CENTRAL MESA
LRT EXTENSION

DRAFT ENVIRONMENTAL ASSESSMENT

TRANSPORTATION TECHNICAL REPORT

August 2010

METRO

Central Mesa LRT Extension
Draft Environmental Assessment

Transportation Technical Report

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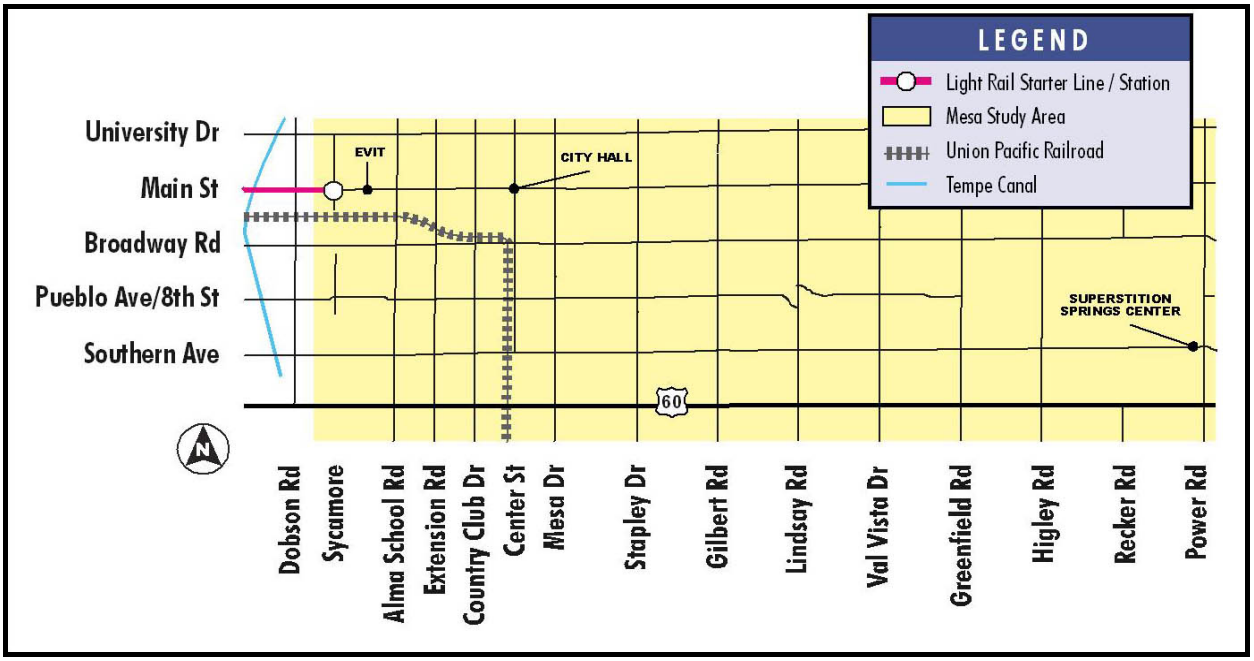
1.0 INTRODUCTION

This Transportation Study technical report is being prepared to support the Environmental Assessment (EA) for high capacity transit improvements being considered in the Central Mesa Corridor. This chapter begins with a short background of the study and a description of the alternatives being considered in the EA.

1.1 STUDY BACKGROUND

The Central Mesa Corridor study area is bounded on the west by the Central Phoenix / East Valley (CP/EV) eastern terminus at Main Street/Sycamore; University Drive to the north; Power Road to the east; and the Superstition Freeway (U.S. 60) on the south (Figure 1).

Figure 1: Central Mesa Study Area



Source: METRO (2009)

A two-tiered alternatives development process was implemented to evaluate the Central Mesa Corridor conceptual alternatives. The first phase (Tier 1) included a conceptual level evaluation that analyzed the advantages and disadvantages of the initial list of potential alternatives to address the transportation needs of the corridor (see separate *Tier 1 Evaluation of Alternatives Report,* October 2007, for more information). The initial alternatives considered both light rail transit (LRT) and bus rapid transit (BRT) modes.

All alternatives began at the eastern terminus of the recently opened LRT Starter Line Station at Main Street/Sycamore and extended east to the Superstition Springs Center area via Main Street (with 1st Street and 1st Avenue suboptions downtown) and Power Road. Fixed guideway (via LRT or BRT) generally extended east to about Horne (between Mesa and Stapley Drives) with BRT offering limited stop express service further east in existing travel lanes (similar to Valley Metro Link) to Superstition Springs Center. LRT consisted of a dedicated fixed guideway with two tracks (one track in each direction) that ran mostly in the middle of the existing street system. BRT also had a dedicated fixed guideway for a portion of the corridor as previously mentioned. The initial alternatives were subject to a "fatal flaw' screening at the Tier 1 phase; the most feasible alternatives were identified and retained for further analysis, and the alternatives deemed unresponsive to Tier 1 evaluation criteria were eliminated from continued study.

The alternatives that remained after the Tier 1 analysis and public, agency, and other stakeholder input were then subjected to a more detailed evaluation (Tier 2). The Tier 2 evaluation continued to consider both LRT and BRT build alternatives. The criteria developed to analyze all of the build alternatives in Tier 2 began to quantify ridership potential, capital and operating and maintenance costs, land use and economic development impacts, traffic issues, environmental factors, conceptual engineering, and public preferences. See the complete *Tier 2 Evaluation of Alternatives Report,* December 2008, which defines the Tier 2 alternatives considered and details the results of the evaluation.

Based on the results of the Tier 2 evaluation, public meetings, and agency and other stakeholder input, the recommended build alternative is to advance light rail transit as the preferred technology and Main Street as the preferred alignment. The locally preferred alternative (LPA) includes a light rail extension on Main Street east to an interim end-of-the-line east of Mesa Drive as Phase 1. See the complete *Recommended Alternative Report*, Draft July, 2009 for discussion of the rationale for selection of the LPA. The Phase 1 project is the major focus of the EA being prepared pursuant to the National Environmental Policy Act (NEPA). The No-Build Alternative will also continue to be considered as specified by NEPA. The Phase 1 project connects logical termini and has independent utility meaning that the project is a reasonable expenditure even if no additional transportation improvements are made in the area.

1.2 BUILD ALTERNATIVE

The LRT Main Street Alternative was selected as the recommended LPA for more detailed analysis in the EA. This LPA recommendation was approved by the City of Mesa City Council (May 2009) and the METRO Board of Directors (June 2009). The LPA has two design options for Main Street in the area east of Country Club Drive: 1) 2 Lanes; and 2) 4 Lanes. The design options are described at the end of this discussion.

Whether to implement the Build Alternative, 2-Lane Option or the Build Alternative, 4-Lane Option will be decided after completion of a series of public workshops, the Draft EA, and receipt of input during the Draft EA public comment period.

The Build Alternative, or LPA, is shown in Figure 2. The Build Alternative includes a double-track LRT guideway that would operate in the center of Main Street from just east of Sycamore to just east of Hobson, a distance of 3.1 miles. LRT is electrically powered and receives its power from overhead power lines within the street right-of-way. LRT operations would include a traffic signal priority system (predictive priority), to allow for faster travel times. The light rail vehicles will be the same as the ones currently being used for the LRT Starter Line. Major operating plan features are listed in Table 1.

TABLE 1: LRT OPERATING PLANS

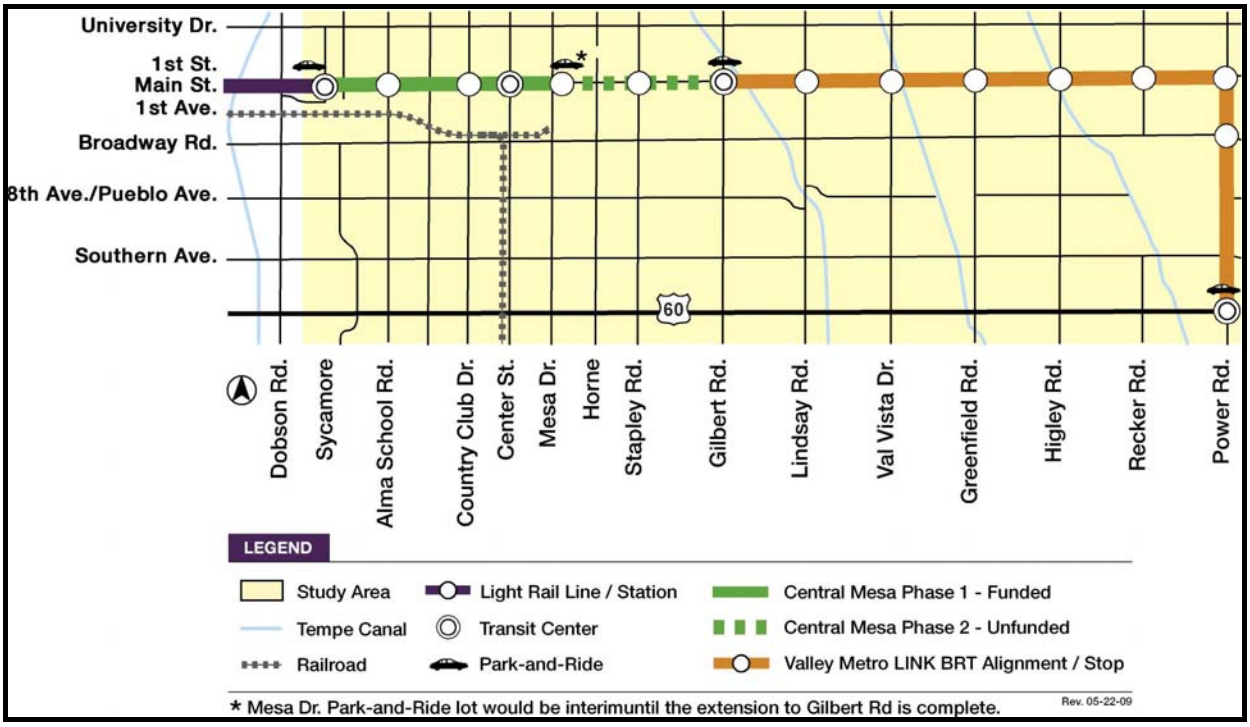
Headways	All day except late evening: Late evening:	10 minutes 20 minutes
Number of Vehicles	42 – LRT Starter Line + Central Mesa LRT Extension 8 – Spare vehicles 50 – Total current fleet	
Line-haul Capacity	2,700 passengers per peak hour per direction (Based on 3 vehicles per train and 150 passengers/vehicle)[1]	
Hours of Operation	Daily = ~20 hours	

[1]Ultimate capacity. LRT operating plans call for 2-car consists during normal operations with 3-car consists operating only during special events or other high periods of demand.

This alternative is an extension of the LRT Starter Line that opened in December 2008 and would provide a seamless connection (no transfer required) from the current eastern terminus of the LRT Starter Line at Sycamore along Main Street to Mesa Drive. Tail tracks would continue east of the station platform a distance of approximately 425 feet east of Hobson.

East of Centennial Way to Superstition Springs Transit Center, the existing Valley Metro LINK BRT would connect to LRT and operate in mixed traffic as it does today as a skip-stop express service. As a result of the Build Alternative, Valley Metro LINK BRT service would be discontinued along Main Street between Sycamore and Centennial Way to eliminate service duplication, and its operational frequency in the off-peak will increase from 30 to 15 minutes. However, service during peak periods will remain the same as today (15 minutes). Other than that, no other changes to the LINK operations or facilities will be necessary for the Phase 1 LRT extension being evaluated in the EA. LRT stations/LINK BRT stops and park-and-ride locations are identified in Table 2. A new park-and-ride facility would be built near the end-of-line LRT station on the northeast corner of Main Street/Mesa Drive. Each LRT station would serve one or more existing or planned bus routes in the area.

FIGURE 2: LOCALLY PREFERRED ALTERNATIVE



Also recommended, as part of the LPA, is a future (Phase 2) extension of LRT to Gilbert Road. This extension would provide enhanced regional transit connections and opportunity for a larger regional park-and-ride facility. At this time, Phase 2 is not identified in the MAG RTP, is unfunded, and is not evaluated in the EA. However, the Phase 2 recommendation has been forwarded to MAG and has been identified as an "illustrative project" for inclusion in the RTP. Should the Phase 2 project move forward as a federal project, it will be subject to NEPA compliance.

Construction of the Build Alternative would include installation of trackwork, an overhead contact system (OCS) for the distribution of electricity to LRT vehicles, traction power substations, and signaling and communication systems.

The LRT transitway would consist of tracks formed of continuously welded rails. The rails would be embedded track supported on a concrete slab.

