D
			NBT	24	8	53.8			
			NBR	0	117	0.2			
		SB	SBL	#201	110	168.6	106.8	179	F
			SBT	41	15	22.0			
			SBR	0	54	0.0			
						Overall Intersection	20.7	2,527	C
8	SH 20 (MESA) & BELVIDERE	EB	EBL	m25	138	7.8	2.7	1,293	A
			EBT	m38	1155	1.9			
			EBR	0	0	0.0			
		WB	WBL	0	0	0.0	5.4	1,009	A
			WBT	106	938	5.4			
			WBR	0	71	0.0			
		SB	SBL	130	157	53.4	35.4	404	D
			SBT	0	0	0.0			
			SBR	45	247	15.3			
						Overall Intersection	9.1	2,706	A
9	RESLER & SH 20 (MESA)	EB	EBL	167	261	39.3	20.3	1,191	C
			EBT	184	770	18.2			
			EBR	4	160	1.7			
		WB	WBL	m61	89	55.0	26.7	838	C
			WBT	m132	568	28.4			
			WBR	m52	181	5.2			
		NB	NBL	103	148	63.8	54.8	716	D
			NBT	219	443	52.3			
			NBR	0	125	0.0			
		SB	SBL	314	587	55.2	40.8	1,518	D
			SBT	319	714	38.2			
			SBR	58	217	6.0			
						Overall Intersection	34.9	4,263	C
10	SH 20 (MESA) & PITT/DRIVEWAY	EB	EBL	0	8	0.0	20.9	82	C
			EBT	13	3	53.8			
			EBR	12	71	13.9			
		WB	WBL	0	58	0.0	96.6	89	F
			WBT	94	4	96.6			
			WBR	0	27	0.0			
		NB	NBL	4	20	2.1	2.7	864	A
			NBT	56	837	2.8			
			NBR	0	7	0.0			
		SB	SBL	m4	35	1.6	2.8	1,459	A
			SBT	68	1404	2.8			
			SBR	m0	20	0.1			
						Overall Intersection	8.3	2,494	A

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
11	SH 20 (MESA) & ALTO MESA	EB	EBL	0	16	0.0	38.6	26	D
			EBT	15	0	65.1			
			EBR	0	10	1.4			
		WB	WBL	0	12	0.0	25.9	37	C
			WBT	24	2	61.8			
			WBR	0	23	3.4			
		NB	NBL	2	29	2.2	1.5	1,086	A
			NBT	23	1046	1.5			
			NBR	0	11	0.0			
		SB	SBL	m4	33	1.4	2.5	1,543	A
			SBT	38	1414	2.5			
			SBR	0	96	0.0			
						Overall Intersection	3.0	2,692	A
12	SH 20 (MESA) & CAMILLE	EB	EBL	0	172	0.0	55.7	230	E
			EBT	124	6	69.7			
			EBR	28	52	14.5			
		WB	WBL	0	7	0.0	40.8	33	D
			WBT	46	26	40.8			
			WBR	0	0	0.0			
		NB	NBL	16	17	7.5	5.0	898	A
			NBT	141	881	4.9			
			NBR	0	0	0.0			
		SB	SBL	2	1	7.0	10.6	1,395	B
			SBT	298	1275	10.6			
			SBR	0	119	0.0			
						Overall Intersection	13.6	2,556	B
13	SH 20 (MESA) & THUNDERBIRD	EB	EBL	0	9	0.0	43.9	22	D
			EBT	34	4	43.9			
			EBR	0	9	0.0			
		WB	WBL	0	128	0.0	45.0	285	D
			WBT	110	9	77.1			
			WBR	57	148	14.9			
		NB	NBL	16	10	44.0	6.6	815	A
			NBT	54	772	5.7			
			NBR	0	33	0.0			
		SB	SBL	120	85	51.0	19.8	1,339	B
			SBT	457	1235	17.3			
			SBR	0	19	0.0			
						Overall Intersection	18.8	2,461	B
14	SH 20 (MESA) & BALBOA	EB	EBL	98	64	85.1	53.5	182	D
			EBT	54	69	31.6			
			EBR	0	49	0.0			
		WB	WBL	104	63	62.2	54.5	195	D
			WBT	91	128	51.5			
			WBR	0	4	0.0			
		NB	NBL	57	41	48.7	10.6	772	B
			NBT	101	698	8.2			
			NBR	0	33	0.0			
		SB	SBL	46	23	93.2	7.6	1,395	A
			SBT	9	1226	5.0			
			SBR	0	146	0.0			
						Overall Intersection	16.4	2,544	B
15	SH 20 (MESA) & SUNLAND PARK/SHADOW MT	EB	EBL	160	107	58.3	54.5	406	D
			EBT	172	217	53.0			
			EBR	0	82	0.0			
		WB	WBL	#739	996	53.8	64.7	1,783	E
			WBT	#859	717	74.1			
			WBR	0	70	1.7			
		NB	NBL	75	109	46.4	19.8	1,133	B
			NBT	144	678	22.6			
			NBR	83	346	5.1			
		SB	SBL	38	51	45.7	55.9	1,316	E
			SBT	#553	1150	56.4			
			SBR	0	115	0.0			
						Overall Intersection	50.0	4,638	D

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
16	SH 20 (MESA) & CRESTMONT	EB	EBL	49	29	47.3	21.6	137	C
			EBT	45	1	15.0			
			EBR	0	107	0.0			
		WB	WBL	116	82	96.8	70.9	116	E
			WBT	3	4	17.0			
			WBR	0	30	0.0			
		NB	NBL	m72	40	77.0	7.1	1,180	A
			NBT	90	1123	3.7			
			NBR	0	17	0.0			
		SB	SBL	m17	15	74.9	3.4	2,246	A
			SBT	m229	2221	2.8			
			SBR	0	10	0.0			
						Overall Intersection	8.3	3,679	A
17	SH 20 (MESA) & MESA HILLS	EB	EBL	249	212	62.9	48.5	487	D
			EBT	34	41	50.0			
			EBR	150	234	35.2			
		WB	WBL	174	151	61.9	46.6	276	D
			WBT	52	71	55.3			
			WBR	0	54	2.1			
		NB	NBL	m#140	192	89.4	20.1	1,072	C
			NBT	53	825	4.6			
			NBR	m0	55	0.1			
		SB	SBL	#135	80	70.2	11.1	2,384	B
			SBT	94	2086	9.5			
			SBR	1	218	0.8			
						Overall Intersection	20.7	4,219	C
18	SH 20 (MESA) & FESTIVAL	EB	EBL	0	94	0.0	59.9	364	E
			EBT	68	39	59.9			
			EBR	0	231	0.0			
		WB	WBL	#388	435	95.3	74.0	559	E
			WBT	#277	12	92.4			
			WBR	12	112	5.3			
		NB	NBL	#222	115	138.6	22.3	1,163	C
			NBT	79	889	11.0			
			NBR	0	159	1.3			
		SB	SBL	m#139	86	79.7	32.8	2,162	C
			SBT	575	2038	30.6			
			SBR	0	38	0.0			
						Overall Intersection	37.6	4,248	D
19	SH 20 (MESA) & MONTECILLO	EB	EBL	81	45	64.9	47.8	63	D
			EBT	7	1	54.0			
			EBR	0	17	1.1			
		WB	WBL	0	0	0.0	5.4	10	A
			WBT	7	1	54.0			
			WBR	0	9	0.6			
		NB	NBL	48	20	41.5	1.6	1,209	A
			NBT	34	1181	1.0			
			NBR	m0	8	0.0			
		SB	SBL	m2	10	4.8	9.9	2,872	A
			SBT	m969	2838	10.0			
			SBR	m0	24	0.0			
						Overall Intersection	8.1	4,154	A
20	SH 20 (MESA) & ARGONAUT	EB	EBL	0	0	0.0	0.0	0	A
			EBT	0	0	0.0			
			EBR	0	0	0.0			
		WB	WBL	130	90	68.9	42.5	176	D
			WBT	0	0	0.0			
			WBR	39	86	13.8			
		NB	NBL	0	0	0.0	11.8	1,126	B
			NBT	19	1102	1.1			
			NBR	#78	24	405.5			
		SB	SBL	m2	50	1.4	2.2	2,925	A
			SBT	20	2875	2.0			
			SBR	0	0	0.0			
						Overall Intersection	6.8	4,227	A

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
21	SH 20 (MESA) & CASTELLANO	EB	EBL	18	7	59.6	14.4	65	B
			EBT	0	0	0.0			
			EBR	0	58	2.6			
		WB	WBL	88	102	63.5	41.1	151	D
			WBT	58	2	64.4			
			WBR	0	47	0.1			
		NB	NBL	m77	78	38.8	14.9	1,187	B
			NBT	182	1070	12.9			
			NBR	0	39	0.0			
		SB	SBL	m13	33	4.5	20.6	3,042	C
			SBT	#1254	2976	21.2			
			SBR	m0	33	0.1			
						Overall Intersection	19.9	4,445	B
22	SH 20 (MESA) & EXECUTIVE CENTER/CUL-DE-SAC	EB	EBL	324	576	56.4	41.2	960	D
			EBT	165	54	33.9			
			EBR	75	330	7.9			
		WB	WBL	11	3	58.7	29.2	27	C
			WBT	21	8	60.5			
			WBR	0	16	1.0			
		NB	NBL	187	287	85.2	26.2	1,108	C
			NBT	75	819	6.9			
			NBR	m0	2	0.0			
		SB	SBL	m11	8	81.2	19.9	2,756	B
			SBT	#557	1827	21.4			
			SBR	m976	921	16.5			
						Overall Intersection	25.4	4,851	C
23	SH 20 (MESA) & DRIVEWAY/BRENT WOOD	EB	EBL	0	1	0.0	0.0	2	A
			EBT	0	0	0.0			
			EBR	0	1	0.0			
		WB	WBL	0	68	0.0	30.3	323	C
			WBT	116	0	69.1			
			WBR	100	255	19.3			
		NB	NBL	4	1	49.0	16.2	865	B
			NBT	282	816	16.1			
			NBR	0	48	0.0			
		SB	SBL	m97	94	55.6	7.0	2,254	A
			SBT	143	2160	5.0			
			SBR	0	0	0.0			
						Overall Intersection	11.5	3,444	B
24	SH 20 (MESA) & SUN BOWL/MESITA	EB	EBL	49	67	59.6	51.9	128	D
			EBT	55	30	42.1			
			EBR	0	31	0.0			
		WB	WBL	49	28	62.4	49.0	104	D
			WBT	52	28	43.5			
			WBR	0	48	0.0			
		NB	NBL	37	15	63.4	12.5	817	B
			NBT	170	778	11.3			
			NBR	0	24	0.0			
		SB	SBL	39	21	41.7	5.2	2,124	A
			SBT	201	1722	5.4			
			SBR	55	381	1.7			
						Overall Intersection	11.7	3,173	B
25	SH 20 (MESA) & GLORY ROAD/BALTIMORE	EB	EBL	0	66	0.0	16.8	96	B
			EBT	47	11	21.6			
			EBR	0	19	0.1			
		WB	WBL	0	26	0.0	16.8	150	B
			WBT	95	61	16.8			
			WBR	0	63	0.0			
		NB	NBL	2	21	3.4	2.9	755	A
			NBT	17	698	2.7			
			NBR	0	36	0.0			
		SB	SBL	30	50	11.2	34.7	1,592	C
			SBT	#513	1290	38.9			
			SBR	43	252	4.1			
						Overall Intersection	23.1	2,593	C

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
26	SH 20 (MESA) & CINCINNATI	EB	EBL	6	2	35.0	21.9	4	C
			EBT	0	0	0.0			
			EBR	0	2	0.0			
		WB	WBL	25	22	27.2	19.1	64	B
			WBT	19	9	12.7			
			WBR	0	33	0.0			
		NB	NBL	m4	8	7.4	16.8	733	B
			NBT	297	725	16.9			
			NBR	0	0	0.0			
		SB	SBL	0	0	0.0	5.3	1,363	A
			SBT	m#28	1361	5.0			
			SBR	0	2	0.0			
						Overall Intersection	10.0	2,164	B
27	SH 20 (MESA) & KERBEY	EB	EBL	0	9	0.0	18.0	30	B
			EBT	23	11	27.6			
			EBR	0	10	0.2			
		WB	WBL	0	90	0.0	36.6	211	D
			WBT	101	54	48.5			
			WBR	18	67	9.9			
		NB	NBL	4	26	2.7	3.4	758	A
			NBT	35	696	3.3			
			NBR	0	36	0.0			
		SB	SBL	m3	106	1.7	4.2	1,275	A
			SBT	495	1144	4.4			
			SBR	0	25	0.0			
						Overall Intersection	7.5	2,274	A
28	SH 20 (MESA) & UNIVERSITY	EB	EBL	0	49	0.0	20.4	128	C
			EBT	27	33	30.4			
			EBR	0	46	1.6			
		WB	WBL	0	35	0.0	24.8	119	C
			WBT	42	51	32.4			
			WBR	3	33	2.8			
		NB	NBL	14	56	4.0	4.7	823	A
			NBT	220	711	5.1			
			NBR	4	56	1.3			
		SB	SBL	m4	41	1.2	2.6	1,194	A
			SBT	36	1099	2.7			
			SBR	m0	54	0.1			
						Overall Intersection	6.0	2,264	A
29	SH 20 (MESA) & RIM	EB	EBL	0	27	0.0	28.5	87	C
			EBT	43	24	28.5			
			EBR	0	36	0.0			
		WB	WBL	0	13	0.0	49.2	89	D
			WBT	96	60	49.2			
			WBR	0	16	0.0			
		NB	NBL	m69	83	31.4	5.3	973	A
			NBT	66	871	2.6			
			NBR	0	19	0.0			
		SB	SBL	m20	12	51.3	3.9	1,049	A
			SBT	10	970	2.3			
			SBR	0	67	0.0			
						Overall Intersection	8.3	2,198	A
30	SH 20 (MESA) & SCHUSTER	EB	EBL	82	131	16.3	20.6	460	C
			EBT	112	283	22.4			
			EBR	0	46	0.0			
		WB	WBL	m24	66	9.6	12.6	396	B
			WBT	m51	271	13.2			
			WBR	0	59	0.0			
		NB	NBL	62	98	20.1	31.2	875	C
			NBT	300	749	32.8			
			NBR	0	28	0.0			
		SB	SBL	73	139	19.9	45.0	1,122	D
			SBT	#456	902	42.0			
			SBR	0	81	0.0			
						Overall Intersection	32.2	2,853	C

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
31	SH 20 (MESA) & RIVER	EB	EBL	0	8	0.0	31.8	16	C
			EBT	25	5	31.8			
			EBR	0	3	0.0			
		WB	WBL	0	30	0.0	33.5	84	C
			WBT	69	17	33.5			
			WBR	0	37	0.0			
		NB	NBL	3	4	2.5	2.9	962	A
			NBT	108	883	2.9			
			NBR	0	75	0.0			
		SB	SBL	15	44	3.3	2.8	886	A
			SBT	93	837	2.8			
			SBR	0	5	0.0			
						Overall Intersection	4.4	1,948	A
32	SH 20 (MESA) & ARIZONA	WB	WBL	104	97	32.4	21.7	360	C
			WBT	118	113	32.7			
			WBR	50	150	6.4			
		NB	NBL	m6	11	11.1	13.6	820	B
			NBT	125	809	13.5			
			NBR	0	0	0.0			
		SB	SBL	0	0	0.0	10.4	830	B
			SBT	189	816	10.4			
			SBR	0	14	0.0			
						Overall Intersection	13.7	2,010	B
33	SH 20 (MESA) & RIO GRANDE	EB	EBL	0	9	0.0	33.7	84	C
			EBT	94	71	33.7			
			EBR	0	4	0.0			
		NB	NBL	0	4	0.0	4.5	971	A
			NBT	37	798	4.4			
			NBR	0	169	0.0			
		SB	SBL	93	104	9.3	5.0	886	A
			SBT	43	774	4.2			
			SBR	0	8	0.0			
						Overall Intersection	6.0	1,941	A
34	SH 20 (MESA) & MONTANA	EB	EBL	0	17	0.0	24.7	27	C
			EBT	35	3	24.7			
			EBR	0	7	0.0			
		WB	WBL	0	10	0.0	25.5	21	C
			WBT	15	6	25.5			
			WBR	0	5	0.0			
		NB	NBL	m9	10	22.6	22.3	968	C
			NBT	277	940	21.1			
			NBR	0	18	0.0			
		SB	SBL	0	22	0.9	0.7	789	A
			SBT	2	749	0.6			
			SBR	0	18	0.0			
						Overall Intersection	12.9	1,805	B
35	SH 20 (MESA) & YANDELL	EB	EBL	0	0	0.0	0.0	0	A
			EBT	0	0	0.0			
			EBR	0	0	0.0			
		WB	WBL	0	82	0.0	31.1	914	C
			WBT	188	396	31.1			
			WBR	0	436	0.0			
		NB	NBL	m11	42	6.5	8.4	569	A
			NBT	53	527	8.4			
			NBR	0	0	0.0			
		SB	SBL	0	0	0.0	10.5	784	B
			SBT	271	740	10.3			
			SBR	0	44	0.0			
						Overall Intersection	18.3	2,267	B

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
36	SH 20 (MESA) & WYOMING	EB	EBL	0	140	0.0	39.9	820	D
			EBT	229	484	39.9			
			EBR	0	196	0.0			
		WB	WBL	0	0	0.0	0.0	0	A
			WBT	0	0	0.0			
			WBR	0	0	0.0			
		NB	NBL	0	0	0.0	44.0	496	D
			NBT	212	468	41.1			
			NBR	0	28	0.0			
		SB	SBL	102	381	17.5	20.8	808	C
			SBT	146	427	23.3			
			SBR	0	0	0.0			
						Overall Intersection	33.6	2,124	C
37	SH 20 (MESA) & MISSOURI	EB	EBL	0	0	0.0	0.0	0	A
			EBT	0	0	0.0			
			EBR	0	0	0.0			
		WB	WBL	0	388	0.0	51.9	1,123	D
			WBT	#482	422	70.9			
			WBR	44	313	2.6			
		NB	NBL	20	8	23.0	23.8	208	C
			NBT	102	200	23.9			
			NBR	0	0	0.0			
		SB	SBL	0	0	0.0	10.1	591	B
			SBT	218	541	8.2			
			SBR	0	50	0.0			
						Overall Intersection	36.0	1,922	D
38	SH 20 (MESA) & FRANKLIN	EB	EBL	0	18	0.0	31.2	109	C
			EBT	39	69	31.2			
			EBR	0	22	0.0			
		WB	WBL	0	0	0.0	0.0	0	A
			WBT	0	0	0.0			
			WBR	0	0	0.0			
		NB	NBL	0	0	0.0	1.5	219	A
			NBT	10	186	1.5			
			NBR	0	33	0.0			
		SB	SBL	m85	167	8.7	10.8	921	B
			SBT	m179	753	9.4			
			SBR	0	1	0.0			
						Overall Intersection	10.9	1,249	B
39	SH 20 (MESA) & MAIN	EB	EBL	0	11	0.0	20.7	46	C
			EBT	23	27	20.7			
			EBR	0	8	0.0			
		WB	WBL	0	28	0.0	18.3	53	B
			WBT	45	11	24.9			
			WBR	0	14	0.1			
		NB	NBL	0	3	0.0	8.6	225	A
			NBT	m46	202	8.6			
			NBR	0	20	0.0			
		SB	SBL	0	112	0.0	12.8	756	B
			SBT	260	628	12.5			
			SBR	0	16	0.0			
						Overall Intersection	12.5	1,080	B
40	SH 20 (MESA) & MILLS	EB	EBL	0	0	0.0	0.0	0	A
			EBT	0	0	0.0			
			EBR	0	0	0.0			
		WB	WBL	0	48	0.0	140.9	67	F
			WBT	#102	0	140.9			
			WBR	0	19	0.0			
		NB	NBL	0	0	0.0	5.6	218	A
			NBT	66	208	5.2			
			NBR	0	10	0.0			
		SB	SBL	0	92	0.0	2.5	628	A
			SBT	28	536	2.4			
			SBR	0	0	0.0			
						Overall Intersection	13.4	913	B

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
41	SH 20 (MESA) & TEXAS	EB	EBL	0	8	0.0	23.7	42	C
			EBT	47	33	23.7			
			EBR	0	1	0.0			
		WB	WBL	0	95	0.0	21.1	163	C
			WBT	63	38	21.1			
			WBR	0	30	0.0			
		NB	NBL	0	0	0.0	16.4	203	B
			NBT	115	183	12.6			
			NBR	0	20	0.0			
		SB	SBL	0	96	0.0	3.9	560	A
			SBT	m34	452	3.5			
			SBR	0	12	0.0			
						Overall Intersection	10.3	968	B
42	SH 20 (MESA) & SAN ANTONIO	EB	EBL	0	25	0.0	34.7	64	C
			EBT	35	27	34.7			
			EBR	0	12	0.0			
		WB	WBL	0	2	0.0	26.7	12	C
			WBT	20	3	26.7			
			WBR	0	7	0.0			
		NB	NBL	0	3	0.0	82.4	188	F
			NBT	#264	174	82.4			
			NBR	0	11	0.0			
		SB	SBL	#295	199	271.0	105.9	427	F
			SBT	#289	220	105.9			
			SBR	0	8	0.0			
						Overall Intersection	139.1	691	F
43	SH 20 (MESA) & OVERLAND	EB	EBL	0	11	0.0	6.0	64	A
			EBT	30	37	6.0			
			EBR	0	16	0.0			
		WB	WBL	0	3	0.0	7.2	7	A
			WBT	7	3	7.2			
			WBR	0	1	0.0			
		NB	NBL	0	4	0.0	31.6	193	C
			NBT	141	166	31.6			
			NBR	0	23	0.0			
		SB	SBL	0	34	0.0	51.6	241	D
			SBT	230	204	51.5			
			SBR	0	3	0.0			
						Overall Intersection	37.6	505	D
44	SH 20 (MESA) & PAISANO	EB	EBL	#87	47	101.7	40.1	538	D
			EBT	146	473	34.2			
			EBR	0	18	0.0			
		WB	WBL	56	33	70.0	31.7	378	C
			WBT	91	268	28.0			
			WBR	0	77	0.0			
		NB	NBL	0	21	0.0	16.1	161	B
			NBT	112	105	16.1			
			NBR	0	35	0.0			
		SB	SBL	0	76	0.0	18.1	239	B
			SBT	172	94	18.1			
			SBR	0	69	0.0			
						Overall Intersection	30.7	1,316	C

Table 3 - Existing PM Peak Hour Intersection LOS and Delay

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
1	DONIPHAN & SH 20 (MESA)	EB	EBL	101	120	25.4	29.3	656	C
			EBT	243	435	30.3			
			EBR	0	101	0.0			
		WB	WBL	108	150	25.6	23.1	1,230	C
			WBT	204	705	32.0			
			WBR	68	375	5.3			
		NB	NBL	221	174	66.5	105.5	861	F
			NBT	#494	621	118.9			
			NBR	0	66	0.0			
		SB	SBL	324	265	58.6	58.4	771	E
			SBT	328	465	58.3			
			SBR	0	41	0.0			
						Overall Intersection	52.9	3,518	D
2	CROSSROADS & SH 20 (MESA)	EB	EBL	m26	67	6.7	9.4	907	A
			EBT	m148	785	10.3			
			EBR	m14	55	2.3			
		WB	WBL	11	96	2.8	5.2	1,403	A
			WBT	213	1271	5.4			
			WBR	0	36	0.0			
		NB	NBL	0	62	0.0	42.7	209	D
			NBT	127	28	88.0			
			NBR	41	119	8.4			
		SB	SBL	0	161	0.0	58.0	319	E
			SBT	171	65	58.0			
			SBR	0	93	0.0			
						Overall Intersection	16.7	2,838	B
3	OSBORNE & SH 20 (MESA)	EB	EBL	14	5	52.6	8.7	1,217	A
			EBT	138	1158	8.3			
			EBR	0	54	0.0			
		WB	WBL	178	295	72.1	15.9	1,882	B
			WBT	m75	1586	2.6			
			WBR	0	1	0.0			
		NB	NBL	0	76	0.0	23.2	418	C
			NBT	36	1	79.7			
			NBR	37	341	8.5			
		SB	SBL	0	7	0.0	41.0	34	D
			SBT	28	12	41.0			
			SBR	0	15	0.0			
						Overall Intersection	15.0	3,551	B
4	DESERT SOUTH & SH 20 (MESA)	EB	EBL	0	0	0.0	24.9	1,591	C
			EBT	318	1183	30.1			
			EBR	87	408	6.7			
		WB	WBL	m242	260	49.3	10.7	1,912	B
			WBT	m74	1652	4.1			
			WBR	0	0	0.0			
		SB	SBL	#618	508	84.4	77.1	783	E
			SBT	#553	109	69.5			
			SBR	0	166	0.0			
						Overall Intersection	28.4	4,286	C
5	DESERT NORTH & SH 20 (MESA)	EB	EBL	m301	278	45.7	12.2	1,717	B
			EBT	m123	1439	4.6			
			EBR	0	0	0.0			
		WB	WBL	0	0	0.0	38.0	1,967	D
			WBT	#640	1331	38.0			
			WBR	0	636	0.0			
		NB	NBL	#432	567	70.7	42.2	1,094	D
			NBT	310	211	51.9			
			NBR	0	316	0.3			
						Overall Intersection	30.5	4,778	C

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
6	BARTLETT & SH 20 (MESA)	EB	EBL	130	178	62.4	25.8	1,727	C
			EBT	320	1179	25.9			
			EBR	101	370	7.2			
		WB	WBL	m84	109	45.8	14.7	1,619	B
			WBT	430	1447	12.4			
			WBR	0	63	0.0			
		NB	NBL	247	293	73.8	68.8	364	E
			NBT	240	54	73.4			
			NBR	0	17	0.0			
		SB	SBL	155	136	69.7	37.5	386	D
			SBT	147	64	69.2			
			SBR	0	186	0.2			
						Overall Intersection	26.3	4,096	C
7	REMCON & SH 20 (MESA)	EB	EBL	78	46	57.1	13.5	1,298	B
			EBT	115	1197	12.1			
			EBR	0	55	0.0			
		WB	WBL	89	157	51.1	21.0	1,660	C
			WBT	507	1327	17.2			
			WBR	0	176	0.0			
		NB	NBL	187	154	80.7	34.7	428	C
			NBT	56	44	39.2			
			NBR	0	230	0.3			
		SB	SBL	238	192	58.8	41.2	290	D
			SBT	37	22	13.1			
			SBR	0	76	0.0			
						Overall Intersection	22.1	3,676	C
8	SH 20 (MESA) & BELVIDERE	EB	EBL	#345	263	35.4	9.7	1,718	A
			EBT	215	1455	4.9			
			EBR	0	0	0.0			
		WB	WBL	0	0	0.0	9.6	1,655	A
			WBT	167	1476	9.6			
			WBR	0	179	0.0			
		SB	SBL	68	102	31.8	26.0	331	C
			SBT	0	0	0.0			
			SBR	61	229	13.9			
						Overall Intersection	11.2	3,704	B
9	RESLER & SH 20 (MESA)	EB	EBL	#244	324	69.7	28.8	1,428	C
			EBT	116	854	21.8			
			EBR	2	250	2.2			
		WB	WBL	m81	143	66.6	34.6	1,606	C
			WBT	m411	1095	37.7			
			WBR	m133	368	14.7			
		NB	NBL	185	301	63.8	54.5	1,202	D
			NBT	325	830	51.5			
			NBR	0	71	0.0			
		SB	SBL	246	410	61.8	42.8	1,092	D
			SBT	242	470	41.0			
			SBR	66	212	7.2			
						Overall Intersection	39.2	5,328	D
10	SH 20 (MESA) & PITT/DRIVEWAY	EB	EBL	0	21	0.0	27.7	84	C
			EBT	41	10	51.9			
			EBR	22	53	12.4			
		WB	WBL	0	104	0.0	282.4	199	F
			WBT	#306	7	282.4			
			WBR	0	88	0.0			
		NB	NBL	m2	26	2.9	11.5	1,496	B
			NBT	349	1440	11.9			
			NBR	9	30	2.0			
		SB	SBL	m9	86	9.1	3.6	1,463	A
			SBT	82	1358	3.3			
			SBR	m0	19	0.1			
						Overall Intersection	35.0	3,242	C

