ADOT

Milton Road Corridor Master Plan

Working Paper #2 - Alternative Analysis

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1.0 INTRODUCTION

1.1 Corridor Master Plan Purpose & Need

The purpose of the Milton Road Corridor Master Plan (CMP) is to identify a 20-year vision for the Milton Road corridor that addresses the seven goals (expressed in Figure 1-1 below) by evaluating a mixture of previously recommended and newly introduced System Alternatives. These System Alternatives include a mix of alternatives that utilize and maintain the existing Milton Road right-of-way, alternatives that would require an expanded right-of-way, and alternative routes separate and in addition to the Milton Road corridor itself.

The System Alternatives are also complemented by a series of Base Build Spot Improvements – which constitute targeted, near term, low investment mitigation measures that support mid-term and long-term System Alternatives.

The Milton Road CMP process has included, and will to continue to include, public and stakeholder involvement that consists of a thorough and community-vetted, quantitative evaluation criteria exercise for the review of the System Alternatives to ultimately reach a set of preferred System Alternative(s) and achieve an informed consensus by the Project Partners, stakeholders, and the community.

1.2 Project Partner Goals & Objectives

As part of the CMP Process, a team of Project Partners was assembled by representatives from the following agencies:

- Arizona Department of Transportation (ADOT);
- Flagstaff Metropolitan Planning Organization (FMPO) (AKA MetroPlan);
- Northern Arizona Intergovernmental Public Transportation Authority (NAIPTA) (AKA Mountain Line);
- City of Flagstaff;
- Coconino County;
- US Forest Service (USFS);
- Federal Highways Administration (FHWA);
- Northern Arizona University (NAU); and the
- BNSF

The Project Partners are established to guide the success of the Milton Road CMP planning process by maintaining a positive and supportive working relationship with all partnering agencies, communicating regularly, and staying committed to the project's core values. The Project Partners met early in the planning process to agree upon and create a Charter (Appendix A) to establish a set of fundamental principles for the Partners to abide by. The Project Partners also established the following seven goals (**Figure 1-1**) for the Milton Road CMP which are not prioritized in any particular order.

Figure 1-1: Milton Road CMP Goals

1.3 Milton Road Corridor Overview

The nature and function of Milton Road has changed over the years with the evolution and growth of the City of Flagstaff. Historically, Milton Road primarily served residents and visitors as a connection between Interstate 17 (I-17) to downtown Flagstaff, Interstate 40 (I-40), Historic Route 66 and US Highway 180 (US 180). Although Milton Road continues to serve in that capacity today, the roadway is now a formidable commercial corridor for NAU students and residents throughout Coconino County. Milton Road is home to a considerable portion of the destination commercial retail growth south of downtown. Illustrated in **Figure 1-2**, the Milton Road Corridor Master Plan study corridor consists of a 1.8-mile segment from West Forest Meadows Street (Mile Post 402.16) to Beaver Street (MP 180.20).

Milton Road is a multi-functional corridor serving residents and regional visitors as the gateway to the Grand Canyon and recreational sites in the Coconino National Forest. There is an extensive list of issues within the study corridor, including severe traffic congestion caused by the combination of local traffic and visitors, especially during the winter snow play season. The frequency and close proximity of driveways and intersections causes access management conflicts, and Milton Road's proximity to a significant number of commercial, employer and housing destinations, as well as adjacency to Northern Arizona University brings multimodal challenges facing bicyclists, pedestrians and transit users.

Chapter 5: Existing Roadway and Corridor Conditions of *Working Paper #1 Existing & Future Conditions* offers a more comprehensive examination of the existing travel and operational characteristics of Milton Road. Refer to Appendix B for reference to *Working Paper #1 Existing & Future Conditions*.

looking northbound on Milton Road at the southern terminus of the corridor

Source: City of Flagstaff

Figure 1-2: Milton Road CMP Study Corridor

2.0 THREE TIER ALTERNATIVE EVALUATION PROCESS OVERVIEW

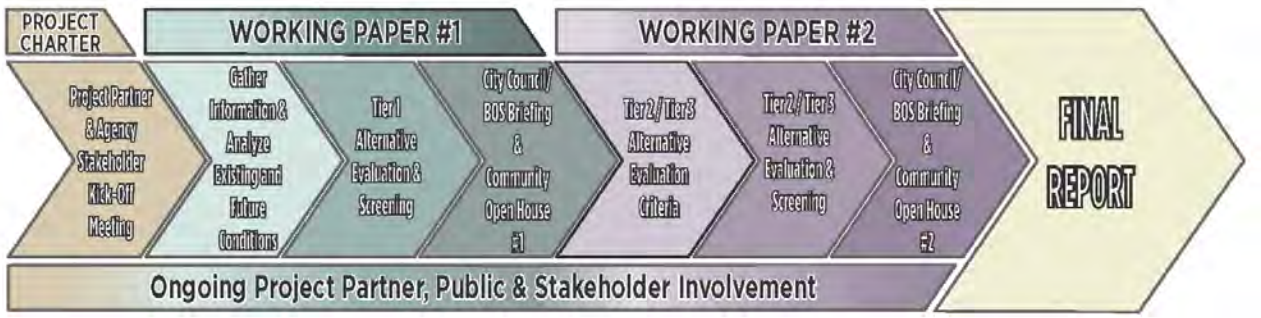
2.1 Working Paper #2 Objectives

The objective of *Working Paper #2 – Alternatives Analysis* is to describe the Tier 1, Tier 2, and Tier 3 Alternative Evaluation/Screening processes. *Working Paper #1 – Existing & Future Conditions* (Appendix B) and the Public Open House Meeting #1 were the foundation of Tier 1 Alternative Evaluation/Screening (refer to *Section 3.0 - Tier 1 Alternative Evaluation* for more information on Tier 1 Alternative Evaluation/Screening). However, this working paper will primarily focus on Tier 2 and Tier 3 Alternative Evaluation/Screening analysis and results. See *Section 4.0 - Tier 2 Alternative Evaluation & Selection* of this working paper for details regarding Tier 2 Evaluation/Screening analysis and results, and see *Section 5.0 - Tier 3 Alternative Evaluation* of this working paper for details regarding Tier 3 Evaluation/Screening analysis and results.

The results of Working Paper #2 will be presented to the City of Flagstaff City Council, the Coconino County Board of Supervisors, and the community through Public Open House Meeting/Survey #2 prior to the development of the Final Report, which will include a recommended alternative(s).

Figure 2-1 illustrates the progression of the Milton Road CMP process.

Figure 2-1: Milton Road CMP Study Process



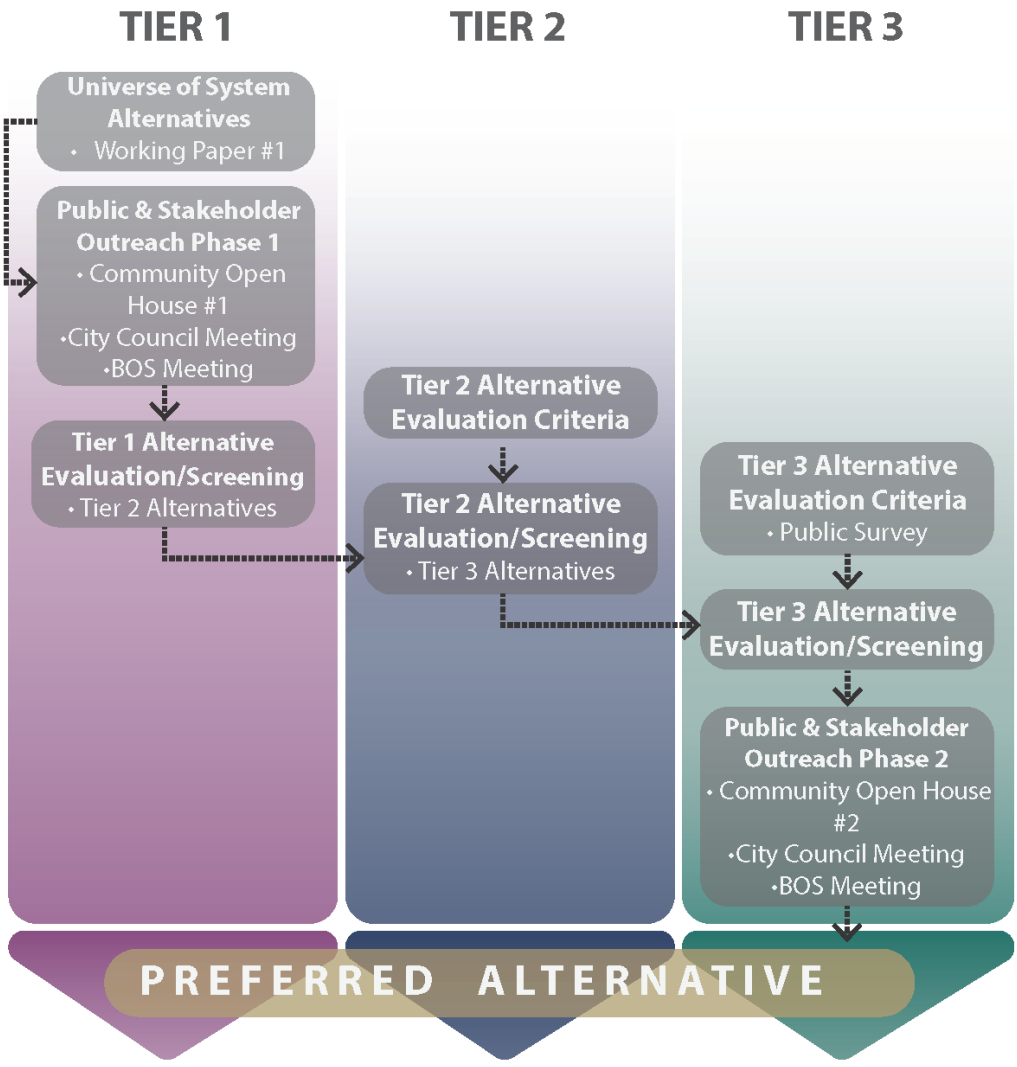
2.2 Three Tier Approach

The Milton Road CMP alternative evaluation and screening process includes a Three Tier approach (**Figure 2-2**) that is discussed in detail in throughout this working paper. Each of the Three Tier Alternative Evaluation and Screening processes have been conducted under the guidance and advice of the Project Partners with updates and meetings at major milestones during the process. The Three Tiers are described below.

- **Tier 1 Alternative Evaluation** was based on public and stakeholder feedback on the Preliminary System Alternatives developed through the initial phases of the study presented in *Working Paper #1 – Existing & Future Condition* (Appendix B) for the first screening of alternatives.
- **Tier 2 Alternative Evaluation** focused on the development of qualitative and quantitative evaluation criteria to analyze and measure the performance of the Tier 2 Alternatives.

- **Tier 3 Alternative Evaluation** expanded upon efforts conducted in the Tier 2 Alternative Evaluation phase to further analyze the remaining alternatives through a further refined series of diverse evaluation criteria focusing on quantitative measures to complement qualitative traffic modeling outputs to assess the overall performance of the Tier 3 Alternatives.

Figure 2-2: Three Tier Alternative Evaluation Process Flowchart



3.0 TIER 1 ALTERNATIVE EVALUATION

The foundation of Tier 1 Alternative Evaluation was based on public and stakeholder feedback on the Preliminary System Alternatives presented in *Working Paper #1 – Existing & Future Conditions* (Appendix B). The majority of the feedback was received at Public Open House Meeting #1 held at Flagstaff High School on May 10, 2018 in which 86 community members attended.

The primary objective of Public Open House Meeting #1 was to present the Preliminary System Alternatives for the Milton Road CMP study corridor and seek public input to help the Project Partners determine which Preliminary System Alternatives should move forward into Tier 2 Alternative Evaluation. A simple sticky-dot prioritization exercise (just one of many sources of data captured at this meeting) was utilized on the display boards at four stations to capture which preliminary system alternatives were preferred - or not preferred - by meeting community members who attended the meeting. Each participant was given one sticky-dot for each alternative and then asked to place a sticker based on whether they believed each Preliminary System Alternative should either *Move Forward for Further Study*, *Be Eliminated from Further Study,* or *Move Forward for Further Study with Adjustment.* **Table 3-1** shows and summarizes the results of the sticky-dot prioritization exercise for each System Alternative with the total number of dots for each category. Refer to Appendix C for the *Milton Road CMP Public Open House Meeting #1 Summary Report.*

Photo of public participation at the Public Open House Meeting #1

Table 3-1: Preliminary System Alternative Sticky-Dot Prioritization Exercise Results from Public Open House #1

Station/Preliminary System Alternative	Move Forward for Further Study	Be Eliminated from Further Study	Move Forward for Further Study with Adjustment
Station 2: System Alternatives Utilizing Existing Right-of-Way			
Preliminary System Alternative 1: No-Build (Maintain as Is)	Not Applicable		
Base Build Spot improvements	See Table 2		
Preliminary System Alternative 2: Milton Road Reversible Lane	2	**34**	4
Preliminary System Alternative 3: Six, 11-Foot General Purpose Lanes with Center Median/Turn Lane with 6-foot Sidewalks	17	**26**	2
Preliminary System Alternative 4: Four, 11-Foot General Purpose Lanes with Center Median/Left Turn Lane, and two 14-foot Shared Bus/Bike Lanes (SBBL) with 7-foot sidewalks	**34**	7	8
Station 3: System Alternatives that May Require Expanded Right-of-Way			
Preliminary System Alternative 5: Six, 11-Foot General Purpose Lanes with a Center Median/Center Turn Lane, and 6-Foot Bicycle Lanes with 6-Foot Sidewalks	**25**	20	3
Preliminary System Alternative 6: Six, 11-Foot General Purpose Lanes, Two 13-Foot Shared Bus/Bike Lanes (SBBL), and Center Median/Turn Lane with 7-Foot Sidewalks	4	**36**	0
Preliminary System Alternative 7: Eight, 11-Foot General Purpose Lanes	0	**42**	2
Preliminary System Alternative 8: Four, 11-Foot General Purpose Lanes, Two 14-Foot Shared Bus/Bike Lanes (SBBL), 14-Foot Landscaped Median, 10-Foot Landscaped Setbacks, and 10-Foot Sidewalks	17	**34**	0
Station 4: Alternative Routes to Milton Road			
Preliminary System Alternative 9: Milton Road No Build and Lone Tree Design Concept Report	**43**	3	1
Preliminary System Alternative 10: Backage Road Improvement: Clay Avenue/Malpais Lane/McCracken/Blackbird Roost Street	2	**17**	2
Preliminary System Alternative 10: Backage Road Improvement: West Route 66/Riordan Ranch Street	**22**	0	9
Preliminary System Alternative 10: Backage Road Improvement: Metz Walk Extension to Plaza Way	8	**10**	3
Preliminary System Alternative 10: Backage Road Improvement: Plaza Way/Yale Street/University Avenue	**14**	6	4
Preliminary System Alternative 10: Backage Road Improvement: Route 66/Yale Street/Beulah Blvd. Extension/Ft. Tuthill	**33**	7	1

4.0 TIER 2 ALTERNATIVE EVALUATION & SELECTION

4.1 Tier 2 Alternative Evaluation

Subsequent to Public Open House Meeting #1 of May 10, 2018, the Project Partners deliberated over a series of meetings to discuss and select which Milton Road alternatives that would proceed to the Tier 2 analysis stage. Utilizing the technical inputs and analysis presented in *Working Paper #1 Existing & Future Conditions* as well as drawing from the public and stakeholder inputs received from the public open house meeting and survey, the Project Partners evaluated the public feedback and technical findings to recommend Tier 1 alternatives for Tier 2 consideration.

The Project Partners were presented with the summary results of Public Open House Meeting #1. Based upon the information presented, as well as the previous technical considerations contained in Working Paper #1, the Project Partners agreed to move forward with the following system alternatives for Tier 2 consideration:

- No Build;
- Alternative 3;
- Alternative 4;
- Alternative 5;
- Alternative 6; and
- Alternative 9.

Table 4-1 on the following pages shows which of the Tier 1 Preliminary System Alternatives were elected to move forward into Tier 2 Alternative Evaluation by the Project Partners.

4.2 Refinement of the Tier 2 Recommended Alternatives

Once the initial selection of the Tier 2 alternatives was established, the next series of Project Partner meetings began to focus on a refinement of the Tier 2 alternatives as previously presented. It was recognized by the Project Partners that, while the Tier 1 alternatives selected for Tier 2 analysis generally captured the range and functionality of facility types being sought/preferred, those roadway cross sections needed to reflect the possibility of what modernized improvements, particularly for multiple modes of travel, would look like for the Build alternative types. Some modified BRT alternatives were also introduced by Mountain Line for Project Partner consideration in line with the project goals.

It is worth noting here that the Tier 1 System Alternatives included a series of alternate routes to Milton Road known as "backage roads" that were collectively captured as System Alternative 10 in Tier 1. Through the Project Partner review and deliberation of the public inputs and operational challenges of the backage road concept, Alternative 10 was eliminated from Tier 2 consideration as those improvements are outside ADOT control. Should the City assess that backage roads are beneficial to the corridor it may include them in its plans and programs.

Table 4-1: Preliminary System Alternatives Elected to Move Forward into and Removed from Tier 2 Alternative Evaluation

Station/Preliminary System Alternative	Move Forward for Further Study	Be Eliminated from Further Study	Move Forward for Further Study with Adjustment
Station 2: System Alternatives Utilizing Existing Right-of-Way			
Preliminary System Alternative 1: No-Build (Maintain as Is)	Not Applicable		
Base Build Spot improvements	See Table 2		
~~Preliminary System Alternative 2: Milton Road Reversible Lane~~	~~2~~	~~**34**~~	~~4~~
Preliminary System Alternative 3: Six, 11-Foot General Purpose Lanes with Center Median/Turn Lane with 6-foot Sidewalks	17	**26**	2
Preliminary System Alternative 4: Four, 11-Foot General Purpose Lanes with Center Median/Left Turn Lane, and two 14-foot Shared Bus/Bike Lanes (SBBL) with 7-foot sidewalks	**34**	7	8
Station 3: System Alternatives that May Require Expanded Right-of-Way			
Preliminary System Alternative 5: Six, 11-Foot General Purpose Lanes with a Center Median/Center Turn Lane, and 6-Foot Bicycle Lanes with 6-Foot Sidewalks	**25**	20	3
Preliminary System Alternative 6: Six, 11-Foot General Purpose Lanes, Two 13-Foot Shared Bus/Bike Lanes (SBBL), and Center Median/Turn Lane with 7-Foot Sidewalks	4	**36**	0
~~Preliminary System Alternative 7: Eight, 11-Foot General Purpose Lanes~~	~~0~~	~~**42**~~	~~2~~
~~Preliminary System Alternative 8: Four, 11-Foot General Purpose Lanes, Two 14-Foot Shared Bus/Bike Lanes (SBBL), 14-Foot Landscaped Median, 10-Foot Landscaped Setbacks, and 10-Foot Sidewalks~~	~~17~~	~~**34**~~	~~0~~
Station 4: Alternative Routes to Milton Road			
Preliminary System Alternative 9: Milton Road No Build and Lone Tree Design Concept Report	**43**	3	1
~~Preliminary System Alternative 10: Backage Road Improvement: Clay Avenue/Malpais Lane/McCracken/Blackbird Roost Street~~	~~2~~	~~**17**~~	~~2~~
~~Preliminary System Alternative 10: Backage Road Improvement: West Route 66/Riordan Ranch Street~~	~~**22**~~	~~0~~	~~9~~
~~Preliminary System Alternative 10: Backage Road Improvement: Metz Walk Extension to Plaza Way~~	~~8~~	~~**10**~~	~~3~~
~~Preliminary System Alternative 10: Backage Road Improvement: Plaza Way/Yale Street/University Avenue~~	~~**14**~~	~~6~~	~~4~~
~~Preliminary System Alternative 10: Backage Road Improvement: Route 66/Yale Street/Beulah Blvd. Extension/Ft. Tuthill~~	~~**33**~~	~~7~~	~~1~~

Notes:
Alternatives displayed with a strikethrough were eliminated from further study during the Tier 2 Alternative Evaluation

4.2a Controlling Design Criteria

Born out of Project Partner discussions and desire to refine the newly selected Tier 2 alternatives, it was determined that a set of Controlling Design Criteria were going to be collectively developed by the Project Partners to guide Tier 2 Alternative Evaluation.

The Controlling Design Criteria were created to:

1. To identify and compare identified FHWA, ADOT, and Flagstaff/MetroPlan/Mountain Line agency standards for the various roadway features in the Milton Road corridor and ensure that ADOT/FHWA standards are met.
2. Acknowledge that once ADOT/FHWA minimum standards are met, which City of Flagstaff/MetroPlan/Mountain Line standard(s) is preferred for inclusion in any refined Tier 2 Alternative.
3. To ensure if any variances or design exceptions would require FHWA approval.
4. Use this comparison to recognize that different agencies may have different views on preferred roadway feature dimensions during the Tier 2 Analysis. As such, it was felt to be important to the planning process to document the similarities and differences between agencies, while also aiding in helping assign potential construction cost obligations between agencies (if the need should arise based on the nature of any preferred alternative that may be identified in this study process).
5. In recognition of possible different preferences between agencies, it was discussed and confirmed what type and size of roadway features ADOT would/could contribute possible construction dollars towards (should a particular alternative be recommended through this study process), versus those roadway feature types above and beyond the ADOT standards that other agencies would be required to contribute construction cost (should the need arise).
6. Flagstaff/MetroPlan/Mountain Line collectively expressed that the current adopted Flagstaff minimum standards for roadway features were a bit dated and didn't necessarily represent current policies that reflect city preferences for certain roadway features. This resulted in identifying Flagstaff/MetroPlan/Mountain Line "current standards" and "preferred standards" separately.
7. The Controlling Design Criteria information would help inform and apply the Tier 2 evaluation criteria to quantify thresholds of scoring for bicycle and pedestrian oriented features across the various alternatives.

Over the course of several meetings, the Project Partners discussed and confirmed the series of Controlling Design Criteria shown in **Table 4-2**.

Table 4-2: Controlling Design Criteria

Roadway Feature	FHWA Standard	ADOT Standard	Flagstaff/FMPO/NAIPTA Standard	Flagstaff/FMPO/NAIPTA Preferred Standard	Notes
General Purpose Lane Width	**Urban:** • *Arterial Minimum - 10' with low truck and bus volumes • Arterial desired – 12' (AASHTO 7.3 Urban Arterials) * Anything below 12' has to obtain an variance from the Assistant State Engineer over Roadway Engineering Group.	**Urban:** • *Through lane Min – 11' • Through lane Max – 16' **Rural:** • Through lane Min – 12' Through lane Max – 12' * Anything below 12' has to obtain an variance from the Assistant State Engineer over Roadway Engineering Group.	**Urban Milton & US 180:** • 12' **Suburban Milton & US 180:** • 12' **Rural US 180:** • 12'	**Urban Milton & US 180:** • 11' **Suburban Milton & US 180:** • 11' **Rural US 180:** • 12'	**For these categories, the preferred widths are less than the minimums, in contexts where the City/NAIPTA/FMPO have allowed for narrower lanes to improve multimodal functionality. In urban areas in particular, the Regional Plan supports this strategy based on a case by case assessment.
Left Turn Lane	**Urban:** • *Auxiliary lane Min. – 10' • Auxiliary lane Max. – 16' * Anything below 12' has to obtain an variance from the Assistant State Engineer over Roadway Engineering Group.	**Urban:** • *Auxiliary (turn) lane Min – 10' • Auxiliary lane Max = none **Rural:** • Auxiliary lane Min – 12' • Auxiliary lane Max – 12' * Anything below 12' has to obtain an variance from the Assistant State Engineer over Roadway Engineering Group.	**Urban Milton & US 180:** • 12 **Suburban Milton & US 180:** • 12' **Rural US 180:** • 11'	**Urban Milton:** • 11' **Urban US 180:** • 10' **Suburban Milton & US 180:** • 12' **Rural US 180:** • 11'	**
Right Turn Lane	**Urban:** • *Auxiliary lane Min. – 10' • Auxiliary lane Max. – 16' * Anything below 12' has to obtain an variance from the Assistant State Engineer over Roadway Engineering Group.	**Urban:** • *Auxiliary (turn) lane Min – 10' • Auxiliary lane Max = none **Rural:** • Auxiliary lane Min – 12' • Auxiliary lane Max – 12' * Anything below 12' has to obtain an variance from the Assistant State Engineer over Roadway Engineering Group.	**Urban Milton & US 180:** • 12' **Suburban Milton & US 180:** • 12' **Rural US 180:** • 11'	**Urban Milton & US 180:** • 11' - Regional Plan policy supports no RT lanes, except at major intersections **Suburban Milton & US 180:** • 12' **Rural US 180:** • 11'	**
Median Width	**Urban:** • Arterial minimum Median Width – 4' • Arterial minimum Median Width for pedestrian refuge – 6' • *Auxiliary lane Min. – 10' • Auxiliary lane Max. – 16' **Rural:** Not applicable on US 180 cross sections * Anything below 12' has to obtain an variance from the Assistant State Engineer over Roadway Engineering Group.	**Urban:** • **Raised** - 16' Through lane - 4' with a turn lane **Rural:** Not applicable on US 180 cross sections	**Urban Milton & US 180:** • 4' **Suburban Milton & US 180:** • 4' **Rural US 180:** Not Applicable	**Urban Milton & US 180:** • 4' **Suburban Milton & US 180:** • 4' **Rural US 180:** Not Applicable	

Roadway Feature	FHWA Standard	ADOT Standard	Flagstaff/FMPO/NAIPTA Standard	Flagstaff/FMPO/NAIPTA Preferred Standard	Notes
Median Width (With Plantings)			**Urban Milton & US 180:** • 8' **Suburban Milton & US 180:** • 8' **Rural US 180:** Not Applicable	**Urban Milton:** • 12' **Urban US 180:** • 11' **Suburban Milton & US 180:** • 12' **Rural US 180:** Not Applicable	Same as left turn lane - would be wider when combined with a median separating the turn lane from oncoming traffic
Median Width (With Turn Lane)			**Urban Milton & US 180:** • 15' **Suburban Milton & US 180:** • 15' **Rural US 180:** Not Applicable	**Urban Milton & US 180:** • 15' **Suburban Milton & US 180:** • 16' **Rural US 180:** Not Applicable	This assumes 4-foot median with no plantings. Can be narrowed up to 1 foot.
Two Way Left Turn Lane	• **Raised Max –** - *TWLT Min – 10' - TWLT Max – 12' * Anything below 12' has to obtain an variance from the Assistant State Engineer over Roadway Engineering Group.	• **Raised Max –** - *TWLT Min – 10' - TWLT Max – 12' * Anything below 12' has to obtain an variance from the Assistant State Engineer over Roadway Engineering Group.	• 11'	• 11' (12' for Suburban US 180)	Urban contexts have narrower turn lanes to slow truck/bus traffic and because they are not preferred in this context for loading and unloading
Landscape Buffer/Parkway	Desired - 6' Minimum - 3' if a 5' sidewalk is provided	Desired = 5' Minimum = back of curb The location of the sidewalk should be coordinated with the local government and with the Roadside Development Section when the highway project involves landscaping.	**Urban Milton & US 180:** • 5' **Suburban Milton & US 180:** • 5' **Rural US 180:** Not applicable	**Urban Milton & US 180:** • 7' **Suburban Milton & US 180:** • 8' **Rural US 180:** Not applicable	Furnishing strips and tree grates are preferred for the urban context associated with Milton and US 180 because it is consistent with the existing urban design
Utility Setback			**Urban Milton & US 180:** • 1' **Suburban Milton & US 180:** • 2' **Rural US 180:** Not applicable	**Urban Milton & US 180:** • 1' **Suburban Milton & US 180:** • 2' **Rural US 180:** Not applicable	Used for poles, signage, utilities, etc. Used for sidewalk stabilization
Shoulder	**Rural Shoulder:** Desirable – 8' Minimum - 4'	**Rural Shoulder:** Desirable – 8' DHV > 200 vph Minimum - 6' DHV<200 vph	**Rural US 180:** Not applicable within Flagstaff City Limits	**Rural US 180:** Not applicable within Flagstaff City Limits	

Roadway Feature	FHWA Standard	ADOT Standard	Flagstaff/FMPO/NAIPTA Standard	Flagstaff/FMPO/NAIPTA Preferred Standard	Notes
Bike Lane	**Urban:** Desirable – 5' Minimum - 4' **Rural Shoulder:** Desirable – 8' Minimum - 4'	**Urban:** **See ADOT Bicycle Policy –** (1.f) incremental costs for construction and maintenance are funded by a local agency AND 2) the bicycle lane is included as a part of a bicycle facilities plan adopted by a local agency.) Desirable – 5' Minimum - 4' **Rural Shoulder:** Desirable – 8' DHV > 200 vph Minimum - 6' DHV<200 vph	*Measurements do not include gutter pan* **Urban Milton & US 180:** • 4.5' **Suburban Milton & US 180:** • 4.5' **Rural US 180:** • 4'	*Measurements do not include gutter pan* **Urban Milton & US 180:** • 6' with Buffer **Suburban Milton & US 180:** • 6' with Buffer **Rural US 180:** • 8'	buffer is a double stripe with crosshatch 1.5 foot wide
Sidewalk	Desired – 8' Minimum – 4' with a 5' passing section every 200'.	5' (unless local standards require greater and locals agree to pay additional cost of design, construction and agree to maintain the sidewalks.)	**Urban Milton & US 180:** • 10' **Suburban Milton:** • 10' **Suburban US 180:** • 6' (one-side - if paired with FUTs on other side) **Rural US 180:** Not applicable on US 180 cross sections	**Urban Milton & US 180:** • 10' **Suburban Milton:** • 10' **Suburban US 180:** • 6' (one-side - if paired with FUTs on other side) **Rural US 180:** Not applicable on US 180 cross sections	A sidewalk is preferred over a multi-use path on Milton Road.
Multi-Use Path/ Offset (parkway)			**Urban Milton & US 180:** Not applicable **Suburban Milton:** Not applicable **Suburban US 180:** • 20' **Rural US 180:** • 15'	**Urban Milton & US 180:** Not applicable **Suburban Milton:** Not applicable **Suburban US 180:** • 20' **Rural US 180:** • 15'	Dimension includes the parkway/buffer
Pedestrian Island Refuge (Pedestrian Islands at a Right Turn must meet ADA std)	6' (info from NACTO), when 6 ft cannot be attained, narrower raised median is preferred, refuge is ideally 40 ft in length	ADOT does not have a standard for this so minimum would be AASHTO	**Urban Milton & US 180:** • 6' **Suburban Milton & US 180:** • 6' **Rural US 180:** • 6'	**Urban Milton:** • 11' **Urban US 180:** • 10' **Suburban Milton & US 180:** • 12' **Rural US 180:** • 11'	For preferred, a pedestrian island refuge can be as wide as the center lane, if one is present.