The OCS would consist of poles, approximately 25 feet tall, installed along the operating right-of-way at intervals from 90 to 170 feet to support the electrical power line. The OCS would be designed to be compatible with visual and aesthetic characteristics of the corridor. The poles would generally be located in the center of the two tracks, wherever possible. In some locations, catenary poles may be located on the side of the LRT trackway with the overhead electrical line suspended over the LRT tracks with head spans.

TABLE 2: STATION AND PARK-AND-RIDE LOCATIONS

Station/Stop	Park-and-Ride	Location[1]
LRT Facilities (Stations)		
Sycamore/Main St. (LRT Starter Line End-of-Line Station)	Yes	East of intersection Existing facility and not attributable to LRT extension
Alma School/Main St.	No	East of intersection
Country Club/Main St.	No	East of intersection
Center/Main St.	No	East of intersection
Mesa Dr./Main St.	Yes	Station—East of intersection Park-and-Ride—Northeast of intersection. A 6.4-acre area of interest identified. Park-and-ride would accommodate approximately 500 vehicles and will not likely require the entire 6.4-acre site. Layout to be determined during final design. The park-and-ride site may have potential market value for transit-oriented development sometime in the future.
Valley Metro Link BRT Facilities (Existing Stops—Facilities not attributable to LRT extension)		
Stapley/Main St.[2]	No	East of intersection
Gilbert/Main St.[2]	No	West/east of intersection
Lindsay/Main St.[2]	No	East of intersection
Val Vista/Main St.[2]	No	West/east of intersection
Greenfield/Main St.[2]	No	West/east of intersection
Higley/Main St.[2]	No	East of intersection
Recker/Main St.[2]	No	West/east of intersection
Power/Main St.[2]	No	West of intersection
Broadway/Power[2]	No	North of intersection
U.S. 60/Power (Superstition Springs Center)[2]	Yes	North of intersection

[1]All LRT stations have a center platform configuration.
[2]Station locations as part of existing Valley Metro LINK BRT project. Station locations and amenities would remain.
Source: METRO, 2010.

Electricity for LRT operations would be supplied to the OCS from traction power substations (TPSS) located along the proposed LRT alignment. These electrical substations would be enclosed structures approximately 20-by-40 feet (30-by-60 feet including the grounding mat around the substation) located proximally to the LRT alignment. One TPSS would be required for roughly each one to one and a half mile of track. Specific locations will be determined as design is further refined.

LRT vehicles for the Central Mesa LRT Extension would be maintained and serviced at the existing LRT Starter Line Operations and Maintenance Center (OMC), located south of Washington Street between State Route (SR) 143 and Loop 202. The OMC will have sufficient capacity to service LRT vehicles allocated to the Central Mesa LRT Extension, and expansion of the existing facility, or construction of a new facility will not be required.

The existing traffic lane capacity along Main Street would be maintained between Sycamore and Country Club Drive. Typical cross sections are presented in Figure 3. For the segment east of Country Club Drive to the LRT eastern terminus near Hobson (just east of Mesa Drive), two design options are being considered:

- Build Alternative, 2-Lane Option
- Build Alternative, 4-Lane Option

These design options are further described below.

1.2.1 Build Alternative, 2-Lane Option

Main Street's traffic lane capacity would generally be reduced from two lanes in each direction to one lane in each direction from Country Club Drive to Horne. The exception is in the westbound direction only between Mesa Drive and Horne where two through lanes would be available. At the westbound approach to Mesa Drive intersection, one through lane would be trapped into a right turn lane. Single left turn lanes would be maintained at Country Club Drive (double left is removed), Robson, MacDonald, Center Street, Centennial Way/Sirrine Street, Hibbert, Mesa Drive, Lesueur, and Hobson. Acquisition of additional right-of-way along the alignment would be minimal to accommodate the fixed guideway as a result of the reduction of travel lanes. Typical cross sections at various locations along the Build Alternative, 2-Lane Option are shown in Figure 4. The station and park-and-ride locations presented in Table 2 apply to the 2-Lane Option. This option could allow for future conversion, if desired, to 2 lanes in each direction through downtown by eliminating the dedicated left turn lanes and using split-phase traffic signals that would allow through and left-turning traffic to share the same left lane. The conversion would require minor curb revisions and/or parking removal beyond that shown in the current design between Country Club Drive and Robson. Between Mesa Drive and Udall, some additional curb and right-of-way revisions would be needed on the south side of Main Street.

1.2.2 Build Alternative, 4-Lane Option

With the 4-lane option, the current four through travel lanes (two in each direction) would be maintained from Country Club to Hobson. This scenario assumes split-phase traffic signals, and single left turn lanes would only be provided at Country Club Drive and Mesa Drive. All other existing turning lanes would be removed. The bike lane would be eliminated west of Lesueur, and parking would continue to be provided at most locations along this segment where it presently exists. To keep the existing numbers of through lanes will require acquisition of additional right-of-way at the northeast and southeast corners of Main Street and Mesa Drive. Typical cross sections at various locations along the Build Alternative, 4-Lane Option are shown in Figure 5. All of the stations and park-and-ride facility locations are as illustrated in Table 2.

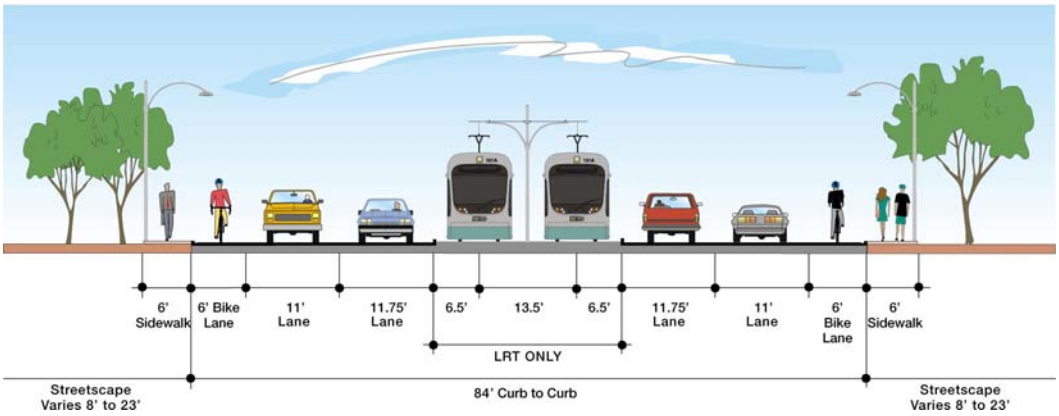
1.2.3 Unresolved Issues

Several issues will be further refined as the EA proceeds and community outreach continues. In addition to the previously discussed optional traffic design configurations downtown, decisions will need to be made about the following:

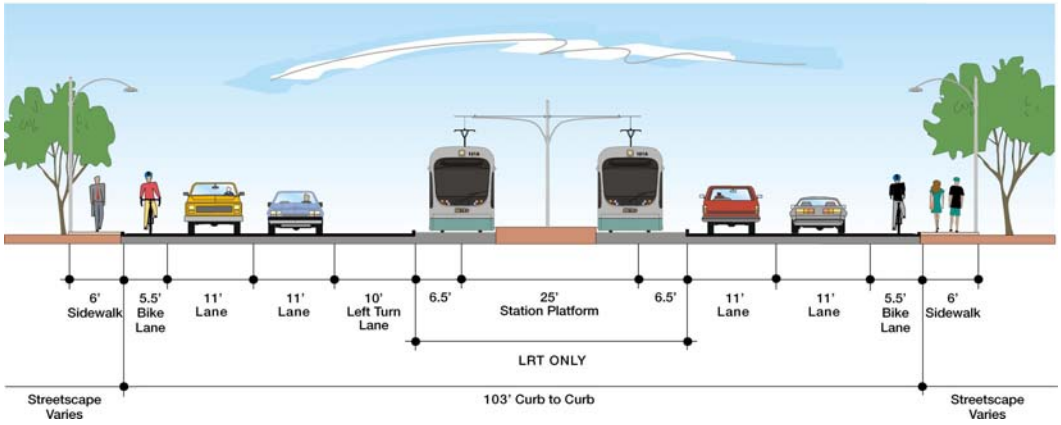
- TPSS locations
- OCS
- Pedestrian access points
- Park-and-ride sizing, layout and capacity
- Station design
- Urban design/public art
- Refinement of utilities and location
- Construction staging

FIGURE 3: MAIN STREET SECTIONS, SYCAMORE TO COUNTRY CLUB DRIVE

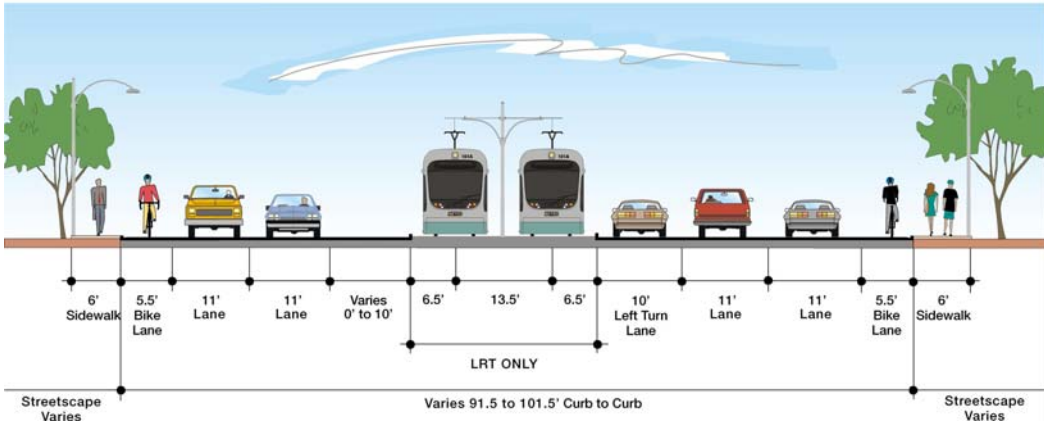
Main Street Typical Section



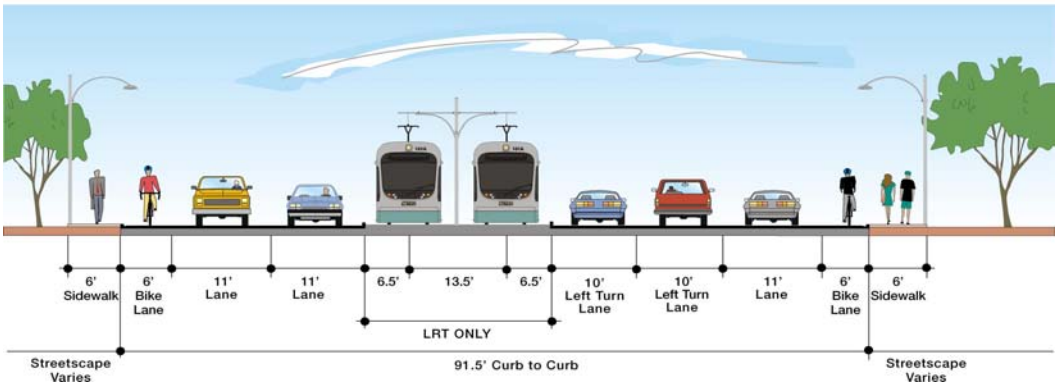
Main Street Typical Section at Station



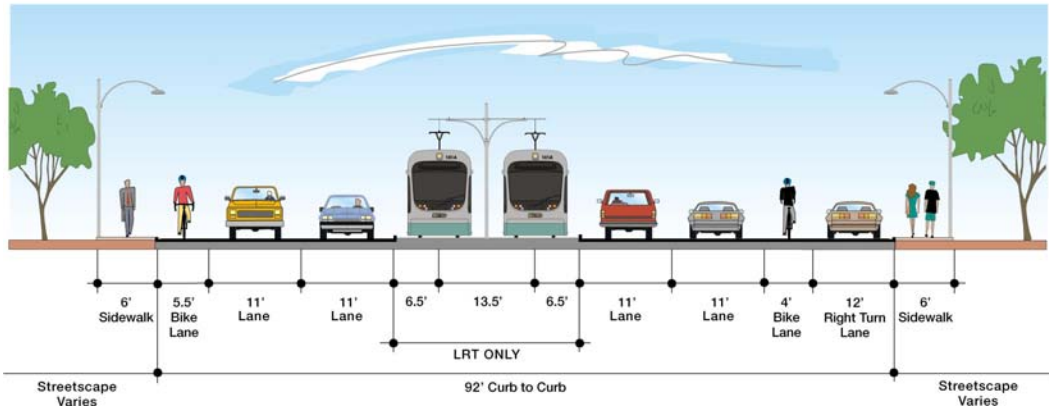
Main Street Typical Section EB Left Turn