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
11	SH 20 (MESA) & ALTO MESA	EB	EBL	0	70	0.0	49.8	115	D
			EBT	71	4	74.1			
			EBR	13	41	13.5			
		WB	WBL	0	21	0.0	27.8	53	C
			WBT	15	1	54.9			
			WBR	7	31	3.7			
		NB	NBL	m12	23	5.3	10.2	1,804	B
			NBT	443	1758	10.2			
			NBR	0	23	0.0			
		SB	SBL	m32	58	14.2	10.4	1,449	B
			SBT	m330	1360	10.2			
			SBR	0	31	0.0			
						Overall Intersection	12.3	3,421	B
12	SH 20 (MESA) & CAMILLE	EB	EBL	0	138	0.0	65.4	187	E
			EBT	164	14	78.4			
			EBR	26	35	13.5			
		WB	WBL	0	10	0.0	46.1	22	D
			WBT	44	12	46.1			
			WBR	0	0	0.0			
		NB	NBL	m27	37	12.0	7.9	1,621	A
			NBT	m246	1583	7.7			
			NBR	0	1	0.0			
		SB	SBL	0	1	3.0	3.1	1,423	A
			SBT	52	1277	3.1			
			SBR	0	145	0.0			
						Overall Intersection	9.7	3,253	A
13	SH 20 (MESA) & THUNDERBIRD	EB	EBL	0	5	0.0	32.2	12	C
			EBT	16	2	32.2			
			EBR	0	5	0.0			
		WB	WBL	0	90	0.0	67.4	246	E
			WBT	84	4	56.6			
			WBR	#116	152	74.9			
		NB	NBL	m21	10	59.4	14.2	1,613	B
			NBT	50	1533	13.8			
			NBR	0	70	0.0			
		SB	SBL	#200	129	92.2	13.6	1,342	B
			SBT	136	1204	4.4			
			SBR	0	9	0.0			
						Overall Intersection	18.6	3,213	B
14	SH 20 (MESA) & BALBOA	EB	EBL	143	106	69.0	50.8	249	D
			EBT	79	110	40.0			
			EBR	0	33	0.0			
		WB	WBL	87	56	63.2	45.4	162	D
			WBT	61	79	35.1			
			WBR	0	27	0.0			
		NB	NBL	m48	43	87.0	30.5	1,601	C
			NBT	m521	1478	29.0			
			NBR	0	80	0.0			
		SB	SBL	81	47	70.8	17.1	1,298	B
			SBT	250	1132	14.2			
			SBR	0	119	0.0			
						Overall Intersection	27.8	3,310	C
15	SH 20 (MESA) & SUNLAND PARK/SHADOW MT	EB	EBL	248	207	47.8	52.0	763	D
			EBT	342	467	53.3			
			EBR	0	89	0.0			
		WB	WBL	#449	456	70.0	56.2	1,014	E
			WBT	#371	457	59.6			
			WBR	3	101	2.6			
		NB	NBL	#185	270	73.4	85.0	2,569	F
			NBT	#675	1504	98.2			
			NBR	#790	795	61.0			
		SB	SBL	73	93	77.2	65.3	1,273	E
			SBT	#504	936	64.4			
			SBR	0	244	0.0			
						Overall Intersection	71.1	5,619	E

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
16	SH 20 (MESA) & CRESTMONT	EB	EBL	67	36	67.4	38.6	108	D
			EBT	19	11	25.0			
			EBR	0	61	0.0			
		WB	WBL	40	18	62.9	37.4	54	D
			WBT	31	5	24.1			
			WBR	0	31	0.0			
		NB	NBL	m62	59	42.8	18.7	2,395	B
			NBT	694	2288	18.0			
			NBR	0	48	0.0			
		SB	SBL	m31	25	66.1	6.6	1,434	A
			SBT	122	1375	5.3			
			SBR	0	34	0.0			
						Overall Intersection	15.4	3,991	B
17	SH 20 (MESA) & MESA HILLS	EB	EBL	238	206	66.0	40.7	645	D
			EBT	82	122	57.1			
			EBR	88	317	14.5			
		WB	WBL	108	88	46.5	33.7	280	C
			WBT	53	74	55.4			
			WBR	13	118	4.9			
		NB	NBL	m209	357	72.8	42.5	2,668	D
			NBT	m#856	2191	39.1			
			NBR	m38	120	7.1			
		SB	SBL	#173	114	79.7	15.3	1,427	B
			SBT	146	1131	10.4			
			SBR	2	182	0.9			
						Overall Intersection	34.4	5,020	C
18	SH 20 (MESA) & FESTIVAL	EB	EBL	0	56	0.0	31.7	156	C
			EBT	71	17	31.7			
			EBR	0	83	0.0			
		WB	WBL	134	160	67.3	45.8	264	D
			WBT	92	10	67.4			
			WBR	0	94	4.1			
		NB	NBL	#204	150	62.4	26.7	2,922	C
			NBT	#963	2432	28.1			
			NBR	54	340	3.9			
		SB	SBL	170	110	100.2	15.5	1,356	B
			SBT	108	1210	6.8			
			SBR	0	36	0.0			
						Overall Intersection	25.0	4,698	C
19	SH 20 (MESA) & MONTECILLO	EB	EBL	97	58	66.1	57.0	67	E
			EBT	0	0	0.0			
			EBR	0	9	0.2			
		WB	WBL	0	10	0.0	32.0	17	C
			WBT	28	0	55.0			
			WBR	0	7	0.4			
		NB	NBL	m31	29	58.4	13.1	2,780	B
			NBT	880	2745	12.4			
			NBR	m0	6	0.8			
		SB	SBL	m1	6	4.7	0.9	1,606	A
			SBT	40	1560	0.9			
			SBR	m0	40	0.1			
						Overall Intersection	9.4	4,470	A
20	SH 20 (MESA) & ARGONAUT	EB	EBL	0	0	0.0	0.0	0	A
			EBT	0	0	0.0			
			EBR	0	0	0.0			
		WB	WBL	80	46	66.2	37.5	114	D
			WBT	0	0	0.0			
			WBR	38	68	17.8			
		NB	NBL	0	0	0.0	39.2	2,792	D
			NBT	29	2718	2.5			
			NBR	m#140	74	1207.4			
		SB	SBL	34	60	37.2	5.6	1,426	A
			SBT	178	1366	3.7			
			SBR	0	0	0.0			
						Overall Intersection	28.1	4,332	C

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
21	SH 20 (MESA) & CASTELLANO	EB	EBL	55	55	63.2	34.1	128	C
			EBT	73	1	62.9			
			EBR	4	72	12.2			
		WB	WBL	71	69	63.6	42.0	114	D
			WBT	24	3	63.9			
			WBR	0	42	0.0			
		NB	NBL	m33	54	12.6	27.6	2,991	C
			NBT	#1170	2833	28.0			
			NBR	0	104	0.0			
		SB	SBL	33	38	29.4	8.3	1,634	A
			SBT	506	1582	7.8			
			SBR	0	14	0.1			
						Overall Intersection	21.9	4,867	C
22	SH 20 (MESA) & EXECUTIVE CENTER/CUL-DE-SAC	EB	EBL	#442	738	61.8	41.4	1,099	D
			EBT	100	28	9.1			
			EBR	47	333	8.4			
		WB	WBL	46	24	64.1	40.9	89	D
			WBT	45	25	66.2			
			WBR	0	40	1.9			
		NB	NBL	m79	171	28.2	20.8	2,168	C
			NBT	#811	1977	20.5			
			NBR	m0	20	0.1			
		SB	SBL	52	28	43.8	27.4	1,637	C
			SBT	409	1029	37.8			
			SBR	583	580	9.5			
						Overall Intersection	28.4	4,993	C
23	SH 20 (MESA) & DRIVEWAY/BRENT WOOD	EB	EBL	0	5	0.0	43.5	8	D
			EBT	9	1	43.5			
			EBR	0	2	0.0			
		WB	WBL	0	46	0.0	44.7	368	D
			WBT	49	0	62.4			
			WBR	182	322	40.6			
		NB	NBL	m2	1	78.0	24.6	2,099	C
			NBT	770	2029	24.6			
			NBR	0	69	0.0			
		SB	SBL	243	175	51.2	7.3	1,697	A
			SBT	94	1522	2.1			
			SBR	0	0	0.0			
						Overall Intersection	20.1	4,172	C
24	SH 20 (MESA) & SUN BOWL/MESITA	EB	EBL	#399	493	67.3	61.5	591	E
			EBT	124	63	35.4			
			EBR	0	35	0.0			
		WB	WBL	43	21	58.8	29.5	90	C
			WBT	49	11	19.1			
			WBR	0	58	0.0			
		NB	NBL	54	29	63.2	24.4	1,705	C
			NBT	476	1663	23.5			
			NBR	0	13	0.0			
		SB	SBL	57	32	80.6	11.9	1,292	B
			SBT	121	1135	10.9			
			SBR	9	125	1.3			
						Overall Intersection	26.4	3,678	C
25	SH 20 (MESA) & GLORY ROAD/BALTIMORE	EB	EBL	0	205	0.0	55.5	314	E
			EBT	208	46	69.3			
			EBR	20	63	5.9			
		WB	WBL	0	27	0.0	19.1	164	B
			WBT	76	27	19.1			
			WBR	0	110	0.0			
		NB	NBL	3	18	3.7	22.3	1,444	C
			NBT	#660	1350	22.7			
			NBR	0	76	0.0			
		SB	SBL	30	51	11.7	15.9	1,167	B
			SBT	339	1020	17.4			
			SBR	26	96	3.5			
						Overall Intersection	23.4	3,089	C

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
26	SH 20 (MESA) & CINCINNATI	EB	EBL	40	27	45.3	43.4	29	D
			EBT	0	0	0.0			
			EBR	0	2	0.0			
		WB	WBL	37	24	43.4	25.4	96	C
			WBT	36	10	17.7			
			WBR	0	62	0.0			
		NB	NBL	m2	32	1.7	3.9	1,345	A
			NBT	97	1311	3.6			
			NBR	0	2	0.0			
		SB	SBL	0	0	0.0	3.2	1,061	A
			SBT	63	1039	3.2			
			SBR	0	22	0.0			
						Overall Intersection	5.3	2,531	A
27	SH 20 (MESA) & KERBEY	EB	EBL	0	38	0.0	32.3	104	C
			EBT	94	39	42.5			
			EBR	0	27	0.6			
		WB	WBL	0	47	0.0	31.5	198	C
			WBT	72	32	46.2			
			WBR	66	119	20.3			
		NB	NBL	6	18	2.7	6.1	1,333	A
			NBT	98	1269	6.2			
			NBR	0	46	0.0			
		SB	SBL	26	99	12.8	9.2	1,086	A
			SBT	419	964	8.8			
			SBR	0	23	0.0			
						Overall Intersection	10.5	2,721	B
28	SH 20 (MESA) & UNIVERSITY	EB	EBL	0	112	0.0	27.2	226	C
			EBT	70	55	36.5			
			EBR	13	59	4.2			
		WB	WBL	0	45	0.0	21.5	124	C
			WBT	47	41	29.7			
			WBR	8	38	4.9			
		NB	NBL	7	65	2.4	4.1	1,306	A
			NBT	99	1191	4.5			
			NBR	0	50	0.2			
		SB	SBL	4	40	2.8	3.7	1,017	A
			SBT	91	931	3.8			
			SBR	0	46	0.2			
						Overall Intersection	6.9	2,673	A
29	SH 20 (MESA) & RIM	EB	EBL	0	72	0.0	36.7	199	D
			EBT	164	42	36.6			
			EBR	0	85	0.0			
		WB	WBL	0	22	0.0	30.1	64	C
			WBT	45	32	30.1			
			WBR	0	10	0.0			
		NB	NBL	m41	29	35.3	10.8	1,259	B
			NBT	170	1208	9.9			
			NBR	0	22	0.0			
		SB	SBL	34	21	27.8	22.4	1,014	C
			SBT	454	958	21.8			
			SBR	0	35	0.0			
						Overall Intersection	18.4	2,536	B
30	SH 20 (MESA) & SCHUSTER	EB	EBL	148	208	30.0	25.4	565	C
			EBT	124	240	22.4			
			EBR	0	117	0.0			
		WB	WBL	m13	30	10.5	11.0	330	B
			WBT	m30	228	11.1			
			WBR	0	72	0.0			
		NB	NBL	40	61	15.6	26.4	904	C
			NBT	307	832	27.2			
			NBR	0	11	0.0			
		SB	SBL	55	128	19.7	23.4	1,106	C
			SBT	446	887	23.5			
			SBR	0	91	0.0			
						Overall Intersection	23.1	2,905	C

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
31	SH 20 (MESA) & RIVER	EB	EBL	0	12	0.0	31.2	21	C
			EBT	30	2	31.2			
			EBR	0	7	0.0			
		WB	WBL	0	16	0.0	23.7	72	C
			WBT	49	1	23.7			
			WBR	0	55	0.0			
		NB	NBL	2	3	2.0	2.4	878	A
			NBT	86	848	2.4			
			NBR	0	27	0.0			
		SB	SBL	7	21	2.3	2.6	1,028	A
			SBT	105	1000	2.6			
			SBR	0	7	0.0			
						Overall Intersection	3.5	1,999	A
32	SH 20 (MESA) & ARIZONA	WB	WBL	83	74	31.7	19.1	346	B
			WBT	106	99	32.3			
			WBR	53	173	6.2			
		NB	NBL	m2	10	7.4	9.3	730	A
			NBT	m75	720	8.5			
			NBR	0	0	0.0			
		SB	SBL	0	0	0.0	11.6	1,040	B
			SBT	255	1022	11.6			
			SBR	0	18	0.0			
						Overall Intersection	12.1	2,116	B
33	SH 20 (MESA) & RIO GRANDE	EB	EBL	0	12	0.0	35.6	132	D
			EBT	139	113	35.6			
			EBR	0	7	0.0			
		NB	NBL	0	1	0.0	49.4	888	D
			NBT	#316	727	49.4			
			NBR	0	160	0.0			
		SB	SBL	11	115	6.0	3.4	1,099	A
			SBT	34	982	3.1			
			SBR	0	2	0.0			
						Overall Intersection	24.7	2,119	C
34	SH 20 (MESA) & MONTANA	EB	EBL	0	41	0.0	23.9	65	C
			EBT	63	2	23.6			
			EBR	0	22	0.0			
		WB	WBL	0	19	0.0	23.7	41	C
			WBT	23	10	23.7			
			WBR	0	12	0.0			
		NB	NBL	m8	8	16.6	25.3	821	C
			NBT	413	798	24.3			
			NBR	0	15	0.0			
		SB	SBL	0	50	1.3	12.3	916	B
			SBT	320	854	12.7			
			SBR	0	12	0.0			
						Overall Intersection	18.8	1,843	B
35	SH 20 (MESA) & YANDELL	EB	EBL	0	0	0.0	0.0	0	A
			EBT	0	0	0.0			
			EBR	0	0	0.0			
		WB	WBL	0	93	0.0	35.5	974	D
			WBT	216	479	35.5			
			WBR	0	402	0.0			
		NB	NBL	m77	68	29.4	40.6	508	D
			NBT	225	440	40.9			
			NBR	0	0	0.0			
		SB	SBL	0	0	0.0	3.9	926	A
			SBT	33	877	3.9			
			SBR	0	49	0.0			
						Overall Intersection	24.4	2,408	C

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
36	SH 20 (MESA) & WYOMING	EB	EBL	0	94	0.0	42.7	807	D
			EBT	238	623	42.7			
			EBR	0	90	0.0			
		WB	WBL	0	0	0.0	0.0	0	A
			WBT	0	0	0.0			
			WBR	0	0	0.0			
		NB	NBL	0	0	0.0	30.6	493	C
			NBT	241	426	29.4			
			NBR	0	67	0.0			
		SB	SBL	94	651	14.3	20.4	1,028	C
			SBT	m202	377	30.3			
			SBR	0	0	0.0			
						Overall Intersection	30.3	2,328	C
37	SH 20 (MESA) & MISSOURI	EB	EBL	0	0	0.0	0.0	0	A
			EBT	0	0	0.0			
			EBR	0	0	0.0			
		WB	WBL	0	180	0.0	22.9	861	C
			WBT	288	446	30.5			
			WBR	39	235	2.6			
		NB	NBL	39	25	23.8	24.2	293	C
			NBT	122	268	24.2			
			NBR	0	0	0.0			
		SB	SBL	0	0	0.0	10.8	482	B
			SBT	55	441	10.7			
			SBR	0	41	0.0			
						Overall Intersection	19.6	1,636	B
38	SH 20 (MESA) & FRANKLIN	EB	EBL	0	29	0.0	38.6	257	D
			EBT	87	201	38.6			
			EBR	0	27	0.0			
		WB	WBL	0	0	0.0	0.0	0	A
			WBT	0	0	0.0			
			WBR	0	0	0.0			
		NB	NBL	0	0	0.0	1.5	327	A
			NBT	18	260	1.5			
			NBR	0	67	0.0			
		SB	SBL	m24	110	3.8	4.3	611	A
			SBT	m46	501	3.5			
			SBR	0	0	0.0			
						Overall Intersection	10.9	1,195	B
39	SH 20 (MESA) & MAIN	EB	EBL	0	11	0.0	19.6	38	B
			EBT	20	18	19.6			
			EBR	0	9	0.0			
		WB	WBL	0	73	0.0	20.8	157	C
			WBT	110	42	27.3			
			WBR	14	42	3.0			
		NB	NBL	0	3	0.0	12.0	260	B
			NBT	67	243	12.0			
			NBR	0	14	0.0			
		SB	SBL	0	40	0.0	11.9	528	B
			SBT	221	466	11.6			
			SBR	0	22	0.0			
						Overall Intersection	13.7	983	B
40	SH 20 (MESA) & MILLS	EB	EBL	0	0	0.0	0.0	0	A
			EBT	0	0	0.0			
			EBR	0	0	0.0			
		WB	WBL	0	124	0.0	43.2	153	D
			WBT	169	1	43.2			
			WBR	0	28	0.0			
		NB	NBL	0	0	0.0	5.9	238	A
			NBT	78	232	5.4			
			NBR	0	6	0.0			
		SB	SBL	0	41	0.0	3.5	552	A
			SBT	45	511	3.4			
			SBR	0	0	0.0			
						Overall Intersection	10.6	943	B

NO	INTERSECTION	APPROACH	TURNING MOVEMENT	95TH PERCENTILE QUEUE LENGTH (FEET)	TURNING MOVEMENT VOLUME	CONTROL DELAY	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
41	SH 20 (MESA) & TEXAS	EB	EBL	0	8	0.0	23.1	25	C
			EBT	32	16	23.1			
			EBR	0	1	0.0			
		WB	WBL	0	108	0.0	22.6	224	C
			WBT	86	72	22.6			
			WBR	0	44	0.0			
		NB	NBL	0	3	0.0	16.9	210	B
			NBT	120	193	12.9			
			NBR	0	14	0.0			
		SB	SBL	0	40	0.0	15.9	635	B
			SBT	272	566	15.4			
			SBR	0	29	0.0			
						Overall Intersection	17.7	1,094	B
42	SAN ANTONIO & SH 20 (MESA)	EB	EBL	0	50	0.0	35.3	100	D
			EBT	48	30	34.8			
			EBR	0	20	0.0			
		WB	WBL	0	5	0.0	30.9	16	C
			WBT	26	6	30.4			
			WBR	0	5	0.0			
		NB	NBL	0	7	0.0	730.3	197	F
			NBT	#353	173	730.3			
			NBR	0	17	0.0			
		SB	SBL	#312	222	192.2	150.5	527	F
			SBT	#361	291	96.1			
			SBR	0	14	0.0			
						Overall Intersection	270.2	840	F
43	SH 20 (MESA) & OVERLAND	EB	EBL	0	21	0.0	8.2	113	A
			EBT	59	70	8.2			
			EBR	0	22	0.0			
		WB	WBL	0	7	0.0	6.9	25	A
			WBT	17	8	6.9			
			WBR	0	10	0.0			
		NB	NBL	0	4	0.0	26.9	194	C
			NBT	134	163	26.9			
			NBR	0	27	0.0			
		SB	SBL	0	12	0.0	17.9	314	B
			SBT	m195	289	17.7			
			SBR	0	13	0.0			
						Overall Intersection	18.5	646	B
44	SH 20 (MESA) & PAISANO	EB	EBL	#135	58	152.6	46.1	774	D
			EBT	214	683	37.5			
			EBR	0	33	0.0			
		WB	WBL	#115	53	119.7	43.3	532	D
			WBT	138	428	34.9			
			WBR	0	51	0.0			
		NB	NBL	0	29	0.0	17.2	179	B
			NBT	126	89	17.2			
			NBR	0	61	0.0			
		SB	SBL	0	104	0.0	24.3	331	C
			SBT	273	152	24.3			
			SBR	0	75	0.0			
						Overall Intersection	38.5	1,816	D

Critical Intersections

Based on the Study's initial traffic analysis, the intersections in **Table 4** and **Table 5** were identified as existing critical intersections and operating with an overall LOS D, E, or F during the AM and PM peak periods, respectively. These intersection locations were therefore focused and prioritized in order to evaluate and develop subsequent recommendations (Build Alternatives) to alleviate each intersection.

Table 4 - Existing Critical Intersections (AM)

Signalized Intersection along Mesa Street	Delay (s)	LOS
DONIPHAN DRIVE (SH 20)	98.4	F
DESERT SOUTH BOULEVARD (IH 10 SB FRONTAGE ROAD)	67.7	E
SUNLAND PARK DRIVE / SHADOW MOUNTAIN DRIVE	50.0	D
FESTIVAL DRIVE	37.6	D
MISSOURI AVENUE	36.0	D
SAN ANTONIO AVENUE	139.1	F
OVERLAND AVENUE	37.6	D
STANTON STREET	44.6	D

Note: Based on February 2016 traffic counts

Table 5 - Existing Critical Intersections (PM)

Signalized Intersection along Mesa Street	Delay (s)	LOS
DONIPHAN DRIVE (SH 20)	52.9	D
RESLER DRIVE	39.2	D
SUNLAND PARK DRIVE / SHADOW MOUNTAIN DRIVE	71.1	E
SAN ANTONIO AVENUE	270.2	F
PAISANO DRIVE (US 62)	38.5	D

Note: Based on February 2016 traffic counts

Crash Analysis

From January 2010 to January 2017, a total of 3,633 crashes were reported on the SH 20 / Mesa Street Study corridor. A total of 407 crashes were reported for the Stanton Street corridor during the same period.

Table 6 shows the summary of crash data for each crash report year. Two of the most common factors which accounted for over 50% of the crashes were speeding violations and driver inattention.

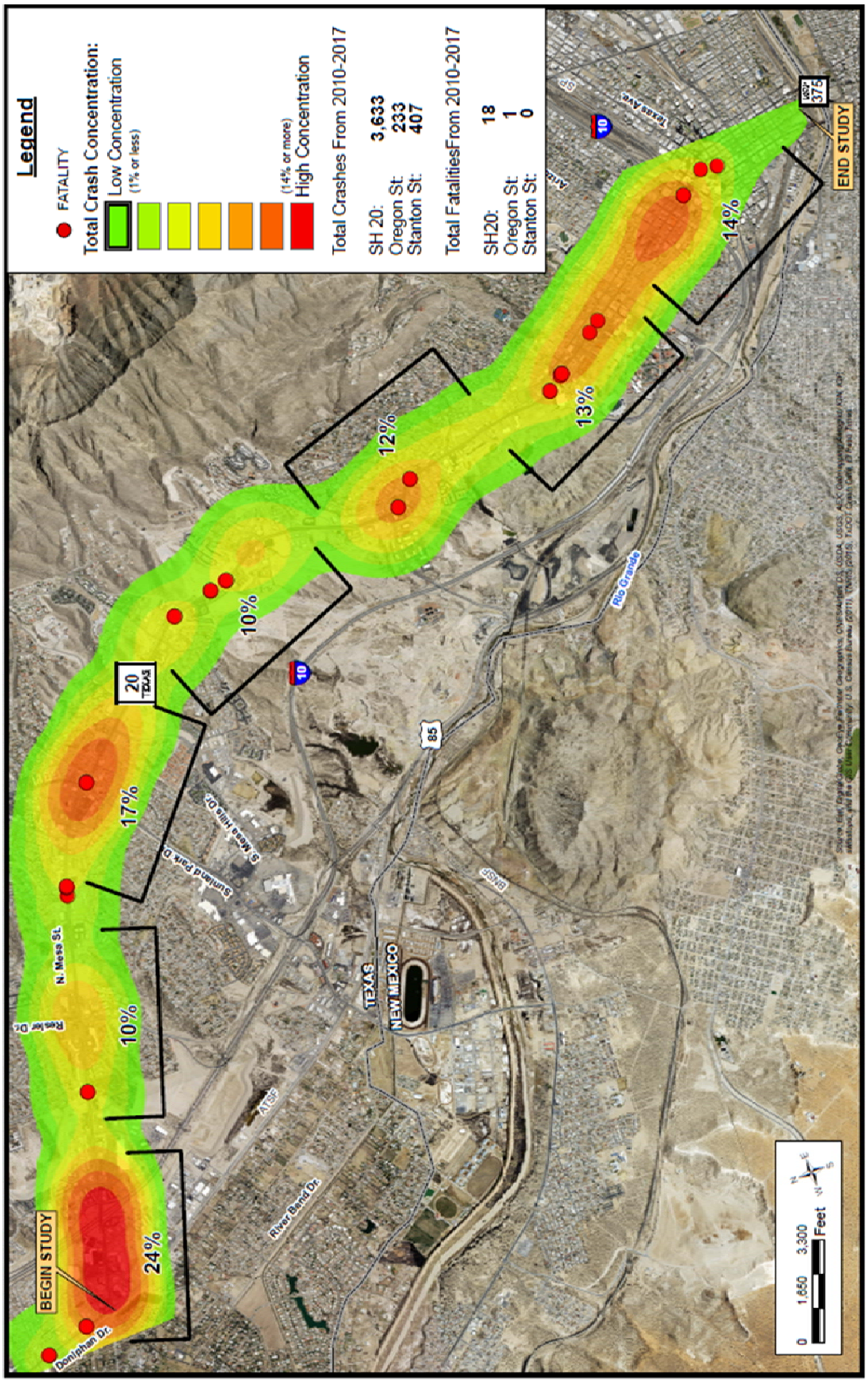
Table 6 - Crashes by Year for Mesa Street, Stanton Street, and Oregon Street Corridors

Total Crashes	Year								
	2010	2011	2012	2013	2014	2015	2016	2017	Total
SH 20	501	543	483	416	456	520	684	30	3,633*
N. STANTON ST.	59	69	68	66	58	82	5	-	407
OREGON ST.	25	19	26	28	40	52	41	2	233

*N Stanton St data limits are Silver Spring Dr to Loop 375
**Oregon St data limits are Cincinnati Ave to Loop 375

Figure 2 shows the concentration of crashes and the location of the fatalities along the SH 20 / Mesa Street corridor. Detailed crash analysis data is located in **Appendix K (Data Collection and Mobilization Report)**.