November 2, 2018

Roadway Feature	FHWA Standard	ADOT Standard	Flagstaff/FMPO/NAIPTA Standard	Flagstaff/FMPO/NAIPTA Preferred Standard	Notes
Bus Bay/Pullouts		Bus pullouts may be required under any one of the following conditions: 1) Posted speed limit is 35 mph or higher; and 2) There are less than three through-travel lanes in the direction that the bus is traveling 3) There is an identified bicycle facility adjacent to the travel lane. If a bus stop is to be located at an intersection where the traffic on the State highway is controlled by a traffic signal or stop sign, the bus stop must be located on the far side of the intersection. A bus stop sign, denoting the front of the location of a stopped bus, must be located 85 feet from the intersection's radius return ADOT construction detail C-05.50 has dimensions for a bus pullout.	**Urban Milton & US 180:** • 12' **Suburban Milton & US 180:** • 12' **Rural US 180:** Not applicable	**Urban Milton & US 180:** • 12' (NAIPTA does not prefer in this context, very site specific) **Suburban Milton & US 180:** • 12' **Rural US 180:** • 12'	NAIPTA will not stop in ROW in a rural context, only stop will be Snowbowl lower parking lot. Bus Bays will not be used in BRT Alternatives.
Side running shared bus bike lane (SBBL) (with right turns)			**Urban Milton & US 180:** • 12' **Suburban Milton & US 180:** • 12' **Rural US 180:** • 12'	**Urban Milton & US 180:** • 16' **Suburban Milton & US 180:** • 16' **Rural US 180:** • 16'	Based on NACTO standards
Side running bus lane (with right turns)			**Urban Milton & US 180:** • 12' **Suburban Milton & US 180:** • 12' **Rural US 180:** • 12'	**Urban Milton & US 180:** • 12' **Suburban Milton & US 180:** • 12' **Rural US 180:** • 12'	Based on NACTO standards
Bus Stop (Back of Curb)			**Urban Milton & US 180:** • 8' **Suburban Milton & US 180:** • 8' **Rural US 180:** • 8'	**Urban Milton & US 180:** • 10' **Suburban Milton & US 180:** • 10' **Rural US 180:** • 8'	This standard can vary when topography is in play due to ADA standards
Center Running transit - 2 lanes + buffer			**Urban & Suburban Milton:** • 25' (2, 11' lanes with 2, 1.5' buffers) **Urban, Suburban, & Rural US 180:** Not Applicable	**Urban & Suburban Milton:** • 28' (2, 12' lanes with 2, 2' buffers) **Urban, Suburban, & Rural US 180:** Not Applicable	See Assumptions for details

Roadway Feature	FHWA Standard	ADOT Standard	Flagstaff/FMPO/NAIPTA Standard	Flagstaff/FMPO/NAIPTA Preferred Standard	Notes
Center Running Transit - Intersection Transit Station			**Urban & Suburban Milton:** • 33' (2, 11' lanes with 2, 1.5' buffers and an 8' Platform) **Urban, Suburban, & Rural US 180:** Not Applicable	**Urban & Suburban Milton:** • 34' (2, 11' lanes with 2, 2' buffers and an 8' Platform) **Urban, Suburban, & Rural US 180:** Not Applicable	See Assumptions for details Option A: Scissors Platforms Options B: Offset Platforms
Center Running Transit - Mid-Block Transit Station			**Urban & Suburban Milton:** • 33' (2, 11' lanes with 2, 1.5' buffers and an 8' Platform) **Urban, Suburban, & Rural US 180:** Not Applicable	**Urban & Suburban Milton:** • 34' (2, 11' lanes with 2, 2' buffers and an 8' Platform) **Urban, Suburban, & Rural US 180:** Not Applicable	See Assumptions for details Option A: Scissors Platforms Options B: Offset Platforms
Clear Recovery Zone	**Urban:** 4' - 6' **Rural:** 14' - 18'	14' – 18'. Can be adjusted for right of way constraints in urban areas.			

The Controlling Design Criteria would be used as a reference for each Alternative to ensure:

a. Minimum ADOT/FHWA standards are being met
b. If any variances or design exceptions would require FHWA approval
c. Once min standards are met, which FMPO/City/NAIPTA standard is preferred
d. Understanding that if max ADOT standards are exceeded, it would be the local agency's responsibility to fund such enhancements
e. Ensure that we do not recommend enhancements that exceed FMPO/City/NAIPTA policy/standards
f. Prior to Tier 2 Analysis, we could review each alternative to ensure and reach consensus on a spec that meets the Controlling Design Criteria

FMPO/City/NAIPTA Assumptions:

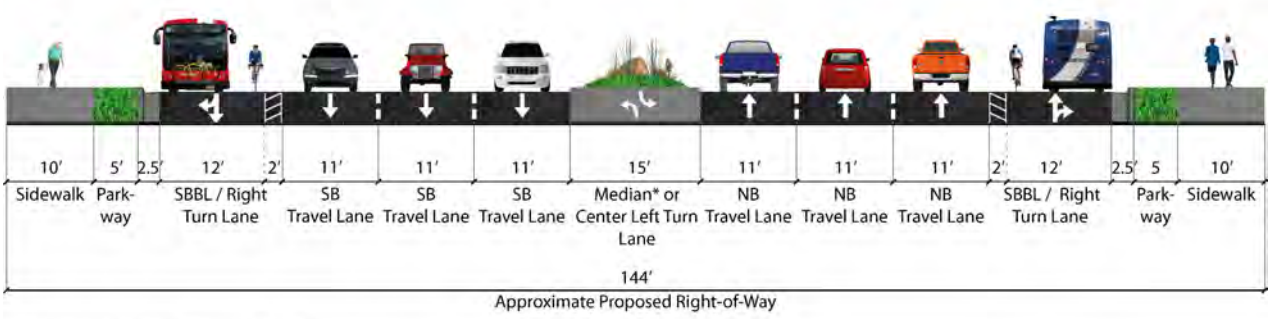
- Widths include the curb to its face
- Assumptions about widths of BRT center running features
- Center lane breakdown
- Side running lane
- Buffers could be added at for safety/ landscape + beautification – approximate 2' each side (4' total)
- Some of the Preferred Minimum and Maximum Standards do not meet the City of Flagstaff's current engineering standards. The City of Flagstaff is in the process of updating its engineering standards and requested that the Preferred Minimum/Maximum standards, as shown in the Controlling Design Criteria be utilized.

In addition to the application of the Controlling Design Criteria to refine the Tier 2 alternatives, three additional alternatives were evaluated and added by the Project Partners. These are; 1) the refinement of Alternative 6 into Alternative 6a and 6b; 2) conversion of Alternative 9 into the No Build Alternative, and 3) introduction and review of newly introduced Bus-Rapid Transit (BRT) alternatives.

4.2b Refinement of Alternative 6 to hybrid Alternative 6a and Alternative 6b

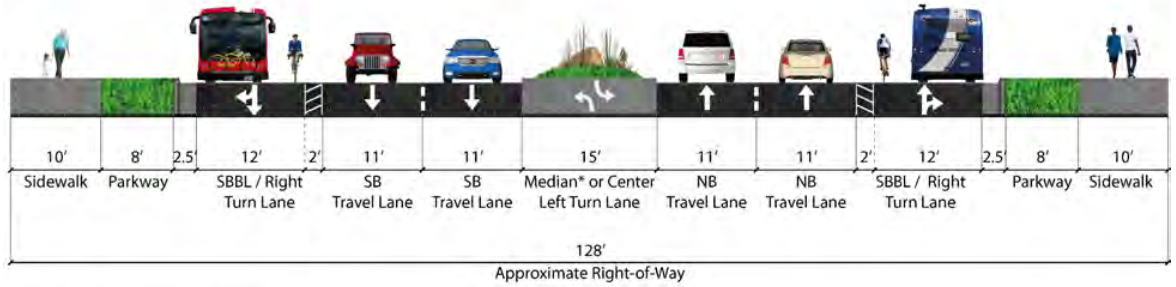
While the public sentiment obtained from public open house meeting #1 (and survey) generally did not support the higher capacity (expanded right-of-way) of System Alternative 6 (as presented at the public open house meeting #1), the Project Partners respected the public's feedback, yet also desired to maintain a diversity of higher capacity options in order to allow for a full range of options for public consideration and traffic operation analysis in Tier 2 Analysis. The result of this discussion and analysis yielded two hybrid alternatives for Tier 2 analysis that had not been previously contemplated. These became System Alternative 6a and Alternative 6b, as shown in **Figure 4-1** and **Figure 4-2**:

Figure 4-1: System Alternative 6a Mid-Block Cross Section



*Median treatment may vary along the study corridor.
**An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

Figure 4-2: System Alternative 6b Mid-Block Cross Section



*Median treatment may vary along the study corridor.
**An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

4.2c Alternative 9 converts into the No-Build Alternative

Recognizing that the Lone Tree Overpass funding was now approved by Flagstaff voters via Proposition 419, System Alternative 9 – already closely resembling the No Build alternative, became redundant to the No Build alternative and not necessary for Tier 2 analysis. The important new distinction however was that, now that voter funding was approved for the Lone Tree Overpass, the Tier 2 analysis could now include the projected benefit of the Lone Tree Overpass into the Tier 2 traffic modeling exercise for the No-Build option and all other Tier 2 Alternatives.

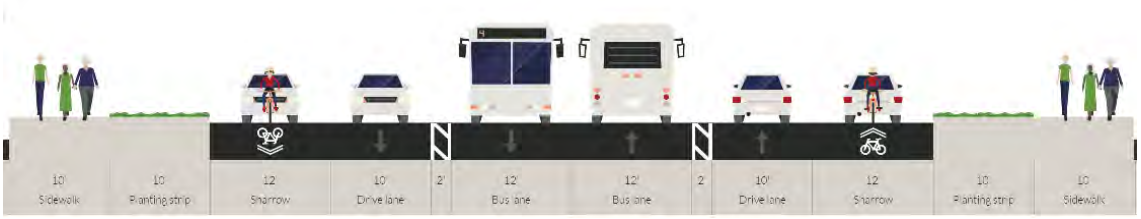
4.2d Modified BRT Alternatives

Though not presented at the Public Open House Meeting #1 or within *Working Paper #1 – Existing & Future Conditions*, Mountain Line expressed a desire to introduce additional BRT alternatives for Project Partner consideration into the Tier 2 analysis. These BRT alternatives were identified as Alternative 11, Alternative 12, and Alternative 13 as shown in **Figure 4-3**, **Figure 4-4**, and **Figure 4-5**. These three BRT alternatives included Alternative 11 with a shared bus-bike lane (SBBL) with two, 10-foot general purpose travel lanes, and Alternatives 12 and 13 that both featured a center running, dedicated BRT lane.

Figure 4-3: System Alternative 11 Mid-Block Cross Section

Figure 4-4: System Alternative 12 Mid-Block Cross Section

Figure 4-5: System Alternative 13 Mid-Block Cross Section



After Project Partner deliberation on the three newly introduced BRT alternatives, it was determined that Alternative 13 would move forward for Tier 2 consideration.

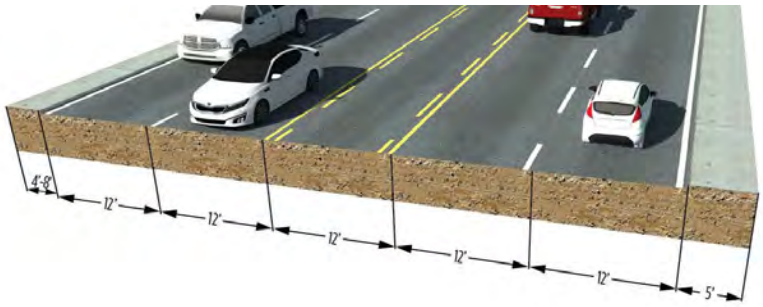
4.3 Final Tier 2 Alternatives Presented

The Project Partners reached consensus on the seven Tier 2 alternatives that are introduced and described in the following sub-sections.

4.3a No-Build

The No-Build option represents the existing roadway conditions of Milton Road, which includes two travel lanes in each direction with a center two-way left turn lane (TWTL), and (generally) six-foot sidewalks on both sides of the corridor, though the width of the sidewalk is narrower than six-foot in some locations. **Figure 4-7** shows the mid-block cross section of the No-Build. It should be noted that the No Build option does reflect existing right turn lanes and transit facilities, and incorporates future funded improvements in the City of Flagstaff TIP/CIP.

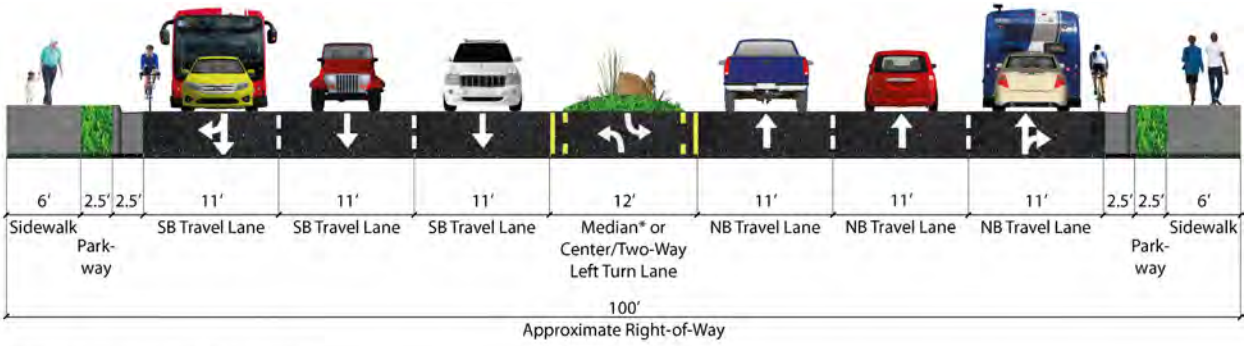
Figure 4-6: Existing Mid-Block Cross Section



4.3b System Alternative 3

System Alternative 3 includes six, 11-foot, general purpose travel lanes with center median/turn lane with 6-foot sidewalks. Alternative 3 offers increased capacity through the addition of two travel lanes – one in each direction. Alternative 3 also includes the introduction of a parkway between the curb and the sidewalk to provide a buffer between vehicular lanes and the sidewalk. **Figure 4-7** shows the mid-block cross section of System Alternative 3.

Figure 4-7: System Alternative 3 Mid-Block Cross Section

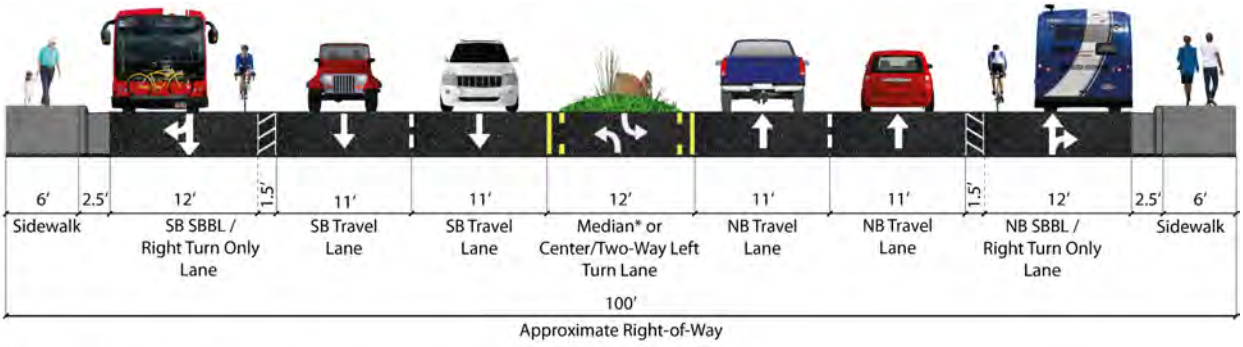


*Median treatment may vary along the study corridor.
**An ADOT design exception and FHWA approval would be required for the appliation of 11' travel lanes.

4.3c System Alternative 4

System Alternative 4 includes four, 11-foot general purpose travel lanes with center median/left turn lane and two 13.5-foot shared bus bike lanes (SBBL) with 10-foot sidewalks. Alternative 4 offers increased opportunities for expanded mode choices through the introduction of a Shared Bus-Bike Lane (SBBL) in each direction while maintaining the existing configuration of vehicular lanes and the existing conditions for the facilities back of curb. **Figure 4-8** shows the mid-block cross section of System Alternative 4.

Figure 4-8: System Alternative 4 Mid-Block Cross Section

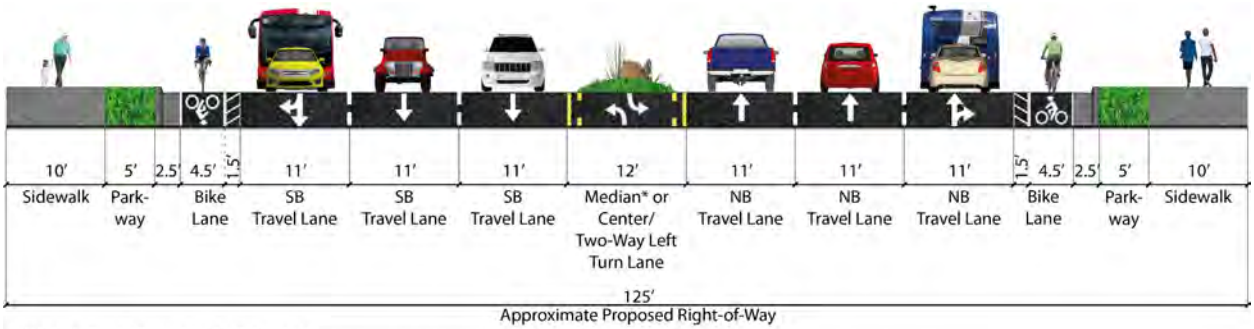


*Median treatment may vary along the study corridor.
**An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

4.3d System Alternative 5

System Alternative 5 includes six, 11-foot general purpose travel lanes with center median/left turn lane and 6-foot bicycle lanes and 10-foot sidewalks. Alternative 5 offers both increased capacity and opportunities for expanded mode choices through the introduction of two vehicular lanes – one in each direction – and the addition of buffered bike lanes on both sides of the road. Alternative 5 also includes enhanced facilities back of curb with a 10-foot sidewalk with a parkway on both sides of the road. **Figure 4-9** shows the mid-block cross section of System Alternative 5.

Figure 4-9: System Alternative 5 Mid-Block Cross Section

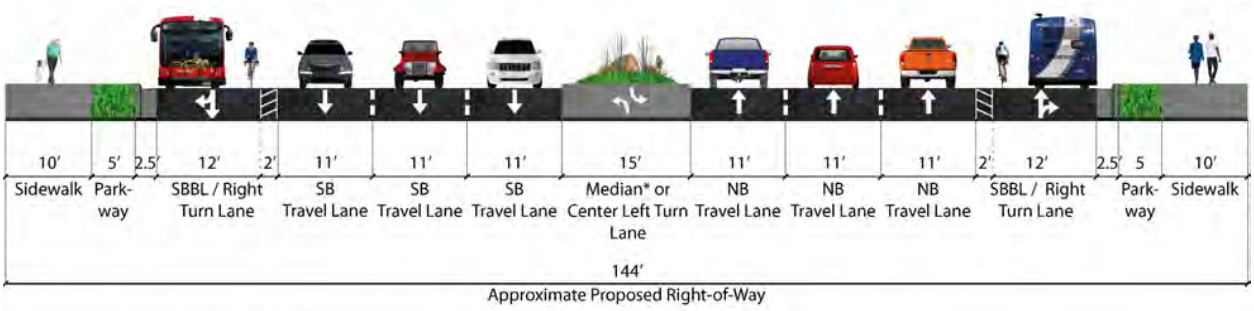


*Median treatment may vary along the study corridor.
**An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

4.3e System Alternative 6a

System Alternative 6a includes six, 11-foot general purpose lanes, Two 14-foot SBBLs, and center median/turn lane with 10-foot sidewalks. Alternative 6a offers a combination of both increased capacity and opportunities for expanded mode choices by adding both an additional vehicular lane and a SBBL in each direction. Alternative 6a also includes enhanced facilities back of curb with a 10-foot sidewalk with a parkway on both sides of the road. **Figure 4-10** shows the mid-block cross section of System Alternative 6a.

Figure 4-10: System Alternative 6a Mid-Block Cross Section



*Median treatment may vary along the study corridor.
**An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

4.3f System Alternative 6b

System Alternative 6b includes four, 11-foot General Purpose Lanes, Two 14-Foot SBBLs, 14-foot Center Median/Turn Lane with 10-foot Landscaped buffers and 10-foot sidewalks. Alternative 6b primarily provides increased opportunities for expanded mode choices by adding a SBBL in each direction while introducing a larger buffer between the vehicular lanes and the widened sidewalk. **Figure 4-11** shows the mid-block cross section of System Alternative 6a.

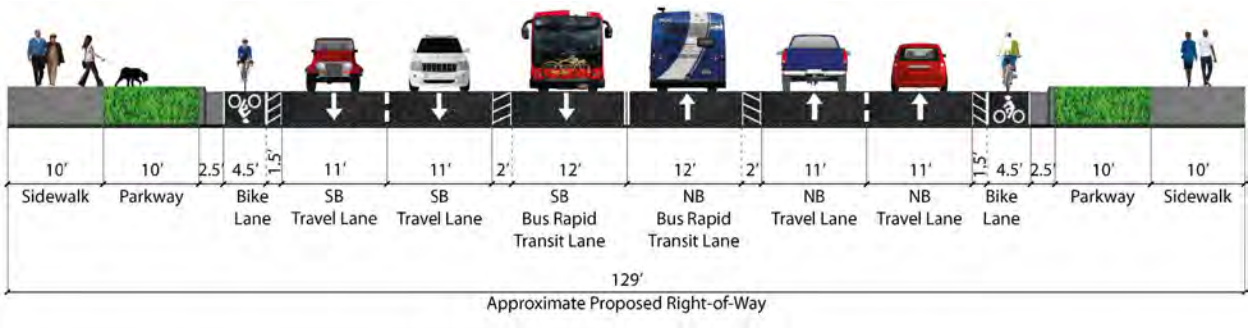
Figure 4-11: System Alternative 6b Mid-Block Cross Section

*Median treatment may vary along the study corridor.
**An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

4.3g System Alternative 13

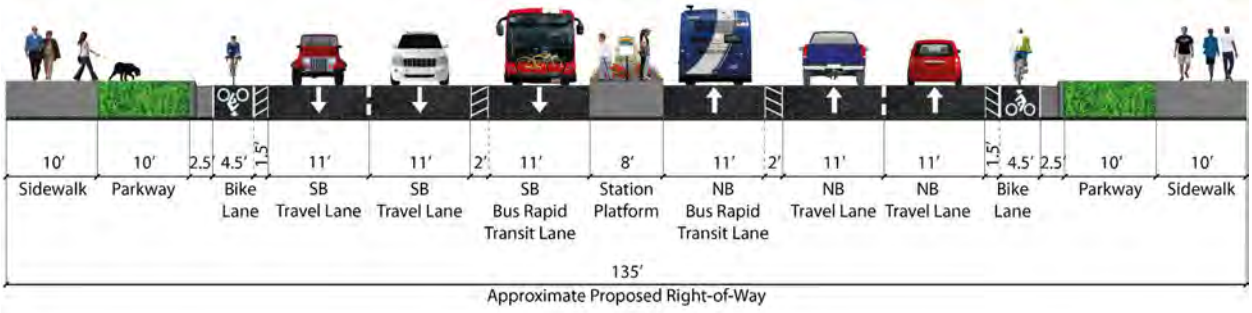
System Alternative 13 maintains the existing vehicular capacity with two 11-foot general purpose lanes with the introduction of a six-foot buffered bike lane. Alternative 13 primarily provides increased opportunities for expanded mode choices by introducing center running BRT lanes and a buffered bike lane in each direction. Alternative 13 also offers an even larger buffer between the vehicular lanes and the widened sidewalk. **Figure 4-12** shows the mid-block cross section of System 13, while **Figure 4-13** shows the cross section of Alternative 13 with BRT platforms at specific signalized intersections.

Figure 4-12: System Alternative 13 Mid-Block Cross Section



*An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

Figure 4-13: System Alternative 13 Cross Section at Platform Locations



*An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

4.4 Tier 2 Evaluation Criteria

A series of Tier 2 evaluation criteria and weightings were developed to evaluate and measure the performance of the seven Tier 2 Alternatives. The Tier 2 evaluation criteria were crafted to be diverse in nature through the combination of quantitative and qualitative measurements specific to features of each Tier 2 Alternative.

The first step in developing the evaluation criteria was to identify general categories of roadway performance to measure the operational and environmental qualities of the corridor. The

Consultant Team worked with the Project Partners and agreed to use the following categories – in no particular order of importance – on to measure and compare the Tier 2 Alternatives:

- Traffic Operations;
- Safety;
- Expand Travel Mode Choices;
- Public Acceptance;
- Construction/Implementation;
- Project Economics; and
- Environmental Impacts.

Once the categories were selected, the Consultant Team and the Project Partners created a preliminary list of evaluation criteria metrics for each category. The process included researching regulatory mandates across the state and with ADOT; understanding what issues were of highest importance for the ADOT Districts; communicating with ADOT and the Project Partners to understand strategic safety initiatives of the highest value within the various organizations and agencies; investigating measures to evaluate the level of difficulty of implementation through assessment of the costs and right-of-way impacts; and the publics acceptance of each alternative.

As a result, 16 different evaluation criteria were initially developed over the seven categories to use in Tier 2 Alternative evaluation process. **Table 4-3** describes the different evaluation criteria for each category and the following sections go into more detail.

Table 4-3: Initial Tier 2 Evaluation Criteria

Initial Tier 2 Evaluation Criteria		
Category	**Evaluation Criteria**	**Description**
Reduction in Vehicular Congestion	Improved Congestion – Volume/Capacity	ADOT's Congestion Needs Score Tool is the source that calculates the results for the Improves Congetion criterion that essentially rates the prefomance of an alterative through a volume to capacity ratio.
	Travel Speed as Percentage of Base Free Flow Speed	This metric that measures reduction in vehicular congestion by comparing the 2040 travel speed in relative to the base free flow speed of the Milton Road corridor.
	Intersection Level-of-Service (LOS)	The Intersection LOS metric measures reduction in vehicular congestion by identifying the number of operationally failing intersections (LOS grade E or F) under the 2040 condition.
	Travel Time	The Travel Time criterion is a metric that measures reduction in vehicular congestion by calculating the amount of time it takes to travel the corridor from one end to the other.
Safety	Reduction in All Crashes	The Reduction in All Crashes metric measures safety performance of the No-Build option and the six Tier 2 Alternatives through the use Crash Modification Factors (CMFs) and Crash Reduction Factors (CRFs).

Initial Tier 2 Evaluation Criteria		
Category	**Evaluation Criteria**	**Description**
	Reduction in All Injury-Related Crashes	The Reduction in All Injury-Related Crashes metric measures safety performance of the No-Build option and the six Tier 2 Alternatives through the use Crash Modification Factors (CMFs) and Crash Reduction Factors (CRFs) for crashes only involving injuries.
	Reduction in Bicycle-Related Only Crashes	The Reduction in Bicycle-Related Only Crashes metric measures safety performance of the No-Build option and the six Tier 2 Alternatives through the use Crash Modification Factors (CMFs) and Crash Reduction Factors (CRFs) for crashes only involving injuries.
Expand Travel Mode Choices	Improved Pedestrian Facilities	The Improved Pedestrian Facilities criterion is a qualitative metric that measures how pedestrian facilities are improved utilizing the Controlling Design Criteria to see if pedestrian facilities meet or exceed minimum and preferred design standards of ADOT and the various Project Partner agencies.
	Improved Bicycle Facilities	The Improved Pedestrian Facilities criterion is a qualitative metric that measures how pedestrian facilities are improved utilizing the Controlling Design Criteria to see if pedestrian facilities meet or exceed minimum and preferred design standards of ADOT and the various Project Partner agencies.
	Transit Travel Time	The Improved Transit criterion is a metric that measures transit improvement by calculating the amount of time it takes for transit vehicles to travel the corridor from one end to the other.
Public Acceptance	Public Support	The Public Support metric measures the No-Build and Tier 2 Alternatives based on the percentage of support received by the public.
Construction/ Implementation	Project Cost	The Project Cost criterion is a metric that measures the ease of construction/implementation by evaluating the total project cost to implement through detailed cost estimates.
	Right-of-Way Impact	The Right-of-Way Impact criterion is a metric that measures the ease of construction/implementation by evaluating the impact to the adjacent properties by calculating the impact by finding the amount land - in square feet - required for right-of-way acquisition.
Project Economics	Cost-Benefit (C-B) Analysis	The C-B Analysis metric measures the alternatives by calculating total Project cost by the performance of the Reduction in Congestion Criterion to compare costs vs. benefits.
Environmental Impacts	Environmental Impacts	The Environmental Impacts metric scores the No-Build and Tier 2 Alternatives on whether not they can be completed within existing right-of-way or not.

4.5 Project Partner Weighting of the Tier 2 Evaluation Criteria

Once consensus on the Tier 2 Alternative Evaluation Criteria was reached among the Project Partners, the next step was to formulate and assign a weighting value to each criterion. The weight of the criterion is a numeric value that represents the level of importance of each criterion. The weights are then used to calculate the results of the evaluation of each criterion – the higher the weight results in a higher score for that criterion.

In order to determine a weight for each criterion, the Project Team developed an excel-based survey to distribute to each of the Project Partner agencies. The survey included in-depth instructions on how to populate the excel-based tool. The Project Partners were asked to provide two responses per agency that assigned each criterion a numeric value on a scale of 100 based on their perceived level of importance. For example, a completely balanced weight among the criterion would be 7.14 – the value of equilibrium.

100	**/**	**14**	**=**	**7.14**
Weighted total		*# of Criterion*		*Value of Equilibrium*

The Project Team was asked in the survey to adjust the value of equilibrium, by increasing or decreasing the number, based on their respective agency's perception of the relative importance of each criterion. The two responses provided from each Project Partner agency were averaged to arrive at a final weight for each evaluation criteria.

The results of the criteria weighting survey show that the Project Partners shared some commonalities in their perceptions of which criterion were more important, while also some groups assigned a large portion of the points to the criteria that specifically align with their agency goals and objectives. For instance, ADOT had a fairly equal distribution with somewhat of an emphasis in Safety and Project Economics. On the other hand, Mountain line (AKA NAIPTA) assigned the majority of their points into Expand Travel Mode Choices and Public Acceptance. The City of Flagstaff and the USFS both had a fairly equal distribution of points neat the value of equilibrium. Coconino County had a balanced distribution on points across all categories with the exception of Project Economics and Expand Travel Mode Choices by putting a lot of emphasis on Project Economics and a very little focus on Travel Mode Choices.

FHWA and BNSF decided to opt out of the Project Partner Weighting Survey of the Tier 2 Evaluation Criteria and thus their voided responses were not included in the Tier 2 Evaluation Criteria Weighting process.

Table 4-4 captures the results of the Project Partner weighting survey and the assigned averages for each category based upon the survey inputs received.

Table 4-4: Project Partner Weighting Survey Results of the Tier 2 Evaluation Criteria

Category	Criteria	ADOT		NAIPTA		Coconino County		FMPO		USFS		Flagstaff		NAU		Average Response
		Response 1	Response 2	Response 1	Response 2	Response 1	Response 2	Response 1	Response 2	Response 1	Response 2	Response 1	Response 2	Response 1	Response 2	
Reduction in Vehicular Congestion	Improved Congestion Need Score (Volume/Capacity)	1	2	0	0	6	6	2.5	1.5	6	6	6.25	6.25	15	15	5.25
	Travel Speed as % of Base Free Flow Speed	4	3	0	0	6	6	2.5	1.5	6	5	6.25	6.25	0	0	3.32
	Improved Intersection LOS	8	5	7.5	7.5	6	6	2.5	1.5	6	6	6.25	6.25	8	8	6.04
	Signal/Stop Control Delay	4	3	0	0	6	6	2.5	1.5	6	6	5.55	5.55	0	0	3.29
	Travel Time	8	5	7.5	7.5	6	6	2.5	1.5	6	6	5.55	5.55	0	0	4.79
Safety	Reduction in Total Crashes	5	5	7.5	7.5	8.33	8.33	7.1	5.9	7	7	5.55	5.55	10	10	7.13
	Reduction in All Injury-Related Crashes	5	3	7.5	7.5	8.33	8.33	8.9	5.9	7	7	8	8	15	15	8.18
	Reduction in Bicycle-Related Only Crashes	15	10	7.5	7.5	8.33	8.33	1.8	5.9	7	7	5.55	5.55	5	5	7.10
Expand Travel Mode Choices	Improved Pedestrian Facilities	6	5	13.5	13.5	1.67	1.67	4.1	7.3	6	5	8	8	10	10	7.12
	Improved Bicycle Facilities	7	9	13	13	1.67	1.67	4.1	7.3	6	6	8	8	10	10	7.48
	Transit Travel Time	7	5	10	10	1.67	1.67	5.4	6.5	6	6	6.25	6.25	8	8	6.27
Public Acceptance	Public Support	4	10	10	10	5	5	16.2	16	6	7	6.25	6.25	7	7	8.26
Construction/ Implementation	Project Cost	4	8	4	4	5	5	6.7	6.8	6	6	5	5	0	0	4.68
	ROW Impact	5	7	4	4	5	5	6.7	6.8	6	6	5	5	2	2	4.96
Project Economics	Cost-Benefit Analysis (Total Project Cost vs. reduction in congestion)	14	15	4	4	20	20	13.8	11.9	6	6	7	7	5	5	9.91
Environmental Impacts	Environmental Impacts	3	5	4	4	5	5	12.7	12.2	7	8	5.55	5.55	5	5	6.21
TOTAL VALUE		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

4.6 Final Tier 2 Evaluation Criteria

After the weighting of the Tier 2 Evaluation Criteria was determined, a series of meetings were conducted between the Consultant Team and the Project Partners to refine the Tier 2 Evaluation Criteria and develop a scoring methodology.