Main Street Typical Section EB Left (Country Club Drive West Leg)



Main Street Typical Section EB Right Turn



Main Street Typical Section WB Left Turn

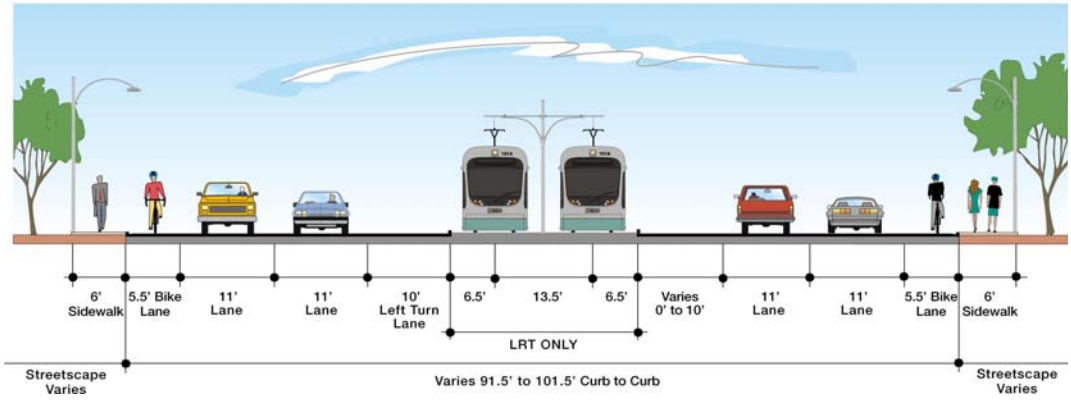
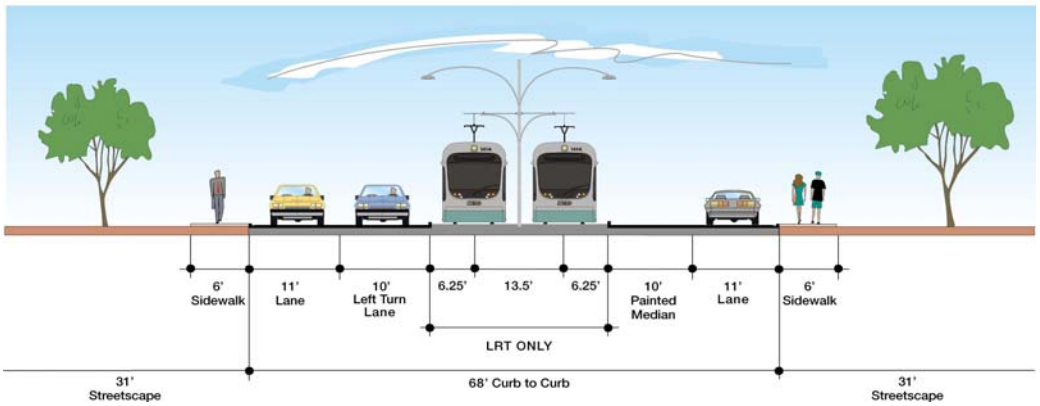
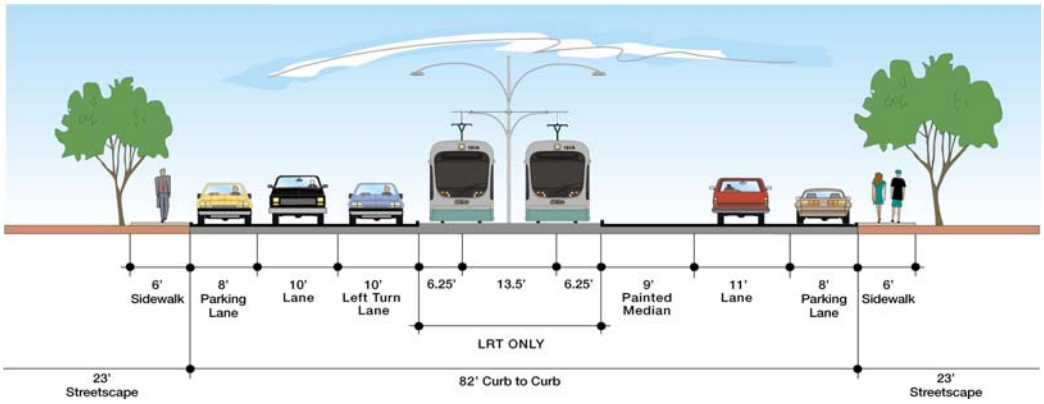


FIGURE 4: MAIN STREET SECTIONS, 2-LANE OPTION

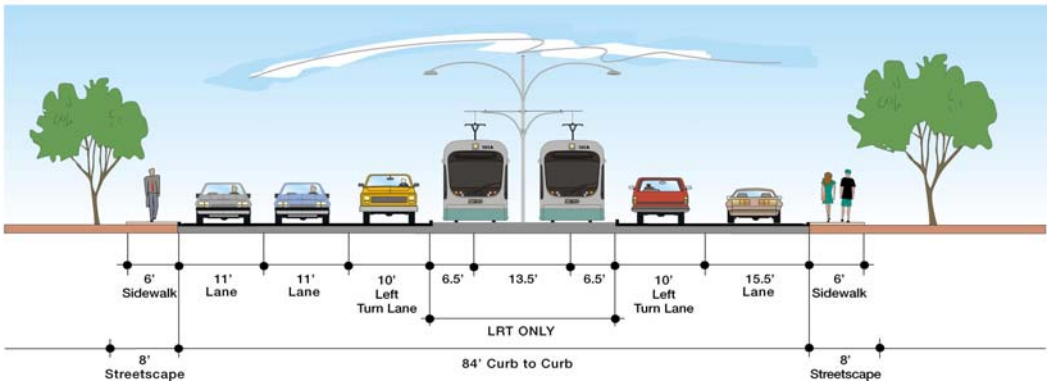
Main Street 2-lane Typical Section Without Parking Lane



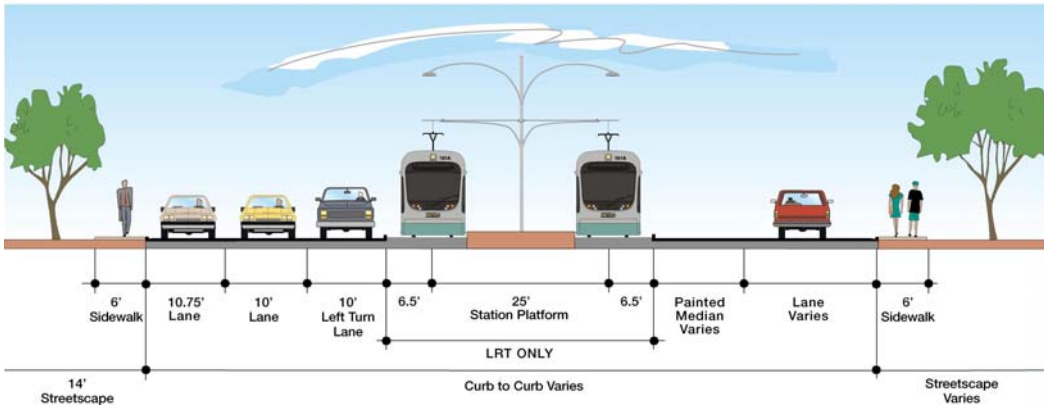
Main Street 2-lane Typical Section with Parking Lane



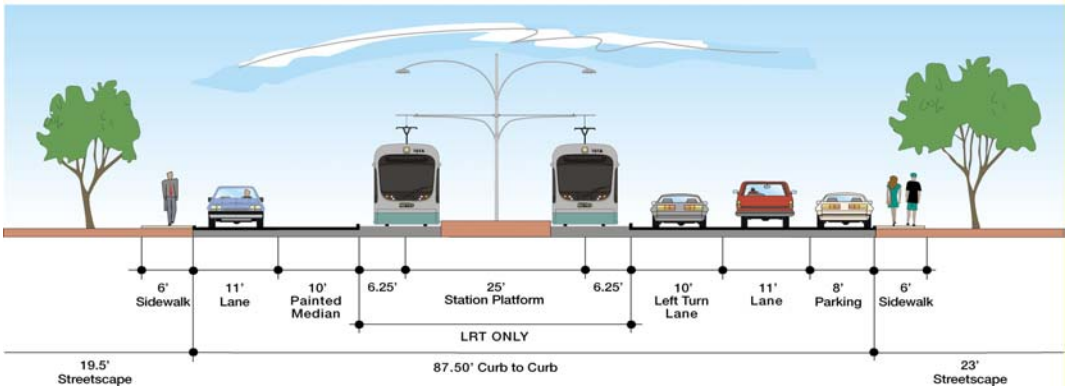
Main Street 2-lane Typical Section (Between Lesueur and Hobson)



Main Street 2-lane Typical Section at Country Club Drive Station



Main Street 2-lane Typical Section at Center Street Station



Main Street 2-lane Typical Section at Mesa Drive Station

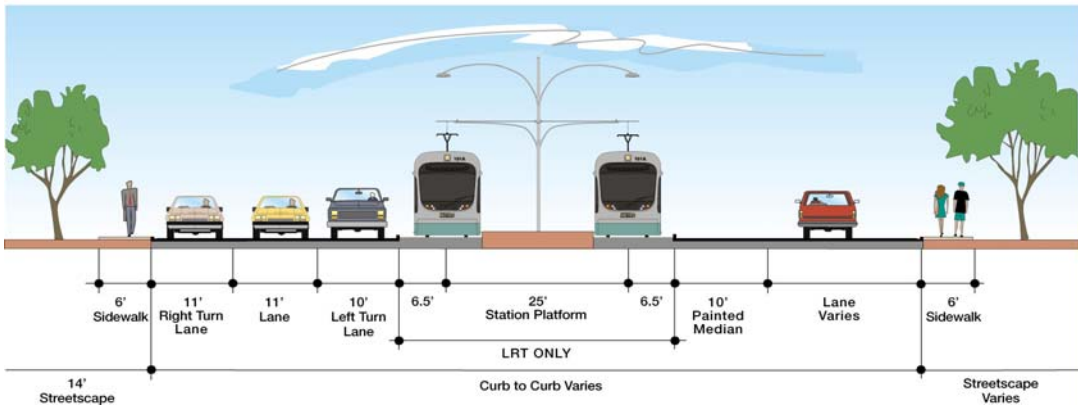
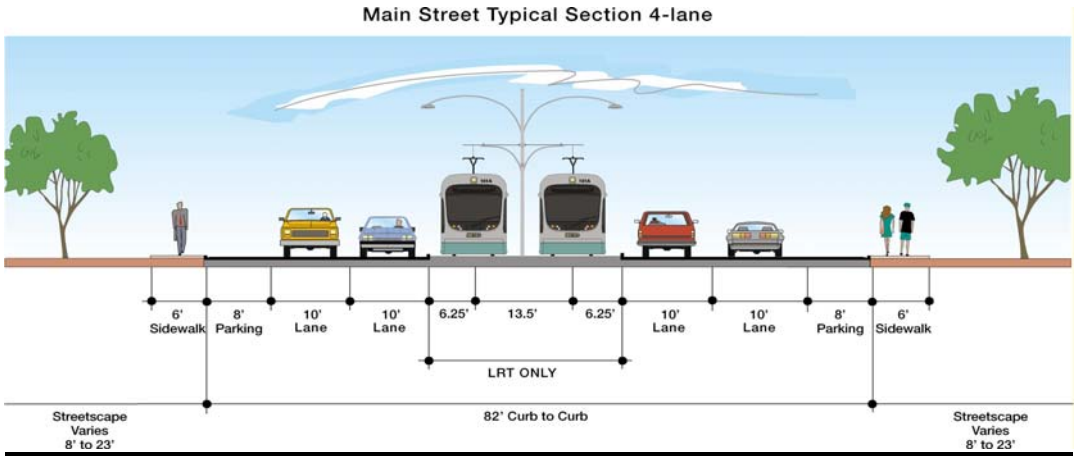
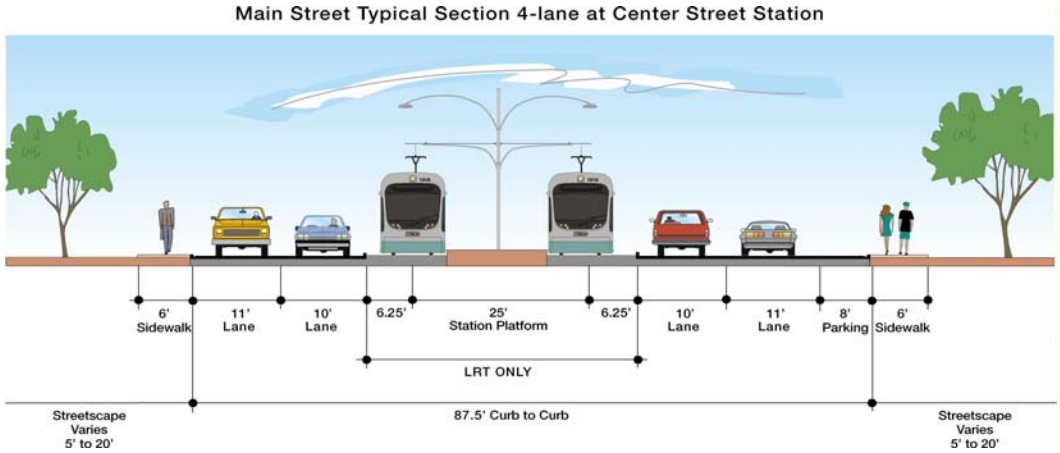
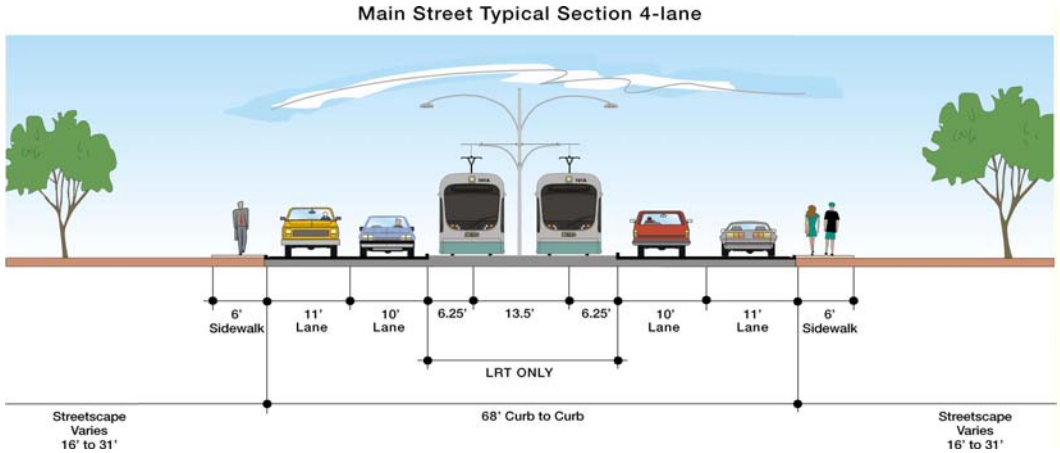