Figure 2 - Spatial Crash Analysis of Mesa Street Corridor



NOTE: Each percentage shown indicates the percent of total SH 20 corridor crashes at the corridor segment location.

Constraints Mapping

Another Study aspect undertaken by the Study Team was the assembly of environmental and design constraints that could possibly influence the alternatives in a pro or con, benefit or disbenefit manner. Portions of the constraint data was collected and solicited via one-on-one discussions with the Study Area stakeholders such as UTEP, the City of El Paso, El Paso County, El Paso Water Utilities, and Sun Metro.

Overall and specific Study Area data that was collected from multiple sources included:

- Land Use (homes, businesses, schools or parks);
- Water Resources (Waters of the U.S. and wetlands);
- Upland vegetation and riparian corridor and bottom land vegetation resources (type, area, and density of vegetation);
- Potential Section 4(f) and Section 6(f) (parklands and Land and Water Conservation Act funded properties);
- Major Transportation Generators (major existing and proposed transportation generators);
- Proposed, known developments (existing and proposed);
- Known Utilities (including Sun Metro fiber optic);
- Inventory existing hydraulic structures, particularly regarding drainage **(see Appendix E - Existing Utilities Coordination Contact Lists & Mapping)**; and;
- Field Reconnaissance Photo Inventory.

Where appropriate, data collected was stored via a Geographic Information System (GIS) and Global Positioning System (GPS). GIS Constraints Maps prepared by the Study Team are located in **Appendix F (Constraints Maps)** and include identified environmental, physical, and human constraints within the Study Area.

TRAFFIC ANALYSIS AND METHODOLOGY

2020 No-Build Scenario

In the 2020 No-Build Alternative analyses, no hypothetical modifications were made to the SH 20 / Mesa Street corridor. The existing (year 2016) volumes were grown at an annual rate of 1.1% [see growth rate discussion in **Appendix K (Traffic Projections Methodology Memorandum)**] as a means to forecast the year 2020 volumes. The existing signal timing was also reoptimized as much as possible to accommodate the increased traffic volumes.

CRITICAL INTERSECTIONS

The purpose of the No-Build analysis was to compare the effectiveness of the subsequent 2020 Build recommendations. Most of the intersections are expected to operate at an acceptable LOS in the AM and PM peak hours for the No-Build scenario in year 2020. The critical intersections were determined to be those operating at an unacceptable LOS D, E or F.

A summary of the analysis results showing LOS and delay for the critical intersections is provided in **Table 7** and **Table 8** for the AM and PM peak hours, respectively.

Figure 3, Figure 4, and **Figure 5** show the overall intersection LOSs and are provided in the next few pages.

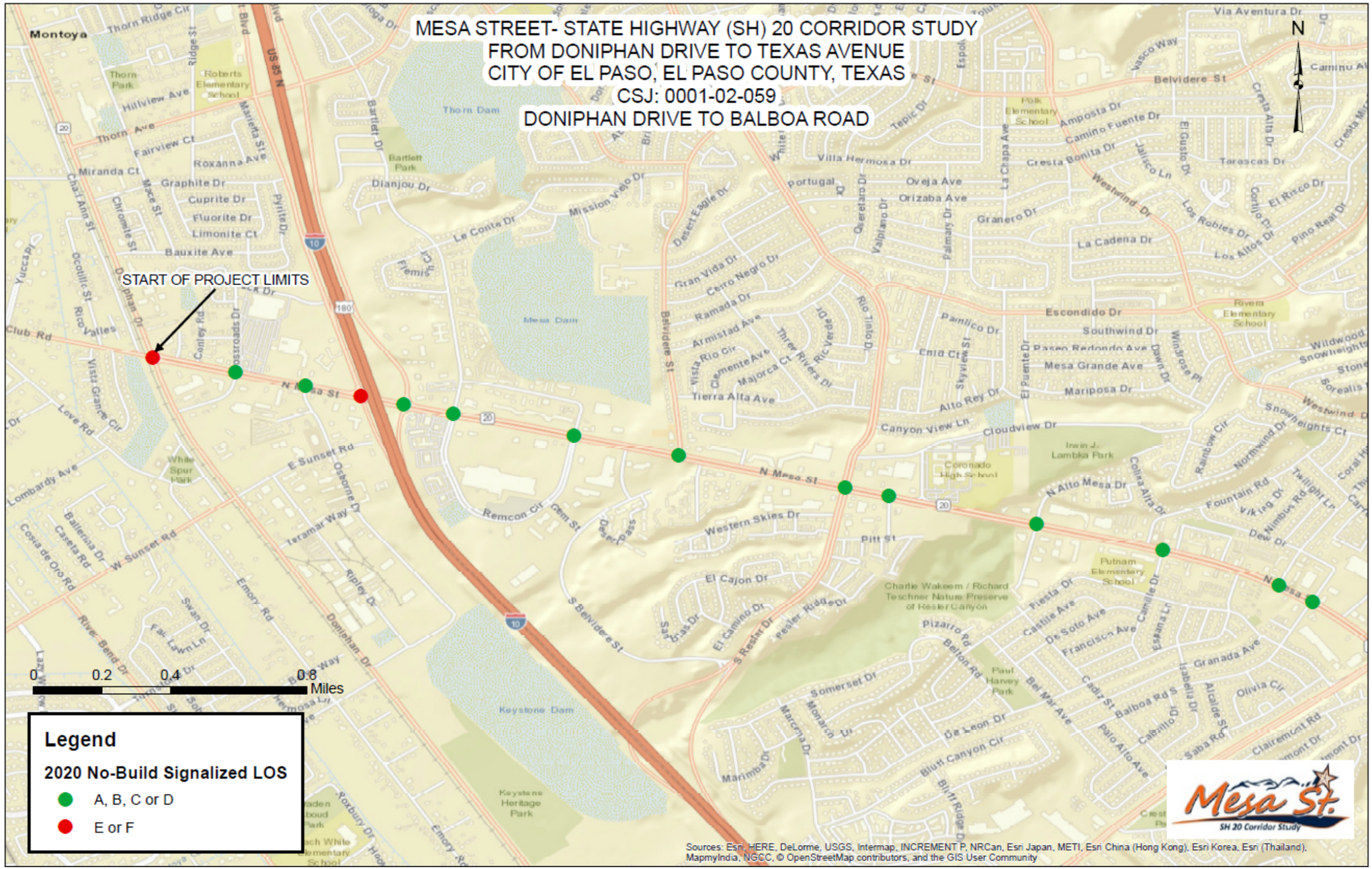
Table 7 - 2020 No Build Critical Intersections (AM)

Signalized Intersection along Mesa Street	Delay (s)	LOS
DONIPHAN DRIVE (SH 20)	98.4	F
DESERT SOUTH BOULEVARD (IH 10 SB FRONTAGE ROAD)	67.7	E
SUNLAND PARK DRIVE / SHADOW MOUNTAIN DRIVE	50.0	D
FESTIVAL DRIVE	37.6	D
MISSOURI AVENUE	36.0	D
SAN ANTONIO AVENUE	139.1	F
OVERLAND AVENUE	37.6	D
SCHUSTER AVENUE	44.6	D

Table 8 - 2020 No Build Critical Intersections (PM)

Signalized Intersection along Mesa Street	Delay (s)	LOS
DONIPHAN DRIVE (SH 20)	52.9	D
RESLER DRIVE	39.2	D
SUNLAND PARK DRIVE / SHADOW MOUNTAIN DRIVE	71.1	E
SAN ANTONIO AVENUE	270.2	F
PAISANO DRIVE (US 62)	38.5	D

Figure 3 - 2020 No-Build LOS (Doniphan Dr to Balboa Rd)



MATCHLINE A

Figure 4 - 2020 No-Build LOS (Balboa Rd to Mesita Dr)

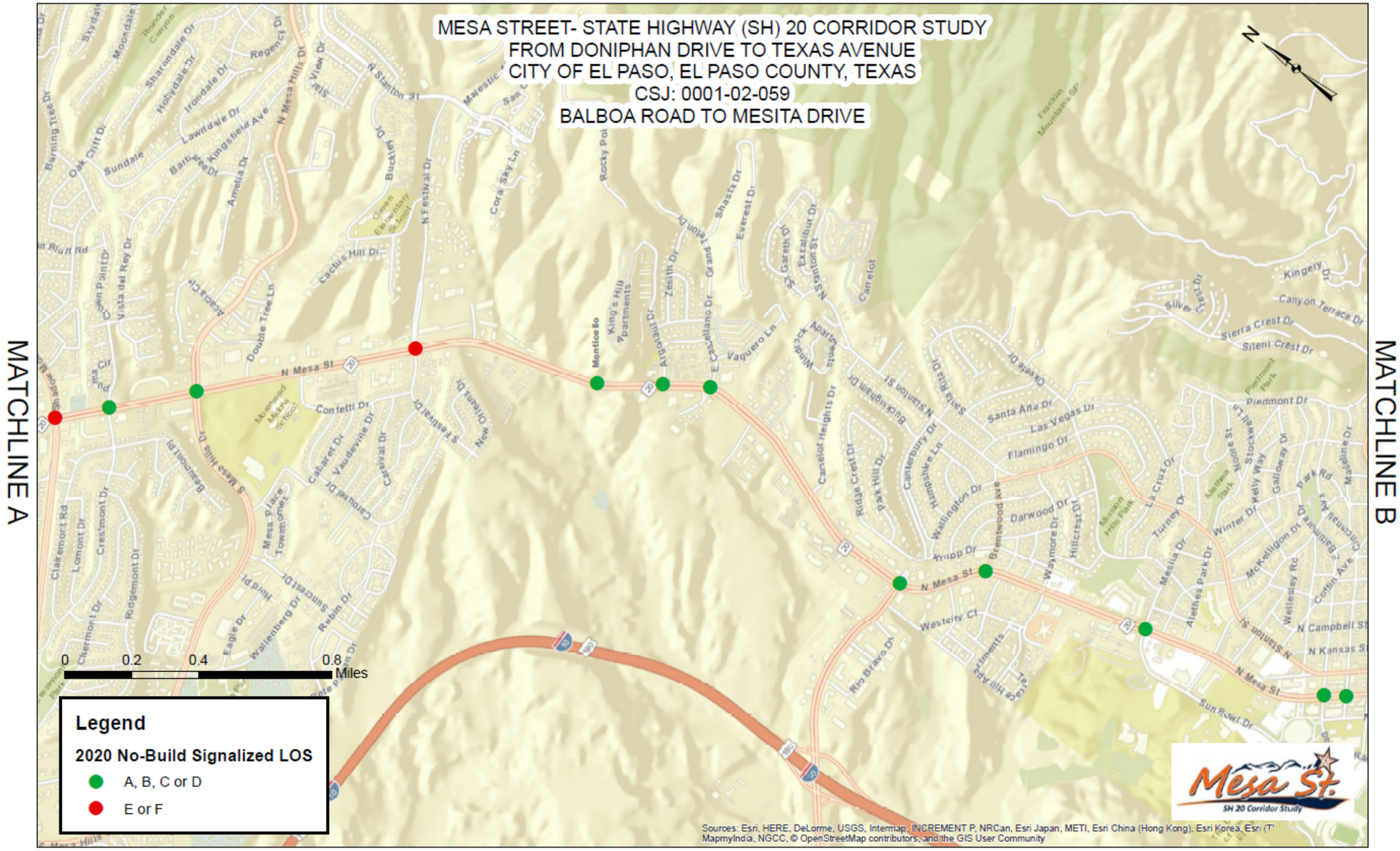
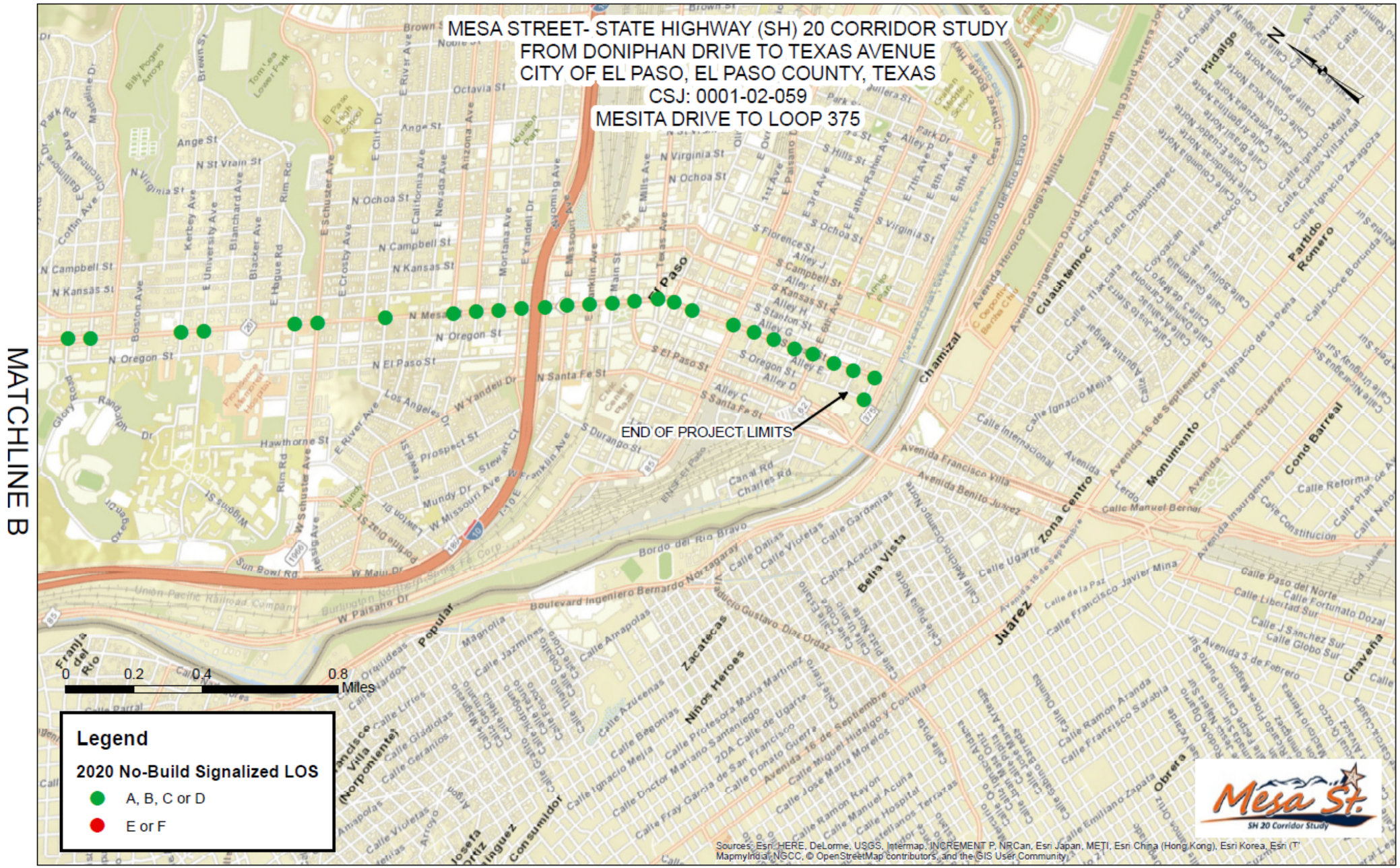


Figure 5 - 2020 No-Build LOS (Mesita Dr to LP 375)



2020 Short-Term Recommendations Build Alternative

The year 2020 Recommended Build Scenario is composed of the following improvements which were applied to the SH 20 / Mesa corridor to produce acceptable LOSs for the identified critical intersections:

- Optimize signal timing and phasing;
- Lengthen right-and left-turn lane bay storage (see **Table 21** for bay locations and lengths);
- Add northbound right-turn lane at the SH 20 / Mesa Street and Castellano Drive intersection (see **Table 21** for lane length);
- Convert existing northbound left-turn lane to dual left-turn lanes at the SH 20 / Mesa Street and Festival Drive intersection (see **Table 21** for lane length);
- "Pedestrian Scramble" signal timing added at the SH 20 / Mesa Street and University Avenue and SH 20 / Mesa Street and River Avenue intersections;
- Remove "Pedestrian Scramble" signal timing at the Mesa Street and San Antonio Avenue intersection; and
- Insert ALT route signage at the SH 20 / Mesa Street and Wyoming Avenue intersection to inform drivers of the option to bypass the intersection and access IH 10 via an ALT-signed downstream Franklin Avenue signal.

CRITICAL INTERSECTIONS

The purpose of the year 2020 Build analysis was to evaluate the effectiveness of the recommended Build modifications. All the studied SH 20 / Mesa Street intersections are expected to operate at an acceptable LOS in the AM and PM peak hours for the Build Alternative in year 2020. The critical intersections were determined to be those operating at an unacceptable LOS D, E or F. Implementing the 2020 Build analysis results in no failing (unacceptable LOS E or LOS F) intersections in the AM or PM peak hours.

The intersection delay and LOS results for the year 2020 Build Alternative are presented in **Table 9** and **Table 10** for the AM and PM peak hours, respectively. The No-Build and the Build traffic analysis are independent and do not build upon each other, in other words they are not layered solutions.

Table 9 - 2020 Build Critical Intersections (AM)

Signalized Intersection along Mesa Street	Delay (s)	LOS
DONIPHAN DRIVE	38.2	D
RESLER DRIVE	37.3	D
FESTIVAL DRIVE	44.5	D

Table 10 - 2020 Build Critical Intersections (PM)

Signalized Intersection along Mesa Street	Delay (s)	LOS
RESLER DRIVE	46.2	D
SUNLAND PARK DRIVE/SHADOW MOUNTAIN DRIVE	38.9	D
MONTANA AVENUE	40.8	D
WYOMING AVENUE	37.9	D

The intersection delay and LOS results for the year 2020 Build Alternative are presented in **Table 11** and **Table 12** for the AM and PM peak hours, respectively.

Figure 6, Figure 7, and **Figure 8** show the overall intersection LOSs and are provided in the next few pages.

Table 11 - 2020 Build AM Peak Hour Intersection LOS and Delay

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
1	DONIPHAN & SH 20 (MESA)	EB	23.5	883	C
		WB	24.3	990	C
		NB	54.6	921	D
		SB	45.7	1,387	D
		Overall Intersection	38.2	4,181	**D**
2	CROSSROADS & SH 20 (MESA)	EB	8.4	1,061	A
		WB	9.9	931	A
		NB	23.6	99	C
		SB	58.2	156	E
		Overall Intersection	13.9	2,247	**B**
3	OSBORNE & SH 20 (MESA)	EB	11.3	1,320	B
		WB	20.4	1,453	C
		NB	34.4	63	C
		SB	56.3	286	E
		Overall Intersection	18.8	3,122	**B**
4	DESERT NORTH & SH 20 (MESA)	EB	32.9	1,951	C
		WB	34.4	954	C
		NB	25.9	1,060	C
		SB	16.7	923	B
		Overall Intersection	27.8	4,888	**C**
5	BARTLETT & SH 20 (MESA)	EB	18.1	1,588	B
		WB	22.1	1,132	C
		NB	65.0	278	E
		SB	24.8	151	C
		Overall Intersection	23.7	3,149	**C**
6	REMCON & SH 20 (MESA)	EB	5.4	1,156	A
		WB	16.8	1,083	B
		NB	20.6	191	C
		SB	50.3	179	D
		Overall Intersection	15.0	2,609	**B**
7	SH 20 (MESA) & BELVIDERE	EB	2.2	1,293	A
		WB	9.1	1,009	A
		SB	36.2	404	D
		Overall Intersection	10.4	2,706	**B**
8	SH 20 (MESA) & CRESTMONT	EB	18.1	137	B
		WB	78.3	116	E
		NB	7.9	1,080	A
		SB	15.0	1,546	B
		Overall Intersection	15.9	2,879	**B**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
9	SH 20 (MESA) & PITT/DRIVEWAY	EB	19.4	82	B
		WB	59.6	89	E
		NB	4.1	1,153	A
		SB	4.1	1,459	A
		Overall Intersection	7.2	2,783	**A**
10	Champions Pl & SH 20 (MESA)	EB	2.1	1,248	A
		WB	8.5	1,164	A
		NB	35.9	75	D
		SB	0.0	0	A
		Overall Intersection	6.1	2,487	**A**
11	SH 20 (MESA) & ALTO MESA	EB	33.5	36	C
		WB	27.7	37	C
		NB	3.1	1,390	A
		SB	1.8	1,543	A
		Overall Intersection	3.4	3,006	**A**
12	SH 20 (MESA) & CAMILLE	EB	50.9	240	D
		WB	38.8	33	D
		NB	3.2	898	A
		SB	4.4	1,070	A
		Overall Intersection	10.2	2,241	**B**
13	SH 20 (MESA) & THUNDERBIRD	EB	34.4	22	C
		WB	41.1	285	D
		NB	9.3	815	A
		SB	15.4	914	B
		Overall Intersection	17.0	2,036	**B**
14	SH 20 (MESA) & BALBOA	EB	52.7	182	D
		WB	54.8	195	D
		NB	12.3	922	B
		SB	8.6	969	A
		Overall Intersection	18.6	2,268	**B**
15	SH 20 (MESA) & SUNLAND PARK/SHADOW MT	EB	61.1	406	E
		WB	30.9	1,783	C
		NB	13.6	459	B
		SB	36.3	196	D
		Overall Intersection	32.9	2,844	**C**
16	SH 20 (MESA) & CRESTMONT	EB	18.1	137	B
		WB	78.3	116	E
		NB	7.9	1,080	A
		SB	15.0	1,546	B
		Overall Intersection	15.9	2,879	**B**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
17	SH 20 (MESA) & MESA HILLS	EB	46.9	550	D
		WB	44.0	276	D
		NB	28.3	1,072	C
		SB	15.4	1,784	B
		Overall Intersection	26.5	3,682	**C**
18	SH 20 (MESA) & FESTIVAL	EB	59.0	364	E
		WB	159.3	566	F
		NB	18.7	1,174	B
		SB	26.5	2,012	C
		Overall Intersection	44.5	4,116	**D**
19	SH 20 (MESA) & MONTECILLO	EB	53.8	63	D
		WB	5.4	10	A
		NB	3.8	1,328	A
		SB	1.7	2,634	A
		Overall Intersection	3.2	4,035	**A**
20	SH 20 (MESA) & ARGONAUT	EB	0.0	0	A
		WB	45.7	176	D
		NB	2.5	1,274	A
		SB	1.1	2,575	A
		Overall Intersection	3.8	4,025	**A**
21	SH 20 (MESA) & CASTELLANO	EB	15.2	65	B
		WB	91.3	151	F
		NB	16.1	1,417	B
		SB	21.8	2,722	C
		Overall Intersection	22.9	4,355	**C**
22	SH 20 (MESA) & EXECUTIVE CENTER	EB	46.6	1,006	D
		WB	0.0	0	A
		NB	27.0	1,006	C
		SB	12.0	2,446	B
		Overall Intersection	22.7	4,458	**C**
23	SH 20 (MESA) & DRIVEWAY/BRENT WOOD	EB	0.0	2	A
		WB	28.8	323	C
		NB	11.7	815	B
		SB	3.4	1,894	A
		Overall Intersection	8.4	3,034	**A**
24	SH 20 (MESA) & SUN BOWL/MESITA	EB	60.0	128	E
		WB	61.6	104	E
		NB	13.4	889	B
		SB	5.5	1,902	A
		Overall Intersection	13.8	3,023	**B**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
25	SH 20 (MESA) & GLORY ROAD/BALTIMORE	EB	20.8	96	C
		WB	21.4	150	C
		NB	2.7	243	A
		SB	7.5	460	A
		Overall Intersection	10.2	949	**B**
26	SH 20 (MESA) & CINCINNATI	EB	23.7	4	C
		WB	20.3	64	C
		NB	6.5	217	A
		SB	9.8	180	A
		Overall Intersection	10.5	465	**B**
27	SH 20 (MESA) & KERBEY	EB	20.1	30	C
		WB	38.0	211	D
		NB	7.2	812	A
		SB	14.0	1,275	B
		Overall Intersection	14.1	2,328	**B**
28	SH 20 (MESA) & UNIVERSITY	EB	27.4	128	C
		WB	31.2	119	C
		NB	7.9	737	A
		SB	3.2	1,095	A
		Overall Intersection	8.5	2,079	**A**
29	SH 20 (MESA) & RIM	EB	43.8	87	D
		WB	50.6	89	D
		NB	9.1	802	A
		SB	8.5	1,079	A
		Overall Intersection	13.2	2,057	**B**
30	SH 20 (MESA) & Schuster	EB	34.4	460	C
		WB	38.5	396	D
		NB	21.1	775	C
		SB	10.4	972	B
		Overall Intersection	22.2	2,603	**C**
31	SH 20 (MESA) & RIVER	EB	34.4	16	C
		WB	35.7	84	D
		NB	2.6	779	A
		SB	0.8	799	A
		Overall Intersection	3.7	1,678	**A**
32	SH 20 (MESA) & ARIZONA	WB	16.9	360	B
		NB	13.0	670	B
		SB	15.1	739	B
		Overall Intersection	14.7	1,769	**B**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
33	SH 20 (MESA) & RIO GRANDE	EB	41.8	84	D
		NB	1.7	961	A
		SB	1.5	812	A
		Overall Intersection	3.4	1,857	A
34	SH 20 (MESA) & MONTANA	EB	33.5	27	C
		WB	32.8	21	C
		NB	8.2	968	A
		SB	0.8	679	A
		Overall Intersection	5.9	1,695	A
35	SH 20 (MESA) & YANDELL	WB	26.3	914	C
		NB	12.1	529	B
		SB	15.5	710	B
		Overall Intersection	19.3	2,153	B
36	SH 20 (MESA) & WYOMING	EB	39.8	820	D
		NB	22.3	426	C
		SB	9.0	688	A
		Overall Intersection	25.0	1,934	C
37	SH 20 (MESA) & MISSOURI	WB	13.0	1,093	B
		NB	14.7	208	B
		SB	20.2	526	C
		Overall Intersection	15.3	1,827	B
38	SH 20 (MESA) & FRANKLIN	EB	27.8	109	C
		NB	1.5	219	A
		SB	5.1	791	A
		Overall Intersection	6.6	1,119	A
39	SH 20 (MESA) & MAIN	EB	26.5	46	C
		WB	23.5	53	C
		NB	6.5	305	A
		SB	4.1	726	A
		Overall Intersection	6.5	1,130	A
40	SH 20 (MESA) & MILLS	EB	0.0	0	A
		WB	24.5	67	C
		NB	6.7	218	A
		SB	2.8	548	A
		Overall Intersection	5.6	833	A
41	SH 20 (MESA) & TEXAS	EB	28.0	42	C
		WB	25.8	163	C
		NB	9.8	203	A
		SB	4.5	530	A
		Overall Intersection	10.4	938	B