4.6a Refinement of Tier 2 Alternative Evaluation Criteria

As the Project Partners and the Consultant Team met to review the Tier 2 Evaluation Criteria, it became evident that some of the criteria had duplicative measures making the potential for an unequitable emphasis on some elements of the Tier 2 Evaluation Criteria. For instance, the Environmental Impacts Criterion and Right-of-Way Impacts Criterion both use right-of-way as the unit of measure putting extra emphasis on the application of right-of-way in the scoring of the Tier 2 Alternatives and the No-Build. This duplicative measure in right-of-way would seem to favor the No-Build and alternatives with a smaller right-of-way footprint while creating a disadvantage on alternatives with a wider footprint. As a result, the Consultant Team and the Project Partners determined this created an advantageous edge for some alternatives and decided to remove the Environmental Impacts Criterion from the Tier 2 Evaluation Criteria.

The Project Partners also discussed potential drawbacks of the Project Economics/Cost-Benefit (C-B) Analyses Criterion. Although this evaluative method is relatively straight forward, and versatile, the Project Partners decided against using a C-B analysis as a decision-making tool. Project Partners were mainly concerned with the potential subjectivity in identifying and quantifying costs and benefits. As a result, the Project Partners decided to remove the Project Economics/C-B Analyses Criterion from the Tier 2 Evaluation Criteria.

Table 4-5 shows the final set of Tier 2 Evaluation Criteria used in the Tier 2 Alternative Evaluation process.

Table 4-5: Final Tier 2 Alternative Evaluation Criteria & Weightings

Evaluation Criteria				Weight
Category	**Criteria / Measure**	**Threshold / Formula**	**Modifier**	
Reduction in Vehicular Congestion	Improves Congestion	Formula = (Best Result / Alternative Result) * Weight * 100 Ex - Alt 4: (6.25/11.03) * 5.25% * 100 = 2.97	N/A	5.25%
	Travel Speed as % of Base Free Flow Speed	Formula = ((Alternative Result * 100) / Best Result) * Weight * 100 / 2 Ex - Alt 4: ((46.1%*100)/62)* 3.32% * 100 /2 = 1.24	N/A	3.32%
	AM			(1.66%)
	PM			(1.66%)
	Improved Intersection LOS	Formula = (Best Result / Alternative Result) * Weight * 100 / 2 Ex - Alt 4: (2/3) * 6.04% * 100 /2 = 3.02	N/A	6.04%
	AM			(3.02%)
	PM			(3.02%)
	Signal/Stop Control Delay	Formula = (Best Result / Alternative Result) * Weight * 100 / 2 Ex - Alt 4: (29.5/41.6) * 3.29% * 100 /2 = 1.17	N/A	3.29%
	AM			(1.645%)
	PM			(1.645%)
	Travel Time:	Formula = (Best Result / Alternative Result) * Weight * 100 / 2 Ex - Alt 4: (339/560) * 4.79% * 100 /2 = 1.45	N/A	4.79%
	AM			(2.395%)
	PM			(2.395%)
Safety	Reduction in Total Crashes	Formula = (Alternative Result / Best Result) * Weight * 100 Ex - Alt 4: (19.4/28.98) * 7.13% * 100 = 4.77	N/A	7.13%
	Reduced Injury Crashes	Formula = (Alternative Result / Best Result) * Weight * 100 Ex - Alt 5: (21.78/28.78) * 8.18% * 100 = 6.19	N/A	8.18%
	Reduced Bicycle Crashes	Formula = (Alternative Result / Best Result) * Weight * 100 Ex - Alt 5: (14/14) * 7.10% * 100 = 7.10	N/A	7.10%
Expand Travel Mode Choices	Pedestrian	Meets or Exceeds both ADOT's minimum standard and the City/FMPO/NAIPTA's (PP) preferred standards	1	7.12%
		Meets or Exceeds ADOT's minimum standard OR the City/FMPO/NAIPTA's (PP) preferred standards, but not both	0.5	
		Maintains Existing Condition	0	
	Bicycle	Meets or Exceeds both ADOT's minimum standard and the City/FMPO/NAIPTA's preferred standards	1	7.48%
		Meets or Exceeds ADOT's minimum standard OR the City/FMPO/NAIPTA's preferred standards, but not both	0.5	
		Maintains Existing Condition	0	
	Transit	Formula = (Best Result / Alternative Result) * Weight * 100 / 2 Ex - Alt 4: (250/371) * 6.27% * 100 /2 = 2.11	N/A	6.27%
	AM			(3.135%)
	PM			(3.135%)
Public Acceptance	Public Support	*TBD*	*TBD*	8.26%
Construction/ Implementation	Project Cost[#+-]	Formula = (Best Result / (Alternative Result/10M)) * Weight * 100 Ex - Alt 4: (1/(40.542M/10M)) * 4.68% * 100 = 1.15	N/A	4.68%
	ROW Impact[+-] (Square Feet)	Formula = (Best Result / (Alternative Result/10K)) * Weight * 100 Ex - Alt 4: (1/(26,326/10K)) * 4.98% * 100 = 1.89	N/A	4.96%
			Aggregate Score	**83.88%**
				Rank

4.6b Tier 2 Evaluation Criteria Scoring Thresholds and Methodology

The Project Partners and the Consultant Team worked collaboratively to develop uniform scoring methodologies to be applied across all the Tier 2 Evaluation Criteria. The Project Partners and Consultant Team recognized the fact that the metrics used within the evaluation criteria fell into one of two categories – quantitative or qualitative – and determined a scoring methodology would have to be developed to complement the quantitative or qualitative nature of the evaluation criteria. The following sub-sections describe the Tier 2 Evaluation Criteria Scoring Methodology for the quantitative and qualitative evaluation criteria.

Quantitative Scoring Methodology

The quantitative Tier 2 Evaluation Criteria use inputs measured in the form of numbers with numerical values associated with each alternative. Given the numerical values-based nature of these criteria, the Consultant Team worked with ADOT to develop a scoring formula that compliments the quantitative complexion of the criteria. The formula developed for the quantitative evaluation criteria was derived from uses within ADOT's Planning-to-Programming (P2P) process which is used to prioritize projects on the state's highway system. The formula used to calculate the technical score for each of the quantitative Tier 2 Evaluation Criteria is as follows:

Quantitative Tier 2 Evaluation Criteria Scoring Formula

*Technical Score = ((Alternative Result / Best Result) * Evaluation Criteria Weight)*

Results Ratio **Application of the Weight**

The quantitative Tier 2 Evaluation Criteria Scoring Formula has two fundamental steps or sub-calculations – the "Results Ratio" and the "Application of the Weight". The first step or sub-calculation is the results ratio that divides an alternative's result by the best result within a specific evaluation criterion. This step is formulated to reach a value of between one and zero relative to the result of best performing alternative within that specific evaluation criterion. The value of this ratio scales relative to the difference between the alternative result and the best result. Certain evaluation criteria have numeric metrics where the smaller values reflect a higher performing alternative. For example, the Travel Time Criterion is one of the "Reverse Ranked" criterion since the shorter amount of travel time represents a higher performance. In order to preserve the functionality of the results ratio, the following formula is used for quantitative criteria with reverse ranked results:

Reverse Ranking Quantitative Tier 2 Evaluation Criteria Scoring Formula

*Technical Score = ((Best Result / Alternative Result) * Evaluation Criteria Weight)*

Results Ratio **Application of the Weight**

The second step or sub-calculation of the formula is the application of the weight for a specific evaluation criteria determined through the weighing process described in *Section 4.5 - Project Partner Weighting of the Tier 2 Evaluation Criteria*. This calculation is simply applying the weight

to the value of the results ratio that falls within the value of one and zero. The weight is applied through a simple multiplication of the weight percentage.

The Quantitative Tier 2 Evaluation Criteria Scoring Formula ensures the highest performing alternative receives the full amount of possible points which is determined by the evaluation criteria weight. For instance, if the Travel Time Criterion has an assigned weight of 2.40%, the most possible points an alternative can receive for the Travel Time Criterion is 2.40 points.

The following example for the application of the scoring formula illustrates how the quantitative scoring works through the numerical scaling relative to the results of the best performing alternative:

In the purpose of the example, three hypothetical alternatives have the following travel times:

- Alternative A: 339 seconds of travel time;
- Alternative B: 400 seconds of travel time; and
- Alternative C: 560 seconds travel time.

Since travel time is a reverse ranked measurement, the following formula is used to calculate the technical score:

*Technical Score = (Best Result / Alternative Result) * Weight * 100*

Table 4-6 illustrates how the technical scores are calculated for each of the example alternatives for their respective travel time results.

Table 4-6: Example Application of the Quantitative Scoring Formula

Alternative	Travel Time Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative A	339 seconds	((339/339)	* 2.40%) * 100	2.40
Alternative B	400 seconds	((339/400)	* 2.40%) * 100	2.03
Alternative C	560 seconds	((339/560)	* 2.40%) * 100	1.45

Alternative A has the best travel time and as a result of the formula Alternative A is awarded full possible points of 2.40 points. On the other hand, Alternative B and Alternative C receive a lower score relative to their difference in travel time compared to Alternative A – the alterative with the best result. In essence, the scoring formula is structured to assign points based on the difference between an alternative result and the best result, and the greater the difference will result in a lower score relative to the magnitude of the difference.

The following Tier 2 Evaluation Criteria use the Quantitative Scoring Methodology:

- Improved Congestion – Volume/Capacity;
- Travel Speed as Percentage of Base Free Flow Speed;
- Intersection Level-of-Service (LOS);
- Travel Time;
- Reduction in All Crashes;
- Reduction in Injury-Related Crashes;

- Reduction in Bicycle-Related Only Crashes;
- Transit Travel Time;
- Project Cost; and
- Right-of-Way Impact.

Qualitative Scoring Methodology

The subjectivity inherently infused within the qualitative evaluation criteria require a different scoring methodology than the quantitative evaluation criteria. The two qualitative Tier 2 Evaluation Criteria are Improved Pedestrian Facilities and Improved Bicycle Facilities which reference the Controlling Design Criteria discussed in *Section 4.2a - Controlling Design Criteria*. The Consultant Team and ADOT developed three thresholds to ensure compliance of the Controlling Design Criteria while simultaneously instill an advantage for alternatives that meet and exceed the design standards imbedded in the Controlling Design Criteria. The following three thresholds described in Table 4-7were developed with a corresponding modifier to be multiplied by the weight to calculate a score for the alternative.

Table 4-7: Example Application of the Qualitative Scoring Formula

	Qualitative Threshold	Modifier	Weight	Score
1	Meets or exceeds both ADOT's minimum standard and the Project Partner preferred standards*	1	7.12	7.12
2	Meets or exceeds ADOT's minimum standard OR the Project Partners preferred standards, but not both*	0.5		3.56
3	Maintains existing condition/does not meet any standards*	0		0
**Per the minimum and preferred standards outlined in the Controlling Design Criteria*				

This scoring methodology ensures that alternatives with facilities that meet or exceed both ADOT's minimum design standard and the Project Partner preferred design standard in the Controlling Design Criteria are awarded full possible points; while also permitting alternatives with facilities that meet or exceed ADOT's minimum design standard OR the Project Partners preferred standards, but not both, to receive half of the possible points; and finally, confirm that all alternatives with facilities that maintain existing condition and/or does not meet any design standards receive zero points.

4.7 Summary of Tier 2 Evaluation Criteria Results and Analysis Findings

This section describes a brief summary of the results for the Tier 2 Alternative Evaluation process of the seven Tier 2 Alternatives through the application of the Tier 2 Evaluation Criteria. Immediately following this summary, *Section 4.8* - Tier 2 Evaluation Criteria Detailed Results includes more detailed results and a systematic synopsis for each of the Tier 2 Evaluation Criteria.

The Milton Road CMP Tier 2 Alternatives range in performance rating based on the score of the Tier 2 Alternative Evaluation Criteria. The highest performing alternative received a score of 59.02 points while the lowest performing alternative received a score of 29.20 points – nearly a 30-point difference. **Table 4-8** ranks the alternatives from highest scoring to lowest scoring alternative.

Table 4-8: Tier 2 Alternative Rankings Based on Tier 2 Evaluation Criteria Results

Rank	Tier 2 Alternative	Score
1	Alternative 5 (six travel lanes)	59.02
2	Alternative 6a (six travel lanes + 2 SBBLs)	51.51
3	No-Build (leave road as is)	46.39
4	Alternative 13 (center-running bus lanes)	43.44
5	Alternative 3 (six travel lanes)	39.08
6	Alternative 6b (four travel lanes + 2 SBBLs)	34.87
7	Alternative 4 (four travel lanes + 2 SBBLs)	29.20

As demonstrated in **Table 4-8**, Alternative 5 received the highest score of 59.02 points followed by Alternative 6a with 51.51 points, No-Build with 46.39 points, Alternative 13 with 43.44 points, Alternative 3 with 39.08 points, Alternative 6b with 34.87 points, and Alternative 4 with 29.20 points.

The results of the Tier 2 Alternative Evaluation process appear to be aligned with the visual representation of the benefits and trade-offs associated with each of the alternatives. For instance, Alternative 5 intuitively could be expected to be the best performing alternative because the alternative includes a benefit for all modes of transportation by increasing vehicular capacity through the addition of two travel lanes, improving the corridor for bicyclists by introducing a buffered bike lane, and enhancing back-of-curb facilities with a parkway and a widened sidewalk improving the pedestrian environment; all while not having the highest project cost or the largest right-of-way footprint compared to come of the other alternatives.

Conversely, Alternative 4 and Alternative 6b both could be expected to not perform as well as the other alternatives because these two alternatives do not add vehicular capacity and do not sufficiently address other modes of transportation. These two alternatives differ from each other in their back-of-curb facility types, where Alternative 3 may maintain a narrower right-of-way footprint and thus a less expensive cost, but does not have sufficient sidewalks; while on the other hand, Alternative 6b may have much wider sidewalks and a parkway, consequently resulting in a much larger right-of-way impact and a much higher project cost.

The reason why the No-Build option ranks third of all seven Tier 2 Alternatives could be primarily due to the zero cost and right-of-way impact, but also correlated with the fact that the No-Build condition performs operationally at a high enough level compared to the lower scoring alternatives across the other evaluation criteria. In theory, the No-Build option ranking third could provide a baseline for a hypothetical cost-benefit ratio where the alternatives that rank below the No-Build have a cost/impacts that outweigh the overall benefits, while the alternatives that rank above the No-Build have overall benefits that outweigh to the cost/impacts.

Figure 4-14 illustrates a graphical summary of the results for Tier 2 Alternative Evaluation process and the detailed results are provided in **Table 4-9.**

Figure 4-14: Tier 2 Alternative Rankings Summary by Tier 2 Evaluation Criteria Categories

No Build

- Project Cost: N/A
- Required ROW: 0 ft²
- Potential Buildings Impacted: 0

No Build Alternative Evaluation Criteria Results								Rank
Reduction in Vehicular Congestion (22.69 Possible Points)	Safety (22.41 Possible Points)	Expand Travel Mode Choices (20.87 Possible Points)	Public Acceptance (8.62 Possible Points)	Construction/ Implementation (9.64 Possible Points)	Project Economics (9.91 Possible Points)	Environmental Impacts (6.21 Possible Points)	Total Score (100 Possible Points)	3rd
17.12	0.00	3.51	0.00	9.64	9.91	6.21	**46.39**	

Alternative 3

- Project Cost: $40,514,000
- Required ROW: 26,326 ft²
- Potential Buildings Impacted: 9

Alternative 3 Evaluation Criteria Results								Rank
Reduction in Vehicular Congestion (22.69 Possible Points)	Safety (22.41 Possible Points)	Expand Travel Mode Choices (20.87 Possible Points)	Public Acceptance (8.62 Possible Points)	Construction/ Implementation (9.64 Possible Points)	Project Economics (9.91 Possible Points)	Environmental Impacts (6.21 Possible Points)	Total Score (100 Possible Points)	5th
18.73	12.92	4.16	0.00	3.04	0.23	0.00	**39.08**	

Alternative 4

- Project Cost: $40,542,000
- Required ROW: 26,326 ft²
- Potential Buildings Impacted: 9

Alternative 4 Evaluation Criteria Results								Rank
Reduction in Vehicular Congestion (22.69 Possible Points)	Safety (22.41 Possible Points)	Expand Travel Mode Choices (20.87 Possible Points)	Public Acceptance (8.62 Possible Points)	Construction/ Implementation (9.64 Possible Points)	Project Economics (9.91 Possible Points)	Environmental Impacts (6.21 Possible Points)	Total Score (100 Possible Points)	7th
16.48	4.77	4.92	0.00	3.04	0.00	0.00	**29.20**	

Alternative 5

- Project Cost: $60,994,000
- Required ROW: 203,517 ft²
- Potential Buildings Impacted: 21

Alternative 5 Evaluation Criteria Results								Rank
Reduction in Vehicular Congestion (22.69 Possible Points)	Safety (22.41 Possible Points)	Expand Travel Mode Choices (20.87 Possible Points)	Public Acceptance (8.62 Possible Points)	Construction/ Implementation (9.64 Possible Points)	Project Economics (9.91 Possible Points)	Environmental Impacts (6.21 Possible Points)	Total Score (100 Possible Points)	1st
21.31	17.42	18.56	0.00	1.01	0.71	0.00	**59.02**	

Alternative 6a

- Project Cost: $73,667,000
- Required ROW: 362,398 ft²
- Potential Buildings Impacted: 32

Alternative 6a Evaluation Criteria Results								Rank
Reduction in Vehicular Congestion (22.69 Possible Points)	Safety (22.41 Possible Points)	Expand Travel Mode Choices (20.87 Possible Points)	Public Acceptance (8.62 Possible Points)	Construction/ Implementation (9.64 Possible Points)	Project Economics (9.91 Possible Points)	Environmental Impacts (6.21 Possible Points)	Total Score (100 Possible Points)	2nd
21.79	15.30	13.39	0.00	0.77	0.26	0.00	**51.51**	

Alternative 6b

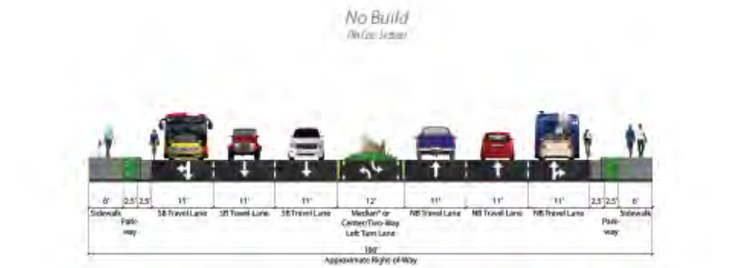
- Project Cost: $55,137,000
- Required ROW: 237,564 ft²
- Potential Buildings Impacted: 23

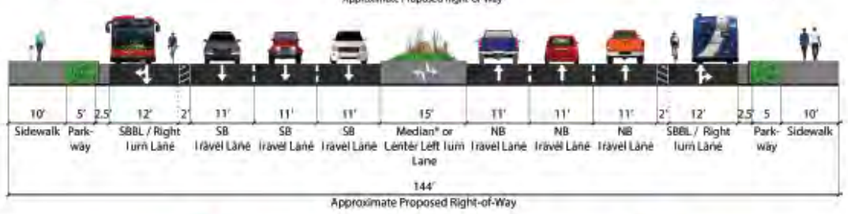
Alternative 6b Evaluation Criteria Results								Rank
Reduction in Vehicular Congestion (22.69 Possible Points)	Safety (22.41 Possible Points)	Expand Travel Mode Choices (20.87 Possible Points)	Public Acceptance (8.62 Possible Points)	Construction/ Implementation (9.64 Possible Points)	Project Economics (9.91 Possible Points)	Environmental Impacts (6.21 Possible Points)	Total Score (100 Possible Points)	6th
17.00	4.77	12.04	0.00	1.06	0.00	0.00	**34.87**	

Alternative 13

- Project Cost: $57,695,000
- Required ROW: 245,096 ft²
- Potential Buildings Impacted: 23

Alternative 13 Evaluation Criteria Results								Rank
Reduction in Vehicular Congestion (22.69 Possible Points)	Safety (22.41 Possible Points)	Expand Travel Mode Choices (20.87 Possible Points)	Public Acceptance (8.62 Possible Points)	Construction/ Implementation (9.64 Possible Points)	Project Economics (9.91 Possible Points)	Environmental Impacts (6.21 Possible Points)	Total Score (100 Possible Points)	4th
16.31	7.28	18.83	0.00	1.01	0.00	0.00	**43.44**	





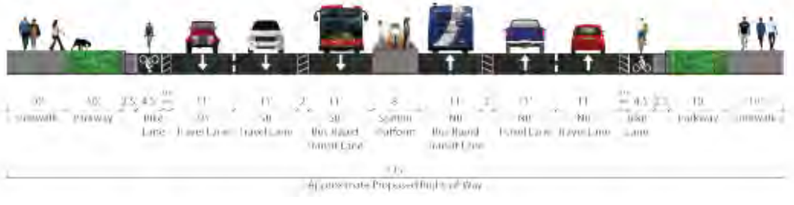


Table 4-9: Detailed Results of the Tier 2 Evaluation Criteria

Evaluation Criteria				Weight	No Build		Alternative 3		Alternative 4		Alternative 5		Alternative 6a		Alternative 6b		Alternative 13	
Category	**Criteria / Measure**	**Threshold / Formula**	**Modifier**		Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score
Reduction in Vehicular Congestion	Improves Congestion	Formula = (Best Result / Alternative Result) * Weight * 100 Ex - Alt 4: (6.25/11.03) * 5.25% * 100 = 2.97	N/A	5.25%	11.03	2.97	7.36	4.46	11.03	2.97	7.36	4.46	6.25	5.25	9.38	3.50	10.81	3.04
	Travel Speed as % of Base Free Flow Speed	Formula = ((Alternative Result * 100) / Best Result) * Weight * 100 / 2 Ex - Alt 4: ((46.1%*100)/62)* 3.32% * 100 /2 = 1.24	N/A	3.32%														
	AM			(1.66%)	52.7%	1.41	54.6%	1.46	46.1%	1.24	62.0%	1.66	57.9%	1.55	46.1%	1.24	47.7%	1.28
	PM			(1.66%)	52.6%	1.63	52.4%	1.62	49.7%	1.54	53.6%	1.66	51.2%	1.58	49.7%	1.54	39.8%	1.23
	Improved Intersection LOS	Formula = (Best Result / Alternative Result) * Weight * 100 / 2 Ex - Alt 4: (2/3) * 6.04% * 100 /2 = 3.02	N/A	6.04%														
	AM			(3.02%)	2	3.02	3	2.01	2	3.02	2	3.02	2	3.02	2	3.02	2	3.02
	PM			(3.02%)	3	2.01	3	2.01	3	2.01	2	3.02	2	3.02	3	2.01	3	2.01
	Signal/Stop Control Delay	Formula = (Best Result / Alternative Result) * Weight * 100 / 2 Ex - Alt 4: (29.5/41.6) * 3.29% * 100 /2 = 1.17	N/A	3.29%														
	AM			(1.645%)	104.8	0.71	45.1	1.65	86.3	0.86	70.4	1.05	58.5	1.27	86.3	0.86	57.3	1.30
	PM			(1.645%)	44.8	1.08	42.4	1.15	41.6	1.17	29.5	1.65	30.2	1.61	41.6	1.17	49.2	0.99
	Travel Time:	Formula = (Best Result / Alternative Result) * Weight * 100 / 2 Ex - Alt 4: (339/560) * 4.79% * 100 /2 = 1.45	N/A	4.79%														
	AM			(2.395%)	420	1.93	400	2.03	560	1.45	339	2.40	370	2.20	560	1.45	479	1.70
	PM			(2.395%)	395	2.35	396	2.34	418	2.22	387	2.40	405	2.29	418	2.22	530	1.75
Safety	Reduction in Total Crashes	Formula = (Alternative Result / Best Result) * Weight * 100 Ex - Alt 4: (19.4/28.98) * 7.13% * 100 = 4.77	N/A	7.13%	0	0*	19.28	4.74	19.40	4.77	16.78	4.13	28.98	7.13	19.4	4.77	16.9	4.16
	Reduced Injury Crashes	Formula = (Alternative Result / Best Result) * Weight * 100 Ex - Alt 5: (21.78/28.78) * 8.18% * 100 = 6.19	N/A	8.18%	0	0*	28.78	8.18	0	0*	21.78	6.19	28.78	8.18	0	0*	-14	-3.98
	Reduced Bicycle Crashes	Formula = (Alternative Result / Best Result) * Weight * 100 Ex - Alt 5: (14/14) * 7.10% * 100 = 7.10	N/A	7.10%	0	0*	0	0*	0	0*	14	7.10	0	0*	0	0*	14	7.10
Expand Travel Mode Choices	Pedestrian	Meets or Exceeds both ADOT's minimum standard and the City/FMPO/NAIPTA's (PP) preferred standards	1	7.12%	Maintains Existing Conditions	0.00	Maintains Existing Conditions	0.00	Maintains Existing Conditions	0.00	Meets or Exceeds both	7.12	Meets or exceeds both	7.12	Meets or exceeds both	7.12	Meets or exceeds both	7.12
		Meets or Exceeds ADOT's minimum standard OR the City/FMPO/NAIPTA's (PP) preferred standards, but not both	0.5															
		Maintains Existing Condition	0															
	Bicycle	Meets or Exceeds both ADOT's minimum standard and the City/FMPO/NAIPTA's preferred standards	1	7.48%	Maintains Existing Conditions	0.00	Maintains Existing Conditions	0.00	Maintains Existing Conditions	0.00	Meets or Exceeds both	7.48	Maintains Existing Conditions	0.00	Maintains Existing Conditions	0.00	Meets or exceeds both	7.48
		Meets or Exceeds ADOT's minimum standard OR the City/FMPO/NAIPTA's preferred standards, but not both	0.5															
		Maintains Existing Condition	0															
	Transit	Formula = (Best Result / Alternative Result) * Weight * 100 / 2 Ex - Alt 4: (250/371) * 6.27% * 100 /2 = 2.11	N/A	6.27%														
	AM			(3.135%)	632	1.24	399	1.96	371	2.11	508	1.54	250	3.13	371	2.11	373	2.10
	PM			(3.135%)	353	2.27	365	2.20	286	2.80	332	2.42	256	3.13	286	2.80	377	2.13

Results continued on the following page

Evaluation Criteria				Weight	No Build		Alternative 3		Alternative 4		Alternative 5		Alternative 6a		Alternative 6b		Alternative 13	
Category	**Criteria / Measure**	**Threshold / Formula**	**Modifier**		Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score
Public Acceptance	Public Support	*TBD*	*TBD*	8.26%	*TBD*		*TBD*		*TBD*		*TBD*		*TBD*		*TBD*		*TBD*	
Construction/ Implementation	Project Cost#+-	Formula = (Best Result / (Alternative Result/10M)) * Weight * 100 Ex - Alt 4: (1/(40.542M/10M)) * 4.68% * 100 = 1.15	N/A	4.68%	$0.00	4.68	$40,514,000	1.15	$40,542,000	1.15	$60,994,000	0.77	$73,667,000	0.64	$55,137,000	0.85	$57,695,000	0.81
	ROW Impact+- (Square Feet)	Formula = (Best Result / (Alternative Result/10K)) * Weight * 100 Ex - Alt 4: (1/(26,326/10K)) * 4.98% * 100 = 1.89	N/A	4.96%	0	4.96	26,326	1.89	26,326	1.89	203,517	0.24	362,398	0.14	237,564	0.21	245,096	0.20
			Aggregate Score	**83.88%**	**30.27**		**38.85**		**29.20**		**58.30**		**51.25**		**34.87**		**43.44**	
				Rank	**6th**		**4th**		**7th**		**1st**		**2nd**		**5th**		**3rd**	

Notes:

*If no bicycle lane is recommended as a component of the alternative (Alt. 3, 4, 6A, 6b) bicycle crash modification factors are not provided by the Clearinghouse, resulting in a score of zero. # Project Costs for Alternative 13 do not include necessary costs for accessible boarding platforms, pedestrian refuge islands or other center-lane transit appurtenances.

+A common denominator has been added to the formula the normalize the relationship between the best result and the other results due to the large disparity between the two. -ROW impact/cost does not include any costs that may be associated with a potential impact to an existing building. Project Economics and Environmental Impacts criterion will be included in Tier 3 Alternative Evaluation Analysis.

4.8 Tier 2 Evaluation Criteria Detailed Results

This section describes the detailed results for the Tier 2 Alternative evaluation process of the seven Tier 2 Alternatives using the Evaluation Criteria, Scoring Thresholds and Scoring Thresholds discussed in the previous sections. Refer back to **Table 4-9** for the results presented in the following sub-sections.

4.8a Reduction in Vehicular Congestion - *Improves Congestion Criterion Results*

ADOT's Congestion Needs Score (CNS) Tool is the source that calculates the results for the Improves Congestion criterion. The results of the CNS for each Tier 2 Alternative are displayed below in **Table 4-10**.

Table 4-10: Improves Congestion Criterion Results

ID #	Future AADT (2040)	Capacity Threshold (2040)	Percent of Threshold (2040)	Future Congestion Need Score*	Fnctl Class
No-Build	42,366	76,800	55.2%	11.03	4-lanes, Urban, Principal Arterial
Alt 3	42,366	115,200	36.8%	7.36	6-lanes, Urban, Principal Arterial
Alt 4	36,011	76,800	46.9%	9.38	4-lanes, Urban, Principal Arterial
Alt 5	42,366	115,200	36.8%	7.36	6-lanes, Urban, Principal Arterial
Alt 6a	36,011	115,200	31.3%	6.25	6-lanes, Urban, Principal Arterial
Alt 6b	36,011	76,800	46.9%	9.38	4-lanes, Urban, Principal Arterial
Alt 13	41,519	76,800	54.1%	10.81	4-lanes, Urban, Principal Arterial

The CNS results are "reversed ranked" whereby the lowest numbers represent the higher performing alternatives. Thus, Alternative 6a is the highest performing alterntive with a CNS of 6.25, where the No-Build is the lowest performing alternative with a CNS of 11.03. The Tier 2 Alternatives are ranked below from highest to lowest in regards to CNS – the Improves Congestion criterion.

1. Alternative 6a – 6.25 CNS
2, 3. Alternative 3 and Alternative 5 (tied) – 7.36 CNS
4, 5. Alternative 4 and Alternative 6b (tied) – 9.38 CNS
6. Alternative 13 – 10.81 CNS
7. No-Build – 11.03 CNS

The results of the CNS appear to parallel the visual test as the alternatives with the most number of vehicular lanes are the lower scoring (higher performing) options where the alternatives with fewer vehicular lanes are higher scoring (lower performing).

The CNS was calculated with the followng four steps:

1. Identified the future AADTs from the FMPO Regional TDM Model traffic volumes.
2. Identified the Capacity Threshold through the multiplication of the number of vehicular lanes for each alternative by the capacity in accordance of facility type as noted **Table 4-11**. Milton Road is

identfied as an urban major arterial facility with an hourly maximum capacity of 800 vehicles per lane. Then Multiply by 24 hours to calculate the alternatives' capacity threshold.

Table 4-11: ADOT's Hourly Capacity Threshold Per Hour by Facility Type

facility_code	facility_type	1-CBD	2-Urban	3-Suburban	4-Rural	5-SmTownCBD	6-OutOfState
0	HOV	2000	2000	2000	2000	2000	99999
1	Freeway	2000	2000	2000	2000	2000	99999
2	Major Arterial	700	800	900	1000	900	99999
3	Minor Arterial	550	625	700	800	700	99999
4	Major Collector	400	450	500	600	500	99999
5	Minor Collector	300	350	400	500	400	99999
7	Ramp	1000	1100	1200	1200	1200	99999
8	Metered Ramp	1000	1100	1200	1200	1200	99999
9	Centroid Connector	99999	99999	99999	99999	99999	99999

The formula below is an example of how the capacity threshold is calculated:

800	*	**6**	*	**24**	**115,200**
*Hourly lane capacity for an urban arterial**		*Number of vehicular lanes*		*Hours of roadway operation*	*Calculated Capacity Threshold*

3. Divide the furture AADT by the Capacity Threshold, then multiply the result by 100 to obtain a percentage.

(42,366	**/**	**115,200)**	*** 100**	**=**	**36.8%**
2040 AADT		*2040 Capacity Threshold*			*Percent of Threshold*

4. Multiply the future AADT percentage by the maximum points possible (20) to obtain the Future CNS.

Two assumptions were used in the calculation of the CNS:

- Assumed 15% reduction in traffic volumes for alternatives with dedicated bus/right-turn lane to account for reduction in bus/right-turn volume
- Assumed 2% reduction in traffic volumes for alternatives with center bus lane to account for reduction in bus volume

Application of the Improves Congestion Results to Calculate the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Improves Congestion criterion. Refer back to *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* for the background behind the development of the formula. The following formula was used to calculate the scores:

*Technical Score = (Best Result / Alternative Result) * Weight * 100*

Table 4-12 shows how the scores were calculated for the No-Build option and the six Tier 2 Alternatives relative to the results of the Improves Congestion creation in order of highest to lowest scoring.