FIGURE 5: MAIN STREET SECTIONS, 4-LANE OPTION







2.0 TRANSPORTATION ANALYSIS

This chapter of the report provides an assessment of, and potential mitigation for the impacts of the Build and No-Build Alternatives on streets, parking, and pedestrian and bicycle facilities.

This information will assist METRO and the City of Mesa in understanding the potential impacts of the proposed project and in developing appropriate design strategies, where needed, to avoid or minimize adverse impacts.

2.1 EXISTING ROADWAY CONDITIONS

Table 3 identifies and documents the existing roadway lane configurations, traffic volumes, transit operations, on-street parking availability and pedestrian/bicycle facilities along the planned 3.1 mile Mesa LRT corridor extension on Main Street from Sycamore Drive on the west through the Mesa town center to Lesueur Street on the east.

2.2 TRAFFIC OPERATIONS ANALYSIS

This section of the report summarizes the traffic analysis conducted for the Central Mesa LRT Extension**.** The traffic analysis was conducted for the PM peak hour traffic conditions at the study intersections as shown in Figure 6 for the following scenarios:

- 2009 Existing Conditions
- 2015 No-Build
- 2015 Build Alternative 2-Lane Option
- 2015 Build Alternative 4-Lane Option

Analyses of these scenarios provide a comparison of impacts to each of the alternatives. At this level, the traffic operations analysis will assist staff in their understanding of the relative impacts of the alternatives on a comparative basis. Future design phases will integrate LRT operations along Main Street using the VISSIM traffic analysis software, or similar, for the preferred alternative.

TABLE 3: MAIN STREET EXISTING ROADWAY CHARACTERISTICS - SYCAMORE DRIVE TO MESA DRIVE

ROAD	TRAVEL LANES	INTERSECTIONS	2008 Traffic Volume vehicles/day	TRANSIT	ON-STREET PARKING	BICYCLE	PEDESTRIAN
Sycamore Street to Alma School Road	Two travel lanes each direction Raised median	**Signalized:** Sycamore Street: EB and WB left turn lanes Longmore Street: EB and WB left turn lanes Alma School Road: EB left, EB right turn lanes **Unsignalized:** North Brooks Street North Rogers Street Standage Street (EB to NB only) Stewart Street (EB to NB only)	16,900	Rte 40 - Apache/Main St *30-minute service weekday/weekend* LINK- Main Street BRT *15-30-min. service weekdays, 60-min. service weekends* METRO LRT @ Sycamore	On-street parking, primarily north side	Striped bicycle lane each direction.	Sidewalks both sides
Alma School Road to Extension Road	Two travel lanes in each direction Raised median	**Signalized:** Alma School Road: WB left turn lane Extension Road: EB left turn lane **Unsignalized:** Beverley: EB and WB left turn pockets	22,000	Rte 40 - Apache/Main St LINK- Main Street BRT Rte. 104 Alma School	Both sides	Striped bicycle lane each direction.	Sidewalks both sides
Extension Road to Country Club Drive	Two travel lanes in each direction Raised median	**Signalized:** Extension Road: WB left turn lane Country Club Drive: Dual EB left, EB right **Unsignalized:** Date: EB and WB left turn lanes South Vineyard: EB and WB left turn lanes		Rte 40 - Apache/Main St LINK- Main Street BRT Rte. 112 - Country Club	Both sides	Striped bicycle lane each direction.	Sidewalks both sides
Country Club Drive to Center Street	Two travel lanes each direction Raised median	**Signalized:** Country Club Drive: Dual WB left, WB right Robson Street: EB and WB left turn lanes Macdonald Street: EB and WB left turn lanes Center Street: EB left turn lane **Unsignalized:** South Drew Street (WB to SB only)	19,800	Rte 40 - Apache/Main St LINK- Main Street BRT BUZZ on Robson BUZZ on Macdonald	On-street parallel parking is provided on both sides of the street, except in the section between Morris Street and Country Club Drive.	Striped bicycle lane each direction.	Sidewalks both sides. Curb extensions at Robson, Macdonald, and Center. East of Morris, sidewalk is behind street trees and landscaping. Signalized mid-block crossings between Robson and MacDonald, and at Drew Street.
Center Street to Mesa Drive	Two travel lanes each direction Raised median	**Signalized:** Center Street: WB left turn lane Sirrine Street/Centennial Way: EB and WB left Hibbert Street: EB and WB left turn lanes Mesa Drive: EB left, EB right turn lanes **Unsignalized:** North Pomeroy Street: Right in/right out	19,400	Rte 40 - Apache/Main St LINK- Main Street BRT BUZZ, LINK on Center Rte. 120 - Mesa Drive	On-street parking is provided on both sides of the street, except between North Pomeroy and Mesa, and east of mid-block between South Pomeroy and Mesa Drive.	Striped bicycle lane each direction.	Sidewalks both sides, with street trees and landscaping. Signalized mid-block crossing with curb bulb between Center and Shrine/ Centennial. Curb bulbs at Sirrine/Centennial and Hibbert Street.
Mesa Drive to LeSueur Street	Two travel lanes each direction Raised median	**Signalized:** Mesa Drive: WB left, WB right turn lanes **Unsignalized:** Udall: EB and WB left turn lanes LeSueur Street: EB and WB left turn lanes	25,300	Rte 40 - Apache/Main St LINK- Main Street BRT	Both sides	Striped bicycle lane each direction.	Sidewalks both sides

2002 City of Mesa Transportation Plan Street Functional Classification: Arterial
2009 Mesa Bicycle Map: Bicycle lanes on Main Street
2008 Traffic Volume: City of Mesa Transportation Division, 2009 Traffic Volume Map
METRO LRT (Central Phoenix/East Valley Light Rail Transit), LINK (Mesa BRT Route, Sycamore – Superstition Springs), BUZZ (Mesa Neighborhood Circulator Route)

2.2.1 Main Street Study Area

The study area for the traffic analysis consists of the Main Street corridor from Sycamore Drive to Horne Street. Figure 6 shows the study corridor along with the study intersections.

FIGURE 6: CENTRAL MESA LRT EXTENSION STUDY INTERSECTIONS

The study area for this phase of the traffic analysis was focused along Main Street to assist in understanding the differences in impacts to traffic operations for the two alternatives studied: 2015 Build Alternative 2-Lane Option versus the 4-Lane Option using a micro-simulation software. A previous study, *Mesa Tier 2 Traffic Evaluations Technical Memorandum, dated November 3, 2009,* by Grijalva Engineering and HDR, evaluated link and intersection level of service impacts to other parallel and cross streets in a larger study area for 2030 in the PM peak period. The results of that study are available upon request.

2.2.2 Methodology

Traffic analysis of roadway and intersection operational performance for the study scenarios was performed using the Synchro/SimTraffic simulation analysis package (version 7, Build series 755) developed by Trafficware, Inc, which evaluates intersection delay and congestion based on procedures similar to those given in the 2000 Highway Capacity Manual (Chapters 16 and 17). Basic inputs used for Synchro relate primarily to traffic data including traffic volumes, lane geometry (i.e., number of lanes, lane widths, turn-lane storage lengths), signal timing data, bus and heavy vehicle traffic levels, on-street parking, bus blockage and a variety of other data items.

The methodology used in this study was based on the 2000 Highway Capacity Manual (HCM), for the determination of Level of Service (LOS) for existing traffic conditions and future traffic conditions. The analysis results are expressed using LOS and Intersection Delay.

Level of Service is a quantitative measure (intersection delay and intersection capacity) is frequently expressed in qualitative terms as LOS A (free-flow) to LOS F (congested), to describe traffic operational conditions and, in qualitative terms, the perception of traffic conditions by motorists and passengers (Tables 4 and 5).

TABLE 4: SIGNALIZED INTERSECTION LOS DEFINITIONS

Level of Service	Description	Average Control Delay (seconds/vehicle)
A	Operations with very low delay occurring with favorable progression and/or short cycle length.	≤ 10
B	Operations with low delay occurring with good progression and/or short cycle lengths.	> 10 – 20
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	> 20 – 35
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, or high volume to capacity (V/C) ratios. Many vehicles stop and individual cycle failures are noticeable.	> 35 – 55
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences. This is considered to be the limit of acceptable delay.	> 55 – 80
F	Operations with delays unacceptable to most drivers occurring due to over saturation, poor progression, or very long cycle lengths.	> 80

Source: Highway Capacity Manual, Transportation Research Board, 2000

TABLE 5: UNSIGNALIZED INTERSECTION LOS DEFINITIONS

Level of Service	Description	Average Control Delay (second/vehicle)
A	Little or no delay	0 – 10
B	Minor delays	> 10 – 15
C	Average delays	> 15 – 25
D	Moderate delays	> 25 – 35
E	Lengthy delays	> 35 – 50
F	Excessive delays/gridlock	> 50

Source: Highway Capacity Manual, Transportation Research Board, 2000

2.2.3 Traffic Analysis Assumptions and Approach

This traffic analysis employed a conventional approach that included basic data collection, investigation of existing roadway and traffic conditions, and analysis of study scenario operational impacts. The traffic volumes and traffic signal timing provided by the City of Mesa were used to document the 2009 existing conditions. New traffic counts were obtained at study intersections where existing counts were not available.

The traffic volumes for the 2015 study scenarios are based upon the MAG Regional Travel Demand Model (TDM) model runs. The 2015 TDM model traffic volumes for No- Build and Build scenarios were adjusted using engineering assumptions.

The study analyzed only the PM peak hour traffic conditions, as the evening peak period is expected to generate the most congested traffic conditions during a weekday. The following are the assumptions and approach adopted during the development of the traffic models in SYNCHRO for traffic analysis:

Existing Volumes

The turning movement counts for the existing conditions were obtained from the City of Mesa. The traffic volumes included counts from 2007, 2008 and 2009. It was observed from the historic counts that the traffic volumes have decreased somewhat in Mesa. As the historic traffic growth rate along study corridor was observed to be negative, an engineering assumption of a conservative 1% annual growth rate was used to project 2009 counts from the 2007 and 2008 traffic counts Table 6 shows the PM peak hour turning movement volume used for analysis of existing conditions.