Table 12 - 2020 Build PM Peak Hour Intersection LOS and Delay

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
1	DONIPHAN & SH 20 (MESA)	EB	23.0	832	C
		WB	17.4	1,562	B
		NB	55.7	1,094	E
		SB	46.9	980	D
	Overall Intersection		34.7	4,468	**C**
2	CROSSROADS & SH 20 (MESA)	EB	9.0	842	A
		WB	6.9	1,122	A
		NB	45.4	209	D
		SB	59.0	309	E
	Overall Intersection		18.9	2,482	**B**
3	OSBORNE & SH 20 (MESA)	EB	17.3	1,077	B
		WB	21.3	1,545	C
		NB	26.4	78	C
		SB	39.6	360	D
	Overall Intersection		21.1	3,060	**C**
4	DESERT NORTH & SH 20 (MESA)	EB	25.0	1,429	C
		WB	30.2	1,296	C
		NB	17.8	1,236	B
		SB	15.3	857	B
	Overall Intersection		22.7	4,818	**C**
5	BARTLETT & SH 20 (MESA)	EB	24.0	1,736	C
		WB	24.0	1,926	C
		NB	70.1	410	E
		SB	41.5	217	D
	Overall Intersection		30.9	4,289	**C**
6	REMCON & SH 20 (MESA)	EB	8.4	1,011	A
		WB	16.6	1,868	B
		NB	33.5	428	C
		SB	40.9	290	D
	Overall Intersection		19.6	3,597	**B**
7	SH 20 (MESA) & BELVIDERE	EB	9.4	1,148	A
		WB	9.1	1,219	A
		SB	31.9	331	C
	Overall Intersection		12.1	2,698	**B**
8	RESLER & SH 20 (MESA)	EB	49.9	574	D
		WB	60.9	511	E
		NB	56.3	1,202	E
		SB	26.8	1,092	C
	Overall Intersection		46.2	3,379	**D**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
9	SH 20 (MESA) & PITT/DRIVEWAY	EB	21.9	84	C
		WB	46.4	199	D
		NB	8.6	1,496	A
		SB	14.1	1,463	B
	Overall Intersection		15.2	3,242	**B**
10	Champions Pl & SH 20 (MESA)	EB	3.8	1,669	A
		WB	2.1	1,334	A
		NB	44.2	65	D
		SB	0.0	0	A
	Overall Intersection		3.9	3,068	**A**
11	SH 20 (MESA) & ALTO MESA	EB	52.8	115	D
		WB	28.4	53	C
		NB	3.4	1,654	A
		SB	7.0	1,449	A
	Overall Intersection		7.7	3,271	**A**
12	SH 20 (MESA) & CAMILLE	EB	62.8	187	E
		WB	43.9	22	D
		NB	2.5	1,621	A
		SB	2.9	1,383	A
	Overall Intersection		6.9	3,213	**A**
13	SH 20 (MESA) & THUNDERBIRD	EB	33.3	12	C
		WB	38.7	246	D
		NB	9.5	1,573	A
		SB	12.2	1,544	B
	Overall Intersection		13.2	3,375	**B**
14	SH 20 (MESA) & BALBOA	EB	57.0	249	E
		WB	46.6	162	D
		NB	12.7	1,601	B
		SB	7.8	1,298	A
	Overall Intersection		16.0	3,310	**B**
15	SH 20 (MESA) & SUNLAND PARK/SHADOW MT	EB	59.4	763	E
		WB	35.3	1,014	D
		NB	34.1	1,065	C
		SB	16.8	337	B
	Overall Intersection		38.9	3,179	**D**
16	SH 20 (MESA) & CRESTMONT	EB	41.1	108	D
		WB	38.3	54	D
		NB	5.6	2,805	A
		SB	7.6	1,434	A
	Overall Intersection		7.8	4,401	**A**

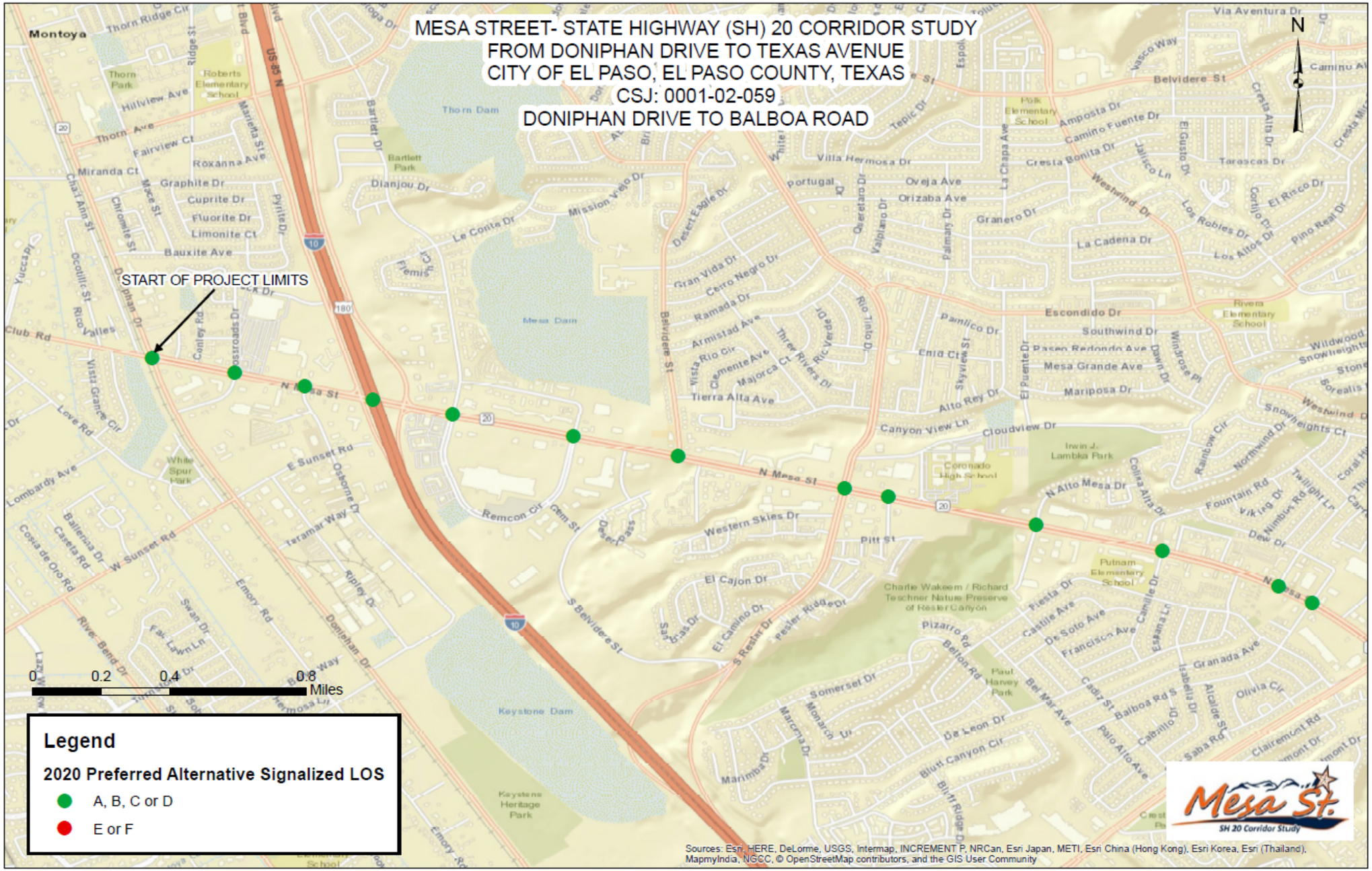
NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
17	SH 20 (MESA) & MESA HILLS	EB	50.7	645	D
		WB	39.5	270	D
		NB	15.2	2,568	B
		SB	20.1	1,427	C
	Overall Intersection		22.8	4,910	**C**
18	SH 20 (MESA) & FESTIVAL	EB	47.4	156	D
		WB	67.8	264	E
		NB	19.9	2,922	B
		SB	20.9	1,790	C
	Overall Intersection		24.0	5,132	**C**
19	SH 20 (MESA) & MONTECILLO	EB	65.5	67	E
		WB	33.1	17	C
		NB	3.8	2,780	A
		SB	0.9	1,606	A
	Overall Intersection		3.8	4,470	**A**
20	SH 20 (MESA) & ARGONAUT	EB	0.0	0	A
		WB	39.8	114	D
		NB	9.7	3,074	A
		SB	4.1	1,426	A
	Overall Intersection		8.8	4,614	**A**
21	SH 20 (MESA) & CASTELLANO	EB	38.6	128	D
		WB	42.2	114	D
		NB	13.9	2,791	B
		SB	7.1	1,574	A
	Overall Intersection		13.3	4,607	**B**
22	SH 20 (MESA) & EXECUTIVE CENTER	EB	33.2	1,159	C
		NB	3.8	2,478	A
		SB	17.7	1,737	B
	Overall Intersection		14.6	5,374	**B**
23	SH 20 (MESA) & DRIVEWAY/BRENT WOOD	EB	42.9	8	D
		WB	43.7	335	D
		NB	8.1	1,959	A
		SB	6.8	1,697	A
	Overall Intersection		11.2	3,999	**B**
24	SH 20 (MESA) & SUN BOWL/MESITA	EB	56.4	591	E
		WB	36.8	90	D
		NB	31.5	1,705	C
		SB	14.9	1,237	B
	Overall Intersection		30.1	3,623	**C**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
25	SH 20 (MESA) & GLORY ROAD/BALTIMORE	EB	42.9	314	D
		WB	12.5	164	B
		NB	10.0	426	A
		SB	12.4	298	B
	Overall Intersection		20.0	1,202	**C**
26	SH 20 (MESA) & CINCINNATI	EB	49.2	29	D
		WB	30.5	96	C
		NB	2.7	372	A
		SB	3.8	244	A
	Overall Intersection		10.0	741	**B**
27	SH 20 (MESA) & KERBEY	EB	36.9	104	D
		WB	31.8	198	C
		NB	9.9	1,333	A
		SB	12.4	1,086	B
	Overall Intersection		13.8	2,721	**B**
28	SH 20 (MESA) & UNIVERSITY	EB	50.5	226	D
		WB	34.9	124	C
		NB	3.5	1,306	A
		SB	4.6	1,017	A
	Overall Intersection		9.8	2,673	**A**
29	SH 20 (MESA) & RIM	EB	45.6	199	D
		WB	30.5	64	C
		NB	10.7	1,209	B
		SB	25.3	1,014	C
	Overall Intersection		20.5	2,486	**C**
30	SH 20 (MESA) & SCHUSTER	EB	30.3	585	C
		WB	25.5	363	C
		NB	31.5	904	C
		SB	29.2	1,106	C
	Overall Intersection		29.6	2,958	**C**
31	SH 20 (MESA) & RIVER	EB	39.6	21	D
		WB	28.0	72	C
		NB	2.2	898	A
		SB	0.7	1,028	A
	Overall Intersection		2.7	2,019	**A**
32	SH 20 (MESA) & ARIZONA	WB	17.9	346	B
		NB	4.8	730	A
		SB	14.5	1,040	B
	Overall Intersection		11.7	2,116	**B**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
33	SH 20 (MESA) & RIO GRANDE	EB	38.2	132	D
		NB	1.5	1,059	A
		SB	2.7	1,099	A
	Overall Intersection		4.2	2,290	**A**
34	SH 20 (MESA) & MONTANA	EB	27.6	79	C
		WB	21.0	346	C
		NB	75.9	978	E
		SB	14.1	996	B
	Overall Intersection		40.8	2,399	**D**
35	SH 20 (MESA) & YANDELL	WB	32.3	974	C
		NB	15.8	468	B
		SB	33.8	796	C
	Overall Intersection		29.4	2,238	**C**
36	SH 20 (MESA) & WYOMING	EB	43.9	817	D
		NB	30.2	499	C
		SB	36.8	1,048	D
	Overall Intersection		37.9	2,364	**D**
37	SH 20 (MESA) & MISSOURI	WB	13.3	876	B
		NB	12.1	293	B
		SB	8.1	441	A
	Overall Intersection		11.6	1,610	**B**
38	SH 20 (MESA) & FRANKLIN	EB	27.1	257	C
		NB	4.5	297	A
		SB	4.4	611	A
	Overall Intersection		9.4	1,165	**A**
39	SH 20 (MESA) & MAIN	EB	18.7	38	B
		WB	19.0	177	B
		NB	10.1	380	B
		SB	9.5	528	A
	Overall Intersection		11.5	1,123	**B**
40	SH 20 (MESA) & MILLS	EB	0.0	0	A
		WB	24.4	153	C
		NB	11.9	238	B
		SB	7.3	552	A
	Overall Intersection		11.2	943	**B**
41	SH 20 (MESA) & TEXAS	EB	26.5	25	C
		WB	26.7	224	C
		NB	10.5	210	B
		SB	6.2	635	A
	Overall Intersection		11.7	1,094	**B**

This Page Intentionally Left Blank

Figure 6 - 2020 Build LOS (Doniphan Dr to Balboa Rd)



MATCHLINE A

Figure 7 - 2020 Build LOS (Balboa Rd to Mesita Dr)

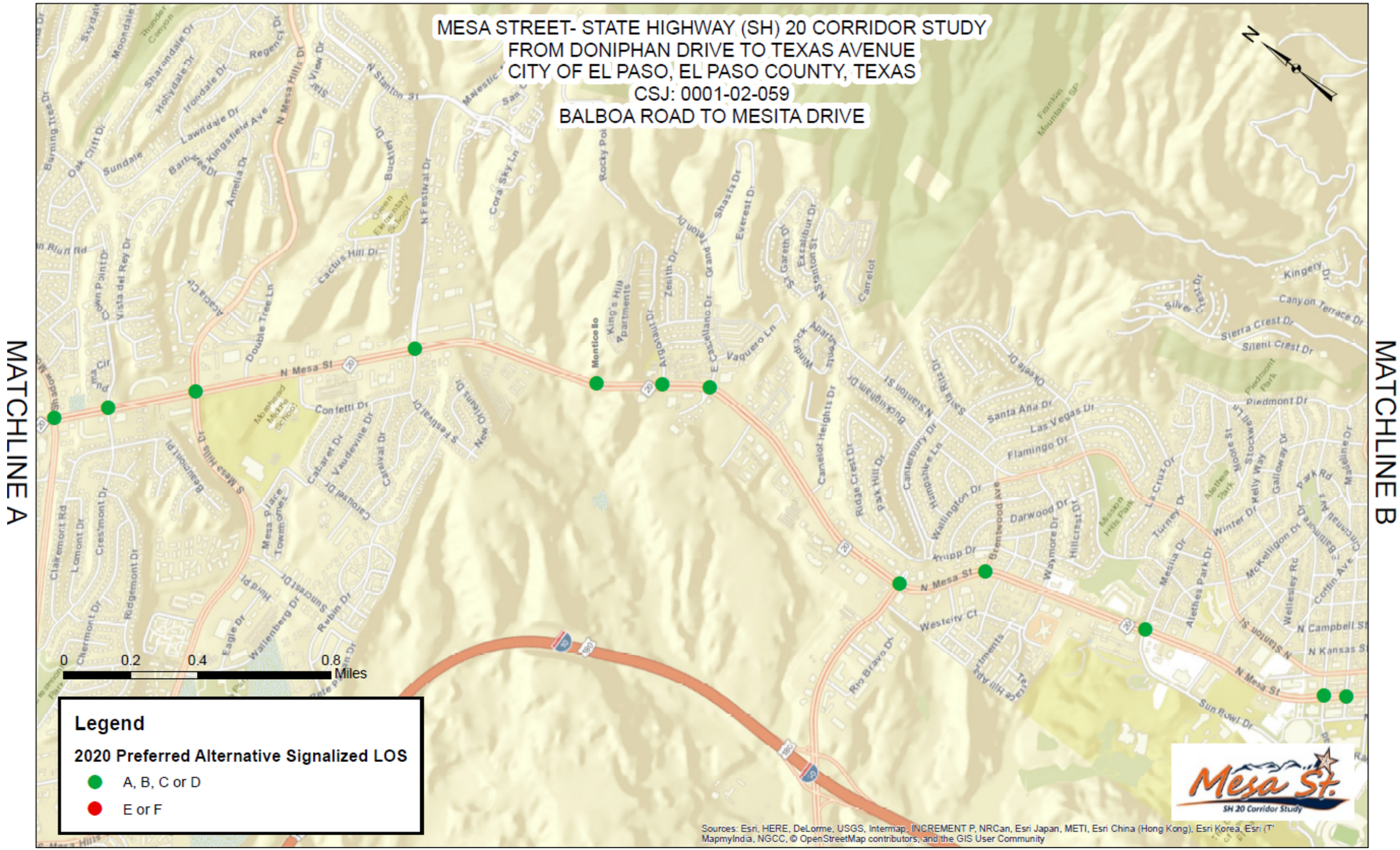
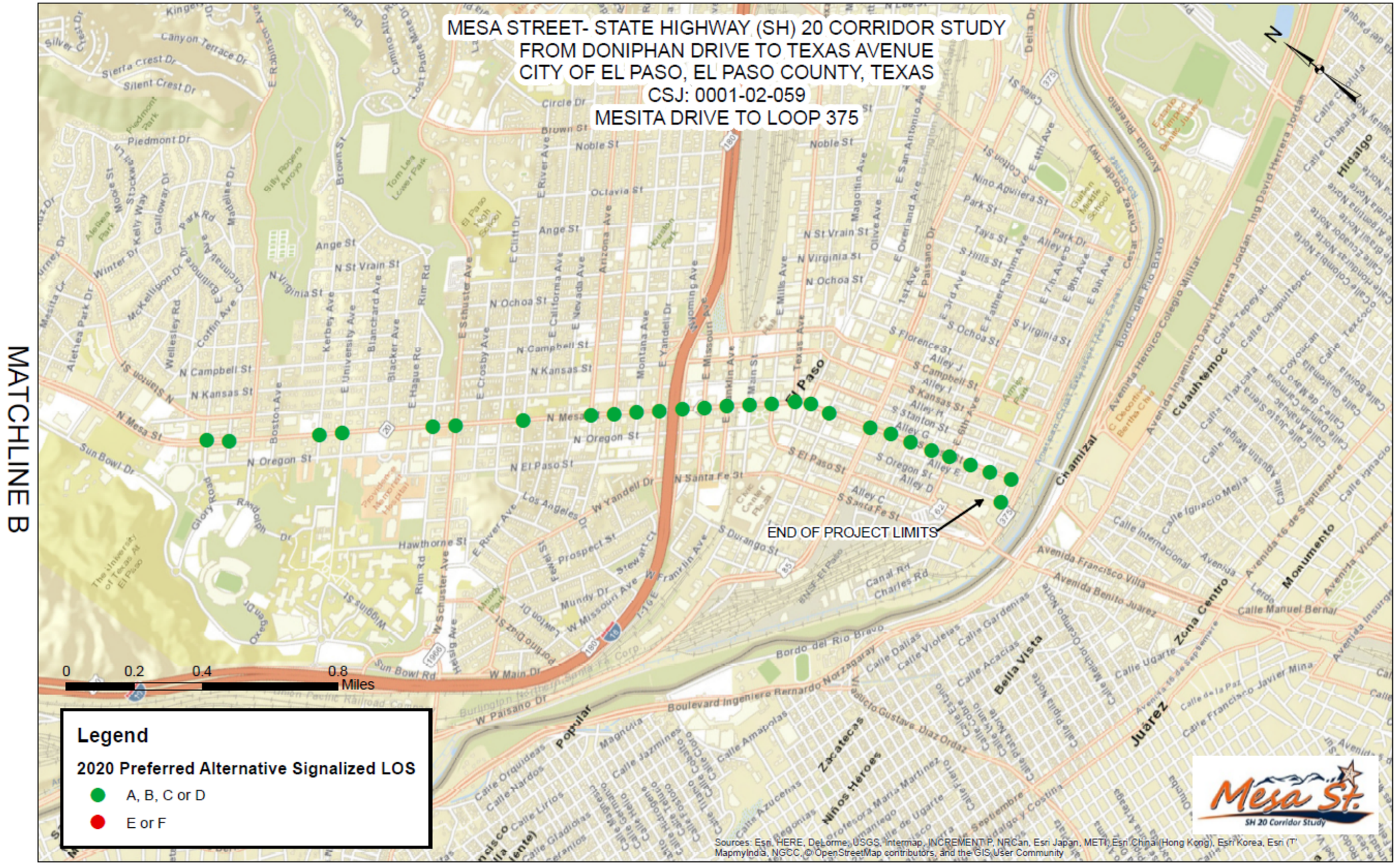


Figure 8 - 2020 Build LOS (Mesita Dr to LP 375)



Mid-Term Recommendations

Traffic analyses for Mid-term improvements were not performed because the traffic projections were only developed for the Short-term (2020) and Long-term (2040) years. However, Mid-term recommendations were developed to supplement the Short-term and Long-term recommendations and were based on ROW acquisition, construction cost, and project duration criteria that were considered to be mid-range (between the Short-term and Long-term criteria). The major Mid-term recommendations are as follows:

- Optimize signal timing and phasing;
- Horizontal and vertical curvature modifications;
- Access Management (removal of redundant driveways and closure of identified median openings);
- Lengthen right-and left-turn lane bay storage (see **Table 21** for lane locations and lengths);
- Convert existing westbound left-turn lane and shared through left-turn lane to dual left-turn lanes, and change right-turn only lane to a shared through-right lane for the intersection of SH 20 / Mesa Street and Festival Drive (see **Table 21** for lane locations and lengths);
- Add northbound right-turn lane at the intersection of SH 20 / Mesa Street and Castellano Drive (see **Table 21** for lane locations and lengths);
- Add northbound right-turn lane at the intersection of SH 20 / Mesa Street and Pitt Street, SH 20 / (Mesa Street is considered to be in the east / west direction for this intersection);
- Doniphan Drive (SH 20) added capacity reconfiguration (channelized right- and left-turn lanes);
- Relocate the eastbound IH 10 exit ramp (to North Mesa Street) northward to allow driver access to McClintock Drive and serve as an alternate route to Doniphan Drive (SH 20) and retail sites and thereby avoid and alleviate the Mesa Street signalized intersections west of IH 10;
- Extend Desert Pass Street to the Mesa Street / Belvidere Street intersection;
- Extend Mesa Park Drive to IH 10 (consistent with El Paso MPO); and
- Link Mesa Park Drive and Executive Center Boulevard via a new location arterial (consistent with City of El Paso Thoroughfare Plan).

Various additional Mid-term recommendations and descriptions are included within the subsequent SH 20 / Mesa Street Build Alternative Recommendations section of this Master Plan.

2040 No-Build Scenario

In the 2040 No-Build Alternative analyses, no prior modifications of any type were made to the SH 20 / Mesa Street corridor. Existing (year 2016) traffic volumes were grown at an annual rate of 1% to forecast the year 2040 traffic volumes. And the existing signal timing was reoptimized for the increased volumes.

CRITICAL INTERSECTIONS

The purpose of the No-Build analysis was to develop future conditions to compare the effectiveness of the subsequent 2040 Build recommendations. Several intersections are expected to operate at an unacceptable LOS in the AM and PM peak hours for the No-Build Alternative in year 2040. The critical intersections for year 2040 were determined to be those operating at an unacceptable LOS E or F.

A summary of the analysis results showing the LOS and delay for the critical intersections is provided in **Table 13** and **Table 14** for the AM and PM peak hours, respectively.

Figure 9, Figure 10, and **Figure 11** show the overall intersection LOSs.

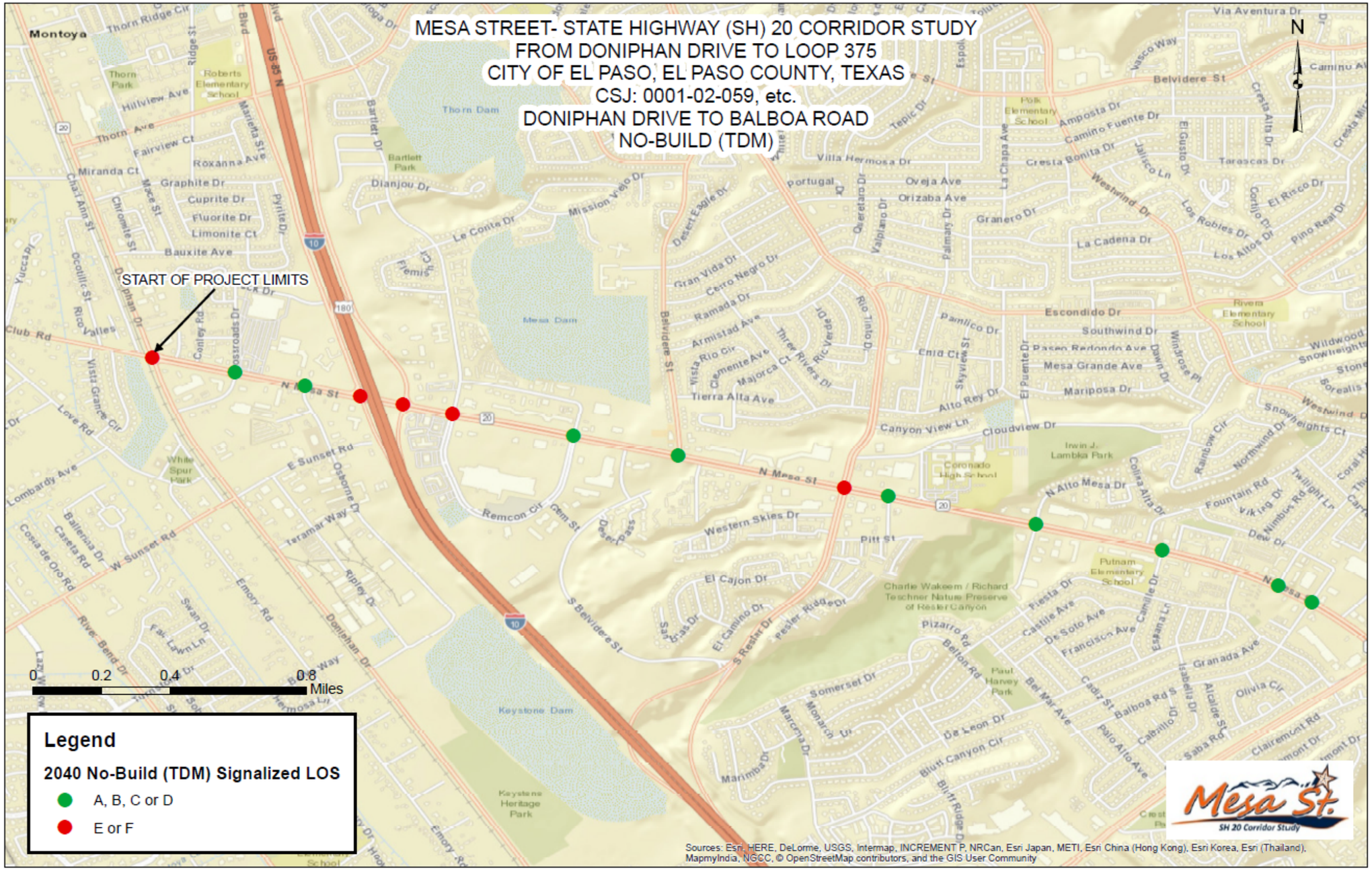
Table 13 - 2040 No-Build Critical Intersections (AM)

Signalized Intersection along Mesa Street	Delay (s)	LOS
DONIPHAN DRIVE (SH 20)	149.3	F
DESERT SOUTH BOULEVARD (IH 10 SB FRONTAGE ROAD)	170.7	F
SUNLAND PARK DRIVE / SHADOW MOUNTAIN DRIVE	181.5	F
FESTIVAL DRIVE	55.8	E
GLORY ROAD / BALTIMORE DRIVE	143.6	F
SCHUSTER AVENUE	113.5	F
YANDELL DRIVE	82.8	F
WYOMING AVENUE	124.7	F
MISSOURI AVENUE	103.4	F
SAN ANTONIO AVENUE	311.3	F

Table 14 - 2040 No-Build Critical Intersections (PM)