Table 4-12: Improves Congestion Criterion Results in the Calculation of the Technical Score

Alternative	Improves Congestion Result	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 6a	6.25 CNS	((6.25/6.25)	* 5.25%) * 100	5.25
Alternative 3	7.36 CNS	((6.25/7.36)	* 5.25%) * 100	4.46
Alternative 5	7.36 CNS	((6.25/7.36)	* 5.25%) * 100	4.46
Alternative 4	9.38 CNS	((6.25/9.38)	* 5.25%) * 100	3.50
Alternative 6b	9.38 CNS	((6.25/9.38)	* 5.25%) * 100	3.50
Alternative 13	10.81 CNS	((6.25/10.81)	* 5.25%) * 100	3.04
No-Build	11.03 CNS	((6.25/11.03)	* 5.25%) * 100	2.97

4.8b Reduction in Vehicular Congestion - *Travel Speed as a % of Base Free Flow Speed Criterion Results*

The Travel Speed as a Percentage of Base Free Flow Speed criterion is a metric that measures reduction in vehicular congestion by comparing the year 2040 travel speed in miles per hour (MPH) relative to the base free flow speed of 30 MPH. The results of the year 2040 travel speed for the No-Build option and the six Tier 2 Alternatives is output from the Vissim Model.

In order to reach a comprehensive measure, travel speeds during both the AM and PM time periods were used to measure the overall performance. The travel speeds in each direction of Milton Road – northbound and southbound – were averaged to reach combined travel speed for the AM and PM timeframes.

The results of the of the Travel Speed as a Percentage of Base Free Flow Speed criterion are shown below in **Table 4-13** for the No-Build option and other six Tier 2 Alternatives.

Table 4-13: AM and PM Travel Speed as a % of Base Free Flow Speed Criterion Results*

				No-Build	Alt 3	Alt 5	Alt 6a	Alt 4/6b	Alt 13
Corridor	Begin	End	Distance (mi)	AM Average Speed (MPH)					
Milton Rd NB	Forest Meadows St	Beaver St	1.7	11.7	12.6	16.0	14.0	7.6	9.8
Milton Rd SB	Beaver St	Forest Meadows St	1.7	19.9	20.2	21.2	20.7	20.0	18.8
Average of Milton Rd NB & SB - AM				15.8	16.4	18.6	17.4	13.8	14.3
Travel Speed as Percent of Base Free Flow Speed				52.7%	54.6%	62.0%	57.9%	46.1%	47.7%
Corridor	Begin	End	Distance (mi)	PM Average Speed (MPH)					
Milton Rd NB	Forest Meadows St	Beaver St	1.7	16.3	15.5	16.4	15.5	15.1	10.4
Milton Rd SB	Beaver St	Forest Meadows St	1.7	15.2	16.0	15.8	15.2	14.7	13.5
Average of Milton Rd NB & SB - PM				15.8	15.7	16.1	15.3	14.9	11.9
Travel Speed as Percent of Base Free Flow Speed				52.6%	52.4%	53.6%	51.2%	49.7%	39.8%

**Alternative 4 and Alternative 6a share results because only one Vissim model was constructed to represent both alternatives because they are identical from an operational perspective.*

As noted in the bottom row for the AM and PM time periods, the higher percentage of base free flow speed results in a higher performing alternative when evaluating the reduction of vehicular congestion. Alternative 5 has the fastest average travel speed in both time periods with an average travel speed of 18.6 MPH in the AM and an average travel speed of 16.1 MPH in the PM. As a result, Alternative 5 will also have the highest travel speed as a percent of base free flow speed in both the AM and PM time periods – receiving 62.0% and 53.6% respectively.

Conversely, Alternative 13 has the slowest average travel speed in the PM period at 11.9 MPH and has the second slowest travel speed by small margin in the AM time period at 14.3 MPH. As a result, Alternative 13 has the lowest percent of base flow speed in the PM at 39.8% and the second lowest in the AM at 47.7%.

The No-Build option and the Tier 2 Alternatives are ranked below for each time frame based on the results of the Travel Speed as a Percentage of Base Free Flow Speed criterion.

AM

1. Alternative 5 – 62.0% of base free flow speed (18.6 MPH)
2. Alternative 6a – 57.9% of base free flow speed (17.4 MPH)
3. Alternative 3 – 54.6% of base free flow speed (16.4 MPH)
4. No-Build – 52.7% of base free flow speed (15.8 MPH)
5. Alternative 13 – 47.7% of base free flow speed (14.3 MPH)
6. Alternative 4/6b – 46.1% of base free flow speed (13.8 MPH)

PM

1. Alternative 5 – 53.6% of base free flow speed (16.1 MPH)
2. No-Build – 52.6% of base free flow speed (15.8 MPH)
3. Alternative 3 – 52.4% of base free flow speed (15.7 MPH)
4. Alternative 6a – 51.2% of base free flow speed (15.3 MPH)
5. Alternative 4/6b – 49.7% of base free flow speed (14.9 MPH)
6. Alternative 13 – 39.8% of base free flow speed (11.9 MPH)

Application of the Travel Speed as a % Base Free Flow Speed Criterion Results to Calculate the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Travel Speed as a Percentage Base Free Flow Speed criterion. The following formula was used to calculate the scores:

*Technical Score = (Alternative Result / Best Result) * Weight * 100*

Since Travel Speed as a Percentage of Base Free Flow Speed was measured in both the AM and PM time periods - two values were produced each receiving half of the value of the 3.32% weight – or 1.66%.

Table 4-14 and **Table 4-15** show how the AM and PM scores were calculated for the No-Build option and the other six Tier 2 Alternatives relative to the results of the Travel Speed as a Percentage of Base Free Flow Speed creation in order of highest to lowest scoring.

Table 4-14: AM Travel Speed as a % Base Free Flow Speed Criterion Results in the Calculation of the Technical Score

Alternative	AM Travel Speed Result	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 5	62.0%	((62.0/62.0)	* 1.66%) * 100	1.66
Alternative 6a	57.9%	((57.9/62.0)	* 1.66%) * 100	1.55
Alternative 3	54.6%	((54.6/62.0)	* 1.66%) * 100	1.46
No-Build	52.7%	((52.7/62.0)	* 1.66%) * 100	1.41
Alternative 13	47.7%	((47.7/62.0)	* 1.66%) * 100	1.28
Alternative 4/6b*	46.1%	((46.1/62.0)	* 1.66%) * 100	1.24

**The Travel Speed as A Percentage of Base Free Flow Speed was converted to a whole value prior to the formula which is not shown in this table*

Table 4-15: AM Travel Speed as a % Base Free Flow Speed Criterion Results in the Calculation of the Technical Score

Alternative	PM Travel Speed Result	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 5	53.6%	((53.6/53.6)	* 1.66%) * 100	1.66
No-Build	52.6%	((52.6/53.6)	* 1.66%) * 100	1.63
Alternative 3	52.4%	((52.4/53.6)	* 1.66%) * 100	1.62
Alternative 6a	51.2%	((51.2/53.6)	* 1.66%) * 100	1.58
Alternative 4/6b*	49.7%	((49.7/53.6)	* 1.66%) * 100	1.54
Alternative 13	39.8%	((39.8/53.6)	* 1.66%) * 100	1.23

**The Travel Speed as A Percentage of Base Free Flow Speed was converted to a whole value prior to the formula which is not shown in this table*

4.8c Reduction in Vehicular Congestion – *Intersection Level-of-Service (LOS) Criterion Results*

The Intersection LOS criterion measures reduction in vehicular congestion by identifying the number of operationally failing intersections (LOS grade E or F) under the 2040 condition within the No-Build option the six other Tier 2 Alternatives. The intersection LOS results are an output from the Vissim Model.

The Milton Road study corridor has 11 intersections that were evaluated under this LOS criterion, including:

- Milton Road / Forest Meadows Street (signalized);
- Milton Road & University Drive (signalized);
- Milton Road & Plaza Way (signalized);
- Milton Road & Riordan Road (signalized);
- Milton Road & Route 66 (signalized);
- Milton Road & Clay Avenue/Butler Avenue (signalized);
- Milton Road & Mikes Pike (two-way stop-controlled);

- Milton Road & Phoenix Avenue (two-way stop-controlled);
- Santa Fe Avenue & Sitgreaves Street (two-way stop-controlled);
- Humphreys St & Route 66 (signalized); and
- Beaver St & Route 66 (signalized).

The LOS grades for each intersection were collected during both the AM and PM time periods in order to capture a comprehensive intersection performance – each receiving half of the 6.04% weight assigned to this criterion. **Table 4-16** shows the number of intersections within each LOS grade for the No-Build option and each of the Tier 2 Alternatives.

Table 4-16: AM and PM Intersection Level-of-Service (LOS) Criterion Results*

	AM							PM						
	A	B	C	D	E	F	**Failing Intersections**	A	B	C	D	E	F	**Failing Intersections**
2040 No-Build	0	2	5	2	0	2	**2**	0	2	5	1	1	2	**3**
2040 Alternative 3	1	4	2	1	0	3	**3**	0	2	5	1	1	2	**3**
2040 Alt 5	1	5	1	2	0	2	**2**	0	3	5	1	1	1	**2**
2040 Alt 6a	1	4	3	1	0	2	**2**	0	2	5	2	1	1	**2**
2040 Alt 4/6b	0	1	5	3	0	2	**2**	0	2	5	1	1	2	**3**
2040 Alt 13	0	1	5	3	0	2	**2**	0	1	4	3	1	2	**3**

**Alternative 4 and Alternative 6a share results because only one Vissim model was constructed to represent both alternatives because they are identical from an operational perspective.*

As noted in **Table 4-16**, there is little to no variation in the number of failing intersections among the No-Build option and the six Tier 2 Alternatives in both the AM and PM time periods. The two or three failing intersections are constant among the No-Build option and the Tier 2 Alternatives, where the two-way stop-controlled intersections are the only failing intersections. Refer to Appendix D for a more detailed result reflecting the intersection LOS output from the Vissim Model.

Application of the Intersection LOS Results Criterion Results to Calculate the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Intersection LOS criterion. The following formula was used to calculate the scores:

*Technical Score = (Best Result/ Alternative Result) * Weight * 100*

Since Intersection LOS was measured in both the AM and PM time periods, two values were produced - each receiving half of the 6.04% weight, or 3.02%.

Table 4-17 and **Table 4-18** below show how the AM and PM scores were calculated for the No-Build option and the other six Tier 2 Alternatives relative to the results of the Travel Speed as a Percentage of Base Free Flow Speed creation in order of highest to lowest scoring.

Table 4-17: AM Intersection LOS Criterion Results in the Calculation of the Technical Score

Alternative	AM LOS Result	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 5	2	((2/2)	* 3.02%) * 100	3.02
Alternative 6a	2	((2/2)	* 3.02%) * 100	3.02
Alternative 4a	2	((2/2)	* 3.02%) * 100	3.02
Alternative 4/6b*	2	((2/2)	* 3.02%) * 100	3.02
No-Build	2	((2/2)	* 3.02%) * 100	3.02
Alternative 3	3	((2/3))	* 3.02%) * 100	2.01
**The Travel Speed as A Percentage of Base Free Flow Speed was converted to a whole value prior to the formula which is not shown in this table*				

Table 4-18: PM Intersection LOS Criterion Results in the Calculation of the Technical Score

Alternative	PM LOS Result	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 5	2	((2/2)	* 3.02%) * 100	3.02
Alternative 6a	2	((2/2)	* 3.02%) * 100	3.02
Alternative 4a	3	((2/3))	* 3.02%) * 100	2.01
Alternative 4/6b*	3	((2/3))	* 3.02%) * 100	2.01
No-Build	3	((2/3))	* 3.02%) * 100	2.01
Alternative 3	3	((2/3))	* 3.02%) * 100	2.01
**The Travel Speed as A Percentage of Base Free Flow Speed was converted to a whole value prior to the formula which is not shown in this table*				

4.8d Reduction in Vehicular Congestion – *Intersection Delay* Criterion *Results*

The Intersection Delay criterion measures reduction in vehicular congestion by evaluating the duration of delay at intersections under the year 2040 condition for the No-Build option as compared to the six other Tier 2 Alternatives. The intersection delay is calculated under seconds and is an output from the Vissim Model. No traffic engineering assessments of turn lane needs was conducted.

The 11 intersections evaluated under this criterion include:

- Milton Road / Forest Meadows Street (signalized);
- Milton Road & University Drive (signalized);
- Milton Road & Plaza Way (signalized);
- Milton Road & Riordan Road (signalized);
- Milton Road & Route 66 (signalized);
- Milton Road & Clay Avenue/Butler Avenue (signalized);
- Milton Road & Mikes Pike (two-way stop-controlled);
- Milton Road & Phoenix Avenue (two-way stop-controlled);
- Santa Fe Avenue & Sitgreaves Street (two-way stop-controlled);
- Humphreys St & Route 66 (signalized); and
- Beaver St & Route 66 (signalized).

The intersection delay for each intersection were collected during both the AM and PM time periods in order to capture a comprehensive intersection performance – each receiving half of the 6.04% weight assigned to this criterion. **Table 4-19** and **Table 4-20** show the seconds of delay at each intersection for the No-Build option and the six Tier 2 Alternatives. Note the average delay among all intersections in both AM and PM time periods is the value used to measure performance.

Table 4-19: AM Intersection Delay Criterion Results*

2040 AM		No-Build	Alt 3	Alt 5	Alt 6a	Alt 4/6b	Alt 13
Intersection	Control	Delay	Delay	Delay	Delay	Delay	Delay
Milton Rd & Forest Meadows St	Signal	20.1	18.6	18.7	18.8	27.0	20.7
Milton Rd & University Dr	Signal	21.1	15.2	15.7	15.9	24.5	20.1
Milton Rd & Plaza Way	Signal	20.5	13.2	13.0	13.3	41.7	38.2
Milton Rd & Riordan Rd	Signal	14.3	5.8	5.9	6.4	28.8	29.2
Milton Rd & Rte 66	Signal	32.7	25.0	16.2	21.4	49.7	54.4
Milton Rd & Clay Ave/Butler Ave	Signal	40.0	46.4	35.7	39.6	40.1	33.0
Milton Rd & Mikes Pike	Two-Way Stop-Control	27.5	50.9	28.5	20.8	24.0	24.8
Milton Rd & Phoenix Ave	Two-Way Stop-Control	859.1	199.9	514.8	384.5	592.0	280.1
Santa Fe Ave & Sitgreaves St	Two-Way Stop-Control	84.6	84.2	91.9	86.6	86.9	74.1
Humphreys St & Rte 66	Signal	11.9	13.7	12.3	12.9	12.4	13.1
Beaver St & Rte 66	Signal	21.3	23.4	21.4	23.0	22.1	42.3
	Average Delay (seconds)	104.8	45.1	70.4	58.5	86.3	57.3

**Alternative 4 and Alternative 6a share results because only one Vissim model was constructed to represent both alternatives because they are identical from an operational perspective.*

Table 4-20: PM Intersection Delay Criterion Results*

2040 PM		No-Build	Alt 3	Alt 5	Alt 6a	Alt 4/6b	Alt 13
Intersection	Control	Delay	Delay	Delay	Delay	Delay	Delay
Milton Rd & Forest Meadows St	Signal	31.7	32.9	34.7	33.3	32.6	36.3
Milton Rd & University Dr	Signal	39.6	37.0	37.6	37.5	44.3	45.9
Milton Rd & Plaza Way	Signal	32.4	27.1	27.0	27.4	31.2	41.1
Milton Rd & Riordan Rd	Signal	13.9	13.4	13.2	13.4	13.6	22.3
Milton Rd & Rte 66	Signal	20.5	20.5	20.0	21.6	22.2	28.2
Milton Rd & Clay Ave/Butler Ave	Signal	31.1	30.8	29.4	29.3	31.8	34.8
Milton Rd & Mikes Pike	Two-Way Stop-Control	44.2	35.9	35.5	29.5	36.7	47.8
Milton Rd & Phoenix Ave	Two-Way Stop-Control	124.7	152.7	23.8	38.5	139.3	123.6
Santa Fe Ave & Sitgreaves St	Two-Way Stop-Control	109.3	72.2	55.3	52.6	62.9	121.4
Humphreys St & Rte 66	Signal	14.5	14.9	16.7	17.0	14.8	12.4
Beaver St & Rte 66	Signal	30.8	29.5	31.2	32.2	28.6	27.7
	Average Delay	44.8	42.4	29.5	30.2	41.6	49.2

**Alternative 4 and Alternative 6a share results because only one Vissim model was constructed to represent both alternatives because they are identical from an operational perspective.*

Interestingly, the duration of the average delay among the No-Build option and the other six Tier 2 Alternatives are shorter in the PM time period compared to the AM time period, which is different from the trends experienced in the other Reduction in Vehicular Congestion criteria

where the traffic operations or worse in the PM. The difference between the best performing alternative and the worst performing alternative in the PM is less than 20 seconds while the difference between the best and worst performing alternative in the AM is nearly 60 seconds. This is due to the fact that the No-Build option has an unusually long average delay of 104.8 second in the AM time period compared to the six Tier 2 Alternatives. The unusually large average delay is largely skewed by the delay at Milton & Phoenix intersection and is a result of vehicles from the side street being unable to access Milton due to no gaps being available from the bottleneck at Santa Fe and lack of intersection control.

The No-Build and the Tier 2 Alternatives are ranked below for each time duration based on the results of the Intersection Delay criterion.

AM

1. Alternative 3 – 45.1 seconds of average delay
2. Alternative 13 – 57.3 seconds of average delay
3. Alternative 6a – 58.5 seconds of average delay
4. Alternative 5 – 70.4 seconds of average delay
5. Alternative 4/6b – 86.3 seconds of average delay
6. No-Build – 104.8 seconds of average delay

PM

1. Alternative 5 – 29.5 seconds of average delay
2. Alternative 6a – 30.2 seconds of average delay
3. Alternative 4/6b – 41.6 seconds of average delay
4. Alternative 3 – 42.4 seconds of average delay
5. No-Build – 44.8 seconds of average delay
6. Alternative 13 – 49.2 seconds of average delay

Application of the Intersection Delay Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Intersection Delay criterion. The following formula was used to calculate the scores:

*Technical Score = (Best Result/ Alternative Result) * Weight * 100*

Since Intersection Delay was measured in both the AM and PM time periods, two values were produced - each receiving half of the 3.29% weight, or 1.645%.

Table 4-21 and **Table 4-22** show how the AM and PM scores were calculated for the No-Build option and the six Tier 2 Alternatives relative to the results of the Intersection Delay creation in order of highest to lowest scoring.

Table 4-21: AM Intersection Delay Criterion Results in the Calculation of the Technical Score

Alternative	AM Delay Result	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 3	45.1 seconds	((45.1/45.1)	* 1.645%) * 100	1.65
Alternative 13	57.3 seconds	((45.1/57.3)	* 1.645%) * 100	1.30
Alternative 6a	58.5 seconds	((45.1/58.5)	* 1.645%) * 100	1.27
Alternative 5	70.4 seconds	((45.1/70.4)	* 1.645%) * 100	1.05
Alternative 4/6b*	86.3 seconds	((45.1/86.3)	* 1.645%) * 100	0.86
No-Build	104.8 seconds	((45.1/104.8)	* 1.645%) * 100	0.71
**Alternative 4 and Alternative 6a share results because only one Vissim model was constructed to represent both alternatives because they are identical from an operational perspective*				

Table 4-22: PM Intersection Delay Criterion Results in the Calculation of the Technical Score

Alternative	PM Delay Result	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 5	29.5 seconds	((29.5/29.5)	* 1.645%) * 100	1.65
Alternative 6a	30.2 seconds	((29.5/30.2)	* 1.645%) * 100	1.61
Alternative 4/6b*	41.6 seconds	((29.5/41.6)	* 1.645%) * 100	1.17
Alternative 3	42.4 seconds	((29.5/42.4)	* 1.645%) * 100	1.15
No-Build	44.8 seconds	((29.5/44.8)	* 1.645%) * 100	1.08
Alternative 13	49.2 seconds	((29.5/49.2)	* 1.645%) * 100	0.99
**Alternative 4 and Alternative 6a share results because only one Vissim model was constructed to represent both alternatives because they are identical from an operational perspective*				

4.8e Reduction in Vehicular Congestion – *Travel Time Criterion Results*

The Travel Time criterion is a metric that measures reduction in vehicular congestion by calculating the amount of time it takes to travel the corridor from one end to the other. The results of the year 2040 travel time for the No-Build option and six other Tier 2 Alternatives is an output from the Vissim Model.

In order to reach a comprehensive measure, travel times during both the AM and PM time periods were used to measure the overall performance of this criterion – each receiving half of the 4.79% weight assigned to this criterion. The travel times in each direction of Milton Road – northbound and southbound – were also averaged to reach a combined travel time for each the AM and PM timeframes.

The results of the of the Travel Time are shown below in **Table 4-23** and **Table 4-24** for the No-Build option and the six Tier 2 Alternatives.

Table 4-23: AM Travel Time Criterion Results*

	No-Build	Alt 3		Alt 5		Alt 6a		Alt 4/6b		Alt 13	
AM Travel Time	Travel Time (sec)	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change
NB Travel Time	528	492	6.8%	387	26.7%	442	16.3%	811	-53.5%	629	-19.2%
SB Travel Time	311	307	1.4%	292	6.2%	298	4.1%	309	0.8%	329	-5.8%
Average Travel Time	420	400	4.1%	339	16.5%	370	10.2%	560	-26.3%	479	-12.5%

Table 4-24: PM Travel Time Criterion Results*

	No-Build	Alt 3		Alt 5		Alt 6a		Alt 4/6b		Alt 13	
PM Travel Time	Travel Time (sec)	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change
NB Travel Time	382	403	-5.5%	382	0.1%	403	-5.5%	414	-8.4%	601	-57.3%
SB Travel Time	407	388	4.6%	392	3.6%	408	-0.2%	421	-3.4%	460	-12.9%
Average PM Travel Time	395	396	-0.5%	387	1.9%	405	-2.8%	418	-5.9%	530	-35.1%

**Alternative 4 and Alternative 6a share results because only one Vissim model was constructed to represent both alternatives because they are identical from an operational perspective.*

The average travel time between the northbound and southbound direction for the No-Build option is 420 seconds (seven minutes) in the AM and 395 seconds (six minutes and 34 seconds) in the PM – a fairly equal or negligible difference in average travel time between the AM and PM time periods. The No-Build travel time results is the baseline condition for calculating the travel time percent change for each of the Tier 2 Alternatives.

Alternate 5 is the only alternative that has an improved travel time condition compared to the No-Build option in both the AM and PM time periods. Alternative 3 has a small difference in travel time compared to the No-Build option in the AM and PM, but the AM has a positive change for both directions while the PM is positive SB but negative NB. Alternative 6a has a shorter travel time than the No-Build in the AM and a slightly longer travel time in the PM. Both Alternative 4/6b and Alternative 13 have longer travel times compared to the No-Build option in both the AM and PM time periods.

With the exception of the northbound bottleneck at Santa Fe/Sitgreaves, movement through the corridor in the southbound direction is primarily determined by intersection control and traffic signal timing. Alternatives like 6b and 13, which do not add lane capacity do not affect travel times. In the case of alternative 6b, the extra bus lane and transit signal priority does improve bus flow and reliability. In the case of alternative 13, in many cases, the protected only left turn phase required for vehicles reduces the efficacy of left turn movements and the intersection in general.

The No-Build option and the Tier 2 Alternatives are ranked below for each time duration based on the Vissim model results of the Travel Time criterion.

AM

1. Alternative 5 – 339 seconds of average travel time
2. Alternative 6a – 370 seconds of average travel time
3. Alternative 3– 400 seconds of average travel time
4. No-Build – 420 seconds of average travel time
5. Alternative 13 – 479 seconds of average travel time
6. Alternative 4/6b – 560 seconds of average travel time

PM

1. Alternative 5 – 387 seconds of average travel time
2. No-Build – 395 seconds of average travel time
3. Alternative 3– 396 seconds of average travel time
4. Alternative 6a – 405 seconds of average travel time
5. Alternative 4/6b – 418 seconds of average travel time
6. Alternative 13– 530 seconds of average travel time

Application of the Travel Time Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Travel Time criterion. The following formula was used to calculate the scores:

*Technical Score = (Best Result / Alternative Result) * Weight * 100*

Since Travel Time was measured in both the AM and PM time periods, two values were produced - each receiving half the value of the 4.79% weight, or 2.395%.

Table 4-25 and **Table 4-26** below show how the AM and PM scores were calculated for the No-Build option and six other Tier 2 Alternatives relative to the results of the Travel Time creation in order of highest to lowest scoring.

Table 4-25: AM Travel Time Results in the Calculation of the Technical Score

Alternative	AM Travel Time Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 5	339 seconds	((339/339)	* 2.395%) * 100	2.40
Alternative 6a	370 seconds	((339/370)	* 2.395%) * 100	2.20
Alternative 3	400 seconds	((339/400)	* 2.395%) * 100	2.03
No-Build	420 seconds	((339/420)	* 2.395%) * 100	1.93
Alternative 13	479 seconds	((339/479)	* 2.395%) * 100	1.70
Alternative 4/6b*	560 seconds	((339/560)	* 2.395%) * 100	1.45

**Alternative 4 and Alternative 6a share results because only one Vissim model was constructed to represent both alternatives because they are identical from an operational perspective*

Table 4-26: PM Travel Time Results in the Calculation of the Technical Score

Alternative	PM Travel Time Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 5	387 seconds	((387/387)	* 2.395%) * 100	2.40
No-Build	395 seconds	((387/395)	* 2.395%) * 100	2.35
Alternative 3	396 seconds	((387/396)	* 2.395%) * 100	2.34
Alternative 6a	405 seconds	((387/405)	* 2.395%) * 100	2.29
Alternative4/6b*	418 seconds	((387/418)	* 2.395%) * 100	2.22
Alternative 13	530 seconds	((387/530)	* 2.395%) * 100	1.75
**Alternative 4 and Alternative 6a share results because only one Vissim model was constructed to represent both alternatives because they are identical from an operational perspective*				

4.8fSafety - *Reduction in All Crashes Criterion Results*

The Reduction in All Crashes metric measures safety performance of the No-Build option and the six Tier 2 Alternatives through the use Crash Modification Factors (CMFs) and Crash Reduction Factors (CRFs). The Crash Modification Factor Clearinghouse is the source of all CMFs and CRFs, and according to the clearinghouse, a CMF is a multiplicative factor that indicates the proportion of crashes that would be expected after implementing a countermeasure. Examples of countermeasures include installing a traffic signal, increasing the width of edgelines, and installing a median barrier. CMFs with a value less than 1.0 indicate an expected decrease in crashes. CMFs greater than 1.0 indicate an expected increase in crashes. The Clearinghouse also identifies a CRF as another way of representing the expected effect of a countermeasure in terms of the percentage decrease in crashes. The formula to convert a CMF to a CRF is as follows:

CRF = 100*(1-CMF)

For example, the application of adding one traffic lane in each direction has a CMF of 0.807 for all crashes according to the Clearinghouse, so the CRF for adding a lane in each direction is 19.3% as shown in the formula below:

(1	**/**	**0.807)**	*** 100**	**=**	**19.3%**	
		CMF of adding one lane in each direction			*CRF of adding one lane in each direction*	

The Reduction in All Crashes Criterion used an approach to combine the CMFs of the different countermeasure included in each of the Tier 2 Alternatives to reach a combined CRF for each alternative. As a result, the alternatives with higher CRFs – greater potential in reduction in all crashes - were the alternatives that scored higher within this criterion. The combined CRF for this criterion includes all crash types (injury and non-injury related crashes). **Table 4-27** shows the combined CRF for all crashes for the six Tier 2 Alternatives. The No-Build condition receives no

CRFs since no countermeasures would be implemented. Refer to Appendix E for the detailed methodology on how the CRFs were calculated.

Table 4-27: Reduction in All Crashes Criterion Results

Alternative	CRF for All Crashes
No-Build	No CRF
Alternative 3	19.28% CRF for all crashes
Alternative 4	19.40% CRF for all crashes
Alternative 5	16.78% CRF for all crashes
Alternative 6a	28.98% CRF for all crashes
Alternative 6b	19.40% CRF for all crashes
Alternative 13	16.90% for all crashes

Application of the Reduction in All Crashes Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Reduction in All Crashes Criterion. The following formula was used to calculate the scores:

*Technical Score = (Alternative Result / Best Result) * Weight * 100*

Table 4-28 shows how the scores were calculated for combined CRFs for all crashes for the No-Build option and the six Tier 2 Alternatives relative to the results of the Reduction in All Crashes Criterion in order of highest scoring to lowest scoring.

Table 4-28: Reduction in All Crashes Criterion Results in the Calculation of the Technical Score

Alternative	CRF for All Crashes	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 6a	28.98%	((28.98/28.98)	* 7.13%) * 100	7.13
Alternative 6b	19.40%	((19.40/28.98)	* 7.13%) * 100	4.77
Alternative 4	19.40%	((19.40/28.98)	* 7.13%) * 100	4.77
Alternative 3	19.28%	((19.28/28.98)	* 7.13%) * 100	4.74
Alternative 13	16.90%	((16.90/28.98)	* 7.13%) * 100	4.16
Alternative 5	16.78%	((16.78/28.98)	* 7.13%) * 100	4.13
No-Build	No CRF and no formula used – automatically received a score of 0			0

4.8g Safety - *Reduction in Injury-Related Crashes Criterion Results*

The Reduction in Injury-Related Crashes metric measures safety performance of the No-Build option and the six Tier 2 Alternatives through the use Crash Modification Factors (CMFs) and Crash Reduction Factors (CRFs). The Crash Modification Factor Clearinghouse is the source of all CMFs and CRFs, and according to the clearinghouse, a CMF is a multiplicative factor that indicates the proportion of crashes that would be expected after implementing a countermeasure. Examples of countermeasures include installing a traffic signal, increasing the width of edgelines, and installing a median barrier. CMFs with a value less than 1.0 indicate an expected decrease in crashes. CMFs greater than 1.0 indicate an expected increase in crashes. The Clearinghouse also

identifies a CRF as another way of representing the expected effect of a countermeasure in terms of the percentage decrease in crashes. The formula to convert a CMF to a CRF is as follows:

CRF = 100*(1-CMF)

For example, the application of adding one traffic lane in each direction has a CMF of 0.807 for all crashes according to the Clearinghouse, so the CRF for adding a lane in each direction is 19.3% as shown in the formula below:

(1	**/**	**0.807)**	*** 100**	**=**	**19.3%**	
		CMF of adding one lane in each direction			*CRF of adding one lane in each direction*	

The Reduction in Injury-Related Crashes Criterion used an approach to combine the CMFs of the different countermeasure included in each of the Tier 2 Alternatives to reach a combined CRF for each alternative. As a result, the alternatives with higher CRFs – greater potential in reduction in injury-related crashes only - were the alternatives that scored higher within this criterion. The combined CRF for this criterion includes injury-related crashes only. **Table 4-29** shows the combined CRF for the injury-related crashes for the six Tier 2 Alternatives. The No-Build condition receives no CRFs since no countermeasures would be implemented. Refer to Appendix E for the detailed methodology on how CRFs were calculated.

Table 4-29: Reduction in Injury-Related Crashes Criterion Results

Alternative	CRF for Injury Crashes
No-Build	No CRF
Alternative 3	28.78% CRF for injury crashes
Alternative 4	0% CRF for injury crashes*
Alternative 5	21.78% CRF for injury crashes
Alternative 6a	28.78%% CRF for injury crashes
Alternative 6b	0% CRF for injury crashes*
Alternative 13	-14% CRF for injury crashes
**No CMF's are available for injury severity for SBBLs, so alternatives with only the addition of a SBBL (Alternatives 4 and 6b) result with a zero percent CRF.*	

Application of the Reduction in Injury-Related Crashes Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Reduction in Injury-Related Crashes Criterion. The following formula was used to calculate the scores:

*Technical Score = (Alternative Result / Best Result) * Weight * 100*

Table 4-30 shows how the scores were calculated for combined CRFs for injury-related crashes for the No-Build option and the six Tier 2 Alternatives relative to the results of the Reduction in Injury-Related Crashes Criterion in order of highest scoring to lowest scoring.