TABLE 6: 2009 EXISTING CONDITIONS INTERSECTION /TURNING MOVEMENT TRAFFIC VOLUME – PM PEAK HOUR

Main Street Intersection at:	Northbound			Southbound			Eastbound			Westbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Sycamore	43	15	49	66	20	27	27	707	25	41	575	30
Longmore	23	17	65	41	12	48	39	647	27	43	438	56
Alma School Road	142	784	175	225	1,441	53	79	511	139	202	429	107
Extension Road	109	323	173	58	372	64	65	713	121	126	561	49
Date	13	8	48	12	8	45	52	888	16	15	647	23
Country Club Drive	126	1,025	197	125	1,165	120	157	608	130	182	397	109
Robson	16	5	10	36	21	53	36	843	44	21	592	15
West 150 Block Crosswalk	0	0	0	0	0	0	0	887	0	0	614	0
MacDonald	42	89	62	38	97	37	35	795	57	53	520	54
West 50 Block Crosswalk	0	0	0	0	0	0	0	905	0	0	627	0
Center Street	19	240	46	88	275	130	157	772	45	60	505	65
Lewis Crosswalk	0	0	0	0	0	0	0	919	0	0	655	0
Sirrine/ Centennial	21	18	70	87	41	71	27	874	32	46	583	40
Hibbert	17	53	92	17	32	31	29	930	26	50	630	14
Mesa Drive	81	679	156	206	927	47	55	899	143	115	479	113
Lesueur	8	10	45	17	5	25	15	1,109	13	26	693	21
Hobson	13	8	32	40	20	20	29	1,162	20	41	640	28
Horne	78	152	92	63	196	16	33	1,252	56	75	693	49

LT = Left Turn TH = Through RT = Right Turn

2015 No-Build Traffic Volume

To develop the 2015 No-Build traffic volume and turning movement counts (TMCs), an assessment of available MAG 2009 and 2015 TMC's and TDM information was required. This involved using TMCs for the 2015 No-Build scenario obtained from the MAG TDM projections. The TDM traffic volumes for 2009 No-Build and 2015 No-Build scenarios were compared and the differences were added to 2009 traffic counts to obtain 2015 No-Build traffic volumes. The projected TMC obtained from the TDM model were adjusted to eliminate inconsistencies using below listed engineering assumptions.

1. If difference between 2015 No-Build and 2009 No-Build traffic volume is negative, a 1% growth per year was applied to 2009 TMC, or the difference was added to 2009 TMC to develop 2015 No-Build Adjusted Volume.

2. If 2009 No-Build MAG TDM TMC value is 0, a 1% growth per year was applied to 2009 TMC to develop 2015 No-Build Adjusted Volume.

3. At the minor street intersections that are not included in TDM model, the 2015 TMC's were developed by applying 1% annual growth rate to 2009 TMC's

Table 7 shows the PM peak hour traffic volume projections for 2015 No-Build scenario.

TABLE 7: 2015 NO-BUILD INTERSECTION /TURNING MOVEMENT TRAFFIC VOLUME – PM PEAK HOUR

Main Street Intersection at:	Northbound			Southbound			Eastbound			Westbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Sycamore	43	16	52	70	21	27	28	746	26	41	574	30
Longmore	24	18	69	44	13	96	41	743	29	46	465	95
Alma School Road	174	896	186	239	1,563	86	84	613	151	267	455	114
Extension Road	116	347	270	62	395	84	83	757	167	221	606	52
Date	15	8	50	13	8	51	54	929	17	17	737	26
Country Club Drive	134	1,139	242	133	1,237	214	165	661	146	193	386	110
Robson	16	5	11	39	22	52	39	913	48	21	579	15
West 150 Block Crosswalk	0	0	0	0	0	0	0	961	0	0	600	0
MacDonald	41	94	67	41	103	36	38	861	62	52	508	53
West 50 Block Crosswalk	0	0	0	0	0	0	0	980	0	0	613	0
Center St	20	255	72	102	292	138	189	800	78	70	536	69
Lewis Crosswalk	0	0	0	0	0	0	0	969	0	0	667	0
Sirrine/ Centennial	21	19	74	92	44	72	28	922	34	47	594	41
Hibbert	17	56	97	18	34	32	31	981	27	51	642	14
Mesa Drive	112	745	166	283	984	50	58	923	165	190	492	120
Lesueur	8	11	49	19	5	26	16	1,214	14	27	718	22

Main Street Intersection at:	Northbound			Southbound			Eastbound			Westbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Hobson	13	8	35	44	21	21	32	1,272	22	42	663	29
Horne	103	163	98	83	208	17	35	1,382	91	77	736	51

Notes:

1. The highlighted cells represent traffic volume projections obtained from Travel Demand Model.
2. The traffic volumes at minor street intersections that are not included in TDM model are estimated by applying 1% annual growth rate to obtain the 2015 volumes

LT = Left Turn TH = Through RT = Right Turn

2015 Build Traffic Volume

The turning movement counts (TMC) for the 2015 Build scenarios for both the 2-Lane Option and the 4-Lane Option were obtained from the MAG TDM projections. The projected TMC obtained from the TDM model were adjusted to eliminate inconsistencies using below listed engineering assumptions.

1. If the sum of 2015 Adjusted No-Build and the difference between 2015 Build and 2015 No-Build is less than zero, then 2015 Build volume is considered as 2015 Build Adjusted Volume, or the difference is added to 2015 adjusted No-Build volume to develop 2015 Build Adjusted Volume.
2. At the minor street intersections that are not included in TDM model, the 2015 TMC's were developed by applying 1% annual growth rate to 2009 TMCs and by balancing the TDM adjusted TMC volumes between major street intersections.

Diversion Considerations

The MAG TDM model runs were used to study the traffic diversion occurring in the build scenarios. It was observed that the traffic diversion in the Build Alternative 4-Lane Option from Sycamore to Mesa Drive was minimal, less than 1%.

The Build Alternative 2-Lane Option reduced the Main Street capacity from existing 4 lanes to 2 lanes between Country Club Drive and Mesa Drive. This reduction in capacity on Main Street with no change to traffic generators (origin and destination of trips) resulted in traffic shifting to other roadways in the network. It was observed that this diversion resulted in an average traffic growth of 7% on University Drive and Broadway Road between Country Club Drive and Mesa Drive. The MAG TDM model traffic generator connectors and roadway network showed that a percentage of traffic was shifted to minor roads between University Drive/Main Street and Broadway Road/Main Street. This traffic growth was assumed to have diverted to minor roads like 1st Street and 1st Avenue which are not included in MAG TDM model. The 1st Street and 1st Avenue intersections have available capacity. These roadways function as a partial couplet with Main Street in Downtown Mesa and also connect all the traffic generators in Downtown.

Tables 8 and 9 show the PM peak traffic volume projections for the 2015 Build Alternative 2-Lane Option and the 4-Lane Option.

TABLE 8: BUILD ALTERNATIVE 2- LANE OPTION INTERSECTION/TURNING MOVEMENT TRAFFIC VOLUMES - PM PEAK

Main Street Intersection at:	Northbound			Southbound			Eastbound			Westbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Sycamore	41	16	51	68	21	26	28	730	26	39	554	29
Longmore	24	18	69	36	13	94	26	725	29	46	436	98
Alma School Road	182	848	254	271	1,483	66	97	496	228	316	441	90
Extension Road	143	275	334	102	356	60	131	586	269	168	599	55
Date	14	8	48	12	8	48	52	881	16	16	688	24
Country Club Drive	224	1,142	145	111	1,240	320	454	241	220	147	174	61
Robson	9	5	6	21	22	29	21	488	25	11	324	8
West 150 Block Crosswalk	0	0	0	0	0	0	0	513	0	0	336	0
MacDonald	23	94	36	22	103	20	20	460	33	29	284	30
West 50 Block Crosswalk	0	0	0	0	0	0	0	524	0	0	343	0
Center Street	29	411	63	48	380	138	124	334	21	77	234	37
Lewis Crosswalk	0	0	0	0	0	0	0	519	0	0	411	0
Sirrine/ Centennial Way	13	19	40	49	44	45	15	493	18	29	366	25
Hibbert	11	56	52	10	34	19	16	525	15	31	395	9
Mesa Drive	83	886	135	244	1,163	79	62	437	75	147	219	162
Lesueur	5	11	33	12	5	16	11	811	10	17	449	14
Hobson	8	8	23	29	21	13	21	850	15	27	414	18
Horne	13	158	232	164	200	17	25	1,036	11	117	584	67

Notes:

1. The shaded cells represent traffic volume projections obtained from Travel Demand Model.
2. The traffic volume at minor street intersections not included in TDM model are estimated by applying 1% annual growth rate to obtain the 2015 volumes and by balancing the TDM adjusted TMC volumes between major street intersections.

LT = Left Turn TH = Through RT = Right Turn

TABLE 9: BUILD ALTERNATIVE 4-LANE OPTION INTERSECTION/TURNING MOVEMENT TRAFFIC VOLUMES – PM PEAK

Main Street Intersection at:	Northbound			Southbound			Eastbound			Westbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Sycamore	43	16	52	69	21	27	28	744	26	41	571	30
Longmore	24	18	69	44	13	95	39	740	29	46	461	94
Alma School Road	172	902	178	249	1,553	86	78	607	160	268	453	109
Extension Road	116	341	276	64	391	85	90	750	164	224	599	51
Date	15	8	50	13	8	51	54	929	17	17	734	26
Country Club Drive	134	1,138	236	128	1,233	220	162	664	147	192	377	114
Robson	16	5	11	39	22	52	39	908	47	20	577	15
West 150 Block Crosswalk	0	0	0	0	0	0	0	956	0	0	598	0
MacDonald	41	94	67	41	103	36	38	857	61	52	507	53
West 50 Block Crosswalk	0	0	0	0	0	0	0	975	0	0	611	0
Center Street	20	253	71	103	285	138	184	794	81	69	534	68
Lewis Crosswalk	0	0	0	0	0	0	0	965	0	0	664	0
Sirrine/ Centennial Way	21	19	73	91	44	72	28	917	34	47	591	41
Hibbert	17	56	97	18	34	31	30	976	27	51	638	14
Mesa Drive	111	742	163	286	981	49	58	917	164	189	488	121
Lusueur	8	11	49	19	5	26	16	1,210	14	27	717	22
Hobson	13	8	35	44	21	21	32	1,268	22	42	662	29
Horne	101	163	99	82	207	17	33	1,378	92	76	738	51

Notes:

1. The shaded cells represent traffic volume projections obtained from Travel Demand Model.
2. The traffic volume at minor street intersections not included in TDM model are estimated by applying 1% annual growth rate to obtain the 2015 volumes and by balancing the TDM adjusted TMC volumes between major street intersections

LT = Left Turn TH = Through RT = Right Turn

2.2.4 Roadway Geometry Input

The 2009 existing roadway geometry including lane configurations, storage lengths and link distances has been obtained from existing available base maps, aerial images and field reviews. The 2009 No-Build and 2015 No-Build Synchro models used the existing roadway geometry. The roadway geometry for 2015 Build models for both the 2-Lane Option and the 4-Lane Option used the roadway geometry proposed for the EA developed by HDR/URS and dated January 2010.

2.2.5 Speed Limit Input

The Main Street Synchro model used the existing posted speed limit for the 2009 and 2015 No-Build options. The existing posted speed limit on Main Street is 40 mph between Sycamore and Alma School Road, 35 mph between Alma School Road and Country Club Drive, 30 mph between Country Club Drive and east of Mesa Drive, and 35 mph between east of Mesa Drive and Horne.

Speeds used for the Synchro model on Main Street for both Build scenarios is 35 mph between Sycamore and Country Club Drive, 25 mph between Country Club Drive and Hobson and 35 mph between Hobson and Horne.

2.2.6 Turn Lane Length Input

Existing turn lane lengths were used as part of the Synchro data input for the 2009 Existing Condition and the 2015 No-Build scenario.
For the two 2015 Build scenarios, the consultant traffic engineers worked with the road and track engineers to develop the proposed design storage lengths as shown in EA drawings developed dated January 2010. Tables 10 and 11 summarize the proposed design turn lane storage lengths shown in the EA drawings. These lengths are consistent with the Mesa Standards. The Mesa Engineering & Design Standards Manual, Section 212.4, specifies:

> Standard left turn lanes within a median shall have one hundred and fifty (150') of storage and one hundred feet (100') of reverse curve. Left turn lanes within a median at an arterial intersection shall have two hundred and fifty feet (250') of storage and one hundred and twenty feet (120') of reverse curve.