Signalized Intersection along Mesa Street	Delay (s)	LOS
DONIPHAN DRIVE (SH 20)	90.9	F
DESERT SOUTH BOULEVARD (IH 10 SB FRONTAGE ROAD)	163.2	F
DESERT NORTH BOULEVARD (IH 10 NB FRONTAGE ROAD)	216.2	F
BARTLETT DRIVE	127.8	F
RESLER DRIVE	77.7	E
SUNLAND PARK DRIVE / SHADOW MOUNTAIN DRIVE	157.2	F
EXECUTIVE BOULEVARD	134.4	F
BRENTWOOD AVENUE	105.4	F
SCHUSTER AVENUE	60.7	E
ARIZONA AVENUE	65.9	E
RIO GRANDE AVENUE	82.9	F
YANDELL DRIVE	133.4	F
WYOMING AVENUE	138.7	F
SAN ANTONIO AVENUE	613.5	F

Figure 9 - 2040 No-Build LOS (Doniphan Dr to Balboa Rd)



MATCHLINE A

Figure 10 - 2040 No-Build LOS (Balboa Rd to Mesita Dr)

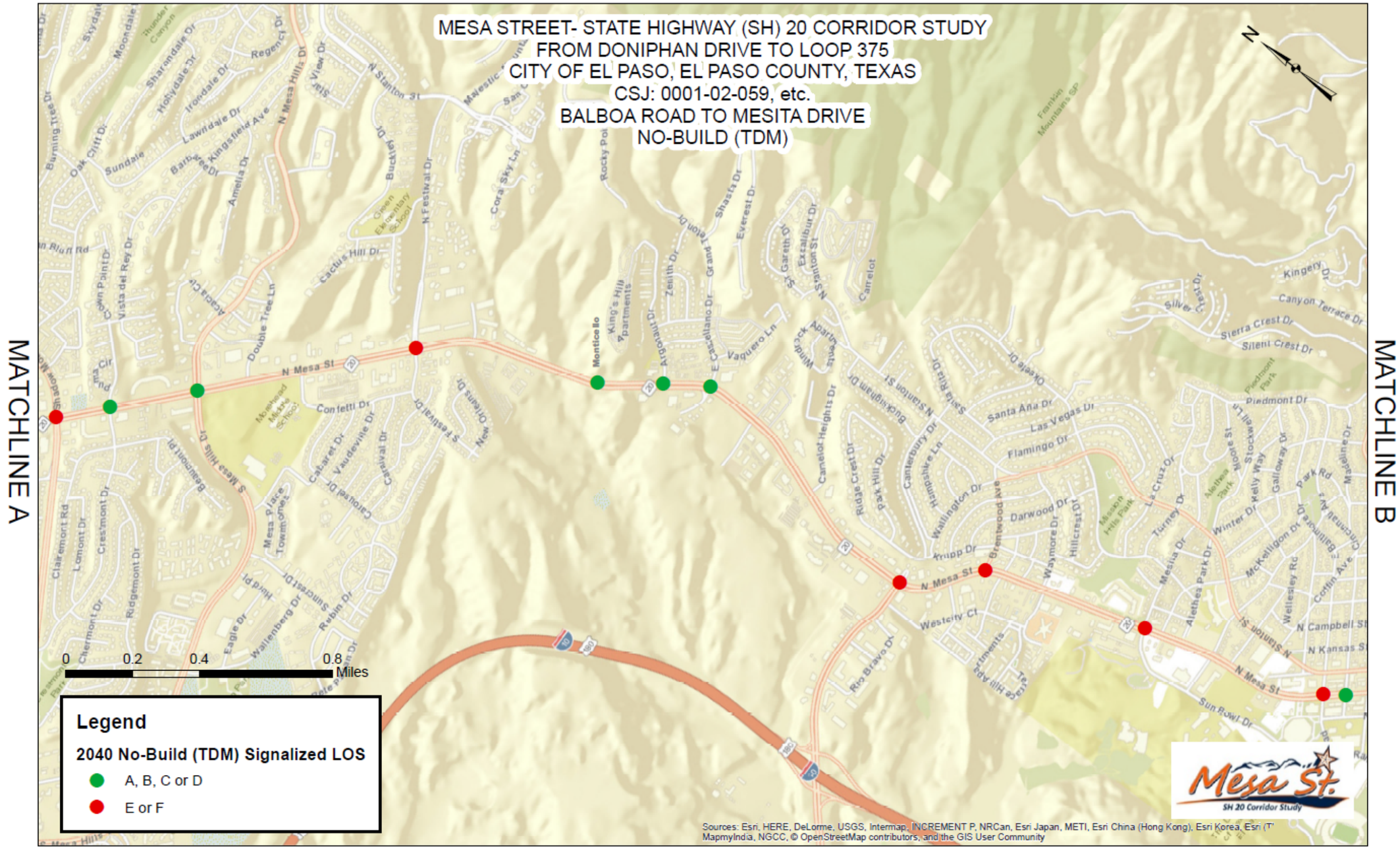
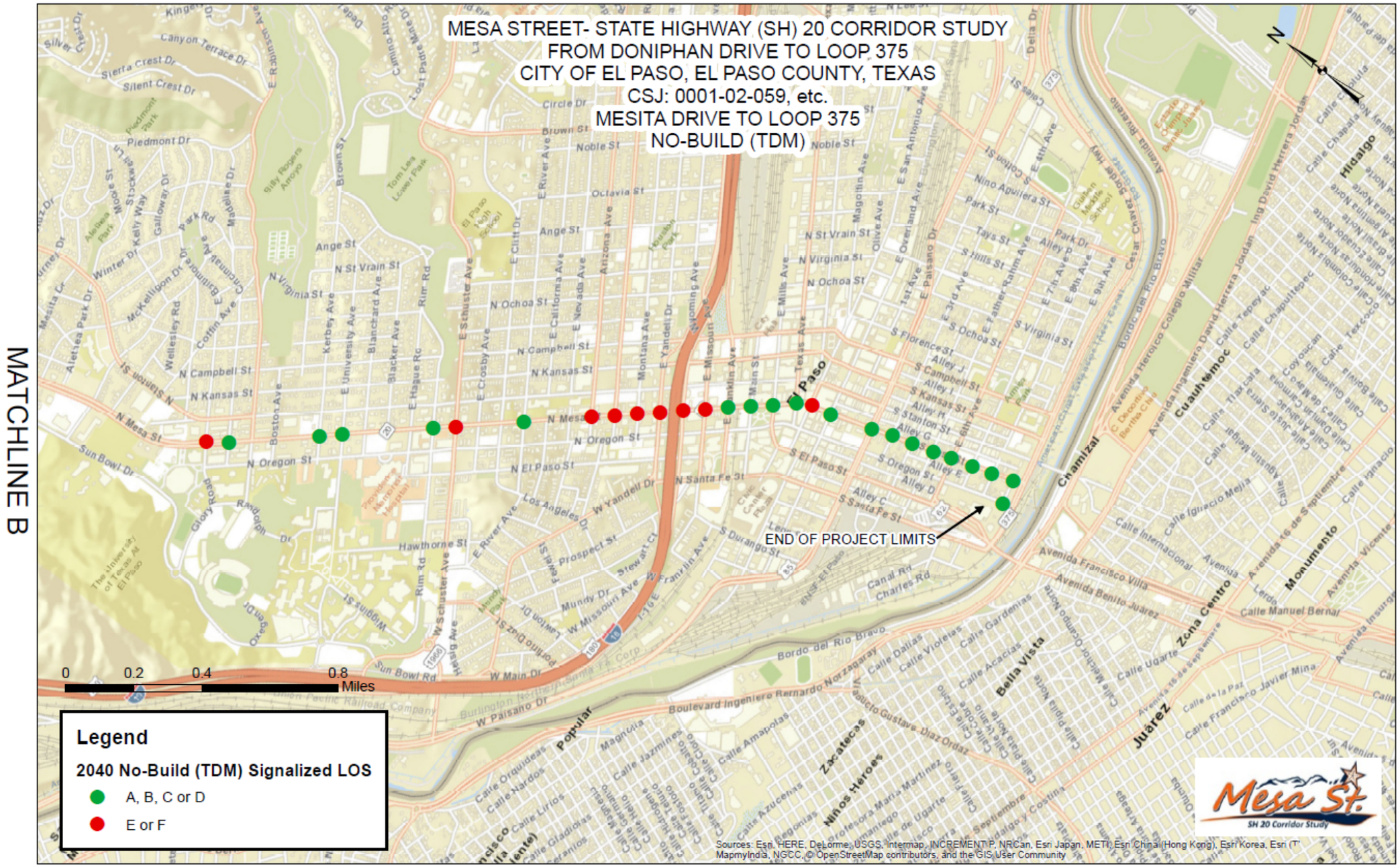


Figure 11 - 2040 No-Build LOS (Mesita Dr to LP 375)



2040 Long-Term Recommendations Build Alternative

In the 2040 Long-term recommended Build Alternative, the following modifications were made to the SH 20 / Mesa Street corridor, in addition to the 2020 Recommended Build Alternative:

- Optimize signal timing and phasing;
- IH 10 Single Point Urban Intersection (SPUI) with below-ground Mesa Street (Signal Bypass) Lanes and overpassing (unsignalized) IH 10 frontage road lanes;
- Resler Drive SPUI with underpassing Mesa Street lanes;
- Sunland Park Drive SPUI with underpassing Mesa Street lanes;
- Executive Center Boulevard Continuous Green T intersection; and
- A Glory Road / Baltimore Avenue Deck Park made possible by routing all the Mesa Street lanes below-ground between the cross-streets of Gregory Avenue and Boston Avenue.

CRITICAL INTERSECTIONS

The purpose of the year 2040 Build Alternative (Long-term) analysis was to evaluate the effectiveness of the recommended SH 20 / Mesa Street Build Alternative modifications. The critical intersections for year 2040 were determined to be those operating at an unacceptable LOS E or F. After the year 2040 Build Alternative is applied, several of the intersections are expected to operate at an unacceptable LOS in the AM and PM peak hours. However, when compared to the 2040 No-Build Alternative, fewer intersections fail in year 2040 after applying the Build Alternative recommendations.

A summary of the analysis results for the LOS and delay for the critical intersections is provided in **Table 15** and **Table 16** for the AM and PM peak hours, respectively. The Wyoming Avenue intersection will be evaluated in greater detail by TxDOT's ongoing *Reimagine I-10* corridor study that involves major IH 10, Mesa Street-related, refinement / reconstruction solutions.

Figure 12, **Figure 13**, and **Figure** 14 show the overall intersection LOSs and are provided in the next few pages.

Table 15 - 2040 Build Critical Intersections (AM)

Signalized Intersection along Mesa Street	Delay (s)	LOS
SAN ANTONIO AVENUE	73.6	E

Table 16 - 2040 Build Critical Intersections (PM)

Signalized Intersection along Mesa Street	Delay (s)	LOS
WYOMING AVENUE	57.0	E
SAN ANTONIO AVENUE	84.7	F

Table 17 presents the year 2040 travel time comparisons by peak hour for the 2040 No-Build and 2040 Build Alternatives. These traffic analysis results indicate the AM and PM peak hour travel time savings to be between seven (7) minutes and twenty-three (23) minutes for the 2040 Build Alternative as compared to the 2040 No-Build Alternative AM and PM peak hour travel time.

Table 17 - Travel Time Comparisons

Year 2040 Travel Time (in minutes)						
	No-Build		Build		Build - NoBuild	
	Westbound/ Northbound	Eastbound/ Southbound	Westbound/ Northbound	Eastbound/ Southbound	Westbound/ Northbound	Eastbound/ Southbound
AM	36.8	49.0	29.4	34.6	-7.4	-14.4
PM	49.0	49.0	30.9	25.6	-18.1	-23.4

Intersection delay and LOS results for year 2040 Build Alternative (Long-term) are presented in **Table 18** and **Table 19** for the AM and PM peak hours, respectively.

Table 18 - 2040 Build AM Peak Hour Intersection LOS and Delay

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
1	DONIPHAN & SH 20 (MESA)	EB	27.0	883	C
		WB	25.7	990	C
		NB	49.8	921	D
		SB	41.3	1,387	D
		Overall Intersection	36.7	4,181	**D**
2	CROSSROADS & SH 20 (MESA)	EB	10.1	564	B
		WB	7.7	542	A
		NB	28.0	99	C
		SB	63.8	156	E
		Overall Intersection	15.0	1,361	**B**
3	OSBORNE & SH 20 (MESA)	EB	24.7	685	C
		WB	27.7	1,008	C
		NB	39.5	63	D
		SB	58.0	286	E
		Overall Intersection	28.5	2,042	**C**
4	DESERT NORTH & SH 20 (MESA)	EB	33.2	1,368	C
		WB	35.1	954	D
		NB	24.7	1,060	C
		SB	16.9	923	B
		Overall Intersection	27.5	4,305	**C**
5	BARTLETT & SH 20 (MESA)	EB	26.0	1,710	C
		WB	33.3	1,232	C
		NB	67.9	278	E
		SB	26.6	151	C
		Overall Intersection	30.9	3,371	**C**
6	REMCON & SH 20 (MESA)	EB	10.5	2,006	B
		WB	17.0	1,083	B
		NB	23.5	191	C
		SB	56.8	179	E
		Overall Intersection	16.8	3,459	**B**
7	SH 20 (MESA) & BELVIDERE	EB	17.1	1,293	B
		WB	27.0	916	C
		SB	38.6	404	D
		Overall Intersection	23.4	2,613	**C**
8	RESLER & SH 20 (MESA)	EB	18.1	421	B
		WB	32.7	209	C
		NB	56.1	716	E
		SB	33.9	1,518	C
		Overall Intersection	37.0	2,864	**D**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
9	SH 20 (MESA) & PITT/DRIVEWAY	EB	23.9	82	C
		WB	61.2	89	E
		NB	10.7	1,453	B
		SB	12.6	1,459	B
Overall Intersection			14.1	3,083	**B**
10	Champions Pl & SH 20 (MESA)	EB	2.5	969	A
		WB	12.0	971	B
		NB	41.7	75	D
		SB	0.0	0	A
Overall Intersection			8.1	2,015	**A**
11	SH 20 (MESA) & ALTO MESA	EB	36.6	36	D
		WB	29.5	37	C
		NB	11.7	1,534	B
		SB	2.2	1,543	A
Overall Intersection			8.0	3,150	**A**
12	SH 20 (MESA) & CAMILLE	EB	74.7	240	E
		WB	42.5	33	D
		NB	12.3	898	B
		SB	17.9	945	B
Overall Intersection			20.4	2,116	**C**
13	SH 20 (MESA) & THUNDERBIRD	EB	32.2	22	C
		WB	41.1	285	D
		NB	20.1	815	C
		SB	37.5	914	D
Overall Intersection			30.4	2,036	**C**
14	SH 20 (MESA) & BALBOA	EB	54.1	182	D
		WB	52.4	195	D
		NB	17.4	1,222	B
		SB	6.2	1,395	A
Overall Intersection			17.5	2,994	**B**
15	SH 20 (MESA) & SUNLAND PARK/SHADOW MT	EB	63.9	406	E
		WB	28.6	1,783	C
		NB	19.5	459	B
		SB	23.2	196	C
Overall Intersection			32.0	2,844	**C**
16	SH 20 (MESA) & CRESTMONT	EB	34.6	137	C
		WB	175.8	116	F
		NB	25.7	1,080	C
		SB	67.2	1,546	E
Overall Intersection			53.1	2,879	**D**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
17	SH 20 (MESA) & MESA HILLS	EB	97.5	550	F
		WB	62.4	276	E
		NB	36.9	1,072	D
		SB	56.1	1,548	E
		Overall Intersection	54.7	3,446	**D**
18	SH 20 (MESA) & FESTIVAL	EB	59.5	299	E
		WB	126.9	566	F
		NB	31.5	1,578	C
		SB	54.5	2,016	D
		Overall Intersection	54.2	4,459	**D**
19	SH 20 (MESA) & MONTECILLO	EB	55.8	63	E
		WB	4.7	10	A
		NB	3.0	1,709	A
		SB	7.8	2,624	A
		Overall Intersection	6.6	4,406	**A**
20	SH 20 (MESA) & ARGONAUT	EB	0.0	0	A
		WB	48.3	176	D
		NB	9.1	1,076	A
		SB	39.3	2,575	D
		Overall Intersection	28.2	3,827	**C**
21	SH 20 (MESA) & CASTELLANO	EB	16.7	65	B
		WB	75.5	151	E
		NB	14.8	1,717	B
		SB	60.1	2,566	E
		Overall Intersection	43.0	4,499	**D**
22	SH 20 (MESA) & EXECUTIVE CENTER	EB	96.9	1,006	F
		NB	34.0	1,006	C
		SB	39.1	2,373	D
		Overall Intersection	48.6	4,385	**D**
23	SH 20 (MESA) & DRIVEWAY/BRENT WOOD	EB	0.0	2	A
		WB	68.6	323	E
		NB	32.0	815	C
		SB	8.8	1,324	A
		Overall Intersection	22.2	2,464	**C**
24	SH 20 (MESA) & SUN BOWL/MESITA	EB	65.8	128	E
		WB	76.7	104	E
		NB	17.5	707	B
		SB	12.5	1,254	B
		Overall Intersection	20.0	2,193	**B**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
25	SH 20 (MESA) & GLORY ROAD/BALTIMORE	EB	20.8	96	C
		WB	21.8	150	C
		NB	7.5	352	A
		SB	8.8	491	A
		Overall Intersection	12.0	1,089	**B**
26	SH 20 (MESA) & CINCINNATI	EB	25.4	4	C
		WB	20.3	64	C
		NB	15.0	326	B
		SB	9.2	220	A
		Overall Intersection	14.2	614	**B**
27	SH 20 (MESA) & KERBEY	EB	21.9	30	C
		WB	53.8	211	D
		NB	12.7	1,018	B
		SB	19.4	1,454	B
		Overall Intersection	19.9	2,713	**B**
28	SH 20 (MESA) & UNIVERSITY	EB	28.8	128	C
		WB	32.8	119	C
		NB	15.6	673	B
		SB	7.2	944	A
		Overall Intersection	12.9	1,864	**B**
29	SH 20 (MESA) & RIM	EB	57.3	87	E
		WB	59.4	89	E
		NB	11.8	1,173	B
		SB	69.9	1,399	E
		Overall Intersection	44.4	2,748	**D**
30	SH 20 (MESA) & Schuster	EB	57.5	460	E
		WB	56.5	396	E
		NB	42.2	736	D
		SB	64.4	972	E
		Overall Intersection	54.8	2,564	**D**
31	SH 20 (MESA) & RIVER	EB	32.5	16	C
		WB	39.6	84	D
		NB	4.7	1,162	A
		SB	6.5	1,136	A
		Overall Intersection	7.0	2,398	**A**
32	SH 20 (MESA) & ARIZONA	WB	30.3	360	C
		NB	6.1	670	A
		SB	15.4	700	B
		Overall Intersection	13.7	1,730	**B**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
33	SH 20 (MESA) & RIO GRANDE	EB	42.0	84	D
		NB	76.9	1,161	E
		SB	8.7	1,086	A
Overall Intersection			43.8	2,331	**D**
34	SH 20 (MESA) & MONTANA	EB	35.5	27	D
		WB	34.5	21	C
		NB	63.9	968	E
		SB	14.4	679	B
Overall Intersection			40.4	1,695	**D**
35	SH 20 (MESA) & YANDELL	WB	40.5	914	D
		NB	72.3	529	E
		SB	43.2	710	D
Overall Intersection			50.8	2,153	**D**
36	SH 20 (MESA) & WYOMING	EB	44.1	820	D
		NB	48.4	426	D
		SB	61.8	688	E
Overall Intersection			52.6	1,934	**D**
37	SH 20 (MESA) & MISSOURI	WB	22.1	1,093	C
		NB	26.9	208	C
		SB	68.1	526	E
Overall Intersection			39.8	1,827	**D**
38	SH 20 (MESA) & FRANKLIN	EB	30.8	109	C
		NB	2.2	219	A
		SB	20.4	791	C
Overall Intersection			17.0	1,119	**B**
39	SH 20 (MESA) & MAIN	EB	27.3	46	C
		WB	25.2	53	C
		NB	7.3	305	A
		SB	6.8	926	A
Overall Intersection			8.4	1,330	**A**
40	SH 20 (MESA) & MILLS	EB	0.0	0	A
		WB	36.8	67	D
		NB	4.8	218	A
		SB	2.5	548	A
Overall Intersection			4.9	833	**A**
41	SH 20 (MESA) & TEXAS	EB	37.4	42	D
		WB	36.6	163	D
		NB	6.8	203	A
		SB	3.3	530	A
Overall Intersection			9.4	938	**A**

Table 19 - 2040 Build PM Peak Hour Intersection LOS and Delay

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
1	DONIPHAN & SH 20 (MESA)	EB	40.5	832	D
		WB	23.7	1,562	C
		NB	64.6	1,094	E
		SB	61.5	980	E
		Overall Intersection	45.5	4,468	**D**
2	CROSSROADS & SH 20 (MESA)	EB	19.6	842	B
		WB	13.3	1,122	B
		NB	50.1	209	D
		SB	56.5	309	E
		Overall Intersection	24.0	2,482	**C**
3	OSBORNE & SH 20 (MESA)	EB	19.6	1,077	B
		WB	21.1	1,545	C
		NB	47.6	78	D
		SB	40.0	360	D
		Overall Intersection	24.6	3,060	**C**
4	DESERT NORTH & SH 20 (MESA)	EB	22.9	1,429	C
		WB	25.6	1,296	C
		NB	23.5	1,236	C
		SB	20.2	857	C
		Overall Intersection	23.4	4,818	**C**
5	BARTLETT & SH 20 (MESA)	EB	37.9	2,236	D
		WB	50.5	1,926	D
		NB	92.0	410	F
		SB	49.7	217	D
		Overall Intersection	49.1	4,789	**D**
6	REMCON & SH 20 (MESA)	EB	23.4	1,298	C
		WB	23.3	1,660	C
		NB	31.2	428	C
		SB	35.6	290	D
		Overall Intersection	26.5	3,676	**C**
7	SH 20 (MESA) & BELVIDERE	EB	11.2	1,148	B
		WB	12.7	1,219	B
		NB	0.0	0	A
		SB	32.9	331	C
		Overall Intersection	14.8	2,698	**B**
8	RESLER & SH 20 (MESA)	EB	54.0	574	D
		WB	56.6	511	E
		NB	58.2	1,202	E
		SB	23.7	1,092	C
		Overall Intersection	45.9	3,379	**D**

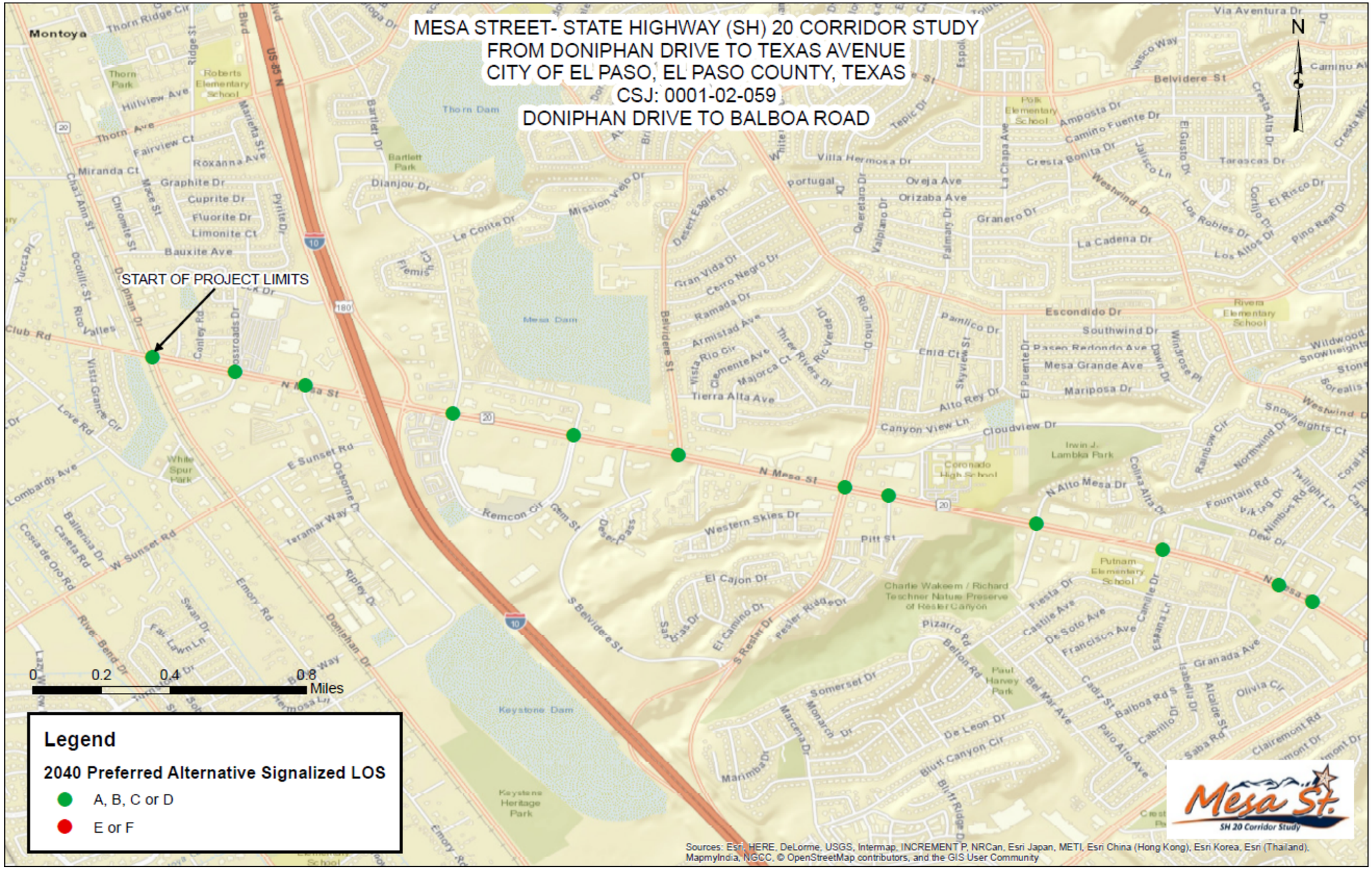
NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
9	SH 20 (MESA) & PITT/DRIVEWAY	EB	20.7	84	C
		WB	49.3	199	D
		NB	15.6	1,496	B
		SB	20.7	1,463	C
Overall Intersection			21.3	3,242	**C**
10	Champions Pl & SH 20 (MESA)	EB	3.4	1,669	A
		WB	10.4	1,041	B
		NB	44.7	65	D
		SB	0.0	0	A
Overall Intersection			7.8	2,775	**A**
11	SH 20 (MESA) & ALTO MESA	EB	52.4	115	D
		WB	29.7	53	C
		NB	4.0	1,654	A
		SB	14.0	1,449	B
Overall Intersection			11.0	3,271	**B**
12	SH 20 (MESA) & CAMILLE	EB	75.7	187	E
		WB	45.4	22	D
		NB	3.3	1,621	A
		SB	7.5	1,383	A
Overall Intersection			10.0	3,213	**B**
13	SH 20 (MESA) & THUNDERBIRD	EB	32.5	12	C
		WB	46.8	246	D
		NB	11.1	1,573	B
		SB	14.6	1,544	B
Overall Intersection			15.7	3,375	**B**
14	SH 20 (MESA) & BALBOA	EB	58.3	249	E
		WB	48.3	162	D
		NB	16.8	1,601	B
		SB	9.8	1,298	A
Overall Intersection			18.9	3,310	**B**
15	SH 20 (MESA) & SUNLAND PARK/SHADOW MT	EB	60.2	763	E
		WB	25.1	1,014	C
		NB	39.4	1,065	D
		SB	19.9	337	B
Overall Intersection			38.0	3,179	**D**
16	SH 20 (MESA) & CRESTMONT	EB	41.3	108	D
		WB	39.4	54	D
		NB	12.6	2,805	B
		SB	13.5	1,434	B
Overall Intersection			14.3	4,401	**B**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
17	SH 20 (MESA) & MESA HILLS	EB	86.0	645	F
		WB	40.5	270	D
		NB	57.6	2,568	E
		SB	28.0	1,427	C
		Overall Intersection	51.3	4,910	**D**
18	SH 20 (MESA) & FESTIVAL	EB	56.4	156	E
		WB	128.0	264	F
		NB	57.2	2,922	E
		SB	20.4	1,790	C
		Overall Intersection	50.3	5,132	**D**
19	SH 20 (MESA) & MONTECILLO	EB	67.1	67	E
		WB	31.5	17	C
		NB	9.1	2,780	A
		SB	3.8	1,606	A
		Overall Intersection	8.1	4,470	**A**
20	SH 20 (MESA) & ARGONAUT	EB	0.0	0	A
		WB	43.9	114	D
		NB	22.6	3,242	C
		SB	4.4	1,426	A
		Overall Intersection	16.7	4,782	**B**
21	SH 20 (MESA) & CASTELLANO	EB	40.9	128	D
		WB	44.0	114	D
		NB	58.3	2,791	E
		SB	8.7	1,574	A
		Overall Intersection	40.9	4,607	**D**
22	SH 20 (MESA) & EXECUTIVE CENTER	EB	49.6	1,502	D
		NB	4.1	3,084	A
		SB	26.0	2,138	C
		Overall Intersection	21.1	6,724	**C**
23	SH 20 (MESA) & DRIVEWAY/BRENT WOOD	EB	45.2	8	D
		WB	94.4	335	F
		NB	56.8	2,022	E
		SB	12.3	1,697	B
		Overall Intersection	44.0	4,062	**D**
24	SH 20 (MESA) & SUN BOWL/MESITA	EB	98.5	763	F
		WB	37.4	115	D
		NB	40.3	2,163	D
		SB	17.9	1,933	B
		Overall Intersection	40.7	4,974	**D**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
25	SH 20 (MESA) & GLORY ROAD/BALTIMORE	EB	39.6	314	D
		WB	12.2	164	B
		NB	16.7	898	B
		SB	17.2	531	B
Overall Intersection			22.1	1,907	**C**
26	SH 20 (MESA) & CINCINNATI	EB	49.5	29	D
		WB	30.5	96	C
		NB	11.9	443	B
		SB	6.8	396	A
Overall Intersection			14.5	964	**B**
27	SH 20 (MESA) & KERBEY	EB	39.0	104	D
		WB	35.3	198	D
		NB	42.8	1,333	D
		SB	17.2	1,664	B
Overall Intersection			30.5	3,299	**C**
28	SH 20 (MESA) & UNIVERSITY	EB	106.8	226	F
		WB	48.4	124	D
		NB	12.5	1,306	B
		SB	6.1	1,017	A
Overall Intersection			20.3	2,673	**C**
29	SH 20 (MESA) & RIM	EB	51.3	199	D
		WB	30.6	64	C
		NB	17.7	1,209	B
		SB	24.7	1,014	C
Overall Intersection			24.0	2,486	**C**
30	SH 20 (MESA) & SCHUSTER	EB	75.5	585	E
		WB	28.0	363	C
		NB	55.5	904	E
		SB	27.6	1,106	C
Overall Intersection			46.5	2,958	**D**
31	SH 20 (MESA) & RIVER	EB	43.4	21	D
		WB	27.9	72	C
		NB	2.6	898	A
		SB	1.2	1,028	A
Overall Intersection			3.2	2,019	**A**
32	SH 20 (MESA) & ARIZONA	WB	26.6	346	C
		NB	4.0	730	A
		SB	14.7	1,040	B
Overall Intersection			12.6	2,116	**B**