Table 4-30: Reduction in Injury-Related Crashes Criterion Results in the Calculation of the Technical Score

Alternative	CRF for Injury Crashes	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 3	28.78%	((28.78/28.78)	* 8.18%) * 100	8.18
Alternative 6a	28.78%	((28.78/28.78)	* 8.18%) * 100	8.18
Alternative 5	21.78%	((21.78/28.78)	* 8.18%) * 100	6.19
Alternative 3	0%*	((0/28.78)	* 8.18%) * 100	0
Alternative 5	0%*	((0/28.78)	* 8.18%) * 100	0
No-Build	No CRF and no formula used – automatically received a score of 0			0
Alternative 13	-14%	((-14/28.78)	* 8.18%) * 100	-3.28

**No CMF's are available for injury severity for SBBLs, so alternatives with only the addition of a SBBL (Alternatives 4 and 6b) result with a zero percent CRF.*

4.8hSafety - *Reduction in Bicycle-Related Only Crashes Criterion Results*

The Reduction in Bicycle-Related Crashes metric measures safety performance of the No-Build option and the six Tier 2 Alternatives also using Crash Modification Factors (CMFs) and Crash Reduction Factors (CRFs). The Crash Modification Factor Clearinghouse is the source of all CMFs and CRFs, and according to the clearinghouse, a CMF is a multiplicative factor that indicates the proportion of crashes that would be expected after implementing a countermeasure. Examples of countermeasures include installing a traffic signal, increasing the width of edgelines, and installing a median barrier. CMFs with a value less than 1.0 indicate an expected decrease in crashes. CMFs greater than 1.0 indicate an expected increase in crashes. The Clearinghouse also identifies a CRF as another way of representing the expected effect of a countermeasure in terms of the percentage decrease in crashes. The formula to convert a CMF to a CRF is as follows:

CRF = 100*(1-CMF)

For example, the application of adding one traffic lane in each direction has a CMF of 0.807 for all crashes according to the Clearinghouse, so the CRF for adding a lane in each direction is 19.3% as shown in the formula below:

(1 /	0.807)	* 100 =	19.3%
	CMF of adding one lane in each direction		*CRF of adding one lane in each direction*

The Reduction in Bicycle-Related Crashes Criterion used an approach to combine the CMFs of the different countermeasure included in each of the Tier 2 Alternatives to reach a combined CRF for each alternative. As a result, the alternatives with higher CRFs – greater potential in reduction in

bicycle-related crashes only - were the alternatives that scored higher within this criterion. The combined CRF for this criterion includes bicycle-related crashes only. **Table 4-31** shows the combined CRF for the injury-related crashes for the six Tier 2 Alternatives. The No-Build condition receives no CRFs since no countermeasures would be implemented. Refer to Appendix E for the detailed methodology on how CRFs were calculated.

Table 4-31: Reduction in Bicycle-Related Only Crashes Criterion Results

Alternative	CRF for Bicycle Crashes
No-Build	0% CRF for bicycle crashes
Alternative 3	0% CRF for bicycle crashes
Alternative 4	0% CRF for bicycle crashes
Alternative 5	14% CRF for bicycle crashes
Alternative 6a	0% CRF for bicycle crashes
Alternative 6b	0% CRF for bicycle crashes
Alternative 13	14% CRF for bicycle crashes
**If no bicycle lane is recommended as a component of the alternative (Alt. 3, 4, 6A, 6b) bicycle crash modification factors are not provided by the Clearinghouse, resulting in a score of zero.*	

Application of the Reduction in Bicycle-Related Crashes Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described was used to calculate the scores:

*Technical Score = (Alternative Result / Best Result) * Weight * 100*

Table 4-32 shows how the scores were calculated for combined CRFs for bicycle-related crashes for the No-Build option and the six Tier 2 Alternatives relative to the results of the Reduction in Bicycle-Related Crashes Criterion in order of highest scoring to lowest scoring.

Table 4-32: Reduction in Bicycle-Related Crashes Criterion Results in the Calculation of the Technical Score

Alternative	CRF for Bicycle Crashes	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 5	14%	((14/14)	* 7.10%) * 100	7.10
Alternative 13	14%	((14/14)	* 7.10%) * 100	7.10
Alternative 3	0%	((0/14)	* 7.10%) * 100	0
Alternative 4	0%	((014)	* 7.10%) * 100	0
Alternative 6a	0%	((0/14)	* 7.10%) * 100	0
Alternative 6b	0%	((0/14)	* 7.10%) * 100	0
No-Build	0%	((014)	* 7.10%) * 100	0
**If no bicycle lane is recommended as a component of the alternative (Alt. 3, 4, 6A, 6b) bicycle crash modification factors are not provided by the Clearinghouse, resulting in a score of zero.*				

4.8i Expand Travel Mode Choices - *Improved Pedestrian Facilities Criterion Results*

The Improved Pedestrian Facilities criterion is one of the qualitative metrics of the Tier 2 Evaluation Criteria. This criterion qualitatively measures how pedestrian facilities are improved

utilizing the Controlling Design Criteria previously discussed in *Section 4.2a - Controlling Design Criteria.* The width of the sidewalk is the determining factor used in the calculation of the score.

Given the qualitative nature of this criterion, a series of thresholds were developed to measure the magnitude of improvement over the baseline condition (No-Build) and a modifier was assigned to each threshold to calculate the weighted score. **Table 4-33** below shows the thresholds and the modifier used to calculate the score for the Improved Pedestrian Facilities criterion.

Table 4-33: Qualitative Scoring Measures of the Pedestrian Facilities Criterion

Sidewalk Width Threshold Rank		Modifier	Weight	Score
1	Meets or exceeds both ADOT's minimum standard and the Project Partner preferred standards*	1	7.12	7.12
2	Meets or exceeds ADOT's minimum standard OR the Project Partners preferred standards, but not both*	0.5		3.56
3	Maintains existing condition/does not meet any standards	0		0
**Per the minimum and preferred standards outlined in the Controlling Design Criteria*				

For example, the No-Build option reflects the existing Milton Rd. roadway conditions, so the No-Build option would receive zero points since it is the baseline condition for this criterion. Conversely, Alternative 5 received the full 7.12 points because the proposed width of the sidewalk exceeds the preferred standards for both ADOT and the Project Partners.

The various sidewalk widths excerpted from the Controlling Design Criteria are shown in **Table 4-34.**

Table 4-34: Improved Pedestrian Facilities Criterion Results

Alternative	Sidewalk Width	Result/Threshold
No-Build	6'	Maintains existing condition/does not meet any standards*
Alternative 3	6'	Maintains existing condition/does not meet any standards*
Alternative 4	10'	Maintains existing condition/does not meet any standards*
Alternative 5	10'	Meets or exceeds both ADOT and Project Partner Standards*
Alternative 6a	10'	Meets or exceeds both ADOT and Project Partner Standards*
Alternative 6b	10'	Meets or exceeds both ADOT and Project Partner Standards*
Alternative 13	10'	Meets or exceeds both ADOT and Project Partner Standards*
**Per the minimum and preferred standards outlined in the Controlling Design Criteria*		

Application of the Improved Pedestrian Facilities Criterion Results in the Calculation of the Technical Score

The Improved Pedestrian Facilities criterion results are illustrated in **Table 4-35**.

Table 4-35: Improved Pedestrian Facility Criterion Technical Score

Alternative	Result/Threshold	Score
No-Build	Maintains existing condition/does not meet any standards*	0
Alternative 3	Maintains existing condition/does not meet any standards*	0
Alternative 4	Maintains existing condition/does not meet any standards*	0
Alternative 5	Meets or exceeds both ADOT and Project Partner Standards*	7.12

Alternative 6a	Meets or exceeds both ADOT and Project Partner Standards*	7.12
Alternative 6b	Meets or exceeds both ADOT and Project Partner Standards*	7.12
Alternative 13	Meets or exceeds both ADOT and Project Partner Standards*	7.12
**Per the minimum and preferred standards outlined in the Controlling Design Criteria*		

4.8j Expand Travel Mode Choices - *Improved Bicycle Facilities Criterion Results*

The Improved Bicycle Facilities criterion is another one of the qualitative metrics. This criterion qualitatively measures how bicycle facilities are improved utilizing the Controlling Design Criteria previously discussed in *Section 4.2a - Controlling Design Criteria.* The width of the bike lane and buffer, or SBBL and buffer are two key determining factors used in the calculation of the Improved Bicycle Facilities score.

Similar to the Improved Pedestrian Facilities criterion, the qualitative nature of this criterion resulted in the development of a series of thresholds to measure the magnitude of improvement and a modifier was assigned to each threshold to calculate the weighted score. **Table 4-36** below shows the thresholds and the modifier used to calculate the score for the Improved Bicycle Facilities criterion.

Table 4-36: Qualitative Scoring Measures of the Bike Facilities Criterion

Bike Facility Width Threshold Rank		Modifier	Weight	Score
1	Meets or exceeds both ADOT's minimum standard and the Project Partner preferred standards*	1	7.48	7..48
2	Meets or exceeds ADOT's minimum standard OR the Project Partners preferred standards, but not both*	0.5		3.74
3	Maintains existing condition/does not meet any standards*	0		0
**Per the minimum and preferred standards outlined in the Controlling Design Criteria*				

For example, the No-Build option maintains the existing roadway conditions, so the No-Build option would receive zero points for this criterion. Conversely, Alternative 5 received a full 7.12 points because the width of the proposed bike facility exceeds the preferred standards for both ADOT and the City/MetroPlan/Mountain Line/Project Partners.

The various bicycle facility widths excerpted from the Controlling Design Criteria are shown in **Table 4-37**.

Table 4-37: Improved Bicycle Facilities Criterion Results

Alternative	Facility Width	Result/Threshold
No-Build	n/a	Maintains existing condition/does not meet any standards*
Alternative 3	n/a	Maintains existing condition/does not meet any standards*
Alternative 4	13.5' (SBBL)	Maintains existing condition/does not meet any standards*
Alternative 5	6' (bike lane)	Meets or exceeds both ADOT and Project Partner Standards*
Alternative 6a	14' (SBBL)	Maintains existing condition/does not meet any standards*
Alternative 6b	14' (SBBL)	Maintains existing condition/does not meet any standards*
Alternative 13	6' (bike lane)	Meets or exceeds both ADOT and Project Partner Standards*
**Per the minimum and preferred standards outlined in the Controlling Design Criteria*		

Application of the Improved Bicycle Facilities Criterion Results in the Calculation of the Technical Score

The Improved Bicycle Facilities criterion results are illustrated in **Table 4-38**.

Table 4-38: Improved Bicycle Faculties Criterion Technical Score

Alternative	Result/Threshold	Score
No-Build	Maintains existing condition/does not meet any standards*	0
Alternative 3	Maintains existing condition/does not meet any standards*	0
Alternative 4	Maintains existing condition/does not meet any standards*	0
Alternative 5	Meets or exceeds both ADOT and Project Partner Standards*	7.12
Alternative 6a	Maintains existing condition/does not meet any standards*	0
Alternative 6b	Maintains existing condition/does not meet any standards*	0
Alternative 13	Meets or exceeds both ADOT and Project Partner Standards*	7.12
**Per the minimum and preferred standards outlined in the Controlling Design Criteria*		

4.8k Expand Travel Mode Choices - *Transit Travel Time Criterion Results*

The Transit Travel Time criterion is a metric that measures transit improvement by calculating the amount of time it takes for transit vehicles to travel the corridor from one end to the other – or in other words calculating transit travel time. The results of the transit travel time for the No-Build option and six other Tier 2 Alternatives is under the year 2040 condition and is an output from the Vissim Model.

In order to reach a comprehensive measure, transit travel times during both the AM and PM time periods were used to measure the overall performance of this criterion – each receiving half the value of the 6.27% weight assigned to this criterion, or 3.135% per time duration. The transit travel speeds in each direction of Milton Road – northbound and southbound – were also averaged to reach a combined travel speed for each of the AM and PM durations.

The results of the of the Transit Travel Time are shown below in **Table 4-39** and **Table 4-40** for the No-Build option and six other Tier 2 Alternatives.

Table 4-39: AM Transit Travel Time Criterion Results*

	No-Build	Alt 3		Alt 5		Alt 6a		Alt 4/6b		Alt 13	
AM Transit Travel Time	Travel Time (sec)	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change
NB Transit Travel Time	501	501	0.1%	355	29.2%	230	54.0%	257	48.8%	298	40.5%
SB Transt Travel Time	764	297	61.2%	662	13.3%	269	64.7%	484	36.6%	448	41.3%
Average Transit Travel Time	**632**	**399**	**30.6%**	**508**	**21.3%**	**250**	**59.4%**	**371**	**42.7%**	**373**	**40.9%**

**Alternative 4 and Alternative 6a share results because only one Vissim model was constructed to represent both alternatives because they are identical from an operational perspective*

Table 4-40: PM Improved Transit Travel Time Criterion Results*

	No-Build	Alt 3		Alt 5		Alt 6a		Alt 4/6b		Alt 13	
PM Transit Travel Time	Travel Time (sec)	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change	Travel Time (sec)	Travel Time Percent Change
NB Transit Travel Time	282	317	-12.4%	312	-10.8%	223	21.0%	221	21.6%	252	10.5%
SB Transit Travel Time	424	413	2.7%	352	17.0%	288	32.0%	352	17.1%	501	-18.1%
Average Transit Travel Time	353	365	-4.9%	332	3.1%	256	26.5%	286	19.4%	377	-3.8%

**Alternative 4 and Alternative 6a share results because only one Vissim model was constructed to represent both alternatives because they are identical from an operational perspective.*

The average transit travel time between the northbound and southbound direction for the No-Build option is 632 seconds (10 minutes and 31 seconds) in the AM and 353 seconds (five minutes and 53 seconds) in the PM – a significantly shorter average transit travel time in the PM time period. The No-Build travel time results is the baseline condition for calculating the travel time percent change for each of the Tier 2 Alternatives.

All Alternatives have an improved transit travel time compared to the No-Build option in the AM; while Alternate 4, Alternative 6a, and Alternative 6b are the only alternatives that have an improved transit travel time in both the AM and PM time periods. Alternative 13 interestingly has a reduced transit travel time in the PM time period with the center-running dedicated transit facility, and then conversely, Alternative 5 with no dedicated transit facility, has a positive regression in transit travel time in the PM compared to the No-Build option. The No-Build option and the Tier 2 Alternatives are ranked below for each time duration based on the Vissim model results of the Transit Travel Time criterion.

Transit travel times in the AM peak are significantly impacted in the bottleneck at Santa Fe/Sitgreaves. Since all build alternatives utilize signal control at Santa Fe/Sitgreaves, thus allowing the northbound lefts to clear the through lanes, this bottleneck is eliminated and provides significant benefit to all build alternatives. PM peak travel times are largely controlled by intersection control. The transit signal priority does provide benefit, such as with Alternative 5 even though it has no dedicated bus lane. Other factors affect transit travel times, such as the addition of bus stops, presence of HAWK signals, and signal phasing.

AM

1. Alternative 6a – 250 seconds of average transit travel time
2. Alternative 4/6b – 371 seconds of average transit travel time
3. Alternative 13– 373 seconds of average transit travel time
4. Alternative 3 – 399 seconds of average transit travel time
5. Alternative 5 – 508 seconds of average transit travel time
6. No-Build – 632 seconds of average transit travel time

PM

1. Alternative 6a – 256 seconds of average transit travel time
2. Alternative 4/6b – 286 seconds of average transit travel time

3. Alternative 5 – 332 seconds of average transit travel time
4. No-Build – 353 seconds of average transit travel time
5. Alternative 3 – 365 seconds of average transit travel time
6. Alternative 13 – 377 seconds of average transit travel time

Application of the Transit Travel Time Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Transit Travel Time criterion. The following formula was used to calculate the scores:

*Technical Score = (Best Result/ Alternative Result) * Weight * 100*

Since Transit travel time was measured in both the AM and PM time periods, two values were produced - each receiving half the value of the 6.27% weight, or 3.135%.

Table 4-41 and **Table 4-42** below show how the AM and PM scores were calculated for the No-Build option and the six other Tier 2 Alternatives relative to the results of the Travel Time creation in order of highest to lowest scoring.

Table 4-41: AM Transit Travel Time Criterion Results in the Calculation of the Technical Score

Alternative	AM Travel Time Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 6a	250 seconds	((250/250)	* 3.135%) * 100	3.13
Alternative 4/6b	371 seconds	((250/371)	* 3.135%) * 100	2.11
Alternative 13	373 seconds	((250/373)	* 3.135%) * 100	2.10
Alternative 3	399 seconds	((250/399)	* 3.135%) * 100	1.96
Alternative 5	508 seconds	((250/508)	* 3.135%) * 100	1.54
No-Build	632 seconds	((250/632)	* 3.135%) * 100	1.24

Table 4-42: PM Transit Travel Time Criterion Results in the Calculation of the Technical Score

Alternative	PM Travel Time Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 6a	256 seconds	((256/256)	* 3.135%) * 100	3.13
Alternative 4/6b	286 seconds	((256/286)	* 3.135%) * 100	2.80
Alternative 5	332 seconds	((256/332)	* 3.135%) * 100	2.42
No-Build	353 seconds	((256/353)	* 3.135%) * 100	2.27
Alternative 3	365 seconds	((256/365)	* 3.135%) * 100	2.20
Alternative 13	377 seconds	((256/377)	* 3.135%) * 100	2.13

4.8l Construction/Implementation – *Project Cost Criterion Results*

The Project Cost Criterion is a metric that measures the ease of construction/implementation by evaluating the total project cost to implement the No-Build option and six other Tier 2 Alternatives. This criterion is intended to reflect the fact that more expensive alternatives are

generally more difficult to implement than a less expensive alternatives, and thus alternatives with lower projected costs would score higher than alternatives with more expensive cost estimates.

The No-Build option assumes no cost in order to implement while a detailed cost estimate was developed for each of the other Tier 2 Alternatives. **Table 4-43** below shows the total project cost for implementation of each Alternative.

Table 4-43: Project Cost Criterion Results

Alternative	Project Cost Estimate[1]
No-Build	No Cost
Alternative 3	$40,514,000
Alternative 4	$40,542,000
Alternative 5	$60,994,000
Alternative 6a	$73,667,000
Alternative 6b	$55,137,000
Alternative 13[2]	$57,695,000

1 ROW impact/cost does not include any costs that may be associated with a potential impact to an existing building.
2 Project Costs for Alternative 13 do not include necessary costs for accessible boarding platforms, pedestrian refuge islands or other center-lane transit appurtenances.

As anticipated, the more expansive build alternatives have higher project costs than the narrower build alternatives. Alternative 6a has the highest project cost estimate of $73,667,000 while Alternative 3 and Alternative 4 have the two lowest project cost estimates at $40,514,000 and $40,542,000 respectively. Refer to Appendix F to see the detailed cost estimates for each alternative.

Application of the Project Cost Criterion Results Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Project Cost criterion. One unique element of the formula used for the Project Cost criterion is that a common denominator of $10,000,000 was added to the formula to normalize the ratio between the best result and the other results due to the large disparity between the zero cost for the No-Build option compared to the costs of the other six Tier 2 Alternatives. In addition, the value of $1 was also used in the formula for the cost of the No-Build option since inputting a zero would make all scores result in a zero).

The following formula was used to calculate the scores:

*Technical Score = (Best Result / (Alternative Result/10M)) * Weight * 100*

Table 4-44 below shows how the scores were calculated for each alternative relative to the results of the Cost of Implementation creation in order of highest scoring alternative to the lowest scoring alternative.

Table 4-44: Project Cost Criterion Results in the Calculation of the Technical Score

Alternative	Project Cost[1]	Scoring Formula		Score
		Results Ratio	Applying the Weight	
No-Build	No Cost	No formula used, automatically received full weighted points		4.68
Alternative 3	$40,514,000	(1/40.514M (/10M))	* 4.68% *100))	1.15
Alternative 4	$40,542,000	(1/40.542M(/10M))	* 4.68% *100))	1.15
Alternative 6b	$55,137,000	(1/55.137M (/10M))	* 4.68%) *100))	0.85
Alternative 13[2]	$57,695,000	(1/57.695M (/10M))	* 4.68% *100))	0.81
Alternative 5	$60,994,000	(1/60.994M (/10M))	*4.68% *100))	0.77
Alternative 6a	$73,667,000	(1/73.667M (/10M))	* 4.68% *100))	0.64

1 ROW impact/cost does not include any costs that may be associated with a potential impact to an existing building.
2 Project Costs for Alternative 13 do not include necessary costs for accessible boarding platforms, pedestrian refuge islands or other center-lane transit appurtenances.

4.8m Construction/Implementation - *Right-of-Way Impact Criterion Results*

The right-of-way impact criterion is a metric that measures the amount of right-of-way that will be necessary to implement each alternative. The method to calculate the impact was produced by estimating the amount of land - in square feet - required for right-of-way acquisition to build the alternatives. The No-Build option assumes no right-of-way impact to implement while a detailed process to map and calculate the potential right-of-way impact was conducted for each of the other six Tier 2 Alternatives. **Table 4-45** below shows the total right-of-way impact for the implementation of each Tier 2 Alternative.

Table 4-45: Right-of-Way Impact Criterion Results

Alternative	Mid-Block ROW Width	Right-of-Way Impact*
No-Build	Existing	*No Impact*
Alternative 3	100 ft	26,326 ft^2
Alternative 4	100 ft	26,326 ft^2
Alternative 5	125 ft	203,517 ft^2
Alternative 6a	144 ft	362,398 ft^2
Alternative 6b	128 ft	237,564 ft^2
Alternative 13[2]	129 – 134 ft	245,096 ft^2

**Does not intersection configurations and thus the right-of-way impact only includes the mid-block width over the length of the corridor*

The more expansive build alternatives will naturally have a larger right-of-way footprint than the narrower alternatives. The majority of the right-of-way from alternatives that do not increase the number of lanes is primarily for pedestrian, bicycle and parkway (landscape) features. However, Alternative 3 and Alternative 4 have the same right-of-way width of 100 feet and have a substantially smaller right-of-way footprint than the other alternatives. In fact, Alternative 5 has nearly eight-times more of a right-of-way impact than Alternative 3 and Alternative 4; while Alternative 6b and Alternative 13 have approximately nine-times the right-of-way impact and Alternative 6b has nearly fourteen-times more of a right-of-way impact than Alternative 3 and Alternative 4.

Application of the Right-of-Way Impact Results

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Right-of-Way Impact criterion. One unique element of the formula used for the Right-of-Way Impact criterion is that a common denominator of 10,000 (square feet) was added to the formula to normalize the ratio between the best result and the other results due to the large disparity between the zero impact for the No-Build option compared to the costs of the other six Tier 2 Alternatives. In addition, the value of 1 ft^2 was also used in the formula for the cost of the No-Build option since inputting a zero would make all scores result in a zero). The following formula was used to calculate the scores:

The following formula was used to calculate the scores:

Formula = (Best Result / (Alternative Result/10K)) * Weight * 100

Table 4-46 below shows how the scores were calculated for each alternative relative to the results of the Right-of-Way Impact creation in order of highest scoring alternative to the lowest scoring alternative.

Table 4-46: Right-of-Way Impact Criterion Results in the Calculation of the Technical Score

Alternative	ROW Width	Right-of-Way Impact*	Scoring Formula		Score
			Results Ratio	Applying the Weight	
No-Build	-	*No Impact*	No formula used, automatically received full points		4.96
Alternative 3	100 ft	26,326 ft^2	(1/(26,326/10K))	* 4.96% *100))	1.89
Alternative 4	100 ft	26,326 ft^2	(1/(26,326/10K))	* 4.96% *100))	1.89
Alternative 5	125 ft	203,517 ft^2	(1/(203,517/10K))	* 4.96% *100))	0.24
Alternative 6b	144 ft	237,564 ft^2	(1/(237,564/10K))	* 4.96% *100))	0.21
Alternative 13[2]	128 ft	245,096 ft^2	(1/(245,096/10K))	* 4.96% *100))	0.20
Alternative 6a	129 ft	362,398 ft^2	(1/9362,398/10K))	* 4.96% *100))	0.14
**Does not intersection configurations and thus the right-of-way impact only includes the mid-block width over the length of the corridor*					

4.9 Tier 2 Alternatives Recommended for Tier 3 Analysis

The Project Partners were presented with the modeling findings and Tier 2 Evaluation Criteria matrix results. Over the course of a couple Project Partner meetings, the Project Partners discussed which of the Tier 2 alternatives they would prefer to move forward for final Tier 3 analysis.

As **Figure 4-15** illustrates, the Project Partners ultimately eliminated Alternative 3 and Alternative 4. Simply put, Alternative 4 was the lowest performing alternative in total, ranking last in 7th place. With a total sum of approximately one-half of the top ranked alternative, Alternative 4 performed poorly across almost all criteria, but especially poor in the Safety, Expand Travel Mode Choices

and Congestion Reduction criteria. From a model results perspective, Alternative 4 did not demonstrate significantly improved travel time or travel speed results, LOS at signalized intersections, and all non-signalized intersections experiencing a LOS of F.

The Project Partners also agreed to eliminate Alternative 3 from further study. Receiving a rank of 4th in the Tier 2 analysis, Alternative 3 was eliminated from further consideration due to its marginal performance in the Tier 2 modeling and moderate to below average scoring in the Tier 2 evaluation criteria, particularly in the Expand Travel Mode Choice criteria. Also, as the Project Partners desired to pair-down Tier 2 alternatives for the Tier 3 analysis, it was generally felt that the roadway features of Alternative 3 (six general purpose travel lanes) were already captured in Alternative 5 (which ranked 1st). Moreover, the bicycle, pedestrian and landscape elements of Alternative 3 were felt to be less desirable/sufficient than Alternative 5, so the Project Partners felt that Alternative 3 became duplicative and substandard to the functionality and character of Alternative 5, so Alternative 3 was eliminated for further consideration. The Project Partners also discussed and agreed that Alternative 6a and 6b would move forward to Tier 3 analysis. The No Build was recommended for Tier 3 in part to be compliant with NEPA requirements to maintain a No Build alternative in the analysis and the No Build Plus was created to recognize that select spot improvements to the existing corridor was desired by the Project Partners.

Accordingly, the Project Partners selected the following Alternatives to move forward for Tier 3 analysis:

- No-Build;
- No-Build Plus;
- Alternative 5;
- Alternative 6a;
- Alternative 6b; and
- Alternative 13.

Please refer to Section 5.2 for a description of the No Build Plus alternative.

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Figure 4-15: Tier 2 Alternatives Recommended for Tier 3 Analysis

Recommended for Tier 3 Analysis

No Build / No Build +

- Project Cost: N/A
- Required ROW: 0 ft²
- Potential Buildings Impacted: 0

No Build Evaluation Criteria Results						Rank
Reduction in Vehicular Congestion (22.69 Possible Points)	Safety (22.41 Possible Points)	Expand Travel Mode Choices (20.87 Possible Points)	Public Acceptance (8.62 Possible Points)	Construction/ Implementation (9.64 Possible Points)	Total Score (83.88 Possible Points)	6th
17.12	0.00	3.51	0.00	9.64	**30.27**	

Eliminated from Tier 3 Analysis

Alternative 3

Alternative 3 Evaluation Criteria Results						Rank
						4th

Eliminated from Tier 3 Analysis

Alternative 4

Alternative 4 Evaluation Criteria Results						Rank
						7th

Recommended for Tier 3 Analysis

Alternative 5

- Project Cost: $60,994,000
- Required ROW: 203,517 ft²
- Potential Buildings Impacted: 21

Alternative 5 Evaluation Criteria Results						Rank
Reduction in Vehicular Congestion (22.69 Possible Points)	Safety (22.41 Possible Points)	Expand Travel Mode Choices (20.87 Possible Points)	Public Acceptance (8.62 Possible Points)	Construction/ Implementation (9.64 Possible Points)	Total Score (83.88 Possible Points)	1st
21.31	17.42	18.56	0.00	1.01	**58.30**	

Recommended for Tier 3 Analysis

Alternative 6a

- Project Cost: $73,667,000
- Required ROW: 362,398 ft²
- Potential Buildings Impacted: 32

Alternative 6a Evaluation Criteria Results						Rank
Reduction in Vehicular Congestion (22.69 Possible Points)	Safety (22.41 Possible Points)	Expand Travel Mode Choices (20.87 Possible Points)	Public Acceptance (8.62 Possible Points)	Construction/ Implementation (9.64 Possible Points)	Total Score (83.88 Possible Points)	2nd
21.79	15.30	13.39	0.00	0.77	**51.25**	

Recommended for Tier 3 Analysis

Alternative 6b

- Project Cost: $55,137,000
- Required ROW: 237,564 ft²
- Potential Buildings Impacted: 23

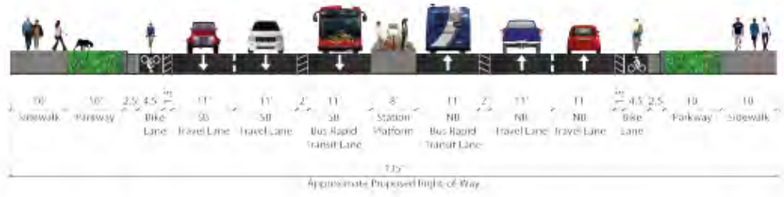
Alternative 6b Evaluation Criteria Results						Rank
Reduction in Vehicular Congestion (22.69 Possible Points)	Safety (22.41 Possible Points)	Expand Travel Mode Choices (20.87 Possible Points)	Public Acceptance (8.62 Possible Points)	Construction/ Implementation (9.64 Possible Points)	Total Score (83.88 Possible Points)	5th
17.00	4.77	12.04	0.00	1.06	**34.87**	

Recommended for Tier 3 Analysis

Alternative 13

- Project Cost: $57,695,000
- Required ROW: 245,096 ft²
- Potential Buildings Impacted: 23

Alternative 13 Evaluation Criteria Results						Rank
Reduction in Vehicular Congestion (22.69 Possible Points)	Safety (22.41 Possible Points)	Expand Travel Mode Choices (20.87 Possible Points)	Public Acceptance (8.62 Possible Points)	Construction/ Implementation (9.64 Possible Points)	Total Score (83.88 Possible Points)	3rd
16.31	7.28	18.83	0.00	1.01	**43.44**	



Updated 10/28/19

5.0 TIER 3 ALTERNATIVE EVALUATION

Based on the recommendations from the Project Partners, the following alternatives are included in the Tier 3 Alternative Evaluation:

- No-Build;
- No-Build Plus Spot Improvements (No-Build Plus);
- Alternative 5;
- Alternative 6a;
- Alternative 6b; and
- Alternative 13.

5.1a Spot Improvements

As previously introduced, one component that separates the Tier 3 Alternative Evaluation process from the Tier 2 Alternative Evaluation process is the inclusion of spot improvements. The Tier 2 traffic modeling analysis focused on a comparison of the alternatives by largely comparing various aspects of travel lane operations only.

Through a progression of meetings between the Consultant Team and the Project Partners, a series of spot improvements were developed to be integrated into all the Tier 3 Alternatives, except the No-Build alternative. Spot improvements were recognized by the Project Partners as being desired to potentially inventory which type of low investment enhancements could/should be included as part of the No Build Plus alternative (newly introduced to the Tier 3 process), but also recognize the desire and value of incorporating and measuring the effectiveness (or not) of other desired enhancements such as pedestrian, bicycle, transit, safety and traffic operations along the Milton Road corridor.

The spot improvements are concentrated at intersections since the alternative's cross section address the mid-block applications. Spot improvements were also characterized in one of the following categories:

- Roadway Geometry;
- Roadway Operations;
- Vehicular Safety;
- Access Management;
- Pedestrian;
- Bicycle; and
- Transit.

Once the spot improvement inventory was completed, the Project Partners collaborated and recognized the variation in the spot improvement applications and identified the need to assign specific improvements to certain Tier 3 Alternatives. Spot improvements are assigned to the Tier 3 Alternatives by one of the three applications:

- No Build + Alternative Only;
- Build Alternatives Only; or
- All Alternatives.

Project Partners discussed and confirmed the Tier 3 Alternative Spot Improvement Inventory as shown in **Table 5-1**.