Table 10: Proposed Design LEFT Turn Lane Length 2015 Build Alternative 2-Lane Option

Main Street Intersection at	Approach Movement	2015 Build Alternative 2-Lane Option PM Peak Peak Volume (Vehicles/Hour)	*Proposed Design Storage Length (feet)
Sycamore	EB LT	28	200
	WB LT	39	165
Longmore	EB LT	26	250
	WB LT	46	265
Alma School Road	EB LT	97	350
	WB LT	316	350
Extension Rd	EB LT	131	250
	WB LT	168	250
Date	EB LT	52	250
	WB LT	16	240
Country Club Drive	EB LT	454	350
	EB RT	220	250
	WB LT	147	200
Robson	EB LT	21	250
	WB LT	11	250
MacDonald	EB LT	20	250
	WB LT	29	225
Center Street	EB LT	124	250
	WB LT	77	220
Centennial Way	EB LT	15	270
	WB LT	29	250
Hibbert	EB LT	16	250
	WB LT	31	250
Mesa Drive	EB LT	62	375
	EB RT	75	120
	WB LT	147	350
	WB RT	162	250
Lesueur	EB LT	11	250
	WB LT	17	230
Hobson	EB LT	21	230
	WB LT	27	250
Horne	EB LT	25	100
	WB LT	117	100

* The "*Proposed Design Storage Lengths*" shown represent an early estimate of available storage lengths based on coordination with traffic and track/civil engineers and available geometry/right of way constraints.
LT = Left Turn

TABLE 11: PROPOSED DESIGN LEFT TURN LANE LENGTHS
2015 BUILD ALTERNATIVE 4-LANE OPTION

Main Street Intersection at	Approach Movement	2015 Build Alternative 4-Lane Option PM Peak	*Proposed Design Storage Length (feet)
		PM Peak Volume (Vehicles/Hour)	
Sycamore	EB LT	28	200
	WB LT	41	165
Longmore	EB LT	39	250
	WB LT	46	265
Alma School Road	EB LT	78	350
	WB LT	268	350
Extension Road	EB LT	90	250
	WB LT	224	250
Date	EB LT	54	250
	WB LT	17	240
Country Club Drive	EB LT	162	350
	WB LT	192	200
Mesa Drive	EB LT	58	240
	WB LT	189	250
Horne	EB LT	33	100
	WB LT	76	100

* The "*Proposed Design Storage Lengths*" shown represent an early estimate of available storage lengths based on coordination with traffic and track/civil engineers and available geometry/right of way constraints.
LT = Left Turn

2.2.7 Signal Timing and Phasing Input

The existing signal timing and phasing information provided by the City of Mesa was used for the 2009 scenario. For the 2015 No-Build scenario the signal timing was optimized using the existing signal phasing.

The 2015 Build options propose a center running LRT along Main Street for the study corridor between Sycamore and Hobson with four LRT stations located at Alma School Road, Country Club Drive, Centennial Way and Mesa Drive. Therefore all roadway signalization along Main Street and all cross streets will require integration and

coordination with LRT operations, i.e. a new signal system, similar to that used in the LRT Starter Line corridor. All crossings/crosswalks at the proposed station locations on Main Street will also be signalized/controlled crossings. The existing un-signalized intersections of Main Street/Date and Main Street/Lesueur will also be signalized.

For the 2015 Build options, the LRT and roadway design and operations are similar for both the Main Street 2-Lane and 4-Lane Options between Sycamore and just east of Country Club Drive. The lane configurations and thus the operations differ in the Downtown area.

For the 2015 Build Main Street 2-Lane Option, the proposed signal phasing will include protected left turn phases at all signalized Main Street intersections. The signal timing and progression were optimized using 120 second cycle length, similar to the LRT Starter Line.

For the 2015 Build Main Street 4-Lane Option, split phase operations are proposed along Main Street between the Country Club Drive and Hobson Drive intersections for the proposed LRT operation. Individual phases for eastbound, westbound and combined northbound and southbound movements will be established. Eastbound and westbound left turns will occur with the movement's split phase. A separate LRT phase will occur at each signal. As the SYNCHRO program cannot model the LRT phase, a HOLD phase was assumed for LRT phase. At Country Club Drive, Center Street and Mesa Drive, left turn lanes are proposed so that the signal phasing can include protected left turn phases, and the LRT phase was assumed to be simultaneous with the through phase on Main Street. The signal timing and progression was optimized using 120 second cycle length.

More analysis will be performed during future Preliminary Engineering/Final Design efforts using VISSIM (or other sophisticated traffic analysis software) that will design and integrate LRT operations along Main Street for the preferred alternative.

2.2.8 Pedestrian Traffic Input

Pedestrian counts obtained in Downtown Mesa in 2007 were used for the study. A 1% annual growth rate was applied to develop the 2015 pedestrian volumes. The passenger boarding and alighting projections at proposed LRT stations were obtained from the MAG TDM model for 2015 Build scenarios, summarized in Table 12. Based on the number of crosswalks at each station, the pedestrian traffic at each crosswalk was estimated and added to existing pedestrian traffic at the corresponding crosswalks in the SYNCHRO model.

TABLE 1: PROPOSED 2015 BUILD SCENARIOS
PEDESTRIAN VOLUME AT LIGHT RAIL STATIONS – DAILY AND PM PEAK HOUR

LRT Station at:	Passenger Boarding and Alighting (Daily)[1]	Passenger Boarding and Alighting (PM Peak - 1 Hour)[2]	No. of Crosswalks[3]	Pedestrian Traffic on Crosswalk 1 at LRT Station	Pedestrian Traffic on Crosswalk 2 at LRT Station
Alma School Road	2426	202	2	101	101
Country Club Drive	2345	195	2	98	98
Center Street	982	82	2	41	41
Mesa Drive	5933	494	2	82	412**

Notes:
1. Passenger Boarding and alighting data obtained from MAG TDM model
2. A 25% of the total daily boarding and alighting is expected to occur during the three hour PM Peak period. Value represents 1-hour Peak.
3. Number of crosswalks at each LRT station.
** 2/3 of projected pedestrian traffic at Mesa Station is assumed to use crosswalk at Lesueur due to the proposed Park & Ride facilities near Lesueur.

2.2.9 Bus Stop and Parking Input

Local buses stopping for passenger boardings/alightings along Main Street at designated bus stops are expected to impact the traffic flow of other vehicles. The number of buses stopping at bus stops near study area intersections in 2009 and 2015 study scenarios during PM peak hour was provided by Valley Metro. On Main Street, the local bus route #40 would be retained in both the Main Street 2-Lane and 4-Lane Options, and the LINK BRT route that currently runs west to Sycamore would be truncated further east at Center Street.

See Bus Route Plan Maps for existing (2009) and planned (2015) in Appendix A.

The maneuvers into and out of on-street parking spaces are expected to impact the traffic flow on Main Street. The number of such maneuvers during the PM peak hour was estimated considering the number of existing on-street parking spaces for No-Build (2009 and 2015) scenarios and proposed on-street parking spaces for the two 2015 Build options. Existing on-street parking counts were determined by field observation in February 2010. The range of on-street parking spaces for Build options was estimated from EA strip plots provided by HDR/URS dated January 2010.

For existing on-street parking space counts and impacts to on-street parking supply due to the build scenarios, see Section 2.3.3.

2.2.10 Traffic Operation Analysis Findings

Table 13 summarizes the intersection delay and LOS of the Main Street study area intersection performance for each study scenario. For purposes of this planning study, LOS E with intersection delay of 80 seconds or less is considered acceptable congestion during the PM peak hour by the City of Mesa Transportation Department. LOS F with signalized intersection delay of greater than 80 seconds is considered unacceptable congestion in downtown Mesa. See Table 4 for Intersection LOS definitions.

LOS E is an acceptable urban standard in congested downtown situations such as downtown Mesa where urban design and pedestrian environment considerations are balanced against traffic flow, where transit service provides a viable option to driving and where roadway/intersection widening constraints are contrary to the vision of downtown. The City of Mesa has allowed LOS E on a similar project, Mesa Proving Grounds Master Transportation Plan 2008, and provides the basis for accepting LOS E for this planning study.

2009 No-Build

All the Main Street study area intersections operate at acceptable LOS of E or better. The intersection of Main Street/Alma School Road presently experiences the highest intersection delay of 59 seconds while all the remaining study intersections operate at intersection delays of 35 seconds or less during the PM peak hour.

2015 No-Build

All the Main Street study area intersections would operate at acceptable LOS of E or better. The intersection of Main Street/Mesa Drive is expected to experience the highest intersection delay of 59 seconds while all the remaining study intersections would operate at intersection delays of 30 seconds or less during PM peak hour. Although all intersections would operate at acceptable LOS, LOS would decrease from D to E at one intersection and from C to D at two intersections compared to existing conditions. LOS would improve at one intersection from LOS E to D compared to existing conditions.

2015 Build Alternative 2-Lane Option

All the Main Street study area intersections would operate at acceptable LOS of E or better during the PM peak hour. The intersection at Main Street/Country Club Drive is expected to experience the highest intersection delay of 63 seconds, followed by Main Street/Mesa Drive with intersection delay of 47 seconds. The forecast increased delay at Main Street/Country Club Drive and Main Street/Mesa Drive is the result of increased turning volumes at these intersections due to traffic diversion with the reduced 2-lane capacity in Downtown. See potential mitigation described in section 2.3.

TABLE 2: LOS RESULTS AT MAIN STREET STUDY AREA INTERSECTIONS

Main Street Intersection at	2009 No-Build		2015 No-Build		2015 Build 2-Lane Option		2015 Build 4-Lane Option	
	HCM LOS [1&1]	Delay (sec)	HCM LOS [1&1]	Delay (sec)	HCM LOS [1&1]	Delay (sec)	HCM LOS [1&1]	Delay (sec)
Station 1 X-Walk					B	11.6	B	13.3
Station 2 X-Walk					B	16.2	C	21.3
Sycamore	B	16.3	B	16.6	B	15.8	B	15.5
Longmore	A	8.2	B	10.0	B	13.5	B	13.4
Alma School Road	E	58.9	D	48.6	D	48.2	D	49.3
Extension Road	C	20.3	C	26.7	C	31.3	C	31.8
Date[2]	D[2]	28.9	E[2]	44.0	B	18.6	B	12.7
Country Club Drive	C	33.5	D	44.8	E	62.4	D	47.9
Robson	A	6.3	A	6.4	B	12.2	C	34.2
W150B X-Walk	A	4.0	A	4.2	B	13.5	A	2.4
Macdonald	B	11.1	B	10.6	B	17.1	D	41.2
W50B X-Walk	B	14.9	B	14.4	A	8.5	A	2.4
Center Street	A	7.8	A	8.3	C	33.4	E	66.1
Lewis X-Walk	B	10.2	B	10.4	A	8.9	A	4.6
Centennial Way	A	8.7	A	8.9	B	15.4	D	44.7
Hibbert	A	9.6	A	9.8	B	19.3	D	50.9
Mesa Drive	C	32.9	D	44.2	D	46.4	D	54.0
Lesueur	D[2]	25.7	D[2]	30.9	B	14.6	E	56.4
Hobson	B	11.7	B	12.1	B	14.9	D	39.3
Horne Street	B	11.7	B	13.5	C	24.1	B	17.8

Notes:

1. Level of service for signalized intersections based on average control delay per vehicle, according to the Highway Capacity Manual (HCM), Transportation Research Board, 2000.
2. Side street stop controlled intersection LOS based on average control delay in seconds per vehicle for the worst approach, based on the methodology in the HCM, Transportation Research Board, 2000.

Approximately 85% of the Main Street study area intersections would operate at intersection delays of 35 seconds or less (LOS C) during the PM peak hour. Although all intersections would operate at acceptable LOS, LOS would decrease, compared to 2015 No-Build, from A to B at 4 intersections; from A to C at 1 intersection; from B to C at 1 intersection; and from D to E at 1 intersection. These changes in LOS have been presented to City of Mesa staff and are acceptable, at this level of study. Future design phases will study better define LOS of LRT operations along Main Street using VISSIM or other traffic analysis software for the preferred alternative.