NO	INTERSECTION	APPROACH	APPROACH DELAY (sec/veh)	APPROACH VOLUME	APPROACH LOS
33	SH 20 (MESA) & RIO GRANDE	EB	39.9	132	D
		NB	2.9	1,059	A
		SB	9.8	1,099	A
		Overall Intersection	8.4	2,290	**A**
34	SH 20 (MESA) & MONTANA	EB	37.0	79	D
		WB	25.0	346	C
		NB	79.1	978	E
		SB	15.8	996	B
		Overall Intersection	44.0	2,399	**D**
35	SH 20 (MESA) & YANDELL	WB	38.5	974	D
		NB	24.2	468	C
		SB	77.9	796	E
		Overall Intersection	49.0	2,238	**D**
36	SH 20 (MESA) & WYOMING	EB	52.7	817	D
		NB	40.8	499	D
		SB	72.1	1,048	E
		Overall Intersection	57.0	2,364	**E**
37	SH 20 (MESA) & MISSOURI	WB	18.3	876	B
		NB	11.9	293	B
		SB	12.3	441	B
		Overall Intersection	15.0	1,610	**B**
38	SH 20 (MESA) & FRANKLIN	EB	34.4	257	C
		NB	1.4	297	A
		SB	2.9	611	A
		Overall Intersection	8.2	1,165	**A**
39	SH 20 (MESA) & MAIN	EB	18.7	38	B
		WB	19.5	177	B
		NB	10.5	380	B
		SB	8.2	528	A
		Overall Intersection	11.1	1,123	**B**
40	SH 20 (MESA) & MILLS	EB	0.0	0	A
		WB	30.5	153	C
		NB	10.5	238	B
		SB	6.1	552	A
		Overall Intersection	11.1	943	**B**
41	SH 20 (MESA) & TEXAS	EB	29.0	25	C
		WB	30.7	224	C
		NB	11.3	210	B
		SB	6.2	635	A
		Overall Intersection	12.6	1,094	**B**

Figure 12 - 2040 Build LOS (Doniphan Dr to Balboa Rd)



MATCHLINE A

Figure 13 - 2040 Build LOS (Balboa Rd to Mesita Dr)

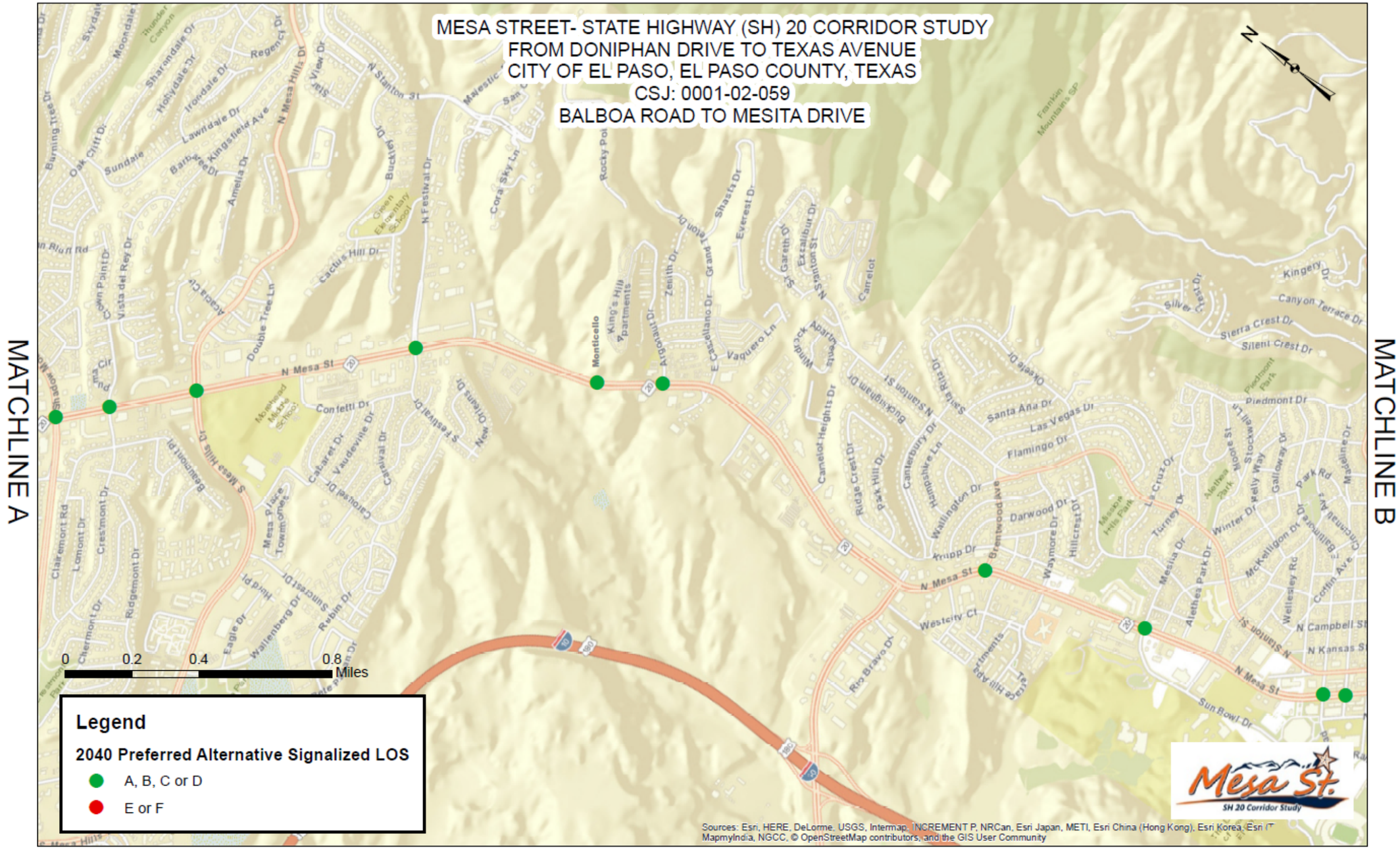
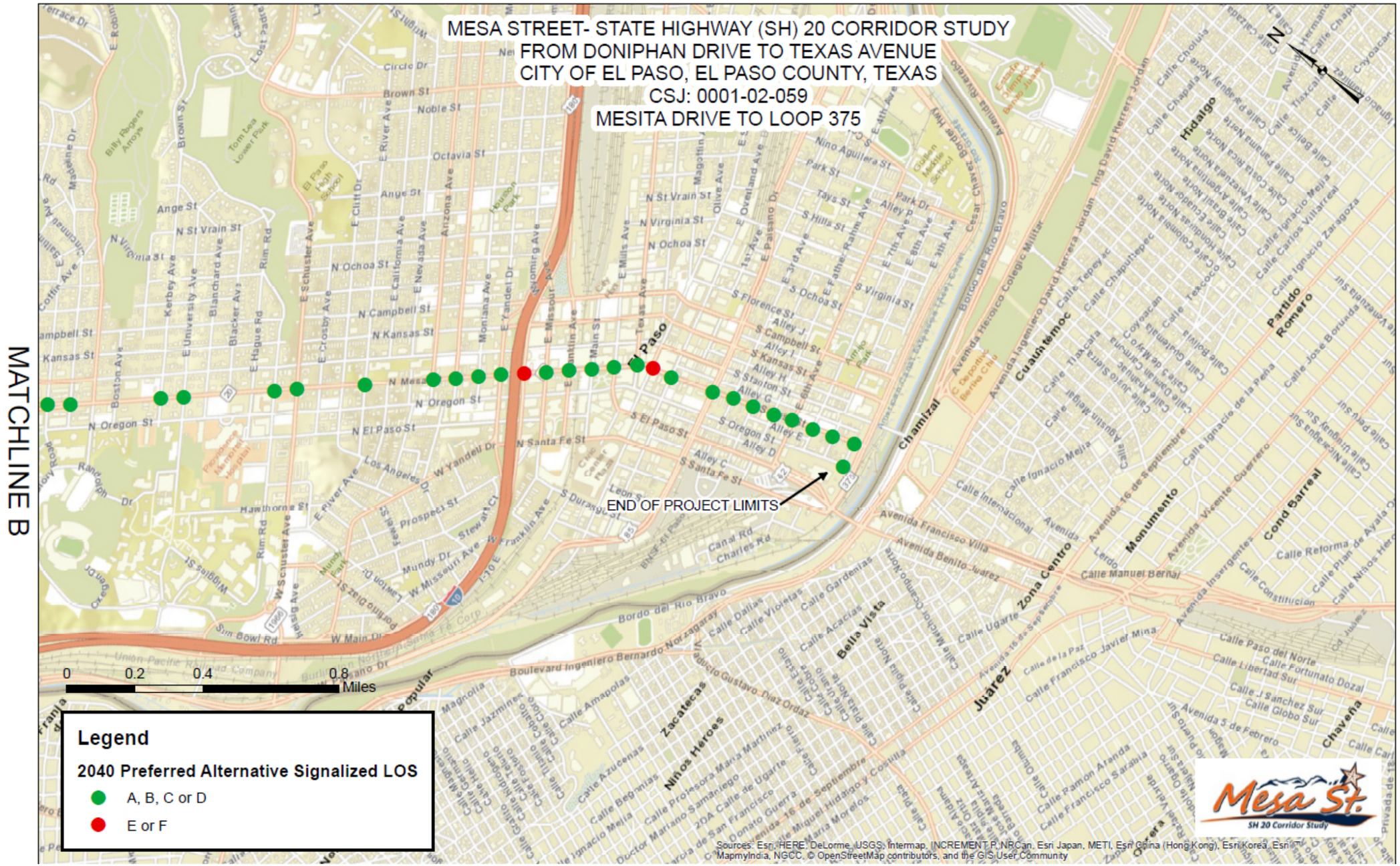


Figure 14 - 2040 Build LOS (Mesita Dr to LP 375)



SH 20 / MESA STREET BUILD ALTERNATIVE RECOMMENDATIONS

Various conceptual recommended (Build Alternative) improvements were evaluated for the SH 20 / Mesa Street corridor. Each final, resulting Alternative recommendation has been evaluated and determined to improve traffic operations within the corridor to varying degrees of positive impact. These recommendations are grouped and discussed in the following sections according to five (5) distinct corridor operational categories:

- Intersections;
- Corridor (between intersections and includes median maintenance vehicle parking zones);
- Pedestrian & Bicycle;
- Transit (includes bus pull-out lanes); and
- Intelligent Transportation System (ITS).

Intersections

Based on the traffic analysis, intersection improvement solutions were produced to optimize operations and efficiency along SH 20 / Mesa Street. These recommended improvements (turn lane additions) are presented in **Table 20** as Short- and Mid-term improvements. In addition, intersection improvements for specific left- and right-turn bay locations and lengths are presented in **Table 21** as Short-term and Mid-term recommendations. Additional intersection-related improvements such as right-turn overlaps, bus queue jump locations, and others are described within subsequent sections of this Master Plan.

Table 20 - Intersection Improvements

Signalized Intersection along SH 20 / Mesa St	Improvements
PITT STREET	Add northbound (NB) right-turn lane from Pitt Street onto Mesa Street (Mid)
FESTIVAL DRIVE	Add an additional NB left-turn lane (Short); and Convert existing configuration to dual left-turn lanes and a shared through/right-turn lane (Short).
CASTELLANO DRIVE	Add NB right-turn lane (Mid)

It is also recommended that intersection crosswalks and select SH 20 / Mesa Street corridor sidewalks be upgraded alongside enhanced pavement markings along the corridor. Traffic signal timing should also be updated periodically due to changes in traffic volumes and patterns.

TURN BAY LENGTHENING

Based on the traffic analysis, Short-term and Mid-term right- and left-turn bay modifications were determined and recommended for the various signalized SH 20 / Mesa Street intersections and are presented in **Table 21.**

Table 21 - Turn Bay Recommendations

NO	INTERSECTION	APPROACH	SHORT-TERM IMPROVEMENTS		MID-TERM IMPROVEMENTS		MESA E-W/N-S
			LEFT TURN LANE BAY LENGTH (ft)	RIGHT TURN LANE BAY LENGTH (ft)	LEFT TURN LANE BAY LENGTH (ft)	RIGHT TURN LANE BAY LENGTH (ft)	
1	DONIPHAN & SH 20 (MESA)	EB	130	N/A	300	N/A	E-W
		WB	N/A	N/A	240	N/A	
2	CROSSROADS & SH 20 (MESA)	EB	205	N/A	N/A	N/A	E-W
		WB	N/A	N/A	195	N/A	
3	OSBORNE & SH 20 (MESA)	EB	130	N/A	N/A	N/A	E-W
		WB	560	N/A	675	N/A	
4	DESERT NORTH/SOUTH & SH 20 (MESA)	EB	N/A	N/A	410	600	E-W
		WB	N/A	N/A	500	400	
5	BARTLETT & SH 20 (MESA)	EB	420	N/A	650	N/A	E-W
		WB	N/A	N/A	N/A	N/A	
6	REMCON & SH 20 (MESA)	EB	215	N/A	N/A	N/A	E-W
		WB	290	N/A	N/A	N/A	
7	SH 20 (MESA) & BELVIDERE	EB	470	N/A	N/A	N/A	E-W
		WB	N/A	N/A	N/A	N/A	
8	RESLER & SH 20 (MESA)	EB	N/A	N/A	N/A	N/A	E-W
		WB	N/A	N/A	285	N/A	
9	SH 20 (MESA) & PITT/DRIVEWAY	NB	N/A	N/A	N/A	N/A	N-S
		SB	N/A	N/A	250	N/A	
10	Champions Pl & SH 20 (MESA)	EB	N/A	N/A	N/A	N/A	E-W
		WB	390	N/A	N/A	N/A	

NO	INTERSECTION	APPROACH	SHORT-TERM IMPROVEMENTS		MID-TERM IMPROVEMENTS		MESA E-W/N-S
			LEFT TURN LANE BAY LENGTH (ft)	RIGHT TURN LANE BAY LENGTH (ft)	LEFT TURN LANE BAY LENGTH (ft)	RIGHT TURN LANE BAY LENGTH (ft)	
11	SH 20 (MESA) & ALTO MESA	NB	N/A	N/A	N/A	N/A	N-S
		SB	200	N/A	N/A	N/A	
12	SH 20 (MESA) & THUNDERBIRD	NB	150	N/A	N/A	N/A	N-S
		SB	260	N/A	305	N/A	
13	SH 20 (MESA) & BALBOA	NB	140	N/A	215	N/A	N-S
		SB	190	N/A	N/A	N/A	
14	SH 20 (MESA) & SUNLAND PARK/SHADOW MT	NB	N/A	N/A	N/A	400	N-S
		SB	170	N/A	N/A	405	
15	SH 20 (MESA) & CRESTMONT	NB	255	N/A	N/A	N/A	N-S
		SB	180	N/A	N/A	N/A	
16	SH 20 (MESA) & MESA HILLS	NB	455	N/A	N/A	N/A	N-S
		SB	380	N/A	430	N/A	
17	SH 20 (MESA) & FESTIVAL	WB	N/A	N/A	350 (Dual lanes)[1]	N/A	N-S
		NB	460 (Dual Lanes)[2]	N/A	555	N/A	
		SB	385	N/A	N/A	N/A	
18	SH 20 (MESA) & ARGONAUT	NB	N/A	N/A	N/A	N/A	N-S
		SB	210	N/A	N/A	N/A	
19	SH 20 (MESA) & CASTELLANO	NB	215	130[3]	N/A	N/A	N-S
		SB	170	N/A	N/A	N/A	
20	SH 20 (MESA) & EXECUTIVE CENTER	NB	500	N/A	650	N/A	N-S
		SB	N/A	N/A	N/A	N/A	

NO	INTERSECTION	APPROACH	SHORT-TERM IMPROVEMENTS		MID-TERM IMPROVEMENTS		MESA E-W/N-S
			LEFT TURN LANE BAY LENGTH (ft)	RIGHT TURN LANE BAY LENGTH (ft)	LEFT TURN LANE BAY LENGTH (ft)	RIGHT TURN LANE BAY LENGTH (ft)	
21	SH 20 (MESA) & DRIVEWAY/BRENT WOOD	NB	N/A	N/A	120	N/A	N-S
		SB	290	N/A	380	N/A	
22	SH 20 (MESA) & SUN BOWL/MESITA	NB	N/A	N/A	180	N/A	N-S
		SB	210	N/A	N/A	N/A	
23	SH 20 (MESA) & UNIVERSITY	NB	N/A	N/A	145	100	N-S
		SB	N/A	N/A	N/A	N/A	
24	SH 20 (MESA) & RIM	NB	N/A	N/A	130	N/A	E-W
		SB	N/A	N/A	105	N/A	
25	SH 20 (MESA) & Schuster	NB	N/A	N/A	260	N/A	N-S
		SB	N/A	N/A	180	N/A	
26	SH 20 (MESA) & RIO GRANDE	NB	N/A	N/A	N/A	N/A	N-S
		SB	N/A	N/A	300	N/A	
27	SH 20 (MESA) & YANDELL	NB	155	N/A	N/A	N/A	E-W
		SB	N/A	N/A	N/A	N/A	
28	SH 20 (MESA) & FRANKLIN	NB	N/A	N/A	N/A	N/A	E-W
		SB	N/A	N/A	245	N/A	

[1] – Change existing configuration from left-turn only lane and shared through/left-turn lane to dual left-turn lanes.
[2] – Add a left-turn lane to convert existing configuration from one left-turn lane to dual left-turn lanes.
[3] – Add a northbound right-turn lane.

Traffic signal warrant studies should be conducted in the future as redevelopment takes place at the existing signalized intersections along SH 20 / Mesa Street, notably at the Pitt Street and Crossroads Drive intersections. This should be carried out using current traffic counts at the intersections and would require coordination between TxDOT, the City of El Paso, and stakeholders.

Non-traditional, innovative intersections were also considered by the Study as geometric and signal design solutions that can provide Long-term operational, LOS and congestion solutions. Examples include Single

Point Urban Intersections (SPUIs), Diverging Diamond Interchanges (DDIs), continuous flow intersections, and roundabouts which are each discussed in the later portion of this Plan.

FLASHING YELLOW ARROWS

Flashing yellow arrow signal heads should be installed at several SH 20 / Mesa Street intersections with existing protected-permitted operations. These intersections include, but are not limited to, those along SH 20 / Mesa Street in the vicinity of UTEP. The flashing yellow arrow is the state of the practice for protected-permitted left turn operations.

Per the 2011 Texas Manual of Uniform Traffic Control Devices (TMUTCD), traditional five-section left turn heads are no longer allowed to be installed on exclusive left turn lanes. The flashing yellow arrow eliminates the "yellow-trap" scenario experienced when operating lead-lag phasing with five-section protected-permitted left turns, where drivers are waiting for gaps in oncoming traffic to turn left on a permitted green signal indication.

A yellow-trap scenario occurs when a driver sees the signals change from green to yellow and mistakenly assumes that oncoming through traffic also has yellow signals at the same time and will soon be stopping. The mistaken assumption "traps" the permitted left-turn driver into thinking it is safe to turn when it is not, because opposing traffic still has the green signal indicator with the lagging left turn and may result in a severe crash. Public outreach needs to take place along with implementation of the flashing yellow arrow.

Flashing yellow arrows allow for protected-permitted left turns with lead-lag sequences. Sequence flexibility has the potential to considerably improve coordinated signal timing along Mesa Street. Flashing yellow arrows could be implemented in the Short-term.

NEAR-SIDE SIGNAL HEADS

Near-side signal heads are supplemental heads positioned to provide additional upstream visibility. For example, roadway curvature (horizontal and/or vertical) may obstruct drivers' view of the downstream signal heads as the driver approaches the intersection. A near-side signal head mirrors the approach display, and provides more perception-reaction time and therefore improves safety. Due to the horizontal and vertical roadway curvature, SH 20 / Mesa Street intersection locations to install near-side signal heads in both directions in the Short-term are Executive Center Boulevard and Montecillo Boulevard.

TRAFFIC SIGNAL CONTROLLERS

Modern traffic signal controllers, such as 2070 and Advanced Traffic Controller (ATC), are highly capable and flexible and have been designed to run multiple non-intersection related components. The ATC is the most current functional type and encompasses features from both the NEMA and Type 2070 architecture types. This improvement could be implemented in the Short-term.

<u>Type 2070</u>

The Type 2070 controller is based on an open-architecture design. All the hardware components in the Type 2070 controller are standardized and interchangeable. The Type 2070 controller can be adapted routinely for all standard rack-mount cabinets as well as shelf-mounted NEMA cabinets. The Type 2070 controller has multiple configuration combinations to accommodate any field control need.

In the Type 2070 controllers, the software running the controller is on the API board. It is upgraded through the serial port. The software is proprietary to the software developer but there are many standard features specified in the Type 2070 specifications. There are software packages available that would run the controller similar to that of a NEMA controller. There are also several software packages to choose from although the City can select switch software packages as desired.

Two operating systems are available for the Type 2070 controller type – OS9 and Linux. The firmware must work with the operating system. They are not interchangeable, thus careful consideration is needed when selecting firmware for the Type 2070 controller.

ATC

The ATC specification is centered on the desire to have a uniform national standard for the traffic signal controller. Additionally, the ATC can control devices other than traffic signal controllers. These devices include dynamic message signs, monitoring equipment, and driver feedback equipment. ATC standardization provides an open architecture, which is important to assure future flexibility.

There are many differences between the ATC and the Type 2070 controller. However, in simple terms, the Type 2070 controller runs the OS 9 software and the ATC specification does not specify a specific operating system. The ATCs are using Linux as the operating system.

The ATC controller also uses an API board for storage of the firmware. It can be upgraded through the serial port. The software is proprietary to the software developer.

TRAFFIC SIGNAL CABINETS

The traffic signal cabinet compliments the Traffic Signal Controller. The cabinet type is selected based on the traffic signal controller selected. There are three basic architecture types for traffic signal cabinets:

- NEMA;
- Type 170 / Type 2070; and
- ATC / ITS.

Furthermore, there are multiple types of cabinets within each architecture type. These include a NEMA TS 1 cabinet, a NEMA TS 2 Type 1 cabinet, a NEMA TS 2 Type 2 cabinet, a Type 2070 cabinet (Type 332 cabinet), and an ATC/ITS cabinet (Type 332 cabinet).

The ATC cabinet combines concepts from both the NEMA and Model 170 traffic signal. From the Model 170 controller it takes the concept of rack-mounted sub-assemblies. From the NEMA controller, it borrows the basic serial connections between the controller and sub-assemblies.

Upgraded traffic signal cabinets, in addition to upgraded traffic signal controllers, for more adaptive, reliable, and expandable operations on SH 20 / Mesa Street.

RIGHT-TURN OVERLAPS

Right-turn overlaps provide a protected right-turn signal while a compatible left-turn signal is active. For example, a northbound right-turn overlap would display a green right-turn arrow while the westbound left-turn signal was active (the right-turn arrow would be suppressed in the presence of a pedestrian call). Right-turn overlaps increase right-turn capacity. Listed below are potential SH 20 / Mesa Street intersections that could benefit from right-turn overlaps in the Short-term:

- Eastbound Osborne Drive at Mesa Street;
- Southbound Mesa Street at Remcon Circle / Bartlett Drive;
- Northbound Mesa Street at Resler Drive;
- Northbound Mesa Street at Sunland Park Drive / Shadow Mountain Drive;
- Eastbound Mesa Hills Drive at Mesa Street;
- Northbound Mesa Street at Festival Drive;
- Southbound Mesa Street at Executive Center Boulevard;
- Eastbound Executive Center Boulevard at Mesa Street;

- Westbound Brentwood Avenue at Mesa Street; and
- Southbound Mesa Street at Sun Bowl Drive.