Table 5-1: Tier 3 Alternative Spot Improvement Inventory

Spot Improvement Alternative Applicability Key
[1] No Build + Alternative Only
[2] Build Alternatives Only
[3] All Alternatives

	Spot Improvement Categories						
Corridor Intersections	Roadway Geometry	Roadway Operations	Vehicular Safety	Access Management	Pedestrian	Bicycle	Transit
Forest Meadows Street (signalized)		• Add NB left turn lane to make dual left (NB Milton to WB Forest Meadows)[3] • Adaptive Traffic Signal[3] • Extend NB right turn lane through intersection and to McConnel Dr bridge[2]		• Restrict U-Turns[3] • 4-foot finger island/median[2]	• Ladder/High-Visibility Crosswalks[3] • North leg crosswalk[2] • ADA-compliant curb ramps[3] • Pedestrian staging area improvement[3]	• Bicycle signal detection and actuation[3] • Combined Bike Lane/Right Turn Lane[2]	
Saunders Drive (stop controlled)	• Reduction is west leg radii[3]			• 4-foot finger island/median[3]	• Ladder/High-Visibility Cross walks[3] • ADA-compliant curb ramps[3] • At-grade pedestrian crossing/signal near Auto Zone[3]		
University Drive (signalized)				• Restrict U-Turns[3] • Right turn restrictions[3] • 4-foot finger island/median[3]	• Ladder/High-Visibility Cross walks (Only apply if grade-separated crossing isn't implemented)[3] • ADA-compliant curb ramps[3]	• Bicycle signal detection and actuation[3]	• Transit signal prioritization[3]
University Avenue (stop controlled)	• Right-in, right-out (impacted by the introduction of the University Dr. intersection and roundabout with Beulah Blvd)[3] • Tighten the SB to WB turn radius to improve pedestrian condition[3]			• Restrict U-Turns[3] • Restrict left turns[3] • 4 foot finger island (my notes say that Nate said the new MillTown site plan calls for a 4 ft finger island from University Dr. to University Ave.)	• Ladder/High-Visibility Cross walks[3] • ADA-compliant curb ramps[3] • Pedestrian refuge on west leg[3]		
Chambers Drive (stop controlled)				• Restrict U-Turns[3] • Construct medians[3] • Restrict SB and WB left turns[3]	• Ladder/High-Visibility Cross walks[3] • ADA-compliant curb ramps[3]	• Combined Bike Lane/Right Turn Lane[2]	• future transit stops are proposed at the NB and SB downstream sides of this intersection.[3] • (BRT station footprints will 100' x 12' to accommodate a 60' long platform with ramps on each end. The sidewalk could go behind the platform

							or this would be wide enough to be a pass-through station)
Plaza Way (signalized)	• Improve the roadway geometry of the west leg – including improving the radius and application of directional ramps[1] • Full west leg/ intersection redesign[2] • Lengthen the storage for NB left turn lane[3]	• Dedicated right and left turn phase for vehicles[3] • Dual left turn lanes[2]		• Restrict U-Turns[3] • Medians[3] • Restrict right turns on red[3]	• Ladder/High-Visibility Cross walks[3] • Shorten south leg crosswalk[3] • ADA-compliant curb ramps[3] • Mid-block crossing south of Plaza[3]	• Bicycle signal detection and actuation[3] • Combined Bike Lane/Right Turn Lane[2]	
Riordan Road (signalized		• Dual left turn lane on Milton Rd to EB/WB Riordan Rd. (requires additional receiving lanes)[2] • Dual left turn lane on Riordan Rd to SB Milton Rd. (requires additional receiving lanes)[2] • Dedicated right and left turn phase for vehicles[3]		• Restrict U-Turns[3]	• Ladder/High-Visibility Cross walks[3] • ADA-compliant curb ramps[3]	• Bicycle signal detection and actuation[3] • Combined Bike Lane/Right Turn Lane[2]	
Historic Route 66 (signalized)		• Dual left turn lane on Milton Rd to WB Rt 66[2] • Dedicated right and left turn phase for vehicles[3]		• Restrict U-Turns[3]	• Ladder/High-Visibility Cross walks[3] • ADA-compliant curb ramps[3] • Pedestrian staging area improvement[2]	• Bicycle signal detection and actuation[3] • Combined Bike Lane/Right Turn Lane[2]	• Transit signal prioritization[3] • future transit stops are proposed at the NB and SB downstream sides of this intersection.[3]
Malpais Lane (stop controlled)		• SB Right turn deceleration lane[2]		• Restrict U-Turns[3] • Restrict left turns in and out (one of top intersections in districts for crashes, left turns)[3] • Right in, right out only (eliminate NB Milton Rd. left turns to WB Malpais per crash reports at this location)[3]	• Ladder/High-Visibility Cross walks[3] • ADA-compliant curb ramps[3] • Grade separated crossing over the north leg, near mid-block (Not an ADOT funded project and not part of the CMP Master Plan funding process.)[2]	• Combined Bike Lane/Right Turn Lane[2]	

Butler/Clay Avenue (signalized)	• Add a pork chop with the NB right turn movement[3]	• SB right turn deceleration lane on Milton Rd[2] • Add EB right turn lane to make left through lane[2]	• Move south leg stop bar closer to the existing intersection curb returns[3]	• Restrict U-Turns[3]	• Ladder/High-Visibility Cross walks[3] • ADA-compliant curb ramps[3] • Increase the pedestrian staging areas at all legs[2] • Introduce a crosswalk on the south leg[3]	• Bicycle signal detection and actuation[3] • Combined SB Bike Lane/Right Turn Lane[2]	• Transit signal prioritization[3] • Transit queue jumping (Alt 13 only) [2] (Needs to show justification of a performance benefit for all users)
Mikes Pike Street (stop controlled)	• Reconfigure the intersection, or shift the intersection north to increase the gap between Butler Ave[2]	• Continue right turn only lane through the intersection[2]		• Right in, right out only[3]	• Ladder/High-Visibility Cross walk to east leg[3] • ADA-compliant curb ramps[3]		
Tucson Avenue (stop controlled)				• Restrict U-Turns[3]	• Ladder/High-Visibility Cross walks[3] • ADA-compliant curb ramps[3]		
Phoenix Avenue (stop controlled)		• Traffic Signal[3]		• Restrict U-Turns[3]	• Ladder/High-Visibility Cross walks (across Phoenix Ave only on both the east and west legs)[3] • ADA-compliant curb ramps[3] • Grade separated crossing (north leg)[4]		• Transit signal prioritization[3] (if signal is implemented) • future transit stops are proposed at the NB and SB downstream sides of this intersection.[3] • (BRT station footprints will 100' x 12' to accommodate a 60' long platform with ramps on each end. The sidewalk could go behind the platform or this would be wide enough to be a pass-through station)
Santa Fe Avenue (stop controlled)	• Reconfigure intersection layout[2]	• Increase NB left turn lane storage in conjunction with BNSF widening[2] • Make NB dual left [2] • NB Milton left turn restrictions[3] • Florida T Concept[2]		• Restrict U-Turns[3] • Restrict NB left turns[3] • Alternative access through new crossing west of Milton Rd (i.e. turn left onto Tucson Ave or Phoenix Ave to new underpass)[2]	• Ladder/High-Visibility Cross walks[3] • ADA-compliant curb ramps[3]		
Humphrey's Street (signalized)		• Dual Left turn on SB Humphrey's St to EB Milton Rd.[2] • Dual Left Turn on Milton Rd to NB Humphrey's St (requires two NB travel lanes on Humphrey's St)[2] • Florida T Concept, in conjunction with the		• Restrict U-Turns[3]	• Ladder/High-Visibility Cross walks[3] • ADA-compliant curb ramps[3] • Pedestrian crossing improvements[3]	• Bicycle signal detection and actuation[3] • Combined Bike Lane/Right Turn Lane[2]	• Transit signal prioritization[3]

		appropriate signal phasing adjustments2					
Beaver Street (signalized)				• Restrict U-Turns[3]	• Ladder/High-Visibility Cross walks[3] • ADA-compliant curb ramps[3]	• Bicycle signal detection and actuation[3] • Combined Bike Lane/Right Turn Lane[2]	• Transit signal prioritization[3]

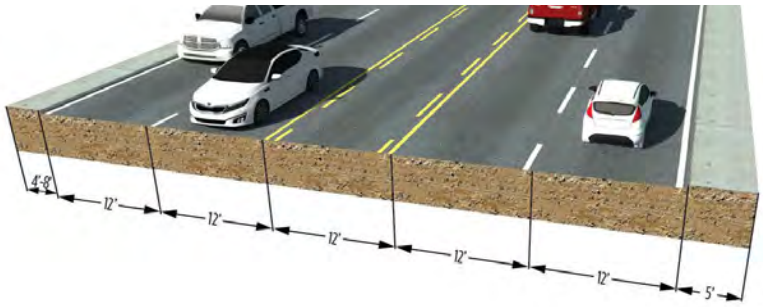
5.2 Tier 3 Milton Road Alternatives

The Project Partners reached consensus on the five Tier 3 Alternatives with the No-Build as described in the following sub-sections.

5.2a No-Build / No-Build Plus

The No-Build option represents the existing roadway conditions of Milton Road, which includes two travel lanes in each direction with a center two-way left turn lane (TWTL), and (generally) six-foot sidewalks on both sides of the corridor; However, the width of the sidewalk is narrower than six-foot in some locations. The No-Build Plus maintains the existing condition with the inclusion of the spot improvements as discussed in *Section 5.1a - Spot Improvements*. **Figure 5-1** shows the mid-block cross section of No-Build and the No-Build Plus without any spot improvements.

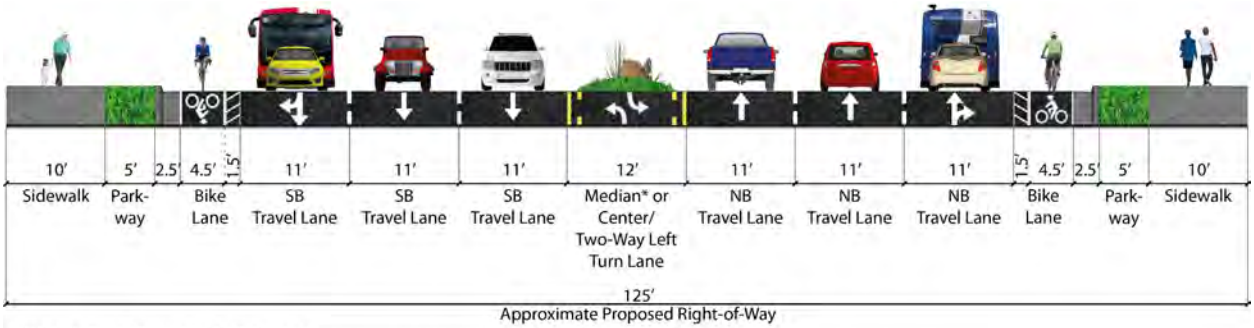
Figure 5-1: Existing Mid-Block Cross Section



5.2b System Alternative 5

System Alternative 5 includes six, 11-foot general purpose travel lanes with center median/left turn lane and 6-foot bicycle lanes and 10-foot sidewalks. Alternative 5 offers both increased capacity and opportunities for expanded mode choices through the introduction of two vehicular lanes – one in each direction – and the addition of buffered bike lanes on both sides of the road. Alternative 5 also includes enhanced facilities back of curb with a 10-foot sidewalk with a parkway on both sides of the road. **Figure 5-2** below shows the mid-block cross section of System Alternative 5.

Figure 5-2: System Alternative 5 Mid-Block Cross Section



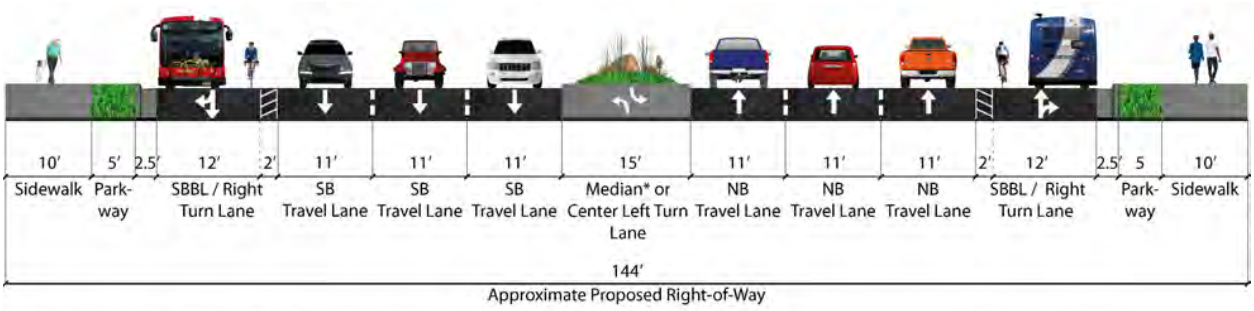
*Median treatment may vary along the study corridor.

**An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

5.2c System Alternative 6a

System Alternative 6a includes six, 11-foot general purpose lanes, Two 14-foot SBBLs, and center median/turn lane with 10-foot sidewalks. Alternative 6a offers a combination of both increased capacity and opportunities for expanded mode choices by adding both an additional vehicular lane and a SBBL in each direction. Alternative 6a also includes enhanced facilities back of curb with a 10-foot sidewalk with a parkway on both sides of the road. **Figure 5-3** shows the mid-block cross section of System Alternative 6a.

Figure 5-3: System Alternative 6a Mid-Block Cross Section

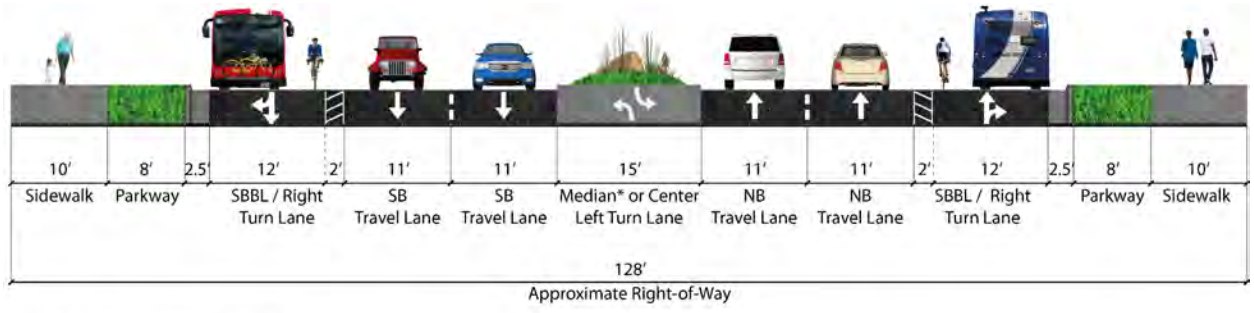


*Median treatment may vary along the study corridor.
**An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

5.2d System Alternative 6b

System Alternative 6b includes four, 11-foot General Purpose Lanes, Two 14-Foot SBBLs, 14-foot Center Median/Turn Lane with 10-foot Landscaped buffers and 10-foot Sidewalks. Alternative 6b primarily provides increased opportunities for expanded mode choices by adding a SBBL in each direction while introducing a larger buffer between the vehicular lanes and the widened sidewalk. **Figure 5-4** below shows the mid-block cross section of System Alternative 6a:

Figure 5-4: System Alternative 6b Mid-Block Cross Section

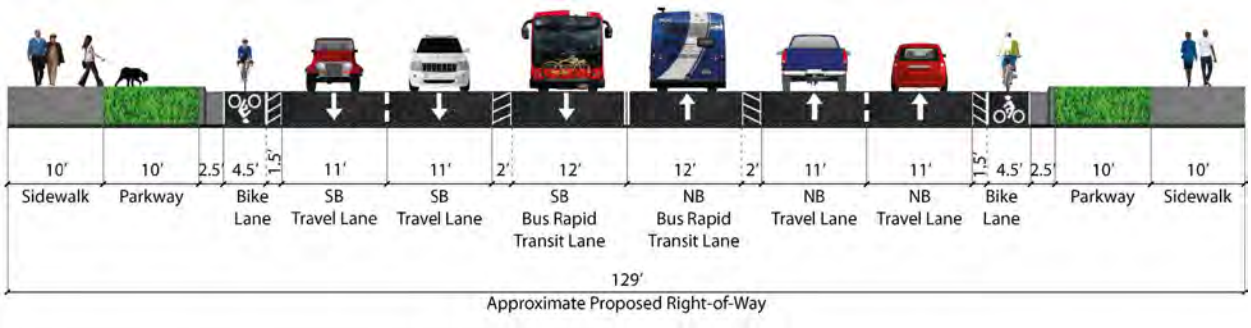


*Median treatment may vary along the study corridor.
**An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

5.2e System Alternative 13

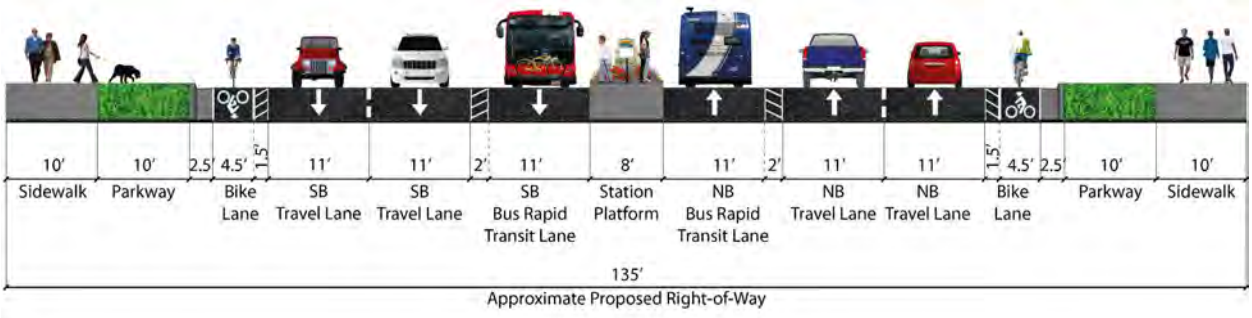
System Alternative 13 maintains the existing vehicular capacity with two 11-foot general purpose lanes with the introduction of a six-foot buffered bike lane. Alternative 13 primarily provides increased opportunities for expanded mode choices by introducing center running BRT lanes and a buffered bike lane in each direction. Alternative 13 also offers an even larger buffer between the vehicular lanes and the widened sidewalk. **Figure 5-5** below shows the mid-block cross section of System 13, while **Figure 5-6** shows the cross section of Alternative 13 with BRT platforms at specific signalized intersections.

Figure 5-5: System Alternative 13 Mid-Block Cross Section



*An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

Figure 5-6: System Alternative 13 Cross Section at Platform Locations



*An ADOT design exception and FHWA approval would be required for the application of 11' travel lanes.

5.3 Tier 3 Evaluation Criteria

Similar to the Tier 2 Alternative Evaluation process, a series of Tier 3 Evaluation Criteria and Weightings were developed to evaluate and measure the performance of the six Tier 3 Alternatives. The Tier 3 evaluation criteria were crafted to be diverse in nature, although the Tier 3 Evaluation Criteria tend to focus more on quantitative measurements and remove any qualitative metrics carried over from Tier 2 Alternative Evaluation process.

The Project Partners held a series of meetings to determine which of the Tier 2 Evaluation Criteria would carry over to the Tier 3 Evaluation Criteria; which Tier 2 Evaluation Criteria should be eliminated from the Tier 3 Evaluation Criteria; which of the Tier 2 Evaluation Criteria need to be revised in order to move into the Tier 3 Evaluation Criteria; and finally, consider potential new evaluation criteria to the Tier 3 Evaluation process. Any newly introduced or revised criteria had to comply with three criteria considerations to in order to be included in the Tier 3 Evaluation Criteria.

1. Cannot be duplicative with any other criteria
2. Needs to be objective and data-driven in nature
3. Feasible/reasonable to evaluate

A few members of the Project Partners were elected to participate in a separate small working group assigned to determine and develop the Tier 3 Evaluation Criteria under the criteria considerations. These meetings of the Consultant Team and the Tier 3 Evaluation Criteria Task Force produced a new set of more refined group of evaluation metrics to be included in the Tier 3 Evaluation Criteria. Detailed notes were collected and distributed during the progression of meetings and can be referenced in Appendix G.

As a result of the small work group meetings, 16 different evaluation criteria were developed to apply in Tier 3 Alternative Evaluation process, 10 of which were newly introduced evaluation criteria. The newly introduced alternative evaluation criteria include:

- Network Delay;
- Conflict Points;
- Bicycle Comfort Index;
- Pedestrian Comfort Index;
- Transit Ridership;
- Title VI Impacts;
- Neighborhood Impacts;
- Air Quality; and
- Community Character.

Table 5-2 illustrates the evolution from the Tier 2 Evaluation Criteria to the Tier 3 Evaluation Criteria, while **Table 5-3** shows the final set of Tier 3 Evaluation Criteria .

Table 5-2: Evolution of the Tier 3 Evaluation Criteria

Final T3 Evaluation Criteria					Criteria Considerations: 1) Is it duplicative? 2) Is it objective (data-driven)? 3) Feasible/reasonable to evaluate?	Result
Category	Criteria / Measure	Scoring Formula	Acceptance Threshold	Weight (TBD)	Notes	Notes
Traffic Operations	Level of Service (Volume / Capacity Ratio)	Formula = (Best Result / Alternative Result) * Weight * 100 Ex - Alt 4: (6.25/11.03) * 5.25% * 100 = 2.97	N/A	TBD	Project Partners agreed to keep this criterion and that a separate Task Force would verify the data and metrics for this criterion.	Keep
	~~Travel Speed as % of Base Free Flow Speed (AM)~~	~~Formula = ((Alternative Result * 100) / Best Result) * Weight * 100 / 2~~ ~~Ex - Alt 4: ((46.1%*100)/62)* 3.32% * 100 /2 = 1.24~~	~~N/A~~	~~TBD~~	See meeting notes for details.	~~Remove~~
	~~Travel Speed as % of Base Free Flow Speed (PM)~~					
	~~Improved Intersection LOS (AM)~~	~~Formula = (Best Result / Alternative Result) * Weight * 100 / 2~~ ~~Ex - Alt 4: (2/3) * 6.04% * 100 /2 = 3.02~~	~~N/A~~	~~TBD~~	See meeting notes for details.	~~Remove~~
	~~Improved Intersection LOS (PM)~~					
	~~Signal/Stop Control Delay (AM)~~	~~Formula = (Best Result / Alternative Result) * Weight * 100 / 2~~ ~~Ex - Alt 4: (29.5/41.6) * 3.29% * 100 /2 = 1.17~~	~~N/A~~	~~TBD~~ ~~TBD~~	Model output to be documented in final report, but Project Partners agred to remove. See meeting notes for details.	~~Remove~~
	~~Signal/Stop Control Delay (PM)~~					
	Travel Time (AM/PM, both directions)	Formula = (Best Result / Alternative Result) * Weight * 100 / 2 Ex - Alt 4: (339/560) * 4.79% * 100 /2 = 1.45	Average of NB (AM/PM) & SB (AM/PM) must be positive. No direction / timeframe may exceed -5% of existing.	TBD	See meeting notes for details.	Keep
	NEW: Network Delay	Model output of VISSIM	TBD - After review model output	TBD	See meeting notes for details.	Keep
Safety	~~Reduction in Total Crashes (Based on CMFs)~~	~~Formula = (Alternative Result / Best Result) * Weight * 100~~ ~~Ex - Alt 4: (19.4/28.98) * 7.13% * 100 = 4.77~~	~~TBD~~	~~TBD~~	See meeting notes for details.	~~Remove~~
	~~Reduced Injury Crashes (Based on CMFs)~~	~~Formula = (Alternative Result / Best Result) * Weight * 100~~ ~~Ex - Alt 5: (21.78/28.78) * 8.18% * 100 = 6.19~~	~~TBD~~	~~TBD~~	See meeting notes for details.	~~Remove~~
	~~Reduced Bicycle Crashes (Based on CMFs)~~	~~Formula = (Alternative Result / Best Result) * Weight * 100~~ ~~Ex - Alt 5: (14/14) * 7.10% * 100 = 7.10~~	~~TBD~~	~~TBD~~	See meeting notes for details.	~~Remove~~
	~~NEW: HSM or FMPO Safety Tool(s)?~~			~~TBD~~	See meeting notes for details.	~~Remove~~
	NEW: Reduction in Conflict Points	Formula: (Alternative Result / Best Result) * Weight * 100	N/A	TBD	See meeting notes for details.	Keep
Expand Travel Mode Choices	~~Pedestrian - Sidewalk Conditions~~	~~Meets or Exceeds both ADOT's minimum standard and the City/FMPO/NAIPTA's (PP) preferred standards~~ ~~Meets or Exceeds ADOT's minimum standard OR the City/FMPO/NAIPTA's (PP) preferred standards, but not both~~ ~~Maintains Existing Condition~~		~~TBD~~	See meeting notes for details.	~~Remove~~
	~~NEW: Bike & Pedestrian - Average Crossing Distance~~	~~Formula = (Best Result / Alternative Result) * Weight * 100~~	~~N/A~~	~~TBD~~	See meeting notes for details.	~~Remove~~
	Bicycle Environmental Quality Index	Subtotal Score from index	N/A	TBD	Keep with minor revision. Refer to Bike & Pedestrian Index and meeting notes for details.	Keep
	Pedestrian Environmental Quality Index	Subtotal Score from index	N/A	TBD	Keep with minor revision. Refer to Bike & Pedestrian Index and meeting notes for details.	Keep
	~~Bicycle~~	~~Meets or Exceeds both ADOT's minimum standard and the City/FMPO/NAIPTA's preferred standards~~ ~~Meets or Exceeds ADOT's minimum standard OR the City/FMPO/NAIPTA's preferred standards, but not both~~ ~~Maintains Existing Condition~~		~~TBD~~	See meeting notes for details.	~~Remove~~
	Transit Travel Time (AM/PM, both directions)	Formula = (Best Result / Alternative Result) * Weight * 100 / 2 Ex - Alt 4: (250/371) * 6.27% * 100 /2 = 2.11	Average of NB (AM/PM) & SB (AM/PM) must be positive. No direction / timeframe may exceed -5% of existing.	TBD	See meeting notes for details.	Keep
	NEW: Transit Ridership	Formula = (Best Result / Alternative Result) * Weight * 100	N/A	TBD	See meeting notes for details.	Keep
Public Acceptance	Public Support	# of Public Support Formula = (Best Result / Alternative Result) * Weight * 100	Majority of public support (>51%)	TBD	Keep as a placeholder. See meeting notes for details.	Keep
Cost / Implementation	Construction Cost	Formula = (Best Result / (Alternative Result/10M)) * Weight * 100 Ex - Alt 4: (1/(40.542M/10M)) * 4.68% * 100 = 1.15	N/A	TBD	See meeting notes for details.	Keep
	ROW Impact (Square Feet)	Formula = (Best Result / (Alternative Result/10K)) * Weight * 100 Ex - Alt 4: (1/(26,326/10K)) * 4.98% * 100 = 1.89	N/A	TBD	See meeting notes for details.	Keep
	~~NEW: Maintenance Cost~~	~~(Cost to Maintain 1 mile of road X 20 years X # of lanes) + (Sq. ft cost of landscaping)~~ ~~Formula = Best Result / Alternative Result * Weight * 100~~	~~N/A~~	~~TBD~~	See meeting notes for details.	~~Remove~~
	NEW: Implementation Opportunities	Formula = Best Result / Alternative Result	N/A	TBD	Project Partners agreed to keep, but consensus on a measure/metric is pending. See meeting notes for details.	Keep
	~~NEW: Cost / Benefit Analysis~~	~~TBD~~	~~TBD~~	~~TBD~~	See meeting notes for details.	~~Remove~~
Environmental Impacts	NEW: Neighborhood Impacts	FMPO Model	TBD	TBD	Project Partners agreed to keep. Sara Dechter proposed to consider additional metrics. Consensus on additional metrics pending. See meeting notes for details.	Keep
	NEW: Title VI Impacts	FMPO Model	TBD	TBD	Project Partners agreed to keep. Sara Dechter proposed to consider additional metrics. Consensus on additional metrics pending. See meeting notes for details.	
	NEW: Air Quality	Same output as Network Delay	TBD	TBD	See meeting notes for details.	Keep
	~~NEW: Stormwater Impacts~~		~~TBD~~	~~TBD~~	See meeting notes for details.	~~Remove~~
	NEW (US180 only): Wildlife Mitigation	TBD - Will compare AGFD recommended mitigation sites with animal crash data	TBD	TBD	See meeting notes for details.	Keep
	~~Others (not recommended)~~	~~See Notes~~	~~N/A~~	~~N/A~~	See meeting notes for details.	~~Remove~~
Community Character	Great Street	50% - Meets *City 2030 Regional Plan Policy 50% - Public Survey Output *Formula for City 2030 Policy: % of corridor able to accommodate trees + % of corridor with "wide" sidewalks	TBD	TBD	See meeting notes for details.	Keep

The sub-criteria in calculating the Pedestrian Comfort Index and the Bicycle Comfort Index are on the following Page

Bicycle Comfort Index Evaluation Criteria

Bicycle Evaluation Criteria	Thresholds	Score
Bicycle Facility Type	No bike facility	0.0
	Shared-lane facility	0.5
	Bike lane	1.0
	Buffered bike lane	2.0
Number of Total Vehicle Though Lanes	8	0.0
	6	1.0
	4	1.5
	2	2.0
Traffic Volume: (Curb Lane)	> 12,000	0
	9,000 - 12,000	0.5
	6,000 - 9,000	1
	3,000 - 6,000	1.5
	< 3,000	2.0
Presence of Median:	No median	0.0
	TWLTL / Left Turn Lane (no median)	1.0
	Left turn Lane with median	1.5
	Left turn Lane with planted median	2.0
		/8

Pedestrian Comfort Index Evaluation Criteria

Pedestrian Evaluation Criteria	Thresholds	Score
Sidewalk Width	6' wide or less	0.0
	6' – 7' wide	1.0
	7' – 9' wide	1.5
	Greater than 9' wide	2.0
Horizontal Buffer Width (select all):	No buffer	0.0
	0' – 3' buffer	0.5
	3' – 6' buffer	1.0
	6' - 9' buffer	1.5
	Greater than 9' buffer	2.0
Number of Total Vehicle Though Lanes	8	0.0
	6	1.0
	4	1.5
	2	2.0
Traffic Volume: (Curb Lane)	> 12,000	0
	9,000 - 12,000	0.5
	6,000 - 9,000	1
	3,000 - 6,000	1.5
	< 3,000	2
Presence of Median:	No median	0.0
	TWLTL / Left Turn Lane (no median)	1.0
	Left turn Lane with median (>5)	1.5
	Left turn Lane with planted median (<5)	2.0
		/10

Table 5-3: Final Tier 3 Evaluation Criteria

Final T3 Evaluation Criteria		
Category	**Metrics**	**Scoring Formula**
Traffic Operations	Level of Service (Volume / Capacity Ratio)	Result = (Alternative Result/ Best Result) * Weight * 100
	Travel Time (AM) - minutes	Result = (Best Result / Alternative Result) * Weight * 100
	Travel Time (PM) - minutes	
	Network Delay (AM) - hours	Result = (Best Result / Alternative Result) * Weight * 100
	Network Delay (PM) - hours	
Vehicular Safety	Reduction in Conflict Points	Result = (Best Result / Alternative Result) * Weight * 100
Expand Travel Mode Choices	Bicycle Comfort Quality Index	Result = (Alternative Result/ Best Result) * Weight * 100
	Pedestrian Comfort Index	Result = (Alternative Result/ Best Result) * Weight * 100
	Transit Travel Time (AM) - minutes	Result = (Best Result / Alternative Result) * Weight * 100
	Transit Travel Time (PM) - minutes	
	Transit Ridership	Result = (Alternative Result/ Best Result) * Weight * 100
Public Acceptance	Public Support	# of Public Support Result = (Best Result / Alternative Result) * Weight * 100
Cost / Implementation	Construction Cost	Result = (Best Result / (Alternative Result/10M)) * Weight * 100
	ROW Impact (Square Feet)	Result= (Best Result / (Alternative Result/10K)) * Weight * 100
	Implementation Opportunities	Result = (Alternative Result/ Best Result) * Weight * 100
Environmental Impacts	Neighborhood Impacts	Result = (Best Result/Alternative Result) * Weight * 100
	Title VI Impacts	Result = (Best Result/Alternative Result) * Weight * 100
	Air Quality	Result = (Best Result/Alternative Result) * Weight * 100
Community Character	Great Street	50% - Meets *City 2030 Regional Plan Policy 50% - Public Survey Output *Formula for City 2030 Policy: % of corridor able to accommodate trees + % of corridor with "wide" sidewalks

5.4 Weighting of the Tier 3 Evaluation Criteria

Tier 3 Evaluation Criteria weights were developed after the Project Partner reached consensus and the Tier 3 Evaluation Criteria were finalized. The Tier 3 Evaluation Criteria Weights were determined through the combined results of a Project Partner and a community-based survey.