2015 Build Alternative 4-Lane Option

All the Main Street study area intersections would operate at acceptable LOS of E or better during the PM peak hour. The intersection at Main Street/Center Street is expected to experience highest intersection delay of 66 seconds, followed by Main Street/Mesa Drive and Main Street/Lesueur with increased delay of 56 seconds. The forecast increased delay is due to the split phase operation that includes a LRT phase at these intersections.

Approximately 60% of the Main Street study area intersections would operate at intersection delays of 40 seconds or less (LOS D) during the PM peak hour. Although all intersections would operate at acceptable LOS, LOS would decrease compared to 2015 No-Build from A to C at 1 intersection; from A to D at 2 intersections; from A to E at one intersection; from B to D at 2 intersections; and from D to E at 1 intersection. These changes in LOS have been presented to City of Mesa staff and are acceptable, at this level of study, but do show more changes (i.e. more than 1 "letter" category changes) than the 2 Lane Option . Future design phases will study better defined LOS of LRT operations along Main Street using VISSIM or other traffic analysis software for the preferred alternative.

Traffic Operations Analysis Summary and Observations:

- All intersections for each option appear to operate at an overall acceptable levels of service.
- Both the 2015 Build Alternative 2-Lane Option and 4-Lane Option would have the same number of intersections that "change/degrade" to a lower LOS category (7) compared to the 2015 No-Build.
- The 2015 Build Alternative 4 Lane Option has more intersections that degrade 2 increments of LOS designations.
- The 2015 Build Alternative 2-Lane Option would have less approach delay overall than the 2015 Build Alternative 4-Lane option. (Refer to Synchro output runs available upon request.)
- For the 2015 Build Alternative 4-Lane Option, the use of split phase, in general, is typically not an efficient form of traffic operation.
- Traffic diversion would occur for the Build Alternative 2-Lane Option. This traffic would divert to other north-south and/or east-west corridors where there is roadway capacity.

2.3 TRAFFIC DESIGN IMPLEMENTATION/CONSIDERATIONS DUE TO LRT

2.3.1 Signal Phasing and Timings - Central Phoenix/East Valley LRT Priority Systems

The existing CP/EV LRT Starter Line uses a Predictive Priority Control system with traffic signals. Predictive priority uses detection devices placed far upstream of intersection crossings to estimate train arrival times at the intersections. With that information, adjustments can be made to traffic signal timing and train station departures in advance of the arrival of the train at the downstream intersections. The detection has to be far enough upstream from the intersection to provide sufficient time to complete minimum phases for any vehicular and pedestrian traffic movements initiated prior to detection. Under predictive priority, the basic traffic signal background cycle will be maintained with changes made to length and sequencing of phases to allow the phase serving LRT trains to be extended or advanced. Upon passage of the LRT train through the intersection, the signal cycle would return to normal operation, with no change in the background cycle length.

2.3.1.1 Mitigation of Signal Phasing and Timings

The City of Mesa plans to use the same Predictive Priority Control system for the Mesa LRT Extension corridor. The design of this system will be performed in the Preliminary Engineering and Final Design phases and will use more advanced traffic analysis software that will determine the signal timings to be used to integrate LRT operations along Main Street. It is anticipated that all traffic control systems, software and hardware, at each signalized intersection will need to be replaced or modified. This will be determined in Final Design.

2.3.2 Turn Lane Lengths

Tables 14 and 15 summarize the required storage lengths needed to accommodate vehicles at turn lanes at each intersection compared to what is proposed and shown in the EA drawings. The left turn vehicle storage lengths proposed in the EA drawings (shown in far right column of Tables 15 and 16) will be sufficient to accommodate both the 50th percentile and 95th percentile queue lengths at all intersections except at Country Club Drive for the eastbound left turn lane. These queue lengths were calculated by Synchro and are shown in the shaded columns of Tables 15 and 16. The 50th percentile maximum queue length is the maximum back of queue on a typical cycle and the 95th percentile queue length is the maximum back of queue with 95th percentile traffic volumes. The maximum queue length is approximately equal to the 50th percentile queue length divided by the upstream v/c ratio. These queue lengths are used to assess the storage length required for turn lanes.

TABLE 3: PROPOSED DESIGN TURN LANE LENGTH
2015 BUILD ALTERNATIVE 2-LANE OPTION

Main Street Intersection at	Approach Movement	2015 Build Alternative 2-Lane Option PM Peak				Proposed Design Storage Length (ft)
		Peak Volume	Number of Lanes[1]	50th percentile Queue Length[2]	95th percentile Queue Length[3]	
Sycamore	EB LT	28	1	23	53	200
	WB LT	39	1	34	73	165
Longmore	EB LT	26	1	20	51	250
	WB LT	46	1	34	55	265
Alma School Road	EB LT	97	1	76	126	350
	WB LT	316	1	~263	#452	350
Extension Road	EB LT	131	1	112	m132	250
	WB LT	168	1	97	165	250
Date	EB LT	52	1	46	m74	250
	WB LT	16	1	12	m16	240
Country Club Drive	EB LT	454	1	~526	#723	350
	EB RT	220	1	41	121	250
	WB LT	147	1	107	142	200
Robson	EB LT	21	1	15	m30	250
	WB LT	11	1	10	m29	250
MacDonald	EB LT	20	1	17	m34	250
	WB LT	29	1	26	61	225
Center Street	EB LT	124	1	105	163	250
	WB LT	77	1	44	96	220
Centennial Way	EB LT	15	1	13	m24	270
	WB LT	29	1	26	m61	250
Hibbert	EB LT	16	1	12	m27	250
	WB LT	31	1	25	m54	250
Mesa Drive	EB LT	62	1	54	m93	375
	EB RT	75	1	8	m41	120
	WB LT	147	1	~127	#266	350
	WB RT	162	1	32	13	250
Lesuer	EB LT	11	1	9	m10	250
	WB LT	17	1	13	m34	230
Hobson	EB LT	21	1	19	m25	230
	WB LT	27	1	22	53	250
Horne	EB LT	25	1	8	22	100
	WB LT	117	1	55	#164	100

Notes:

1. Entered as number of lanes. Shared Lanes are entered as 0.5
2. 50th percentile queue length in feet as reported from SYNCHRO. Queue shown is maximum after two cycles
3. 95th percentile queue length in feet as reported from SYNCHRO. Queue shown is maximum after two cycles

"~" Volume exceeds capacity, queue is theoretically infinite

"#" 95th percentile volume exceeds capacity, queue may be longer

"m" Volume for 95th percentile queue is metered by upstream signal

TABLE 4: PROPOSED DESIGN TURN LANE LENGTHS 2015 BUILD ALTERNATIVE 4-LANE OPTION

Main Street Intersection at	Approach Movement	2015 Build Alternative 4-Lane Option PM Peak				Proposed Design Storage Length (ft)
		PM Peak Volume	Number of Lanes[1]	50th percentile Queue Length[2]	95th percentile Queue Length[3]	
Sycamore	EB LT	28	1	23	54	200
	WB LT	41	1	36	77	165
Longmore	EB LT	39	1	31	69	250
	WB LT	46	1	40	82	265
Alma School Road	EB LT	78	1	74	127	350
	WB LT	268	1	~243	#424	350
Extension Road	EB LT	90	1	62	m79	250
	WB LT	224	1	190	#279	250
Date	EB LT	54	1	42	m58	250
	WB LT	17	1	15	m22	240
Country Club Drive	EB LT	162	1	130	#279	350
	WB LT	192	1	142	#304	200
Mesa Drive	EB LT	58	1	51	m57	240
	WB LT	189	1	~188	#342	250
Horne	EB LT	33	1	8	21	100
	WB LT	76	1	32	#77	100

Note:
General: The Build Alternative 4-Lane Option represents a split phased operation-left turns occur with the thru lane movement. The intersections above represent those locations that will have left turn pockets.
1. Entered as number of lanes. Shared Lanes are entered as 0.5
2. 50th percentile queue length in feet as reported from SYNCHRO. Queue shown is maximum after two cycles
3. 95th percentile queue length in feet as reported from SYNCHRO. Queue shown is maximum after two cycles
"~" Volume exceeds capacity,
"#" 95th percentile volume exceeds capacity, queue may be longer
"m" Volume for 95th percentile queue is metered by upstream signal

2.3.2.1 Mitigation for Turn Lane Lengths

The calculated design turn lane storage lengths proposed in the EA design for the 2-Lane Option and the 4-Lane Option, as shown in Tables 14 and 15, meet or exceed the 50th percentile queue length for each intersection on Main Street, except for:

- 2-Lane Option: Country Club Drive Eastbound Left Turn Lane. At this location, dual left turn lanes are recommended. The length of the dual left turn lanes will be determined in final design.

At many intersections, for both options, the proposed EA strip plot drawings, turn lane lengths significantly exceed the calculated/required turn lengths by Synchro. At these locations further design studies in Final Design should be performed to reduce the proposed turn lane lengths. In particular, for the Build 2-Lane Option, left turn lengths at Extension Road and Date could possibly be reduced to 150-200 feet and 100 feet, respectively; the right turn length at Country Club Drive could be reduced to 100 -150 feet. At Alma School Road, for both the Build 2-Lane and 4-lane Options, the eastbound left turn pocket could be reduced to 150-200 feet. Reducing the length of these turn lanes may assist to minimize impacts to right-of-way, and sidewalk and building impacts at these locations.

Further analysis during Preliminary Engineering and Final Design should be performed to reduce turn lane lengths. Any reduction of turn lane lengths will need to be coordinated and approved by the City of Mesa.

2.3.2 Impacts to On-street Parking

Within the study area, Main Street has four travel lanes and bicycle lanes with parallel parking generally on both sides. Between Sycamore Street and Country Club Drive, all of the 122 existing on-street parking spaces would be displaced in the 2015 Build Alternative for both 2-Lane and 4-Lane Options. In Downtown Mesa - between Country Club Drive and Mesa Drive - there are currently 145 on-street parallel parking spaces. As shown in Table 16, the Build Alternative 2-Lane Option would displace 3 to 4 on-street parking spaces in Downtown Mesa between Country Club Drive and Mesa Drive, while the Build Alternative 4-Lane Option would displace 13 to 15 on-street parking spaces. Between Mesa Drive and Horne, all of the existing 60 parking spaces would be displaced in both the 2-Lane Option and the 4-Lane Option.

TABLE 5: MESA DOWNTOWN PARKING IMPACTS SYCAMORE ST. TO HORNE

Road Segment	Existing Parking*	Estimated Parking Displaced/Retained 2-Lane Option**	Estimated Parking Displaced/Retained 4–Lane Option**
Sycamore – Country Club	122	122/0	122/0
Country Club – Robson	22	3-4/18-19	3-5/17-19
Robson – MacDonald	23	0/23	0/23
MacDonald – Center	25	0/25	0/25
Center – Centennial	20	0/20	6/14
Centennial – Hibbert	23	0/23	0/23
Hibbert – Mesa	32	0/32	4/28
Mesa - Horne	60	60/0	60/0
Total	**327**	**185 – 186 Displaced** **141 – 142 Retained**	**195 – 197 Displaced** **130 – 132 Retained**
Downtown – Country Club Drive to Mesa Drive	**145**	**3 - 4 Displaced** **141 – 142 Retained**	**13 - 15 Displaced** **130 – 132 Retained**

* Existing parking determined from Google Maps (2010) and field observation February 2010
** Range of parking spaces estimated from January 2010 HDR/URS Alignment Strip Plots
Shaded cells indicate the downtown Mesa segment of Main Street.

2.3.3.1 Mitigation for Loss of Main Street On-Street Parking

- **Main Street: Sycamore - Country Club Drive**

No mitigation is proposed for the 122 on-street parking spaces displaced. These spaces are consistently underutilized. There is typically sufficient off-street parking provided for each business, plus on-street parking is available along the north/south cross streets that intersect Main Street.

- **Main Street: Country Club Drive – Mesa Drive**

Much of the parking in downtown Mesa is retained in both the 2-Lane and 4-Lane Options. Three to four on-street spaces would be displaced in the 2-Lane Option and 13 to 15 spaces would be displaced in the 4-Lane Option. No mitigation is proposed for displaced on-street parking along Main Street as there is additional parking available off-street in surface lots behind the commercial buildings that front on Main Street, and on parallel streets and north/south cross streets.

- **Main Street: Mesa Drive to Horne**

No mitigation is proposed for the 60 on-street parking spaces displaced. These spaces are consistently underutilized. There is parking available off-street and along parallel and north/south cross streets.

2.3.3 Impacts on Pedestrian Facilities

Sidewalks exist on Main Street on its entire length within the study area, and these are planned to be maintained. In some locations, especially near the stations, sidewalks will be widened and improved with the development of LRT and LRT Stations, post construction.