SIGNAGE

Alternate route signs are typically used to indicate an officially designated alternate numbered route between two points on the route. Per the MUTCD, the ALTERNATE or ALT auxiliary sign may be mounted directly above an interstate route sign. The shorter (time or distance) route would retain the regular route number and the longer route would be designated as the alternate (ALT) route. Therefore, a Short-term recommendation is the installation of "ALT" and "EAST" IH 10 access ramp signs and directional arrows along southbound SH 20 / Mesa Street at Wyoming Avenue near downtown. This signage would provide drivers the option of bypassing the Wyoming Avenue signalized intersection and accessing IH 10 via the downstream signed Franklin Avenue signal. In turn, this signage would help distribute traffic among the two intersection route options that each provide access to one of two existing eastbound IH 10 entrance ramps from southbound SH 20 / Mesa Street. This distribution would improve the LOS at the Wyoming Avenue and Franklin Avenue intersections to a varying degree, particularly for southbound drivers traveling SH 20 / Mesa Street at the conclusion of upstream special events within the UTEP campus.

INNOVATIVE INTERSECTIONS

Innovative intersections use non-traditional geometric and signal designs to address specific operational concerns. Examples include diverging diamond interchanges (DDIs), single point urban intersections (SPUIs), continuous flow intersections, and roundabouts. Due to the design complexity and construction costs, these innovative intersections are overall considered Long-term improvements. The Long-term innovative intersections or interchanges considered or recommended by the Mesa Street / SH 20 corridor are described below and include grade separations, below-ground signal bypass lanes and a pedestrian roadway pedestrian deck plaza. Screen captures from the VISSIM models for the recommended innovative intersection improvements are located in **Appendix A [Video VISSIM (Video Simulation) Screen Captures]**.

<u>Diverging Diamond Interchanges (DDIs)</u>

Diverging diamond interchanges (DDIs) are an alternative interchange design and best suited for non-retail, open expanse intersections where the through movements on one of the facilities (cross-street or highway) is grade separated. DDIs have two signal-controlled crossover points; at these points on the outside of the interchanges, vehicles cross over to the opposite side of the major road. Drivers are provided with continuous, unsignalized left-turns onto the freeway facility. Through vehicles cross back over to the usual side of the roadway at the other (downstream) end of the DDI. These innovative intersections reduce the number of conflict points and reduce the delay for left-turns to / from highway ramps. In comparison, however, these conflict points exceed the conflict points involving SPUI designs.

Signal operations are simplified, but are less flexible, especially for coordinated arterial progression through the DDI. Although considered and evaluated by the Study, DDIs are not recommended at any SH 20 / Mesa Street intersection. For reference, an existing DDI exists in El Paso at the interchange of Loop 375 and Spur 601.

<u>Single Point Urban Intersections (SPUIs)</u>

SPUIs align left-turns at widely spaced intersections / interchanges to a single point, essentially consolidating two coordinated intersections into one. SPUIs reduce the number of conflict points, more than a DDI, and reduce the overall delay (due to simplified signal timing operations). And arterial progression is not impeded with SPUIs.

Long-Term recommended SPUIs are located at North Mesa Street at IH 10, Mesa Street at Resler Drive, and Mesa Street at Sunland Park Drive. Mesa Street surface street through movements through each SPUI (cross-street signal light) are not recommended, which is typical for SPUI designs. Allowing the signalized through movements deteriorates the LOS. The recommended exception is allowing the low volume Sun Metro buses on the Mesa Street surface streets to navigate through the Resler Drive and Sunland Park Drive SPUIs via "BUS ONLY" lanes and thereby efficiently access the bus stop downstream of each SPUI. Non-bus vehicle access to retail sites downstream of the SPUI would occur via "Michigan left" (U-turn) movements along each cross street (Resler Drive and Sunland Park Drive).

Since the IH 10 frontage road movements [future collector-distributer (CD) road south of IH 10] are not recommended by the Study to be at-grade and signalized movements across North Mesa Street, the Study does recommend elevating these frontage roads (Desert North and Desert South movements) over the Study-recommended IH 10 / North Mesa Street SPUI. Doing so would achieve an acceptable year 2040 LOSs at the North Mesa Street signals which otherwise cannot be achieved if the frontage road / CD through movements remain at-grade and signalized across North Mesa Street. The added benefit of these overpassing frontage road lanes is providing incident / accident management along IH 10 and eliminating a signalized intersection (at IH 10 / North Mesa Street) for IH 10 travelers routing to / from Thorn Avenue (the cross-street north of North Mesa Street that also intersects IH 10). If planned and designed, these overpassing roads can also be aligned to allow for IH 10 braided ramps between North Mesa Street and Thorn Avenue.

The recommended SPUI solutions at IH 10, Resler Drive, and Sunland Park Drive are located at the surface street / cross street level with unsignalized SH 20 / Mesa Street below-ground (signal bypass) lanes underpassing each ground-level signalized SPUI, as opposed to elevating or bridging the SH 20 / Mesa Street lanes over and above each SPUI. These below-ground underpassing lanes are recommended for several reasons:

- Residents typically view bridge overpasses as visual clutter and noise generators;
- Overpasses may also be viewed as a "concrete jungle" of concrete columns that in turn may be perceived to compete with the Franklin Mountain backdrop;
- Line of Sight / safety concerns as pedestrians and cyclists must navigate the bridge columns and retaining walls;
- Visual blockage of the retail storefront destinations;
- Below-ground / underpass lanes can be "capped" with aesthetic decks or visual treatments such as public art that soften the hardscape and create a walkable landscaped solution; and
- SH 20 / Mesa Street traveler avoidance of over a dozen signalized SH 20 / Mesa Street intersections which in turn produces travel time savings; a one-way trip along the corridor in year 2040, after installation of the bypass lanes, is forecasted to be reduced by 7 to 23 minutes depending on the travel direction and the peak hour time of travel.

However, the below-ground lanes must be fully studied regarding cost affordability, feasibility, and constructability involving the hydraulic challenges and utility line obstacles. The Signal Bypass Lanes concept is individually discussed in the following section of this Master Plan.

The following alternatives, and combinations thereof, were evaluated for the North Mesa Street / IH 10 interchange as part of the Study's diamond interchange, SPUI, and diverging diamond interchange alternative solution alternatives:

- At-grade Desert North and Desert South (IH 10 frontage roads) intersecting SH 20 / Mesa Street;
- Grade-separating the Desert North and Desert South through movements over SH 20 / Mesa Street;
- Below-ground SH 20 / Mesa Street bypass lanes with surface street (retail access) lanes; and
- A combination of the above involving grade-separating the Desert North and Desert South through movements over SH 20 / Mesa Street and adding below-ground bypass lanes (3-level interchange solution).

Based on providing the least year 2040 delay and optimal LOS, the Study ultimately recommended the 3-level interchange solution at IH 10 / North Mesa Street composed of below ground bypass, a street level SPUI, and overpassing frontage road lanes as a Long-term solution. If the below-ground bypass lanes cannot be accommodated due to various reasons such as hydraulic challenges and impacts, the interchange is forecasted to operate at an acceptable LOS D in year 2040 without the bypass lanes according to the Study's most recently available traffic volume data and 2040 traffic projections.

Continuous Green T Intersection

A Continuous Green T intersection is an alternative T-intersection design. It provides free-flow operations in one direction on the arterial and reduces the number of approach movements that must stop at a traffic signal. It is best suited for an intersection with heavy through traffic volumes on the major arterial. This intersection produces increased traffic flow efficiency by reducing the number of signalized traffic movements and thereby reducing the stop (red light) condition timing for the movements that are signalized. The dominant heavy through-movement direction of travel on the arterial is free-flow which provides more green time to the other movements at the intersection and thereby reduces delay at the intersection and overall corridor travel times.

The Long-Term recommended location for a continuous Green T intersection is at SH 20 / Mesa Street and Executive Center Boulevard intersection. The northbound Mesa Street movement would be free-flow (green light) until the pedestrian call button (crosswalk beacon) is activated by a pedestrian at the Mesa Street crosswalk south of Executive Center Boulevard. The eastbound left-turn vehicles from Executive Center Boulevard would merge onto northbound Mesa Street from dedicated left-turn lanes. The u-street / cul-de-sac located within the Mesa Street horizontal curve and east of the Executive Center Boulevard / Mesa Street intersection is recommended to be closed for safety concerns due to the free-flow northbound Mesa Street movement passing the u-street within the SH 20 / Mesa Street horizontal roadway s-curve. Because of prior vehicle crashes that included a fatality, the horizontal curvature at this location is also recommended to be flattened.

Continuous Flow Intersections (CFIs)

Continuous flow intersections (CFIs) are similar to DDIs, in that the left-turns cross over to the opposite side of the major road. In advance of a CFI, left-turns make a signalized movement across opposing traffic to a slip lane, and make a free right-turn at the intersection to complete the left-turn movement. At the actual intersection, only through and right-turn movements are allowed.

CFIs reduce conflict points at each intersection and provide free movements intended to reduce delay. They require additional signalization and increased operational complexity, along with additional (broader width) right-of-way requirements. Although considered and evaluated, CFIs are not recommended at any SH 20 / Mesa Street intersection.

Roundabouts

Roundabouts require traffic to circulate counterclockwise around a center island. Roundabouts typically have raised splitter islands to channel approaching traffic to the right. Like other innovative intersections, conflict points are reduced. This enhances safety as compared to a signalized intersection. Roundabouts

are intended to moderate traffic speed, which adversely affects progression on major arterials such as SH 20 / Mesa Street. They are less expensive to operate than traffic signals and typically can provide the opportunity for landscaping and street furniture.

Often, additional right-of-way (ROW) clips are required at the corners of existing intersections retrofitted with roundabouts. Roundabouts are an option for intersections with traffic volumes below the threshold for signalization. TxDOT currently operates a double roundabout on Alameda Avenue and Paisano Drive (US 62) near downtown El Paso.

A mini-roundabout is recommended as a Mid-Term improvement at the Mesa Street / 9th Avenue intersection, north of Loop 375 where the traffic volumes in the future are expected to be lower upon completion of TxDOT's Border West Highway project which diverts a significant portion of traffic away from the 9th Street intersection. However, roundabouts are not recommended by the Study along any other SH 20 / Mesa Street segments due to the corridor's high traffic volumes (ranging from 30,000 to 50,000 ADT), as well as the following mobility and safety-related reasons:

- Traffic volumes and the required lanes to serve the volumes exceed the roundabout capacity limits at the major intersections, even if SH 20 / Mesa Street was grade-separated (crosses under the street level roundabout);
- LOSs at major intersections, such as those along SH 20 / Mesa Street, deteriorate under a roundabout alternative due to the high-volume cross street through and turning movements;
- A roundabout located on a coordinated signal-timed corridor disrupts the timing coordination since it brings randomness to vehicle arrivals at the corridor's upstream and downstream signalized intersections; and
- As a major state highway, SH 20 / Mesa Street serves as an alternate route to IH 10 and therefore roundabouts located along this highway would not efficiently accommodate any type of planned and unplanned detour traffic demand.

Signal Bypass Lanes

Signal Bypass Lanes require grade separations at the signalized intersections that serve to reduce congestion, increase capacity, and improve safety. This type of interchange allows the major, high volume roadway traffic to move unsignalized either below or above a cross-street or series of cross-streets. As previously described within the *INTERSECTION* portion of this Master Plan, below-ground signal bypass lane locations recommended by the Study as Long-term solutions located at the intersections of IH 10 and North Mesa Street (spanning from Crossroads Drive and Belvidere Street), Resler Drive and Mesa Street, and Sunland Park Drive / Shadow Mountain Drive and Mesa Street.

Below-ground signal bypass lanes allow the major traffic volume to flow unsignalized without any cross street or pedestrian interaction / conflicts with vehicles. In this regard, SH 20 / Mesa Street bypass lanes are also recommended as a Long-term pedestrian safety solution near UTEP and spanning from south of Gregory Avenue to north of Kerbey Avenue. Although these specific bypass lanes are not necessary to achieve optimal LOSs along SH 20 / Mesa Street near UTEP they may allow insertion of a pedestrian deck plaza above the SH 20 / Mesa Street bypass lanes which in turn can improve the safety of daily and special event foot traffic near the UTEP campus where prior Mesa Street pedestrian fatalities have occurred. This plaza could be a staged solution as funding allows and enhanced aesthetically with the UTEP pickaxe accent logo / theme. If this plaza is not installed, the bypass lane solution would still allow pedestrians to cross over the underpassing SH 20 / Mesa Street signal bypass lanes via the Glory Road, Cincinnati Avenue and Robinson Avenue cross-streets. These cross-streets would remain operational as desired, per TxDOT, City and stakeholder coordination and depending on how best to design the plaza as a fully

functional pedestrian amenity. If the cross-streets remain operational, pedestrians would walk along each of cross street sidewalk from one side of Mesa Street to the other side, unencumbered by the underpassing (below-ground) and unsignalized Mesa Street bypass lane traffic.

Corridor

Short-term SH 20 / Mesa Street overall corridor recommendations include:

- Pavement (travel lane) marking upgrades; and
- IH 10 “ALT” and “EAST” route directional signage at Franklin Avenue in downtown.

Mid-term SH 20 / Mesa Street overall corridor recommendations include:

- Horizontal and vertical curvature modifications;
- Access Management (removal of redundant driveways and closure of identified median openings);
- Hooded left-turn lane installations at identified median locations.
- Relocating the eastbound IH 10 exit ramp (to North Mesa Street) northward to allow driver access to McClintock Drive and serve as an alternate route to Doniphan Drive (SH 20) and retail sites and thereby avoid and alleviate the Mesa Street signalized intersections;
- Extend Desert Pass Street to the Mesa Street / Belvidere Street intersection;
- Extend Mesa Park Drive to IH 10 (consistent with El Paso MPO); and
- Link Mesa Park Drive and Executive Center Boulevard via a new location arterial (consistent with City of El Paso Thoroughfare Plan).

Long-term SH 20 / Mesa Street overall corridor recommendations include:

- Continuous, standard street luminaires; and
- Upgrade to a “Smart Corridor” or Connected Vehicle / Automated Vehicle (CV/AV) Corridor.

The Mid-term IH 10 ramp relocation, roadway extensions and roadway link listed above are considered key SH 20 / Mesa Street corridor connectivity solutions that can provide alternative travel routes for corridor drivers which in turn can alleviate travel demand on SH 20 / Mesa Street. For example, extending Desert Pass Street north to the Mesa Street / Belvidere Street intersection would improve local connectivity by alleviating the downstream Mesa Street signalized intersections between Belvidere Street and IH 10 by providing an alternate route to / from the Remcon Circle “big box” retail sites and the Sun Metro Westside Transfer Center.

Median Maintenance Vehicle Parking

If installed in the future, low profile, limited native vegetation, such as cacti, may be installed within the SH 20 / Mesa Street median, in contrast to the existing trees and broad shrubs which may limit the driver field of vision (Line of Sight). In light of this, median maintenance (landscaping and debris removal) crews have at times been observed to park their maintenance vehicle within the inside through travel lane along SH 20 / Mesa Street which in turn hinders traffic flow.

Therefore, a Mid-term recommendation is lengthening the left-turn bays to accommodate this parking at identified locations. Coordination and communication would need to occur between the City of El Paso maintenance crews and TxDOT regarding properly parking of the vehicles within these identified left-turn bays as opposed to parking in the through travel lanes. **Figure 15** indicates the left-turn bay lengthening concept that would be required to accommodate the maintenance vehicle parking.

Figure 15 - Median Maintenance Vehicle Parking Zone Concept

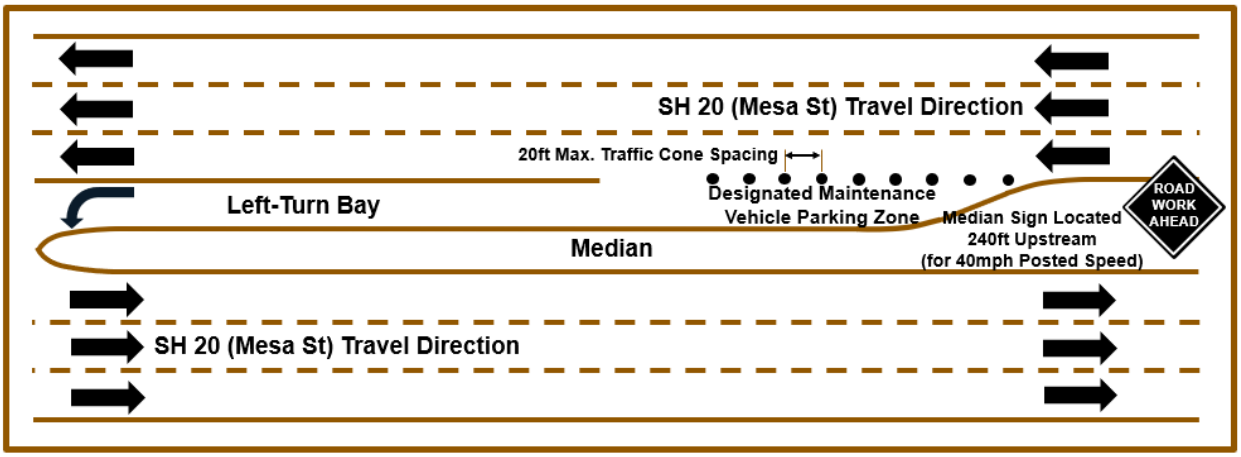


Table 22 identifies the SH 20 / Mesa Street left-turn bay locations where maintenance vehicle parking is recommended in order to maintain the adjacent median or an upstream or downstream median without extensive walking between the medians. Note that these identified locations are partly based on 1) the existing and maintainable median landscaping anticipated to remain after the recommended Short-term Build Alternative left-turn bay lengthening is implemented, 2) salvaging the existing median landscaping in contrast to displacing the landscaping to allow for maintenance parking upon the median, and 3) not reducing the required left-turn bay lengths needed to achieve proper LOSs and left-turn bay storage. Also note the SH 20 / Mesa Street medians, both striped and raised between Glory Road and Loop 375, do not allow for left-turn bay lengthening to accommodate the maintenance vehicles due to the absence of medians to be maintained and due to the left-turn bay storage lengths required to accommodate non-maintenance vehicle storage.

Table 22 - Potential Median Maintenance Vehicle Parking Zone Locations

MEDIAN MAINTENANCE VEHICLE PARKING LOCATIONS
SOUTHBOUND MESA STREET LEFT-TURN BAY LOCATIONS (north to south)
Belvidere Street
Alto Mesa Drive
Thunderbird Drive
Mesa Hills Drive
Camelot Heights Drive
Waymore Drive
Left-Turn Bay north of Sun Bowl Drive
Kern Drive
NORTHBOUND MESA STREET LEFT-TURN BAY LOCATIONS (south to north)
Kern Drive

Brentwood Drive
Castellano Drive
Paragon Lane
Confetti Drive
Crestmont Drive
Camille Drive
Alto Mesa Drive
Brentwood Drive
Belvidere Street
Crossroads Street

Pedestrian and Bicycle

At various locations within the SH 20 / Mesa Street corridor, sidewalks are in poor condition, hampered by utility-related obstacles, or may not be Americans with Disabilities Act (ADA) compliant. Intersection crosswalk markings are also weathered or do not exist depending on the corridor intersection location. Also hampering the sidewalk flow and walkability is the existence of driveways that have been densely added over the course of the part decades due to ongoing development along SH 20 / Mesa Street.

The SH 20 / Mesa Street vertical and horizontal curves pose navigation challenges for all modes of transportation. Public meeting comments noted cyclists trekking uphill can hinder traffic flow behind the cyclists. The constrained ROW and multiple retail drives, cross-streets, and turning movements preclude insertion of bike lanes. And narrowing the SH 20 / Mesa Street lanes to create a bike lane is not considered safe since eighteen fatalities have occurred over the past seven years within the existing full width SH 20 / Mesa Street lanes. Relatedly, the City of El Paso Bike Plan designates a Shared Use Path parallel to SH 20 / Mesa Street. As a means of possibly accommodating this Path, this Study recommends that ten-foot wide Shared Use Path segments be installed at select locations adjacent to the eastbound / southbound SH / Mesa Street travel lanes to accommodate and link the City's Bike Plan routes within the SH 20 / Mesa Street corridor, similar to how the Study has aimed to accommodate the City Thoroughfare Plan and local, planned MPO Mobility Plan planned roadway improvements. These conceptual Paths are located where ROW currently appears reasonably attainable, as opposed to other Mesa Street locations which are highly developed and constrained by abutting buildings, bus stop pavilions, or retail parking spaces. The Mid-term and Long-term recommendations for the Shared Use Paths along SH 20 / Mesa Street are listed below and mapped on the February 2018 Public Meeting Exhibit Boards in the form of bike route map and located in **Appendix G (February 2018 Public Meeting Exhibit Boards of Draft Recommendations)**.

The City Bike Plan also designates Bike Routes along the cross-streets that intersect SH 20 / Mesa Street. These bike routes could potentially link the recommended Shared Use Path segments to create continuous (generally north-south) passage (linked routes) through the SH 20 / Mesa Street corridor.

Short-term recommendations include:

- Intersection ADA sidewalk/ramp, crosswalk, and stop bar upgrades throughout the corridor alongside pavement (travel lane) markings;
- Mesa Street median safety rail at Champions Place near Coronado High School including 10-feet wide crosswalks;
- Mesa Street raised median with safety rail between Baltimore Drive and Cincinnati Avenue, and north of Baltimore Drive, including 10-foot wide crosswalks and removal of the existing mid-block crosswalk north of Glory Road;
- "Pedestrian Scramble" signal timing at Mesa Street / University Avenue and at Mesa Street / River Avenue; and
- Montecillo Boulevard sidewalk installation, 10-foot wide crosswalks, ADA-accessible wheelchair ramps, and cut-through median refuge.

Mid-term recommendations include:

- 10-foot wide Shared Use Path from Doniphan Drive (SH 20) to Resler Drive, and from Sun Bowl Drive to Glory Road;
- Expanded sidewalks and perimeter sidewalk safety rails between Baltimore Drive / Glory Road and Cincinnati Avenue; and
- Retaining Wall relocation at the Mesa Street / River Avenue intersection.

Long-term recommendations include:

- 10-foot wide Shared Use Path from Executive Center Boulevard to Brentwood Avenue; and
- Below-ground Mesa Street Signal Bypass lanes near UTEP (beneath Baltimore Drive / Glory Road, Cincinnati Avenue, and Robinson Avenue).

The Study also proposes SH 20 / Mesa Street sidewalk safety rails and median safety rails near the UTEP / Glory Road vicinity and along SH 20 / Mesa Street near the Coronado High School crosswalk. These safety rails can prevent jaywalking and mid-block pedestrian crossings by providing a barrier that channelizes the pedestrian to the nearby signalized intersection / designated crosswalk. Additional pedestrian modifications recommended at Mesa Street and Champions Place near Coronado High School include 10-foot wide crosswalks, ADA-accessible wheelchair ramps, sidewalk expansion, and non-curb cut-through median (pedestrian) refuge.

During this Study, a pedestrian fatality occurred at the SH 20 / Mesa Street and River Avenue intersection. Because the retaining wall at the northwest quadrant of the intersection appears to hamper the line of sight, it is recommended to relocate this wall further away the street curb to improve the line of sight for both drivers and pedestrians along River Avenue. In addition, both this location, and the Glory Road intersection, are candidate sites to install in-ground pavement lighting as a means to further increase pedestrian safety. Because this type of lighting may involve maintenance regularity and feasibility challenges and subjected to potential traffic volume damage, this Plan suggests the selection of a pilot SH 20 / Mesa Street location to install the lighting and assess its merits regarding future installations at other SH 20 / Mesa Street intersection locations that involve considerable volumes of pedestrians crossing SH 20 / Mesa Street.

Accessible Pedestrian Signals (APS) are recommended at all the SH 20 / Mesa Street traffic signals with those with high pedestrian intersections and near UTEP and within downtown being the high priority locations. APS help the visually handicapped, senior citizens and children cross intersections safely. They produce a separate and distinctive sound for both North / South and East / West crossings.

As stated in the 2011 Texas Manual on Uniform Traffic Control Devices (TMUTCD), pedestrian hybrid beacons (PHBs) are "a special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk." PHBs are appropriate for marked crosswalks where traffic signal warrants are not met, or a traffic signal warrant is undesirable. Pedestrians are provided a protected phase, during which conflicting traffic must stop. The PHB can be coordinated with other signals on the corridor to maintain platooning and coordinated signal timing. The City of El Paso currently operates two PHBs on Schuster Avenue adjacent to the UTEP campus. Although not currently recommended by the Study, any future PHB proposed for the corridor must meet specific warrants before the device is allowed to be installed.

A scenic pedestrian bridge concept was also evaluated to cross Mesa Street near Coronado High School and link the City of El Paso's Bike Plan routes near Lamka Park to the north and Resler Canyon to the south. In doing so, this bridge would also provide safer student, patron, neighborhood access to the retail / food sites south of Mesa Street. Although this is not a currently recommended pedestrian movement solution, a Pedestrian Bridge White Paper was prepared and is included in **Appendix C (White Papers)**.

EXCLUSIVE PEDESTRIAN PHASES

Exclusive pedestrian signal timing phases, also known as "pedestrian scrambles", enable pedestrians to make any movement across a signalized intersection without vehicle conflicts. Locations with very high pedestrian volumes, such as Mesa Street and University Street with over 120 pedestrians / hour can benefit from having one exclusive pedestrian phase instead of a pedestrian phase concurrent with each vehicle phase. An additional potential location for an exclusive pedestrian phase is at SH 20 / Mesa Street and River Avenue if the grading of Mesa Street at this location complies with ADA sloped path standards. Pedestrian safety and mobility can be improved, and vehicular operations can be improved if the exclusive pedestrian phase is shorter than the sum of separate pedestrian phases. Specific timing plans for special events can be developed, if exclusive pedestrian phases are not desired at all times.

The intersection of Mesa Street and San Antonio Avenue currently operates under an all-pedestrian signal timing phase. The recommended Short-term alternative is conversion to typical pedestrian phasing that operates simultaneously with the vehicular phases. This intersection has limited ROW, narrow width streets, city-desired parallel parking, and adjacent historic buildings that limit accommodation of other traffic flow improvement such as installation of through and turn lanes. Retaining the pedestrian phasing at this location will continue to worsen the LOS at this intersection.

PEDESTRIAN HYBRID BEACON

As stated in the 2011 Texas Manual on Uniform Traffic Control Devices (TMUTCD), pedestrian hybrid beacons (PHBs) are "a special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk." PHBs are appropriate for marked crosswalks where traffic signal warrants are not met, or a traffic signal is undesirable. Pedestrians are provided a protected phase, during which conflicting traffic must stop. The PHB can be coordinated with other signals on the corridor to maintain platooning and coordinated signal timing. The City of El Paso currently operates two PHBs on Schuster Avenue adjacent to the UTEP campus. Potential locations could be next to high-volume Brio bus stops. Any proposed / future PHB added to the corridor must meet specific warrants before the device is allowed to be installed. This recommendation could be implemented in the Short-term.

Transit

Sun Metro has existing transit services operating along the Study corridor, including but not limited to, the SH 20 / Mesa Street Brio BRT service. The SH 20 / Mesa Street Brio is running in mixed traffic. Increases

in traffic congestion will affect transit operations and may require future consideration of a dedicated transit lane. The existing traffic signals along the Brio route are equipped with a bus priority signal system that should continue to be maintained.