5.4a Project Partner Tier 3 Evaluation Criteria Weighting Survey

Similar to the exercise conducted in Tier 2, the Project Partners were provided a survey to populate their desired weight (level of importance/preference) for each of the Tier 3 Evaluation Category and Criteria. This survey used a pair-wise comparison mathematical analysis; allowing each respondent to systematically evaluate each Evaluation Criteria Category against each other two at a time and set their relative impact in achieving the project goals. This exercise was repeated for the criteria under each category. Each Project Partner Agency was afforded two responses. Each and all responses from the Project Partners were averaged together to create the weightings. Refer to Appendix H for more information regarding the Project Partner Tier 3 Evaluation Criteria Weighting Survey.

5.4b Community Tier 3 Evaluation Criteria Weighting Survey

The Project Partners desired the public's perspective and input be integrated into the Tier 3 Evaluation Criteria Weighting process. As a result, a Public Survey created by a separate subcommittee of Project Partners was launched on August 12, 2020 within the City of Flagstaff's Online Community Forum. The public only evaluated the criteria categories and not the individual criteria underneath each. The survey was live for two weeks and had 813 attendees and 562 responses. A full detailed report of the Public Survey can be referenced in Appendix I.

5.4c Final Tier 3 Evaluation Criteria Weights

A meeting was held amongst the Project Partners and the Consultant Team to review the results of the Project Partner and Public Tier 3 Evaluation Criteria Weighting Surveys to develop an equitable approach in aggregating the results of each survey to ultimately finalize the Tier 3 Evaluation Criteria Weighting. The Project Partners reached consensus on one of the approaches and decided to used Option 3 as the approach to combine the results of the Project Partner and Public Tier 3 Evaluation Criteria Weighting Surveys. Reference the meeting notes in Appendix J for more information about the four approaches discussed for aggregating the results of the two surveys.

Table 5-4 shows the finalized Tier 3 Evaluation Category and Criteria Weighting results used in the Tier 3 Alternative Evaluation process.

Table 5-4: Final Tier 3 Evaluation Criteria Weighting

Tier 3 Evaluation Criteria Categories	Public & Project Partner Weighting Survey Results (Option 3)	Tier 3 Evaluation Criteria	Project Partner Criteria Weighting Survey Results	Final Tier 3 Weighting
Traffic Operations	13.9	Level of Service	14.9%	2.1%
		Travel Time	58.0%	8.1%
		Network Delay	27.1%	3.8%
Safety	16.6	Conflict Points	N/A	16.6%
Expand Travel Mode	19.3	Bicycle Comfort Index	25.6%	4.9%
		Pedestrian Comfort Index	36.1%	7.0%
		Transit Travel Time	19.0%	3.7%
		Transit Ridership	19.3%	3.72%
Public Acceptance	12.0	Public Acceptance	N/A	12.0%
Cost / Implementation	10.6	Construction Cost	29.2%	3.1%
		ROW Impact	42.9%	4.5%
		Implementation Opportunities	27.9%	3.0%
Environmental Impacts	13.6	Neighborhood Impacts	32.6%	4.4%
		Title VI Impacts	39.4%	5.4%
		Air Quality	27.9%	3.8%
Community Character	14.0	Great Street	N/A	14.0%

5.5 Summary of Tier 3 Evaluation Criteria Results and Analysis Findings

This section provides a brief summary of the results for the Tier 3 Alternative Evaluation process of the six Tier 3 Alternatives through the application of the Tier 3 Evaluation Criteria. Immediately following this summary, *Section 5.6 - Tier 3 Evaluation Criteria Detailed Results* includes more detailed results and a systematic synopsis for each of the Tier 3 Evaluation Criteria.

Unlike the Tier 2 Alternative Evaluation process, the Milton Road CMP Tier 3 Alternatives have a very small range in performance rating based on the score of the Tier 3 Alternative Evaluation Criteria. The highest performing alternative received a score of 60.10 points while the lowest performing alternative received a score of 50.75 points – only a difference of 9.35 points when the difference in points between the best and worst scoring alternatives in Tier 2 was nearly 30 points. In other words, there appears to be little variation in the final results of each of the Tier 3 Alternatives.

Table 5-5 ranks the alternatives from highest scoring to lowest scoring alternative.

Table 5-5: Tier 3 Alternative Rankings Based on Tier 3 Evaluation Criteria Results

Rank	Tier 3 Alternative	Score
1	No-Build	60.10
2	No-Build Plus	56.38
3	Alternative 6a	56.22
4	Alternative 6b	55.35
5	Alternative 5	54.53
6	Alternative 13	50.75

As demonstrated in **Table 5-5**, the No-Build has the highest score of 60.10 points followed by the No-Build Plus with 56.38 points, Alternative 6a with 56.22 points, Alternative 6b with 55.35 points, Alternative 5 with 54.53 points, and Alternative 13 with 50.75 points.

The final results of the Tier 3 Alternative Evaluation process represent the fact that there is a diverse set of evaluation criteria and assigned weightings that yield an array of findings. A couple observations on these findings include:

- The introduction of spot improvements has disproportionally increased the gap in the results for the Project Cost and the Right-of-Way Impact Criteria between the No-Build and the other alternatives.
- According to the Vissim model results, the traffic operations are generally performing worse in Tier 3 than the traffic operations results in Tier 2. Although difficult to pinpoint, the degradation in traffic operations is likely a result of some of the spot improvements which were deemed necessary for safety or connectivity. Items such as dual left turn lanes, the addition of two new traffic signals, and the inclusion of two HAWK signals have a negative consequence on traffic operations, but assist other modes. In addition, Transit Signal Priority (TSP) was also added at select signalized intersections to address deficient transit operations and further decreased traffic operations. However, multimodal improvements were two of the six project goals and the Project Partners agreed that the vehicle delay was a potential for possible tradeoff for the inclusion of multimodal improvements.
- Regarding the effects of the HAWKs - Any inclusion of a stop will increase delay. This is not necessarily negative as this provides benefit to pedestrians as these trade-offs were generally considered by the Project Partners when developing the spot improvement inventory. Although the delay encumbered in minimal, the aggregate of all trade-offs made throughout the corridor contribute to the total vehicular travel time through the corridor.
- The inclusion of dual lefts reduces the amount of green light time for through traffic, particularly noticeable in the southbound operation results. Dual lefts, particularly on the side streets did help left turning traffic. This results in a proportional reduction in time for side street through movements and mainline time as well.
- A Project Partner small working group and the Consultant Team identified to determine and apply an increased set of volumes for the Build Alternatives. Further, it should be

noted that added volumes as a result of rerouted traffic due to widening and increased capacity were not analyzed in the Vissim model and as such, the model results cannot readily attest to the specific effects this would have. Rather, this evaluation was captured in the congestion needs score spreadsheet that was modified according to the Project Team.

In evaluating the results for the higher ranking No-Build and No-Build Plus alternatives, this is likely correlated with the fact that the No-Build and No-Build Plus conditions perform moderately well (that is, not disproportionately worse) when compared to the other alternatives across most of the evaluation criteria. The No-Build and No-Build Plus rankings also reflect the favorable cost-benefit ratio, suggesting that the lower costs of the No Build and No Build Plus generally outweigh the perceived operational benefits (and higher construction costs/right-of-way impacts) of the other build Alternatives. Please see Section 5.7a and 5.7b for reference to Public Support and Community Character (Great Streets).

Table 5-6 illustrates a summary of the detailed final results for Tier Alternative Evaluation process and each of the Tier 3 Evaluation Criteria.

Table 5-6: Detailed Results of the Tier 3 Evaluation Criteria

Final T3 Evaluation Criteria				No-Build		No-Build+		Alternative 5		Alternative 6a		Alternative 6b		Alternative 13		
Category	Criteria	Scoring Formula	Weight	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Best Result
Traffic Operations (13.9% Weight)	Level of Service (Volume / Capacity Ratio)	Result = (Alternative Result/ Best Result) * Weight * 100	2.07%	77.41	1.60	77.41	1.60	92.26	1.91	100.00	2.07	84.44	1.75	80.42	1.67	100.00
	Travel Time (AM) - minutes	Result = (Best Result / Alternative Result) * Weight * 100	4.0310%	7.58	2.90	5.75	3.83	5.46	4.03	5.64	3.90	6.59	3.34	6.49	3.39	5.46
	Travel Time (PM) - minutes		4.0310%	6.58	4.03	7.50	3.53	7.17	3.70	7.13	3.72	7.59	3.49	7.44	3.56	6.58
	Network Delay (AM) - hours	Result = (Best Result / Alternative Result) * Weight * 100	1.88%	1,424.73	1.57	1369.00	1.63	1221.00	1.83	1186.90	1.88	1229.86	1.82	1217.48	1.84	1187
	Network Delay (PM) - hours		1.88%	2,170.18	1.74	2224.00	1.70	2111.09	1.79	2008.35	1.88	2146.28	1.76	2318.74	1.63	2008
Vehicular Safety (16.6% Weight)	Reduction in Conflict Points	Result = (Best Result / Alternative Result) * Weight * 100	16.60%	505.00	16.60	531.00	15.79	687.00	12.20	751.00	11.16	666.00	12.59	694.00	12.08	505
Expand Travel Mode Choices (19.3% Weight)	Bicycle Comfort Quality Index	Result = (Alternative Result/ Best Result) * Weight * 100	4.94%	3.00	2.47	4.00	3.29	5.50	4.53	5.50	4.53	6.00	4.94	4.00	3.29	6
	Pedestrian Comfort Index	Result = (Alternative Result/ Best Result) * Weight * 100	6.97%	3.00	2.32	4.00	3.10	6.50	5.03	8.00	6.19	9.00	6.97	6.00	4.64	9
	Transit Travel Time (AM) - minutes	Result = (Best Result / Alternative Result) * Weight * 100	1.83%	7.92	1.02	4.70	1.71	5.28	1.53	4.91	1.64	4.40	1.83	5.36	1.50	4.40
	Transit Travel Time (PM) - minutes		1.83%	5.83	1.60	6.10	1.53	5.90	1.58	5.08	1.83	5.67	1.64	6.31	1.48	5.08
	Transit Ridership	Result = (Alternative Result/ Best Result) * Weight * 100	3.72%	1,347	2.26	1,347	2.26	1,347	2.26	1,930	3.24	1,930	3.24	2,219	3.72	2219.00

Results continued on the following page

Final T3 Evaluation Criteria				No-Build		No-Build+		Alternative 5		Alternative 6a		Alternative 6b		Alternative 13		
Category	Criteria	Scoring Formula	Weight	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Result	Weighted Score	Best Result
Public Acceptance (12.0% Weight)	Public Support	# of Public Support Result = (Best Result / Alternative Result) * Weight * 100	12.00%													
Cost / Implementation (10.6% Weight)	Construction Cost	Result = (Best Result / (Alternative Result/10M)) * Weight * 100	3.10%	0.0	3.10	9,804,000	3.10	85,417,000	0.36	95,463,000	0.32	74,504,000	0.42	77,334,000	0.40	1.00
	ROW Impact (Square Feet)	Result= (Best Result / (Alternative Result/10K)) * Weight * 100	4.55%	0.0	4.55	53,884	0.84	253,662	0.18	398,689	0.11	271,345	0.17	286,207	0.16	1.00
	Implementation Opportunities	Result = (Alternative Result/ Best Result) * Weight * 100	2.96%	100.00	2.96	33.4	0.99	4.1	0.12	10.4	0.31	11.9	0.35	15.4	0.46	100.00
Environmental Impacts (13.6% Weight)	Neighborhood Impacts	Result = (Best Result/Alternative Result) * Weight * 100	4.43%	185,353	4.38	185,353	4.38	183,149	4.43	183,149	4.43	195,552	4.15	195,552	4.15	183149
	Title VI Impacts	Result = (Best Result/Alternative Result) * Weight * 100	5.36%	9,867	3.29	9,867	3.29	6,065	5.36	6,065	5.36	10,171	3.20	10,171	3.20	6065
	Air Quality	Result = (Best Result/Alternative Result) * Weight * 100	3.79%	22,304.92	3.69	21,702.54	3.79	22,377.27	3.68	22,726.43	3.62	22,265.08	3.70	22,991.71	3.58	21703
Community Character (14.0% Weight)	Great Street	50% - Meets *City 2030 Regional Plan Policy 50% - Public Survey Output *Formula for City 2030 Policy: % of corridor able to accommodate trees + % of corridor with "wide" sidewalks	14.00%													0.00
		Aggregate Score	**100.0%**		**60.10**		**56.38**		**54.53**		**56.22**		**55.35**		**50.75**	
			Rank		1		2		5		3		4		6	

5.6 Tier 3 Evaluation Criteria Detailed Results

This section describes the detailed results for the Tier 3 Alternative evaluation process of the seven Tier 2 Alternatives using the Evaluation Criteria, Scoring Thresholds and Scoring Thresholds discussed in the previous sections. Refer back to **Table 5-6** for the results presented in the following sub-sections.

5.6a Traffic Operations – *Level-of-Service (LOS) (Volume / Capacity Ratio) Criterion Results*

Similar to Tier 2, ADOT's CNS Tool is the source that calculates the results for the Level-of-Service criterion. However, some adjustments were made to refine the embedded formulas. The results of the CNS for each Tier 3 Alternative are displayed below in **Table 5-7**. Refer to Appendix K for the detailed breakdown of Tier 3 CNS calculations.

Table 5-7: Level-of-Service (Volume / Capacity Ratio) Criterion Results

ID #	Length	Future AADT (2040)	Adjusted Future AADT - Mode Shift (2040)	Capacity Threshold (2040)	Percent of Threshold (2040)	Tier 3 V/C Score (out of 100)	Fnctl Class
No-Build / No Build +					**0.89**	**77.41**	4-lanes, Urban, Principal Arterial
No-Build - Segment A	0.10	38,395	38,395	46,400	82.7%		*Butler to Phoenix*
No-Build - Segment B	0.24	51,339	51,339	46,400	110.6%		*Butler to Rte 66*
No-Build - Segment C	1.00	39,323	39,323	46,400	84.7%		*Rte 66 to Forest Meadows*
Alt 5					**0.75**	**92.26**	6-lanes, Urban, Principal Arterial
Alt 5 - Segment A	0.10	50,552	50,552	69,600	72.6%		*Butler to Phoenix*
Alt 5 - Segment B	0.24	67,047	67,047	69,600	96.3%		*Butler to Rte 66*
Alt 5 - Segment C	1.00	48,677	48,677	69,600	69.9%		*Rte 66 to Forest Meadows*
Alt 6a					**0.69**	**100.00**	6-lanes, Urban, Principal Arterial
Alt 6a - Segment A	0.10	50,552	48,924	73,080	66.9%		*Butler to Phoenix*
Alt 6a - Segment B	0.24	67,047	65,419	73,080	89.5%		*Butler to Rte 66*
Alt 6a - Segment C	1.00	48,677	47,049	73,080	64.4%		*Rte 66 to Forest Meadows*
Alt 6b					**0.82**	**84.44**	4-lanes, Urban, Principal Arterial
Alt 6b - Segment A	0.10	39,198	37,570	48,720	77.1%		*Butler to Phoenix*
Alt 6b - Segment B	0.24	50,035	48,407	48,720	99.4%		*Butler to Rte 66*
Alt 6b - Segment C	1.00	39,659	38,031	48,720	78.1%		*Rte 66 to Forest Meadows*
Alt 13					**0.86**	**80.42**	4-lanes, Urban, Principal Arterial
Alt 13 - Segment A	0.10	39,198	37,570	46,400	81.0%		*Butler to Phoenix*
Alt 13 - Segment B	0.24	50,035	48,407	46,400	104.3%		*Butler to Rte 66*
Alt 13 - Segment C	1.00	39,659	38,031	46,400	82.0%		*Rte 66 to Forest Meadows*

Notes

a) Future AADT (2040): Projected traffic volumes provided from FMPO Model Based on mode shift projections from FMPO model, AADT's for BRT alternatives were adjusted to account for reduction in anticipated vehicles.

b) Capacity Threshold (2040) Formula: Capacity X Number of Lanes X 14.5 Hours of Traffic Multiply the # of lanes within the corridor by the corresponding figure in Table 1, then Multiply by 14.5 (hours) to calculate the facility's capacity threshold. Increase capacity 5% for alternatives with dedicated bus/right-turn lane - per FDOT tables (https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/content/planning/systems/programs/sm/los/pdfs/fdot_2012_generalized_service_volume_tables.pdf?sfvrsn=cf17ad0a_0

c) V/C Score Formula: Lowest % Threshold receives maximum score; any % above 100% represents Level of Service F and receives a Score of 0.

The CNS results in Tier 3 are not "reversed ranked" as they are in Tier 2 whereby the lowest numbers represent the higher performing alternatives. In other words, the CNS results in Tier 3 are ranked with the highest score resulting in the highest performing alternative. Thus, Alternative 6a is the highest performing alterntive with a CNS of 100.00, where the No-Build and the No-Build Plus are the lowest performing alternives with a CNS of 77.41. The restructuring of the formula did not impact the ranking of the Alternatives when comparing Tier 2 results to Tier 3 results – just how the final scores are displayed.

The Tier 3 Alternatives are ranked for the CNS-LOS criterion below from highest scoring to lowest scoring.

1. Alternative 6a – 100.00 CNS
2. Alternative 5 – 92.26 CNS
3. Alternative 6b – 84.44 CNS
4. Alternative 13 – 80.42 CNS
5. No-Build and No-Build Plus – 77.41 CNS

Three assumptions were discussed and agreed to by the Project Partners for the calculation of the Tier 3 CNS:

- The hours of operations were reduced to 14.5 from 24 in Tier 2 to reflect a more accurate representation of the typical hours of roadway operatations in a typical day;
- Volumes were decreased by 1,628 for alternatives with dedicated transit to capture approximate mode shift by 1,628. The mode shift value was derived from the 2040 MetroPlan Regional TDM Model; and
- Capacity was increased by 5% for alternatives with an outside bus lane/right turn lane in order to approximate and capture the traffic volumes of right-turning vehicles and busses traveling through the SBBL.

Application of the Level-of-Service (Volume / Capacity Ratio) Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was also used to calculate the score for the Level-of-Service Criterion. The following formula was used to calculate the scores:

*Technical Score = (Alternative Result / Best Result) * Weight * 100*

Table 5-8 below shows how the CNS/LOS scores, from highest to lowest, were calculated for the No-Build and five other Tier 3 Alternatives.

Table 5-8: Level-of-Service Criterion Results in the Calculation of the Technical Score

Alternative	LOS Result	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 6a	100.00 CNS	((100.00/100.00)	* 2.07%) * 100	2.07
Alternative 5	92.26 CNS	((92.26/100.00)	* 2.07%) * 100	1.91
Alternative 6b	84.44 CNS	((84.44/100.00)	* 2.07%) * 100	1.75
Alternative 13	80.42 CNS	((80.42/100.00)	* 2.07%) * 100	1.67
No-Build and No-Build Plus	77.41 CNS	((77.41/100.00)	* 2.07%) * 100	1.60

5.6b Traffic Operations – *Travel Time Criterion Results*

The Travel Time criterion is a metric that measures traffic operations by calculating the amount of time it takes to travel the study corridor from one end to the other. The results of the year 2040 Travel Time for the No-Build option and the five other Tier 3 Alternatives is an output from the Vissim Model.

In order to reach a comprehensive measure, travel times during both the AM and PM time periods were used to measure the overall performance of this criterion – each receiving half of the 8.1% weight assigned to this criterion. The travel times in each direction of Milton Road – northbound and southbound – were also averaged to reach a combined travel time for each the AM and PM timeframes.

The results of the of the Travel Time are shown below in **Table 5-9** for the No-Build option and the five Tier 3 Alternatives.

Table 5-9: Travel Time Criterion Results

Alternative	AM Peak Hour				PM Peak Hour			
	Northbound		Southbound		Northbound		Southbound	
	Travel Time (min)	Travel Time % Change	Travel Time (min)	Travel Time % Change	Travel Time (min)	Travel Time % Change	Travel Time (min)	Travel Time % Change
No Build	9.9	-	5.2	-	6.6	-	6.6	-
No Build Plus	5.9	40.7%	5.6	-7.6%	6.9	-4.8%	8.1	-23.3%
5	5.5	44.5%	5.4	-3.7%	6.8	-2.7%	7.6	-15.3%
6a	5.5	44.3%	5.7	-10.1%	6.9	-4.8%	7.4	-11.9%
6b	6.9	30.5%	6.3	-20.4%	7.3	-11.2%	7.9	-19.7%
13	6.5	34.6%	6.5	-24.5%	7.6	-15.1%	7.3	-11.3%

Alternative	Avgerage AM Travel Time		Average PM Travel Time	
No Build	7.6		6.6	
No Build Plus	5.8	24.1%	7.5	-14.0%
5	5.5	27.9%	7.2	-9.0%
6a	5.6	25.6%	7.1	-8.4%
6b	6.6	13.0%	7.6	-15.4%
13	6.5	14.3%	7.4	-13.2%

The average travel time between the northbound and southbound direction for the No-Build option is 7.6 minutes in the AM and 6.6 minutes in the PM – a one-minute decrease in average travel time between the AM and PM time periods. The No-Build travel time result is the baseline condition for calculating the travel time percent change for each of the other Tier 3 Alternatives.

Interestingly all the Alternatives have an improved travel time compared to the No-Build in the AM time period, while none of the Alternatives have an improved travel time compared to the No-Build option in the PM time period. It is also worth noting that all AM and PM southbound travel movements for all alternatives perform worse compared to the No Build. The southbound PM peak movements continue (from the Tier 2 findings) to be problematic, experiencing anywhere from 10% to 25% increases (which represents 30 seconds to 1 minute difference between alternatives) in travel times for all Tier 3 alternatives (when compared to the No Build alternative).

It should be noted that; 1) the PM travel time period experiences an approximate 25% increase in vehicles than the AM period; 2) PM directionality is more pronounced (approx. 8%) in the PM; and, 3) the PM results are more pronounced since the PM peak is being compared to an off-peak time period (mid-day) versus the traditional AM peak. The primary reason for the AM peak improvement is the removal of the bottleneck by signalizing Santa Fe/Sitgreaves.

The No-Build option and the Tier 3 Alternatives are ranked below for each time frame based on the results of the Travel Time criterion.

AM

1. Alternative 5 – 5.5 minutes of average travel time
2. Alternative 6a – 5.6 minutes of average travel time
3. No-Build Plus – 5.8 minutes of average travel time
4. Alternative 13 – 6.5 minutes of average travel time
5. Alternative 6b – 6.6 minutes of average travel time
6. No-Build – 7.6 minutes of average travel time

PM

1. No-Build – 6.6 minutes of average travel time
2. Alternative 6a – 7.1 minutes of average travel time
3. Alternative 5 – 7.2 minutes of average travel time
4. Alternative 13 – 7.4 minutes of average travel time
5. No-Build Plus – 7.5 minutes of average travel time
6. Alternative 6b – 7.6 minutes of average travel time

Application of the Travel Time Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was also used in Tier 3 to calculate the score for the Travel Time Criterion. The following formula was used to calculate the scores:

*Technical Score = (Best Result/ Alternative Result) * Weight * 100*

Since Travel Time was measured in both the AM and PM time periods, two values were produced - each receiving half the value of the 8.10% weight, or 4.031%.

Table 5-10 and **Table 5-11** below show how the AM and PM scores were calculated for the No-Build option and the five other Tier 3 Alternatives relative to the results of the Travel Time creation in order of highest to lowest scoring.

Table 5-10: AM Travel Time Criterion Results in the Calculation of the Technical Score

Alternative	AM Travel Time Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 5	5.5 minutes	((5.5/5.5)	* 4.031%) * 100	4.03
Alternative 6a	5.6 minutes	((5.5/5.6)	* 4.031%) * 100	3.90
No-Build Plus	5.8 minutes	((5.5/5.8)	* 4.031%) * 100	3.83
Alternative 13	6.5 minutes	((5.5/6.5)	* 4.031%) * 100	3.39
Alternative 6b	6.6 minutes	((5.5/6.6)	* 4.031%) * 100	3.34
No-Build	7.6 minutes	((5.5/7.6)	* 4.031%) * 100	2.90

Table 5-11: PM Travel Time Criterion Results in the Calculation of the Technical Score

Alternative	PM Travel Time Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
No-Build	6.6 minutes	((6.6/6.6)	* 4.031%) * 100	4.03
Alternative 6a	7.1 minutes	((6.6/7.1)	* 4.031%) * 100	3.72
Alternative 5	7.2 minutes	((6.6/7.2)	* 4.031%) * 100	3.70
Alternative 13	7.4 minutes	((6.6/7.4)	* 4.031%) * 100	3.56
No-Build Plus	7.5minutes	((6.6/7.5)	* 4.031%) * 100	3.53
Alternative 6b	7.6 minutes	((6.6/7.6)	* 4.031%) * 100	3.49

5.6c Traffic Operations – *Network Delay Criterion Results*

The Network Delay criterion is a metric that measures traffic operations by total hours of traffic delay in the model (study area). The results of the year 2040 network delay for the No-Build option and the five other Tier 3 Alternatives is an output from the Vissim Model.

The Vissim Model has two outputs under the delay category – Network Delay and Latent Delay. The network delay output is the delay experienced by traffic within the model and latent delay is the amount of delay experienced by traffic trying to enter the model. The Total Delay – sum of network delay and latent delay – was used as the performance metric of traffic operations for each of the Tier 3 Alternatives and the No-Build option. In addition, network delay was measured during both the AM and PM time periods to measure the overall performance of this criterion – each receiving half of the 3.8% weight assigned to this criterion.

The results of the of the Network Delay Criterion are shown below in **Table 5-12** for the No-Build option and five other Tier 3 Alternatives.

Table 5-12: Network Delay Criterion Results

Alternative	AM Peak Hour						PM Peak Hour					
	Network Delay (hrs)	Network Delay % Change	Latent Delay (hrs)	Latent Delay % Change	Total Delay (hrs)	Total Delay % Change	Network Delay (hrs)	Network Delay % Change	Latent Delay (hrs)	Latent Delay % Change	Total Delay (hrs)	Total Delay % Change
No Build	645	-	780	-	1,425	-	824	-	1,346	-	2,170	-
No Build Plus	525	18.6%	844	-8.2%	1,369	3.9%	800	3.0%	1,424	-5.8%	2,224	-2.5%
5	526	18.4%	695	10.9%	1,221	14.3%	769	6.7%	1,342	0.3%	2,111	2.7%
6a	528	18.2%	659	15.5%	1,187	16.7%	779	5.5%	1,229	8.7%	2,008	7.5%
6b	604	6.3%	626	19.8%	1,230	13.7%	826	-0.2%	1,320	1.9%	2,146	1.1%
13	601	6.7%	616	21.0%	1,217	14.5%	954	-15.7%	1,365	-1.4%	2,319	-6.8%

The total delay for the No-Build option is 1,425 hours in the AM and 2,170 hours in the PM – nearly a 50% increase in delay time between the AM and PM time periods. The No-Build total delay result is the baseline condition for calculating the percent change for each of the Tier 3 Alternatives.

All the Alternatives have an improved total delay over the No-Build in the AM time period. Alternative 6a is the only alternative that has a substantial improvement in total delay compared to the No-Build in the PM, while Alternative 5 and Alternative 6b have marginal improvement. Conversely, Alternative 13 and the No-Build Plus actually have an increase in total delay compared to the No-Build option. This is noteworthy because Alternative 13 has the second shortest amount of total delay in the AM while having the longest delay in the PM.

The No-Build option and the Tier 3 Alternatives are ranked below for each time frame based on the results of the Network Delay criterion.

AM

1. Alternative 6a – 1,187 hours of total delay
2. Alternative 13 – 1,217 hours of total delay
3. Alternative 5 – 1,221 hours of total delay
4. Alternative 6b – 1,230 hours of total delay
5. No-Build Plus – 1,369 hours of total delay
6. No-Build – 1,425 hours of total delay

PM

1. Alternative 6a – 2,008 hours of total delay
2. Alternative 5 – 2,111 hours of total delay
3. Alternative 6b – 2,146 hours of total delay
4. No-Build – 2,170 hours of total delay
5. No-Build Plus – 2,224 hours of total delay
6. Alternative 13 – 2,319 hours of total delay

Application of the Network Delay Criterion Results in the Application of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Travel Time criterion. The following formula was used to calculate the scores:

*Technical Score = (Best Result/ Alternative Result) * Weight * 100*

Since Network Delay criterion was measured in both the AM and PM time periods, two values were produced - each receiving half the value of the 3.77% weight, or 1.88%.

Table 5-13 and **Table 5-14** below show how the AM and PM scores were calculated for the No-Build option and the five other Tier 3 Alternatives relative to the results of the Network Delay creation in order of highest to lowest scoring.

Table 5-13: AM Network Delay Criterion Results in the Application of the Technical Score

Alternative	AM Network Delay Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 6a	1,187 hours	((1,187/1,187)	* 1.88%) * 100	1.88
Alternative 13	1,217 hours	((1,187/1,217)	* 1.88%) * 100	1.84
Alternative 5	1,221 hours	((1,187/1,221)	* 1.88%) * 100	1.83
Alternative 6b	1,230 hours	((1,187/1,230)	* 1.88%) * 100	1.82
No-Build Plus	1,369 hours	((1,187/1,369)	* 1.88%) * 100	1.63
No-Build	1,425 hours	((1,187/1,425)	* 1.88%) * 100	1.57

Table 5-14: PM Network Delay Criterion Results in the Application of the Technical Score

Alternative	PM Network Delay Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 6a	2,008 hours	((2,008/2,008)	* 1.88%) * 100	1.88
Alternative 5	2,111 hours	((2,008/2,111)	* 1.88%) * 100	1.79
Alternative 6b	2,146 hours	((2,008/2,146)	* 1.88%) * 100	1.76
No-Build	2,170 hours	((2,008/2,170)	* 1.88%) * 100	1.74
No-Build Plus	2,224 hours	((2,008/2,224)	* 1.88%) * 100	1.70
Alternative 13	2,319 hours	((2,008/2,319)	* 1.88%) * 100	1.63

5.6d Safety – *Conflict Points Criterion Results*

The Conflict Points Criterion is the sole safety-related criteria in the Tier 3 Alternative analysis. This criterion compares the relative measures of safety of each alternative by evaluating the number of total number of potential conflict points at intersections between the No-Build option and the five other Tier 3 Alternatives. This analysis was conducted at the signalized intersections only. A conflict point is defined by the opportunity for potential crashes between various road users. The conflict points were calculated in the three following categories:

- Vehicle-to-pedestrian conflicts;
- Vehicle-to-bicyclist conflicts; and
- Vehicle-to-vehicle conflicts.

Table 5-15 below shows the total number of conflict points for the No-Build option and the five other Tier 3 Alternatives. An alternative with a higher number of total conflict points is only used for comparison and does not necessarily reflect the overall safety of an alternative. Given the same roadway conditions, alternatives with lower potential conflict points may have other safety and operational issues, such as congestion or driver frustration, and the potential for increases in number of crashes. Alternatives with higher number of conflict points, may have less congestion or less driver frustration, and the potential for a decrease in the number of some crashes. This criterion does not infer that one alternative is more or less safe than another, rather documents the potential for conflicts between all vehicles and pedestrians or bicycles. Refer to Appendix K and Appendix L for a detailed breakdown and graphic representation of the conflict points analysis.

Table 5-15: Conflict Points Criterion Results

Alternative	Number of Conflict Points			Total Conflict Points
	Vehicle-Pedestrian Conflicts	Vehicle-Bicyclist Conflicts	Vehicle-Vehicle Conflicts	
No-Build	151	89	265	505
No-Build Plus	169	90	272	531
Alternative 5	223	88	376	687
Alternative 6a	236	88	427	751
Alternative 6b	214	87	365	666
Alternative 13	217	90	387	694

As anticipated, the alternatives with the greatest number of lanes present the higher number of potential conflict points. As a result, Alternative 6a has the highest number of conflict points by a fairly large margin, while Alternatives 13, Alternative 6b, and Alternative 5 have a lower number of conflict points. However, these three alternatives have a much higher number of potential conflict points in comparison to the No-Build option and the No-Build Plus.

Application of the Conflict Points Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Conflict Points Criterion. The following formula was used to calculate the scores:

*Technical Score = (Best Result/ Alternative Result) * Weight * 100*

Table 5-16 below shows how the score was calculated for the No-Build option and five other Tier 3 Alternatives relative to the results of the Conflict Points, in order of highest scoring to lowest scoring.