No permanent impacts to pedestrian facilities are anticipated. (See Section 2.4 for impacts during construction).

2.3.4 Impacts on Bicycle Facilities

Bicycle lanes on Main Street exist between Sycamore and Mesa Drive, with bicycle lanes planned ultimately between the Mesa western city limits and Gilbert Road, according to the Mesa Bicycle Plan (2002). As shown in Figure 7, a bicycle route is designated on 1st Street between Extension Road and Horne. 1st Avenue has no bicycle facility designation. Both the Build Alternative 2-Lane and 4-Lane Options would maintain the existing striped bicycle lane on Main Street west of Country Club Drive and east of Lesueur. However, the 2015 Build options would remove the bicycle lanes on Main Street between Country Club Drive and Lesueur, and would also affect north/south bicycle circulation.

FIGURE 7: MESA BICYCLE MAP - MAIN STREET DOWNTOWN AND WEST MESA

2.3.4.1 Mitigation for Bicycle Facility Impacts

The January 2010 cross sections and alignment strip plots for both of the 2015 Build options do not show a striped bicycle lane on Main Street through downtown Mesa, between Country Club Drive and Lesueur Street. It is recommended that bicyclists ride in mixed traffic along Main Street in a shared travel lane with general purpose traffic. Signage should be placed on Main Street west of Country Club Drive and east of Lesueur advising bicyclists and motorists that the bicycle lane will end and bicyclists ahead will be sharing the travel lane with motorized vehicles.

Figure 8: Bike Lane Ends
MUTCD Sign R3-17bP

Shared bike lanes are recommended for Main Street between Country Club Drive and Lesueur Street, with the use of "sharrow" pavement markings, as shown in Figure 8, together with appropriate regulatory signage, as shown in Figure 9. Sharrow placement should be per MUTCD requirements and City of Mesa standards.

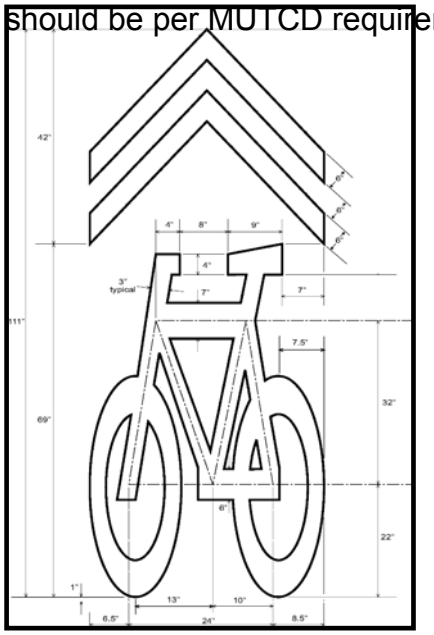


Figure 9: Sharrow Marking
MUTCD Sign 9C-9

This proposed design will be detailed in Final Design and coordinated and approved with City of Mesa staff.

Figure 10: May Use Full Lane
MUTCD Sign R4-11

2.4 IMPACTS ANTICIPATED DURING CONSTRUCTION - MAINTENANCE OF TRAFFIC

This section of the report discusses the preliminary traffic control concepts related to utility relocation, roadway widening and track and station construction.

2.4.1 Utility Relocation

Relocations of underground utilities such as fiber optic cable, sewer storm drains, water lines, irrigation, and electrical cabinets and conduits would be accomplished first, prior to roadway widening and LRT construction although the specific timing for various construction activities would vary depending on the implementation of the construction

process. Several options have been considered to minimize the period of construction and the disruption to downtown businesses caused by construction of the Central Mesa LRT extension project.

Utility relocation will be required to stay 1/2 mile to 1 mile ahead of the track/civil construction to reduce potential conflicts. Local traffic control will be needed due to the utility relocation process that requires all utility work to be completed in one entire reach and should not be truncated into smaller segments. Utility relocations would be done in segments that are between 500 and 1,200 feet in length. Construction would be sequenced to start from the west near Sycamore and move east with about 50 to 100 feet of open trench at any given time.

Local traffic control will be provided. Special maintenance of traffic procedures would be required for offsets from manholes for the 84" storm drain. The storm drain system is very deep and work would require lane closures. Excavations of approximately 25' to 30' in size would be required at the site of each manhole. These would be excavated/constructed one at a time, and would likely require a full travel lane closure in each direction. Construction alternatives could be explored to minimize traffic impacts.

Two lanes of traffic on Main Street and on intersecting north/south streets would be maintained at all times, with partial lane closures implemented as needed. No full closures of Main Street or intersecting streets are expected for utility relocations.

Potential maintenance of traffic strategies include:

- Use of advanced planning during preliminary engineering and final design to minimize interruption of utility services during construction.
- Utility replacement and/or relocation would be planned based on utility provider requirements and coordinated with other construction activities as well as other projects in the area to minimize disruption to adjacent properties and traffic.
- Develop and implement emergency response procedures in consultation with the utility providers to ensure quick and effective repair of any accidental cuts in service.
- City of Mesa street lighting should be maintained at all times during construction of roadway, track, and replacement lighting.

2.4.2 Roadway Widening

All road reconstruction would be done following or concurrent with the utility relocation. Since the current LRT options require road reconstruction/widening in limited areas, those areas would be the focus of construction activity. Locations where road widening would be needed include the south side of Main Street near the East Valley Institute of Technology, around Alma School Road, and around Country Club Drive.

As with the utility relocations, one lane of traffic would be maintained in each direction on Main Street at all times, and no full roadway closures are foreseen, although partial lane closures may be implemented as needed.

Roadway widening associated with turn lanes and center-platform station construction is expected to encroach on existing sidewalks in the segment between Sycamore and Country Club Drive. Some sidewalk encroachment is also expected near each Downtown Mesa station in both the 2-Lane and 4-Lane Options due to the widening of the roadway for the station platforms. As utility relocations and roadway and trackway construction proceed across intersections, north/south pedestrian connections across Main Street will be temporarily severed and detours will be established to safely guide pedestrians until sidewalks and crosswalks are restored.

2.4.3 LRT Track and Station Construction

Track work includes installation of drainage structures, signal and communication fiber optics, steel and concrete foundations for the rail, overhead catenary system (OCS) foundations, and communications vaults. Track and station platform construction would follow the road reconstruction/widening work. Track construction could start on the west at Sycamore Street and could be constructed in 1 mile segments to be efficient. Between Country Club Drive and Mesa Drive, track construction would be completed in segments of 2 to 3 blocks for efficiency and to minimize the extent of construction disruption in downtown Mesa as much as possible. Track construction work should take about 1.5 months for each 2 to 3 block segment. There may be some impact to left turn lanes from time to time as the contractor would need the adjacent lane for material delivery. These turn lanes may be temporarily closed and traffic diverted.

For station construction, most impacts to travel lanes, bicycle facilities and pedestrian facilities along Main Street should be minimized, although short term closure or partial closure of the roadway lane adjacent to the station platforms may be expected. A minimum of one lane of traffic in each direction on Main Street should be maintained at all times. At intersection locations, mitigation should ensure that north/south traffic flow is maintained with at least one lane of traffic in each direction.

Pedestrian north/south circulation across Main Street should be maintained by closing only one intersection crosswalk (west side or east side) at any one time.

Bicyclists should be accommodated in any traffic diversion of north/south streets, especially on the designated bicycle corridors of Alma School Road, Longmore, Extension, Lesueur, Hobson and Horne.

Similarly, transit operations should be accommodated during construction on north/south transit corridors that intersect with Main Street including Alma School Road, Country Club Drive and Mesa Drive.

2.4.4 Bicycle Facilities

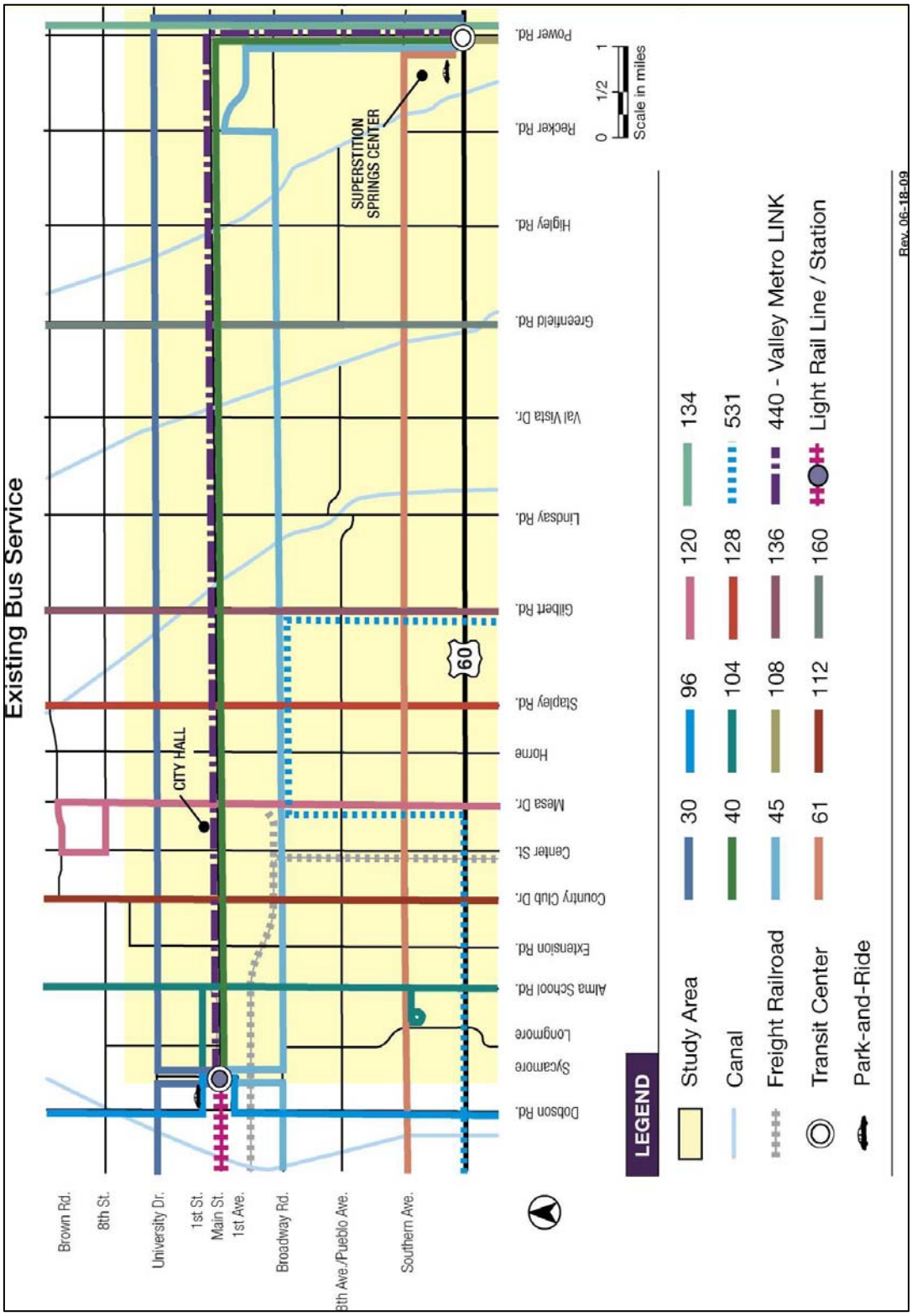
During construction, alternate temporary bicycle routes that run parallel to Main Street could be established on 1st Street (westbound) and 1st Avenue (eastbound). While these routes would be less direct than maintaining the bicycle corridor on Main Street, they would provide a reasonable detour around construction. Currently there are no bike lanes striped on 1st Street or 1st Avenue, but those streets are wide enough to accommodate bicycles and the traffic volume is low (5,400 – 5,900 vehicles per day on 1st Street and 5,600 – 7,200 vehicles per day on 1st Avenue). Front-in angled parking could be switched to back-in angled parking to provide an increased measure of safety for both bicyclists and motorists. Wayfinding signage and pavement markings would be required to mark the temporary bicycle routes between Main Street/Country Club Drive on the west and Main Street/Lesueur Street on the east, and along 1st Street/1st Avenue. This proposed design would need to be coordinated with City of Mesa staff for approval.

APPENDIX A:

Downtown Mesa Existing (2009) Bus Route Map

Downtown Mesa Planned (2015) Bus Route Map

DOWNTOWN MESA EXISTING (2009) BUS ROUTES



DOWNTOWN MESA PLANNED (2015) BUS ROUTES