ITS enhancements should consider improving the LOS and providing real time travel information including travel times and notifications of traffic lane closures, due to incidents etc. This information is useful for transit operations by helping reroute traffic during incidents and by providing reliable mobility to transit users. Sun Metro has the following major, planned improvements along SH 20 / Mesa Street:

- Downtown Terminal Improvements ($650,000 estimated cost);
- Montecillo Outbound Station and Pedestrian Enhancements ($550,000 estimated cost); and
- Repair/Rehab of BRIO Station Lights ($500,000 estimated cost).

It is currently considered acceptable to Sun Metro if TxDOT or the City of El Paso installs and maintains traffic cameras at the Brio bus stops along SH 20 / Mesa Street to monitor traffic.

TRANSIT CONNECTIVITY

This Study recommends improved the connectivity to the Westside Transfer Center near Mesa Street and Remcon Circle. The recommended Mesa Street traffic signal bypass lanes allow the Sun Metro buses to bypass various major intersection traffic signals along SH 20 / Mesa Street from south of Gregory Avenue to north of Kerbey Avenue and between Crossroads Drive and Belvidere Street near IH 10 / North mesa Street. In contrast, if the buses elect to not utilize the bypass lanes and instead traveled the upper surface streets, these streets and associated signals navigate the buses and other vehicles at a much more efficient and effective level of service since the bypass lanes eliminate a considerable volume of vehicles out of each signalized intersection where a bypass lane is recommended.

SUN METRO BUS QUEUE JUMPING LANES

Bus queue jumping lanes provide an advance signal phase for buses (typically in a right-turn lane that exempts the buses from turning right) to jump the traffic queue at the signal and start at the front of the vehicle platoon. By traveling at the front of the platoon within these queue-jumping lanes, the bus has a more reliable and efficient travel time traversing between bud stops as opposed to idling in a queuing through movement lane. This type of improved and reliable bus service also encourages bus ridership and to some degree may reduce non-transit vehicular volumes along SH 20 / Mesa Street.

Bus queue jumping lanes are the most beneficial at locations where high-ridership buses must traverse congested signalized intersections. Listed below are recommended Short- and Mid-term bus queue jump locations. Short-term recommendations are low-cost and involve updated signing and pavement markings within the existing ROW. These also include the installation of right-turn signal heads for the efficient flow of both bus and no-bus vehicles. Short-term recommendations are those that could be implemented with minimal improvements. Mid-term recommendations involve removing channelized right-turns or adding a dedicated right-turn lane where currently the rightmost lane is a shared through-right lane, and each location may also require ROW acquisition.

Short-term recommendations for bus queue jumping lanes are located as follows:

1. Southbound & Northbound Mesa Street at Resler Drive;
2. Northbound Mesa Street at Sunland Park Drive / Shadow Mountain Drive;
3. Southbound Mesa Street at Mesa Hills Drive;
4. Northbound Mesa Street at Festival Drive;
5. Southbound Mesa Street at Argonaut Drive;

6. Southbound & Northbound Mesa Street at Executive Center Boulevard;
7. Southbound Mesa Street at Sun Bowl Drive / Mesita Drive; and
8. Southbound Mesa Street at Glory Road / Baltimore Drive.

Mid-term recommendations include bus queue jumping lanes at the following locations that currently have a shared through / right-turn lane:

1. Southbound Mesa Street at Doniphan Drive (SH 20);
2. Northbound Mesa Street at Remcon Circle;
3. Southbound Mesa Street at Sunland Park Drive / Shadow Mountain Drive;
4. Southbound Mesa Street at Festival;
5. Northbound Mesa Street at Castellano Drive;
6. Northbound Mesa Street at Brentwood Avenue;
7. Northbound Mesa Street at Sun Bowl Drive / Mesita Drive; and
8. Northbound Mesa Street at Glory Road / Baltimore Drive.

Mid-term recommendations include bus queue jumping lane at the following locations that currently have a channelized right-turn lane:

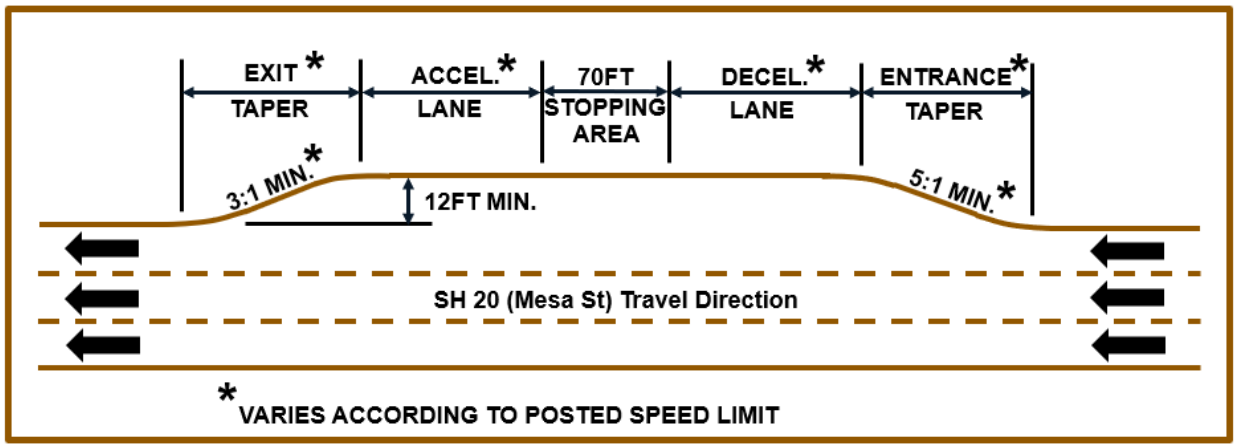
1. Northbound Mesa Street at Doniphan Drive (SH 20);
2. Southbound Mesa Street at Remcon Circle;
3. Northbound Mesa Street at Mesa Hills Drive;
4. Northbound Mesa Street at Argonaut Drive; and
5. Southbound Mesa Street at Castellano Drive.

SUN METRO BUS PULL-OUT LANES

Long-term transit-related solutions recommended by the Study are dedicated bus pull-out lanes. These lanes allow the non-bus vehicles in the SH 20 / Mesa Street through lanes to traverse the corridor unencumbered, thereby mitigating safety at high crash locations involving buses or bus stops by separating the slower moving bus from the non-bus vehicles.

Due to the AASHTO bus pull-out (total length) length requirements of generally 1,000 feet to 1,300 feet, pursuant to suggested guidance received from Sun Metro, these pull-out lengths would conflict with the limited ROW width and the nearby parking lots, driveways and cross-streets. However, bus pull-out locations for each Brio and regular bus stop location along SH 20 / Mesa Street have been identified and recommended by this Study which would likely require design exceptions to the AASHTO pull-out lengths in order to install the lanes. **Figure 16** below indicates the basic pull-out lane concept and transition elements such as tapers that would be required at each bus stop.

Figure 16 - Bus Pull-Out Lane Concept



If installed (pursuant to any required and approved design exception lengths) the bus pull-outs would, to varying degrees, impact the adjacent private property sites, access drives and the existing bus pavilions. The pull-out configurations and locations would be compliant with ADA requirements such as pads for wheelchair ramps / lifts. View the recommended bus pull-out locations and tabulated specifics associated with installing the pull-outs, such as property impacts, in **Appendix B [Bus Stop Pull-out Lane Matrix (Locations & Preliminary Cost Estimate)]**.

ITS (Intelligent Transportation System)

Short-term recommendations include:

- Bluetooth camera surveillance;
- Speed feedback signs; and
- Video Imaging Vehicle Detection System (VIVDS).

Mid-term recommendations include:

- Dynamic Message Signs; and
- Cellular modem/wireless links to TxDOT TransVista.

Long-term recommendations include:

- 144-count fiber along SH 20 / Mesa Street from Doniphan Drive to Loop 375;
- Connecting City of El Paso cameras to TxDOT's LoneStar system; and
- Smart Corridor along SH 20 / Mesa Street.

Bluetooth for Traffic Surveillance

Bluetooth radios can be installed at existing traffic signal cabinets for traffic surveillance at strategic locations. The objective of these devices is to monitor traffic flow using unique descriptor IDs from Bluetooth enabled devices. These devices would be located at entry and exit points of key corridor segments, such as at Doniphan Drive (SH 20), Desert South / North Boulevard (IH 10 Frontage Roads), Sunland Park Drive / Shadow Mountain Drive, Executive Center Boulevard, Sun Bowl Drive / Mesita Drive, Wyoming Avenue, and Yandell Drive. This recommendation is deemed as a short-term improvement.

MICROWAVE VEHICLE DETECTORS

Microwave vehicle detectors can be installed at midblock locations to continuously count and monitor traffic volumes. This could be implemented in the Short-term.

VIDEO IMAGING VEHICLE DETECTION SYSTEM (VIVDS)

VIVDS are recommended along SH 20 / Mesa Street at all the signalized intersections, except where they currently exist and at the signalized intersections in downtown where each signal is pre-timed and thus VIVDS is not needed. VIVDS is recommended along the side streets at the major signalized intersections: Doniphan Drive (SH 20), Desert South / North Boulevard (IH 10 Frontage Roads), Resler Drive, Sunland Park Drive / Shadow Mountain Drive, Executive Center Boulevard, and Sun Bowl Drive / Mesita Drive.

CLOSED CIRCUIT TELEVISION (CCTV)

Closed-circuit television (CCTV) is used to monitor traffic flow or other events from a remote location. Benefits include immediate information on roadway conditions, monitoring traffic flow during special events, and incident identification and management. CCTV could be implemented in the short-term. Below is the list of intersections along SH 20 / Mesa Street that currently have CCTV devices:

- Doniphan Drive (SH 20);
- Desert South Boulevard (IH 20 Frontage Road);
- Desert North Boulevard (IH 20 Frontage Road);
- Remcon Circle;
- Resler Drive;
- Camille Drive;
- Sunland Park Drive / Shadow Mountain Drive;
- Mesa Hills Drive;
- Festival Drive;
- Castellano Drive;
- Executive Center Boulevard;
- Brentwood Avenue;
- Sun Bowl Drive / Mesita Drive;
- Glory Road / Baltimore Drive;
- Schuster Avenue; and
- Wyoming Avenue.

Below is the list of City of El Paso cameras not currently on TxDOT's LoneStar system but that could be potentially connected to TxDOT's LoneStar system:

- Kansas Street & San Antonio Avenue;
- Mesa Street & Schuster Avenue;
- Mesa Street & Glory Road;
- Mesa Street & Castellano Drive;
- Mesa Street & Montecillo Boulevard;
- Mesa Street & Festival Drive;
- Mesa Street & Mesa Hills Drive;
- Mesa Street & Camille Drive;
- Mesa Street & Remcon Circle;
- Executive Center Boulevard & Rio Bravo Street;
- Country Club Road & Hunters Glen;
- Country Club Road & Memory Drive;

- Resler Drive & Helen of Troy Drive; and
- Resler Drive & Redd Road.

FIBER CONNECTIONS

One of the long-term recommendations is installing a 144-count fiber along SH 20 / Mesa Street from Doniphan Drive (SH 20) to Loop 375 to maintain a continuous fiber system.

EMERGENCY VEHICLE PREEMPTION

Emergency vehicle preemption (Opticoms) are recommended at locations that currently do not contain them. These enable police cars, ambulances, and fire trucks to navigate congested intersections effectively in an emergency.

SPEED FEEDBACK SIGNS

Speed feedback signs relay real-time speeds to drivers and flash when a vehicle speed exceeds the posted speed limit. Speed feedback signs are typically mounted on or near speed limit signs and can also be mobile units. They are inexpensive, require no design time, and do not slow emergency vehicles. However, an electrical power source or solar power is required, are only effective for one direction of travel, and are subject to vandalism. Potential locations of speed feedback signs along SH 20 / Mesa Street are the approach to the horizontal s-curve at Executive Center Boulevard where prior speeding crashes have occurred. An accompanying recommendation is to flatten the horizontal and vertical curves at designated SH 20 / Mesa Street locations recommended by this Study and that includes the Executive Center Boulevard horizontal curve location.

DYNAMIC LANE REVERSAL

Dynamic lane reversal uses lane control signs above the roadway and specialized pavement markings to change lane assignments. Typical applications include undivided roadways near stadiums and arenas. Dynamic lane reversal provides additional capacity when necessary (e.g. 3 lanes inbound / 1 lane outbound before a traffic-generating event and 1 lane inbound / 3 lanes outbound after the event), without overbuilding a section solely to handle relatively infrequent events. Dynamic lane reversals were considered along he SH 20 / Mesa Street corridor, such as south of Glory Road for special event traffic. However, these reversals which rely heavily on driver familiarity, and justification via traffic demand directional distribution, are not recommended along SH 20 / Mesa Street foremost for the reason that regular lane reversals would pose a safety concern due foremost to possible wrong way driving.

ARTERIAL DYNAMIC MESSAGE SIGNS

Arterial dynamic message signs (DMS) are a means of communicating with motorists while on the transportation network. By providing timely messages about traffic conditions, the City will ideally be able to proactively manage traffic congestion by advising motorists to use alternate transportation corridors to minimize motorist delays and the corresponding travel time. DMS applications are also useful in identifying alternate transportations corridors for rerouting freeway traffic. DMS play an essential role in instructing motorists along specific routes for emergency evacuations, thereby providing additional support for disaster type situations.

Standardized messages can convey information to drivers including safety, roadway closures, delay information, emergency messages (including AMBER alerts), test messages, and public service announcements. The SH 20 / Mesa Street corridor is planned to be a Smart Corridor. The ITS elements, including DMS signs shown are generically presented as a concept. ITS locations are subject to change. Preliminary arterial dynamic message signs are recommended at the following locations:

- Mesa Street approaching Doniphan Drive (SH 20) in both directions;
- Mesa Street approaching Desert South / North Boulevard (IH 10 Frontage Roads) in both directions;
- Mesa Street approaching Resler Drive in both directions;
- Mesa Street approaching Sunland Park Drive in both directions;
- Mesa Street approaching Executive Center Boulevard in both directions; and
- Mesa Street approaching Rio Grande Avenue in the southbound direction and approaching Franklin Avenue in the northbound direction, north of Main Street.

Depending on the DMS location within the corridor, it may be necessary to acquire the necessary ROW to locate a specific DMS sign. The arterial DMS signs could be aesthetic designs that are context sensitive to the SH 20 / Mesa Street corridor.

VEHICLE TO INFRASTRUCTURE (V2I) COMMUNICATIONS

Vehicle to Infrastructure (V2I) communications, such as signal phase and timing (SPaT) data, communicate between vehicles and infrastructure using several methods, including Dedicated Short-Range Communications (DSRC). Broadcasting this information to vehicles can lead to improved traffic operations on the corridor, for example, confirming priority calls from a bus or instructing drivers when a signal is about to turn yellow. This improvement is deemed Mid-term to Long-term improvement.

SMART CORRIDOR

A long-term recommendation for SH 20 / Mesa Street is developing the corridor as a Smart Corridor. A Smart Corridor uses technology and partnerships to manage the SH 20 / Mesa Street corridor as system, provide quality information to travelers, and maximize corridor capacity using technology. SH 20 / Mesa Street could also be converted into a Connected Vehicle/Automated Vehicle (CV/AV) Pilot Test Corridor. The CV/AV concepts would reshape SH 20 / Mesa Street using the power of data, technology, and creativity to efficiently move people and freight throughout the corridor. This would include the latest technologies for vehicle-to-infrastructure and vehicle-to-vehicle applications. This recommended mitigation is regarded as a Long-term solution.

Connected, smart street lights that can be remotely monitored are recommended as part of the long-term solutions. Smart street lights can be used as a platform for ancillary uses, such as for mounting security cameras, wi-fi, vehicle or pedestrian detection, etc.

DRAINAGE

Flooding due to storm runoff remains a concern at identified locations along the SH 20 / Mesa Street corridor. Although this Traffic Engineering and Planning Study did not undertake a drainage study or drainage capacity assessments, the Study Team did meet with El Paso Water Utilities and TxDOT Area Office maintenance crews to identify drainage / runoff location concerns along the corridor. These locations are identified in **Appendix J (Public & Stakeholder Meeting Notes)** within the El Paso Water Utilities Meeting Notes, as well as located in **Appendix A (Diagrammatic of Final Recommendations)**.

Ideally, the drainage / flooding concerns would be addressed as each Mid-term and Long-term Build Alternatives and which requires major roadway reconstruction and involve underlying drainage capacity upgrades and installs. For example, one flood-prone location is at Brentwood Avenue which releases runoff onto and across all six lanes of SH 20 / Mesa Street before discharging into an adjacent open / drop culvert along southbound SH 20 / Mesa Street. Reconstructing this segment of the corridor, per the Study's Long-term recommendations involving the Executive Center Boulevard / Mesa Street intersection and horizontal roadway curvature should also address the Brentwood Avenue runoff / flooding. One solution suggestion is the installation of curb inlets along Brentwood Avenue and along the SH 20 / Mesa Street median which can control or potentially eliminate roadway flooding.

UTILITIES

The Study Team contacted utility companies and related offices and produced an Existing Utilities Mapping which is located in **Appendix E (Existing Utilities Coordination Contact Lists & Mapping)** and which includes the utility offices contacted and the responses from each. It is noted this Study did not perform any Subsurface Utility Engineering (SUE) to produce the Mapping. Instead, past utility maps available were compared to the information from the responding offices to produce the Mapping, as well as relying on past utility-related information available such as the SH 20 / Mesa Street as-builts and the utility information received from the responding utility contacts / offices.

RIGHT-OF-WAY ACQUISITION AND RIGHT-OF-WAY ENCROACHMENT LOCATIONS

Any required private property land acquisition [proposed right-of-way (ROW)] necessary to install a particular SH 20 / Mesa Street Study recommendation would be determined as part of the National Environmental Policy Act (NEPA) environmental studies, design surveys, and design schematic phases undertaken to plan, design and construct the recommendation.

In regards to the existing (State of Texas-owned) ROW along the SH 20 / Mesa Street corridor, this Study has identified corridor sites where retail parking lots appear to encroach or overlap the existing ROW, based on currently available survey data files. Therefore, it is recommended the existing ROW limits be surveyed and scrutinized at each identified site to fully determine if an encroachment exists. Each encroachment location, and corresponding encroachment length, are identified in **Appendix A (Diagrammatic of Final Recommendations)** and also listed below (from north to south along the corridor).

- Northeast quadrant of Mesa Street and Bartlett Drive (600 feet);
- Southwest quadrant of Mesa Street and Remcon Circle (100 feet);
- Northeast quadrant of Mesa Street and Belvidere Street 500 feet);
- Between Resler Drive and Belvidere Street (600 feet);
- Southwest quadrant of Mesa Street and Camille Drive (700 feet);

- Northeast and southwest quadrants of Mesa Street and Castellano Drive (200 feet); and
- Northeast and southeast quadrants of Mesa Street and Waymore Drive (400 feet).

SH 20 / MESA STREET DIAGRAMMATICS OF BUILD ALTERNATIVE RECOMMENDATIONS

The previously listed and described Final Recommendations to improve and upgrade the SH 20 / Mesa Street corridor are graphically / visually presented in **Appendix A (Diagrammatic of Final Recommendations, etc.)**. These graphical solutions are conceptual and subject to future, more detailed SH 20 / Mesa Street schematic designs, NEPA studies, and traffic volume forecast / projection studies.

Also noted on the Diagrammatics are improvements related to hydraulic upgrades based on field observations, public feedback and input from TxDOT Area (maintenance and construction) Offices. However, these improvements are subject to future schematic design-related hydraulic studies and beyond the scope of this Study and thus are not specifically cost estimated, but rather estimated via upcharge percentages within the Study's cost estimation tables.

SH 20 / MESA STREET PRELIMINARY COST ESTIMATES FOR BUILD ALTERNATIVE RECOMMENDATIONS

The previously listed and described Short-, Mid- and Long-term SH 20 / Mesa Street Final Recommendations to improve and upgrade the SH 20 / Mesa Street corridor have been prioritized, preliminarily cost estimated and presented on the cost estimation spreadsheets in **Appendix D (Preliminary Cost Estimate Spreadsheets for Final Recommendations).**

It is noted this Study and the preparers of the estimations do not control the cost of labor, materials, equipment, or the eventual Contractor's methods of determining prices or other competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to the Study Team at the time of this Study and represent the team's judgment as design professionals familiar with the construction industry and in combination with past and current statewide and local (TxDOT El Paso District) bid prices.

Table 23 summarizes the Short-, Mid- and Long-term preliminary cost estimate totals for SH 20 / Mesa Street Final Recommendations in year 2022, 2030, and 2040 dollars, respectively. The Short-term recommendations are forecasted to be implemented within the next five years, Mid-term recommendations within the next ten years, and Long-term recommendations within the next twenty years. For preliminary cost estimate details for each recommended SH 20 / Mesa Street individual element, access the preliminary cost estimate White Papers located in **Appendix C (White Papers)**.

Table 23 - Preliminary Cost Estimates for Final Recommendations

Preliminary Estimated Costs for SH 20 / Mesa St. Corridor		
Build Recommendation[1]	Cost Estimate Year	Total Estimated Cost
Short-Term (implemented within 5 yrs)	2018	$5,600,000
	2022 [2]	$6,400,000
Mid-Term (implemented in 5-10 yrs)	2018	$46,000,000
	2030 [2]	$69,500,000
Long-Term (implemented in 10-20yrs)	2018	$258,000,000 [3]
	2040 [2]	$549,900,000 [4]

[1] See Appendix for Build Recommendation itemized costs

[2] w/ assumed 3.5% annual inflation rate

[3] Glory Rd Pedestrian Deck Plaza Break-Out Cost (2018): $37,255,266
Bus Stop Pull-out Lane Break-Out Cost (2018): $15,105,649

[4] Glory Rd Pedestrian Deck Plaza Break-Out Cost (2040): $79,410,031
Bus Stop Pull-out Lane Break-Out Cost (2040): $32,197,866

ADDITIONAL SH 20 / MESA STREET STUDY DATA

In addition to the previously referenced SH 20 / Mesa Street Diagrammatic, and cost estimations prepared for the SH 20 / Mesa Street Recommended Build Alternative, the Study also generated:

- Existing Utilities Mapping;
- VISSIM Traffic Simulation Videos for the major intersection Long-term Build Alternatives;
- Measures of Effectiveness Alternative Evaluation Matrices;
- Architectural Renderings / Concepts for the Study's various Build Alternative elements; and
- A Pedestrian Bridge White Paper summarizing a currently non-recommended pedestrian bridge concept near Coronado High School.

The above items are located in the **Appendices** with the exception of the Videos which are on file at the TxDOT El Paso District Office. In place of the lengthy videos, select screen captures from the Videos have been inserted into **Appendix A [Video VISSIM (Video Simulation) Screen Captures]**.

The Study also generated a separate Traffic Methodology Memorandum and a Traffic Operational Analysis Report (see **Appendix K**). The voluminous data sheets associated with the Memorandum and the Report, as well as the previously stated Data Collection and Mobilization Report, are not included in **Appendix K**, but are instead on individually filed in each document at the TxDOT El Paso District Office.

ADDITIONAL CONCEPTS EVALUATED

During the course of this Study, various mobility-related alternatives were evaluated and screened, but not ultimately recommended for the Build Alternative. These non-recommended alternatives are documented in **Appendix H (Measures of Effectiveness Evaluation Matrices / Maps)**.

Assessment and feedback on the non-recommended alternatives were gathered from a variety of sources that included the Study's Agency Working Group Meetings and Public Meetings, individual Study Team meetings with TxDOT staff, consultants managing adjacent TxDOT studies involving IH 10 and Doniphan Drive (SH 20), the City of El Paso, El Paso County, Sun Metro, El Paso Water Utilities, UTEP, and internal Study Team / TxDOT coordination meetings.

The non-recommended alternatives are categorized as follows:

Mesa Street Alternatives

- Additional Mesa Street travel lanes;
- Mesa Street - Stanton Street 1-way street Couplet;
- Mesa Street - Oregon Street 1-way street Couplet;
- Roundabouts at Mesa Street cross-streets including San Antonio Avenue in downtown; and
- Reversible Mesa Street Lanes serving the predominate peak hour traffic direction.

Roadway Connectivity (to alleviate Mesa Street congestion)

- IH 10 direct access roadway "flyover" links to / from local arterials [Doniphan Drive (SH 20), Osborne Drive, Bartlett Drive, Resler Drive, and / or Desert Pass Street]; and
- Stanton Street and Castellano Drive northward extensions to Splendid Sun Drive.

Pedestrian / Bicycle Alternatives

- Mesa Street Bike Lanes or Bike-Vehicle Shared Lanes;
- Pedestrian Bridge near Coronado High School;
- Pedestrian Tunnel or Pedestrian Bridge near Glory Road / UTEP; and
- Mesa Street / San Antonio Avenue intersection closure and conversion to a Pedestrian (walking) Mall.

Transit Alternatives

- Dedicated bus-only SH 20 / Mesa Street Lanes;
- Light Rail Transit (LRT); and
- Personal Rapid Transit (driverless podcar) system along Sun Bowl Drive linking the Glory Road Transfer Center to strategic UTEP main campus and campus expansion sites and parking lots.

SH 20 / MESA STREET STUDY (PUBLIC & STAKEHOLDER) COORDINATION

The SH 20 / Mesa Street Study was coordinated with various corridor stakeholders, agency staff, and the public. **Table 24** below summarizes the various meeting coordination conducted or participated in by the Study Team.

Table 24 - Public & Stakeholder Coordination

PUBLIC & STAKEHOLDER COORDINATION	COORDINATION DATE(S)
City of El Paso (Study Introduction) Staff Meeting	April 18, 2016
El Paso Metropolitan Planning Office (Study Introduction) Staff Meeting	April 18, 2016
El Paso County (Study Introduction) Staff Meeting	April 27, 2016
El Paso Water Utilities (Study Introduction) Staff Meeting	April 27, 2016
Sun Metro (Study Introduction) Staff Meeting	May 2, 2017
Agency Working Group Meeting No. 1	**May 9, 2016**
Corridor Field Trip w/ TxDOT Area Office / Maintenance Staff	June 15, 2016
UTEP (Study Introduction) Staff Meeting	June 15, 2016
Public Meeting Series No. 1	**August 2, 3 & 4, 2016**
City of El Paso Staff Meeting for Study Limit extension (along City's Mesa Street segment to Loop 375)	December 8, 2016
City of El Paso – City Plan Commission Briefing	January 12, 2017
TxDOT / City of El Paso Build Alternative Workshop	May 16, 2017
Post-Workshop TxDOT / City of El Paso Meeting	June 7, 2017
Post-Workshop TxDOT Internal District Meeting	June 15, 2017
Agency Working Group Meeting No. 2	**September 12, 2017**
Post-Agency Working Group Meeting No. 2 Conference Call Briefing to UTEP	September 22, 2017
Post-Agency Working Group Meeting No. 2 Conference Call Briefing to Frontera Land Alliance	September 28, 2017
TxDOT Internal Briefing on Study Recommendations	November 29, 2017
TxDOT ITS Conf. Call on Study Recommendations	October 30, 2017
Agency Working Group Meeting No. 3	**December 7, 2017**
Public Meeting Series No. 2	**February 6, 7 & 8, 2018**

Each applicable **Table 24** Coordination Meeting Notes, Summary, and Sign-in are located in **Appendix J (Public & Stakeholder Meeting Summaries)**.

In addition to the **Table 24** coordination, various additional daily coordination was conducted by the SH 20 / Mesa Street Study Team with the study teams managing TxDOT's other corridor-related studies including the Doniphan Drive (SH 20) and *Reimagine IH 10* studies.