Table 5-16: Conflict Points Criterion Results in the Calculation of the Technical Score

Alternative	Total Conflict Points Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
No-Build	505	((505/505)	* 16.60%) * 100	16.60
No-Build Plus	531	((505/531)	* 16.60%) * 100	15.79
Alternative 6b	666	((505/666)	* 16.60%) * 100	12.59
Alternative 5	687	((505/687)	* 16.60%) * 100	12.20
Alternative 13	694	((505/694)	* 16.60%) * 100	12.08
Alternative 6a	751	((505/751)	* 16.60%) * 100	11.16

5.6e Expand Travel Modes Choices – *Bicycle Comfort Index Criterion Results*

The Bicycle Comfort Index (BCI) criterion is one of the newly introduced criteria into the Tier 3 Alternative analysis. The BCI was created to consolidate multiple bicycle-related performance indicators into one overall performance measure. This criterion measures improved travel mode choices by evaluating the overall comfort of a bicyclist navigating the corridor. Developed primarily using the MetroPlan Bicycle Comfort Evaluation methodology combined with some industry best practices, the following sub-criteria displayed in **Table 5-17** were used to score the overall BCI for the No-Build option and five other Tier 3 Alternatives.

Table 5-17: Qualitative Scoring Measures of the Bicycle Comfort Index Criterion

Bicycle Comfort Index	Scoring Thresholds	Score
Bicycle Facility Type	No bike facility	0.0
	Shared-lane facility	0.5
	Bike lane	1.0
	Buffered bike lane	2.0
Number of Total Vehicle Though Lanes	8	0.0
	6	1.0
	4	1.5
	2	2.0
Traffic Volume: (Curb Lane)	> 12,000	0.0
	9,000 - 12,000	0.5
	6,000 - 9,000	1.0
	3,000 - 6,000	1.5
	< 3,000	2.0
Presence of Median	No median	0.0
	TWLTL / Left Turn Lane (no median)	1.0
	Left turn Lane with median (<5')	1.5
	Left turn Lane with planted median (>5')	2.0

The BCI calculates a score by using a range of thresholds for each BCI indicator, with the thresholds that result in a higher comfort receiving a higher score. The BCI has a maximum score of eight points. **Table 5-18** below shows the final BCI score for the No-Build option and five other Tier 3 Alternatives from highest scoring to lowest scoring. Appendix K has the detailed results for the BCI sub-criteria and how the scores were calculated for the No-Build and the Tier 3 Alternatives.

Table 5-18: Bicycle Comfort Index Criterion Results

Alternative	Bicycle Comfort Index Sub-Criteria				BCI Score
	Bicycle Facility Type	Number of Vehicle Through Lanes	Traffic Volume: (Curb Lane)	Presence of Median	
Alternative 6b	0.5	1.5	2.0	2.0	6.0
Alternative 5	2.0	1.0	0.5	2.0	5.5
Alternative 6a	0.5	1.0	2.0	2.0	5.5
Alternative 13	2.0	1.5	0.5	0.0	4.0
No-Build Plus	0.0	1.5	0.5	2.0	4.0
No-Build	0.0	1.5	0.5	1.0	3.0

The highest scoring Tier 3 Alternatives for the BCI criterion are Alternative 6b, Alternative 5, and Alternative 6a with six and five-and-half points respectively. Alternative 5 has the one of the most comfortable bicycle facilities with a dedicated buffered bike lane and Alternative 6a and Alternative 6b have a shared facility with the SBBL. The SBBL account for a reduction in curb lane volumes compared to the other alternatives with vehicular through lanes as the curb lanes.

Application of the Bicycle Comfort Index Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the BCI Criterion. The following formula was used to calculate the scores:

*Technical Score = (Best Result/ Alternative Result) * Weight * 100*

Table 5-19 below shows how the score was calculated for the No-Build option and five other Tier 3 Alternatives relative to the results of the BCI, in order of highest scoring to lowest scoring.

Table 5-19: Bicycle Comfort Index Criterion Results in the Calculation of the Technical Score

Alternative	BCI Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 6b	6.0	((6.0/6.0)	* 4.94%) * 100	4.94
Alternative 5	5.5	((5.5/6.0)	* 4.94%) * 100	4.53
Alternative 6a	5.5	((5.5/6.0)	* 4.94%) * 100	4.53
Alternative 13	4.0	((4.0/6.0)	* 4.94%) * 100	3.56
No-Build Plus	4.0	((4.0/6.0)	* 4.94%) * 100	3.29
No-Build	3.0	((3.0/6.0)	* 4.94%) * 100	2.47

5.6f Expand Travel Modes Choices – *Pedestrian Comfort Index Criterion Results*

The Pedestrian Comfort Index (PCI) Criterion is another one of the newly introduced criteria into the Tier 3 Alternative analysis. The PCI was created to consolidate multiple pedestrian-related performance indicators into one overall performance measure. This criterion measures improved travel mode choices by evaluating the overall comfort of a pedestrian navigating the corridor. Constructed primarily using the MetroPlan Bicycle Comfort Evaluation methodology combined with some industry best practices, the following sub-criteria displayed in **Table 5-20** were used to score the overall PCI for the No-Build option and five other Tier 3 Alternatives.

Table 5-20: Qualitative Scoring Measures of the Pedestrian Comfort Index Criterion

Pedestrian Comfort Index	Scoring Thresholds	Score
Sidewalk Width	6' wide or less	0.0
	6' – 7' wide	1.0
	7' – 9' wide	1.5
	Greater than 9' wide	2.0
Horizontal Buffer Width (select all):	No buffer	0.0
	0' – 3' buffer	0.5
	3' – 6' buffer	1.0
	6' - 9' buffer	1.5
Number of Total Vehicle Though Lanes	8	0.0
	6	1.0
	4	1.5
	2	2.0
Traffic Volume: (Curb Lane)	> 12,000	0.0
	9,000 - 12,000	0.5
	6,000 - 9,000	1.0
	3,000 - 6,000	1.5
	< 3,000	2.0
Presence of Median	No median	0.0
	TWLTL / Left Turn Lane (no median)	1.0
	Left turn Lane with median (<5')	1.5
	Left turn Lane with planted median (>5')	2.0

The PCI calculates a score by using a range of thresholds for each PCI indicator with the thresholds that result in a higher comfort receive a higher score. The BCI has a maximum score of ten points. **Table 5-21** below shows the final PCI score for the No-Build option and five other Tier 3 Alternatives from highest scoring to lowest scoring. Refer to Appendix K for the detailed results that further illustrate how the No-Build and the Tier 3 Alternatives score within each of the PCI sub-criteria.

Table 5-21: Qualitative Scoring Measures of the Pedestrian Comfort Index Criterion

Alternative	Pedestrian Comfort Index Sub-Criteria					PCI Score
	Sidewalk Width	Horizontal Buffer Width	Number of Vehicle Through Lanes	Traffic Volume: (Curb Lane)	Presence of Median	
Alternative 6b	2.0	1.5	1.5	2.0	2.0	9.0
Alternative 6a	2.0	1.0	1.0	2.0	2.0	8.0
Alternative 5	2.0	1.0	1.0	0.5	2.0	6.5
Alternative 13	2.0	2.0	1.5	0.5	0.0	6.0
No-Build Plus	0.0	0.0	1.5	0.5	2.0	4.0
No-Build	0.0	0.0	1.5	0.5	1.0	3.0

The highest scoring Tier 3 Alternatives for the BCI criterion are Alternative 6b, Alternative 5, and Alternative 6a with six and five-and-half points respectively. Alternative 5 has the one of the most comfortable bicycle facilities with a dedicated buffered bike lane and Alternative 6a and Alternative 6b have a shared facility with the SBBL. The SBBL account for a reduction in curb lane volumes compared to the other alternatives with vehicular through lanes as the curb lanes.

Application of the Pedestrian Comfort Index Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the PCI Criterion. The following formula was used to calculate the scores:

*Technical Score = (Best Result/ Alternative Result) * Weight * 100*

Table 5-22 below shows how the score was calculated for the No-Build option and five other Tier 3 Alternatives relative to the results of the PCI creation in order of highest to lowest scoring.

Table 5-22: Pedestrian Comfort Index Criterion Results in the Calculation of the Technical Score

Alternative	BCI Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 6b	9.0	((9.0/9.0)	* 6.97%) * 100	6.97
Alternative 6a	8.0	((9.0/9.0)	* 6.97%) * 100	6.19
Alternative 5	6.5	((9.0/9.0)	* 6.97%) * 100	5.03
Alternative 13	6.0	((9.0/9.0)	* 6.97%) * 100	4.64
No-Build Plus	4.0	((9.0/9.0)	* 6.97%) * 100	3.10
No-Build	3.0	((9.0/9.0)	* 6.97%) * 100	2.32

5.6g Expand Travel Modes Choices – *Transit Travel Time Criterion Results*

The Transit Travel Time criterion is a metric that measures impact upon transit performance by calculating the amount of time it takes for transit vehicles to travel the corridor from one end to the other – or in other words, calculating total transit travel time. The results of the Transit Travel Time Criterion for the No-Build option and five other Tier 3 Alternatives is under the year 2040 condition and is an output from the Vissim Model.

In order to reach a comprehensive measure, transit travel times during both the AM and PM time periods were used to measure the overall performance of this criterion – each receiving half of the value of 3.72% weight assigned to this criterion, or 1.83% per time duration. The transit travel speeds in each direction of Milton Road – northbound and southbound – were also averaged to reach a combined travel speed for each the AM and PM durations.

The results of the of the Transit Travel Time are shown below in **Table 5-23** for the No-Build option and the five other Tier 3 Alternatives.

Table 5-23: Transit Travel Time Criterion Results

Alternative	AM Peak Hour				PM Peak Hour			
	Northbound		Southbound		Northbound		Southbound	
	Travel Time (min)	Travel Time % Change	Travel Time (min)	Travel Time % Change	Travel Time (min)	Travel Time % Change	Travel Time (min)	Travel Time % Change
No Build	9.4	-	6.4	-	5.0	-	6.6	-
No Build Plus	5.0	46.8%	4.4	31.6%	5.5	-9.5%	6.7	-0.9%
5	5.7	39.8%	4.9	23.7%	5.8	-15.0%	6.0	9.2%
6a	4.7	50.2%	5.1	20.0%	4.6	8.7%	5.6	15.9%
6b	4.1	56.2%	4.7	27.3%	5.4	-6.8%	6.0	9.9%
13	5.0	46.4%	5.7	11.7%	6.0	-19.6%	6.6	0.4%

Alternative	Average AM Travel Time		Average PM Travel Time	
No Build	7.9		5.8	
No Build Plus	4.7	40.6%	6.1	-4.6%
5	5.3	33.3%	5.9	-1.2%
6a	4.9	37.9%	5.1	12.8%
6b	4.4	44.5%	5.7	2.7%
13	5.4	32.3%	6.3	-8.2%

The average transit travel time between the northbound and southbound direction for the No-Build option is 7.9 minutes in the AM and 5.8 minutes in the PM – over a two-minute decrease in average travel time between the AM and PM time periods. The No-Build travel time result is the baseline condition for calculating the travel time percent change for each of the Tier 3 Alternatives.

All the Tier 3 Alternatives have improved transit travel times compared to the No-Build in the AM time period, while only Alternative 6a and Alternative 6b have an improved travel time compared to the No-Build in the PM. The No-Build option and the Tier 3 Alternatives are ranked below for each time frame based on the results of the Transit Travel Time criterion.

AM

1. Alternative 6b – 4.4 minutes of average transit travel time
2. No-Build Plus – 4.7 minutes of average transit travel time
3. Alternative 6a – 4.9 minutes of average transit travel time
4. Alternative 5 – 5.3 minutes of average transit travel time
5. Alternative 13 – 5.4 minutes of average transit travel time
6. No-Build – 7.9 minutes of average transit travel time

PM

1. Alternative 6a – 5.1 minutes of average transit travel time
2. Alternative 6b – 5.7 minutes of average transit travel time

3. No-Build – 5.8 minutes of average transit travel time
4. Alternative 5 – 5.9 minutes of average transit travel time
5. No-Build Plus – 6.1 minutes of average transit travel time
6. Alternative 13 – 6.3 minutes of average transit travel time

Application of the Transit Travel Time Results Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* used to calculate the score for the Transit Travel Time Criterion. The following formula was used to calculate the scores:

*Technical Score = (Best Result/ Alternative Result) * Weight * 100*

Since transit travel time was measured in both the AM and PM time periods, two values were produced - each receiving half the value of the value of 3.72% weight assigned to this criterion, or 1.83% per time duration.

Table 5-24 and **Table 5-25** below show how the AM and PM scores were calculated for the No-Build option and five other Tier 3 Alternatives in order of highest scoring to lowest scoring.

Table 5-24: AM Transit Travel Time Criterion Results in the Calculation of the Technical Score

Alternative	AM Travel Time Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 6b	4.4 minutes	((4.4/4.4)	* 1.83%) * 100	1.83
No-Build Plus	4.7 minutes	((4.4/4.7)	* 1.83%) * 100	1.71
Alternative 6a	4.9 minutes	((4.4/4.9)	* 1.83%) * 100	1.64
Alternative 5	5.3 minutes	((4.4/5.3)	* 1.83%) * 100	1.53
Alternative 13	5.4 minutes	((4.4/5.4)	* 1.83%) * 100	1.50
No-Build	7.9 minutes	((4.4/7.9)	* 1.83%) * 100	1.02

Table 5-25: PM Transit Travel Time Criterion Results in the Calculation of the Technical Score

Alternative	PM Travel Time Results	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 6a	5.1 minutes	((5.1/5.1)	* 1.83%) * 100	1.83
Alternative 6b	5.7 minutes	((5.1/5.7)	* 1.83%) * 100	1.64
No-Build	5.8 minutes	((5.1/5.8)	* 1.83%) * 100	1.60
Alternative 5	5.9 minutes	((5.1/5.9)	* 1.83%) * 100	1.58
No-Build Plus	6.1 minutes	((5.1/6.1)	* 1.83%) * 100	1.53
Alternative 13	6.3 minutes	((5.1/6.3)	* 1.83%) * 100	1.48

5.6h Expand Travel Modes Choices – *Transit Ridership Criterion Results*

The Transit Ridership Criterion helps measure the performance of expanding travel mode choices by evaluating the trends in ridership numbers among the No-Build options and five other Tier3 Alternatives. Certain alternatives solicit higher ridership numbers than others resulting in an expanded travel mode choices. **Table 5-26** below shows the transit ridership estimates based on

FTA STOPs model guidance that was then applied to this study Milton Road. The numbers reflect average daily trips.

Table 5-26: Transit Ridership Criterion Results

Alternative	Transit Ridership Estimate
No-Build	1,347
No-Build Plus	1,347
Alternative 5	1,347
Alternative 6a	1,930
Alternative 6b	1,930
Alternative 13	2,219

Application of the Transit Ridership Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Transit Ridership Criterion.

The following formula below was used to calculate the scores:

*Technical Score = (Alternative Result / Best Result) * Weight * 100*

Table 5-27 below shows how the transit ridership scores were calculated for each alternative, in order of highest scoring alternative to the lowest scoring alternative.

Table 5-27: Transit Ridership Criterion Results in the Calculation of the Technical Score

Alternative	Transit Ridership	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 13	2,219	((2,219/2,219)	* 3.72%*100))	3.72
Alternative 6a	1,930	((1,930/2,219)	* 3.72%*100))	3.24
Alternative 6b	1,930	((1,930/2,219)	* 3.72%*100))	3.24
No-Build	1,347	((1,347/2,219)	* 3.72%*100))	2.26
No-Build Plus	1,347	((1,347/2,219)	* 3.72%*100))	2.26
Alternative 5	1,347	((1,347/2,219)	* 3.72%*100))	2.26

5.6i Cost / Implementation – *Project Cost Criterion Results*

The Cost of Implementation criterion is a metric that measures the potential ease of construction/implementation by evaluating the total project cost to implement the No-Build option and five other Tier 3 Alternatives. This criterion is intended to reflect the fact that more expensive alternatives are generally more complex and difficult to implement than a less expensive alternative, and thus alternatives with lower projected costs would score higher than alternatives with more expensive cost estimates.

The No-Build option assumes no cost to construct while detailed, planning level cost estimates were developed for each of the five Tier 3 Alternatives. **Table 5-28** shows the total project planning-level cost for implementation of each Alternative.

Table 5-28: Project Cost Criterion Results

Alternative	Project Cost Estimate
No-Build	No Cost
No-Build Plus	$9,804,000
Alternative 5	$85,417,000
Alternative 6a	$95,463,000
Alternative 6b	$74,504,000
Alternative 13	$77,334,000

As anticipated, the more expansive build alternatives have higher project costs than the less expansive build alternatives. Alternative 6a has the highest project cost estimate of $95,463,000 while No-Build Plus has the lowest project cost estimate of $9,804,000 (sum of the spot improvements). Refer to Appendix K to see the detailed, planning-level cost estimates for each alternative. It should be noted that ROW costs at intersections are included in the cost estimates.

In evaluating the percentage of right-of-way cost compared to the total cost estimate for each alternative, the following is observed; No Build Plus = 20% of the total cost estimate, Alternative 5 = 11% of the total cost estimate, Alternative 6a = 17% of the total cost estimate, Alternative 6b = 13% of the total cost estimate and Alternative 13 = 13% of the total cost estimate.

Application of the Project Cost Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Project Cost Criterion. One unique element of the formula used for the Project Cost Criterion is that a common denominator of $10,000,000 was added to the formula to the normalize the ratio between the best result and the other results due to the large disparity between the zero cost for the No-Build option compared to the costs of the five Tier 3 Alternatives. In addition, the value of $1 was also used in the formula for the cost of the No-Build option since inputting a zero would make all scores result in a zero).

The following formula below was used to calculate the scores:

*Technical Score = (Best Result / (Alternative Result/10M)) * Weight * 100*

Table 5-29 shows how the scores were calculated for each alternative of the Cost of Implementation, in order of highest scoring alternative to the lowest scoring alternative.

Table 5-29: Project Cost Criterion Results in the Calculation of the Technical Score

Alternative	Project Cost	Scoring Formula		Score
		Results Ratio	Applying the Weight	
No-Build	No Cost	No formula used, automatically received full weighted points		3.10
No-Build Plus	$9,804,000	(1/9.804M(/10M))	* 3.10% *100))	3.10
Alternative 6b	$74,504,000	(1/74.504M(/10M))	* 3.10% *100))	0.42
Alternative 13	$77,334,000	(1/77.334M(/10M))	* 3.10% *100))	0.40
Alternative 5	$85,417,000	(1/85.417M(/10M))	* 3.10% *100))	0.36
Alternative 6a	$95,463,000	(1/95.463M(/10M))	* 3.10% *100))	0.32

5.6j Cost / Implementation – *Right-of-Way Impact Criterion Results*

The Right-of-Way Impact criterion is a metric that measures the approximate amount of right-of-way that will be necessary to implement each alternative. The method to calculate the impact was produced by estimating the amount right-of-way - in square feet – that would be necessary to theoretically construct each of build the alternatives. The No-Build option assumes no right-of-way impact is necessary, while a detailed process to map and calculate the theoretical right-of-way needed was conducted for each of the other five Tier 3 Alternatives. **Table 5-30** shows the total right-of-way impact for the theoretical implementation of each Tier 3 Alternative.

Table 5-30: Right-of-Way Impact Criterion Results

Alternative	Mid-Block ROW Width	Approximate Right-of-Way Impact
No-Build	Existing	*No Impact*
No-Build Plus	100 ft	53,884 ft^2
Alternative 5	125 ft	253,662 ft^2
Alternative 6a	144 ft	398,689 ft^2
Alternative 6b	128 ft	271,345 ft2
Alternative 13	129 – 134 ft	286,207 ft^2

The more expansive build alternatives naturally have a larger right-of-way footprint than the less expansive alternatives. In fact, Alternative 6a has the largest ROW footprint and the No Build Plus having only 53,884 square feet of impact with the application of limited spot improvements. Alternatives 5, 6b and 13 have a roughly proportional ROW impact.

Application of the Right-of-Way Impact Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Right-of-Way Impact Criterion. One unique element of the formula used for the Right-of-Way Impact Criterion is that a common denominator of $10,000 was added to the formula to the normalize the ratio between the best result and the other results due to the large disparity between the zero impact for the No-Build option compared to the costs of the other five Tier 3 Alternatives. In addition, the value of 1 ft^2 was also used in the formula for the cost of the No-Build option (since inputting a zero would make all scores result in a zero).

The following formula was used to calculate the Right-of-Way Impact scores:

Formula = (Best Result / (Alternative Result/10K)) * Weight * 100

Table 5-31 below shows how the scores were calculated for each alternative relative to the results of the Right-of-Way Impact creation in order of highest scoring alternative to the lowest scoring alternative.

Table 5-31: Right-of-Way Impact Criterion Results in the Calculation of the Technical Score

Alternative	ROW Width	Right-of-Way Impact*	Scoring Formula		Score
			Results Ratio	Applying the Weight	
No-Build	Existing	*No Impact*	No formula used, automatically received full points		4.55
No-Build Plus	100 ft	53,884 ft²	(1/53,884 (/10K))	* 4.55% *100))	0.84
Alternative 5	125 ft	253,662 ft²	(1/253,662 (/10K))	* 4.55% *100))	0.18
Alternative 6b	128 ft	271,345 ft2	(1/271,345 (/10K))	* 4.55% *100))	0.17
Alternative 13	129 ft	286,207 ft²	(1/286,207 (/10K))	* 4.55% *100))	0.16
Alternative 6a	144 ft	398,689 ft²	(1/398,689 (/10K))	* 4.55% *100))	0.11
**The Right-of-Way Impact calculations are approximate*					

5.6k Cost / Implementation – *Implementation Opportunities Criterion Results*

The Implementation Opportunities criterion is a metric that estimates the level of implementation possibility by the number of potential grants the No-Build option and the five other Tier 3 Alternatives could be eligible for. A secondary calculation was produced to arrive at a numeric value on a scale of zero to one hundred, with zero points having the least opportunity for implementation and one hundred having the highest likeliness for implementation. Refer to Appendix K for the detailed calculations for the Implementation Opportunities criterion. **Table 5-32** shows the result of the Implementation Opportunities Criterion calculations.

Table 5-32: Implementation Opportunities Criterion Results

Alternative	Implementation Opportunities Score
No-Build	100.0
No-Build Plus	33.4
Alternative 5	4.1
Alternative 6a	10.4
Alternative 6b	11.9
Alternative 13	15.4

Application of the Implementation Opportunities Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Implementation Opportunities Criterion. The following formula below was used to calculate the scores:

*Technical Score = (Alternative Result / Best Result) * Weight * 100*

Table 5-33 shows how the scores were calculated for the Implementation Opportunities in order of highest scoring alternative to the lowest scoring alternative.

Table 5-33: Implementation Opportunities Criterion Results in the Calculation of the Technical Score

Alternative	Implementation Score	Scoring Formula		Score
		Results Ratio	Applying the Weight	
No-Build	100.0	((100.0/100.0)	* 2.96% *100))	2.96
No-Build Plus	33.4	((33.4/100.0)	* 2.96% *100))	0.99
Alternative 13	15.4	((15.4/100.0)	* 2.96% *100))	0.46
Alternative 6b	11.9	((11.9/100.0)	* 2.96% *100))	0.35
Alternative 6a	10.4	((10.4/100.0)	* 2.96% *100))	0.31
Alternative 5	4.1	((4.1/100.0)	* 2.96% *100))	0.12

5.6l Environmental Impacts - *Neighborhood Impacts Criterion Results*

The Neighborhood Impacts Criterion measures the perceived impact on the environment for the No-Build and the other five Tier 3 Alternatives by calculating the approximate number vehicles traveling through adjacent neighborhoods to the Milton Road corridor in order to capture cut through traffic impacts. The resulting cut through traffic volumes are derived from an output of the MetroPlan 2040 Regional TDM Model. Refer to Appendix K for a detailed list of the streets used to calculate the total neighborhood cut through traffic volumes. **Table 5-34** below shows the total AADTs in the adjacent neighborhoods for the No-Build options and the five other Tier 3 Alternatives.

Table 5-34: Neighborhood Impacts Criterion Results

Alternative	Total 2040 AADTs in Adjacent Neighborhoods
No-Build	185,353 AADT
No-Build Plus	185,353 AADT
Alternative 5	183,149 AADT
Alternative 6a	183,149 AADT
Alternative 6b	195,552 AADT
Alternative 13	195,552 AADT

The results presented in **Table 5-34** show less cut through traffic for the alternatives with more lanes, suggesting that the alternatives with more capacity would experience less congestion resulting in less of a cut through traffic impact on the adjacent neighborhoods .

Application of the Neighborhood Impacts Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Neighborhood Impacts Criterion. The following formula below was used to calculate the scores:

*Technical Score = (Best Result / Alternative Result) * Weight * 100*

Table 5-35 shows how the scores were calculated for each alternative for the Neighborhood Impacts criterion in order of highest scoring alternative to the lowest scoring alternative.

Table 5-35: Neighborhood Impacts Criterion Results in the Calculation of the Technical Score

Alternative	Neighborhood Impact (AADT)	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 5	183,149	(183,149/183,149)	* 4.43% *100))	4.43
Alternative 6a	183,149	(183,149/183,149)	* 4.43% *100))	4.43
No-Build	185,353	(185,353/185,353)	* 4.43% *100))	4.38
No-Build Plus	185,353	(185,353/185,353)	* 4.43% *100))	4.38
Alternative 6b	195,552	(195,552/195,552)	* 4.43% *100))	4.15
Alternative 13	195,552	(195,552/195,552)	* 4.43% *100))	4.15

5.6m Environmental Impacts – *Title VI Impacts Criterion Results*

The Title VI Impacts Criterion measures the impact on any Title VI designated neighborhood for the No-Build and five other Tier 3 Alternatives by calculating the perceived number cut through vehicles traveling through the La Plaza Vieja neighborhood (Clay Avenue) adjacent to the Milton Road corridor. The results of the traffic volume are an output of the MetroPlan 2040 Regional TDM Model, and the only thoroughfare with AADTs in the 2040 TDM Model in the La Plaza Vieja to collect traffic volumes are on Clay Avenue between Florence Street and Blackbird Roost Street. **Table 5-36** shows the Clay Avenue AADTs for the No-Build options and five other Tier 3 Alternatives.

Table 5-36: Title VI Impacts Criterion Results

Alternative	2040 AADTs on Clay Avenue
No-Build	9,867 AADT
No-Build Plus	9,867 AADT
Alternative 5	6,065 AADT
Alternative 6a	6,065 AADT
Alternative 6b	10,171 AADT
Alternative 13	10,171 AADT

The results presented above show less perceived cut through traffic for the alternatives with more lanes, indicating the alternatives with more capacity would experience less congestion, resulting in less of a cut through traffic impact on the La Plaza Vieja neighborhood.

Application of the Title VI Impacts Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* was used to calculate the score for the Title VI Impacts Criterion. The following formula below was used to calculate the scores:

*Technical Score = (Best Result / Alternative Result) * Weight * 100*

Table 5-37 shows how the scores were calculated for each alternative for the Title VI Criterion in order of highest scoring alternative to the lowest scoring alternative.

Table 5-37: Title VI Impacts Criterion Results in the Calculation of the Technical Score

Alternative	Title VI Impact (Clay Ave AADT)	Scoring Formula		Score
		Results Ratio	Applying the Weight	
Alternative 5	6,065	(6,065/6,065)	* 5.36% *100))	5.36
Alternative 6a	6,065	(6,065/6,065)	* 5.36% *100))	5.36
No-Build	9,867	(6,065/9,867)	* 5.36% *100))	3.29
No-Build Plus	9,867	(6,065/9,867)	* 5.36% *100))	3.29
Alternative 6b	10,171	(6,065/10,171)	* 5.36% *100))	3.20
Alternative 13	10,171	(6,065/10,171)	* 5.36% *100))	3.20

5.6n Environmental Impacts – *Air Quality Criterion Results*

The Air Quality Criterion measures the perceived impact on the environment for the No-Build and five other Tier 3 Alternatives by calculating the theoretical greenhouse gas (GHG) emissions by using the total vehicle miles travelled (VMT) output from the year 2040 Vissim Model. The GHG emissions is calculated with guidance from EPA MOVES model and is expressed in pounds of carbon dioxide equivalent per mile (lbs CO2e/mile). The GHG calculation also considers the approximate fleet distribution of 97% standard automobile and 3% semi-trucks which each have different GHG emission factors. **Table 5-38** displays the results of the 2040 GHG Emissions and Air Quality Criterion.

Table 5-38: Air Quality Criterion Results

2040 GHG Emissions		
Alternative	VMT	lbs CO2e
No Build	42,545	22,305
No Build Plus	41,396	21,703
Alternative 5	42,683	22,377
Alternative 6A	43,349	22,726
Alternative 6B	42,469	22,265
Alternative 13	43,855	22,992

Fleet Emission Factors		
Fleet	Percentage	lbs CO2e/mile (2040)
Standard automobile	97%	0.519417434
Semi truck	3%	0.681054574

Notes:

1. Emissions are presented in pounds (lbs) carbon dioxide equivalent (CO2e).
2. Emissions factors for Coconino County, Arizona were obtained from EPA MOVES model, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves.
4. All fuel types are included. "Standard US automobile" represents Passenger Car and Passenger Truck in MOVES model. "Commercial semi truck" represents Light Commercial Truck, Refuse Truck, Single Unit Short-haul and Long-haul Truck, and Combination Short-haul and Long-haul Truck in MOVES model.
5. Urban Unrestricted Access roadway type was selected in MOVES model.

Since the GHG emissions calculations is correlated to VMT, the alternatives with the fewest VMT also have the least amount of GHG emissions. There is not a significant variation in VMTs between the alternatives – just a 2,459 VMT difference which is approximately just 6% of No-Build Plus which has the fewest VMT. Alternative 13 and Alternative 6a have the two highest VMT and GHG emissions. The list below ranks the Tier 3 Alternatives in order of lowest amount of GHG emissions to highest amount of GHG emissions.

GHG Emissions

1. No-Build – 21,703 lbs CO2e
2. Alternative 6b – 22,265 lbs CO2e
3. No-Build – 22,305 lbs CO2e
4. Alternative 5 – 22,377 lbs CO2e
5. Alternative 6a – 22,726 lbs CO2e
6. Alternative 13 – 22,992 lbs CO2e

Application of the Air Quality Criterion Results in the Calculation of the Technical Score

The quantitative approach previously described in *Section 4.6b - Tier 2 Evaluation Criteria Scoring Thresholds and Methodology* used to calculate the score for the Air Quality Criterion. The following formula below was used to calculate the scores:

*Technical Score = (Best Result / Alternative Result) * Weight * 100*

Table 5-39 shows how the scores were calculated for each alternative for the Air Quality Criterion in order of highest scoring alternative to the lowest scoring alternative.

Table 5-39: Air Quality Criterion Results in the Calculation of the Technical Score

Alternative	Air Quality (GHG Emissions)	Scoring Formula		Score
		Results Ratio	Applying the Weight	
No-Build Plus	21,703 lbs CO2e	(21,703 /21,703)	* 3.79% *100))	3.79
Alternative 6b	22,265 lbs CO2e	(21,703 /22,265)	* 3.79% *100))	3.70
No-Build	22,305 lbs CO2e	(21,703 /22,305)	* 3.79% *100))	3.69
Alternative 5	22,377 lbs CO2e	(21,703 /22,377)	* 3.79% *100))	3.68
Alternative 6a	22,726 lbs CO2e	(21,703 /22,726)	* 3.79% *100))	3.62
Alternative 13	22,992 lbs CO2e	(21,703 /22,992)	* 3.79% *100))	3.58

5.7 Tier 3 Evaluation Criteria Required to Finalize the Tier 3 Alternative Evaluation Process

Two of the Tier 3 Evaluation Criteria still need to be applied in order to finalize the Tier 3 Alternative Evaluation and screening process. the Public Support and the Community Character – Great Street Criterion require forthcoming public input to evaluate the performance of alternatives. The public input is anticipated to be collected in forthcoming engagement activities following the initial publication of this working paper. See the following sub-sections for more information on the methodology for how these two criteria measure alternative performance.

5.7a Public Support

The results of the Public Support Criterion will be calculated by the community inputs received in the upcoming second public open house and survey.

5.7b Community Character

The results of the Community Character Criterion will be calculated based on the community perception (from the upcoming second open house meeting and survey) of a great street and if each respective alternative meets the City of Flagstaff's 2030 Regional Plan Policy.