

# Metro Rail Expansion Project

## LOCALLY PREFERRED ALTERNATIVE REFINEMENT TECHNICAL REPORT



January 2019



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## Appendix

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Appendix A: Evaluation Scoring Matrix

# 1. Introduction

The Niagara Frontier Transportation Authority (NFTA) completed an Alternatives Analysis (AA) in the fall of 2012 along with study partner, the Greater Buffalo Niagara Regional Transportation Council (GBNRTC). The overall goal of the Transit Options Amherst-Buffalo project was to evaluate a range of high quality transit service alternatives to improve transit access between key activity centers in Buffalo and Amherst and provide enough information to support the recommendation of a locally preferred alternative (LPA) and enable the local Metropolitan Planning Organization (MPO) to adopt the LPA as part of the long-range transportation plan.

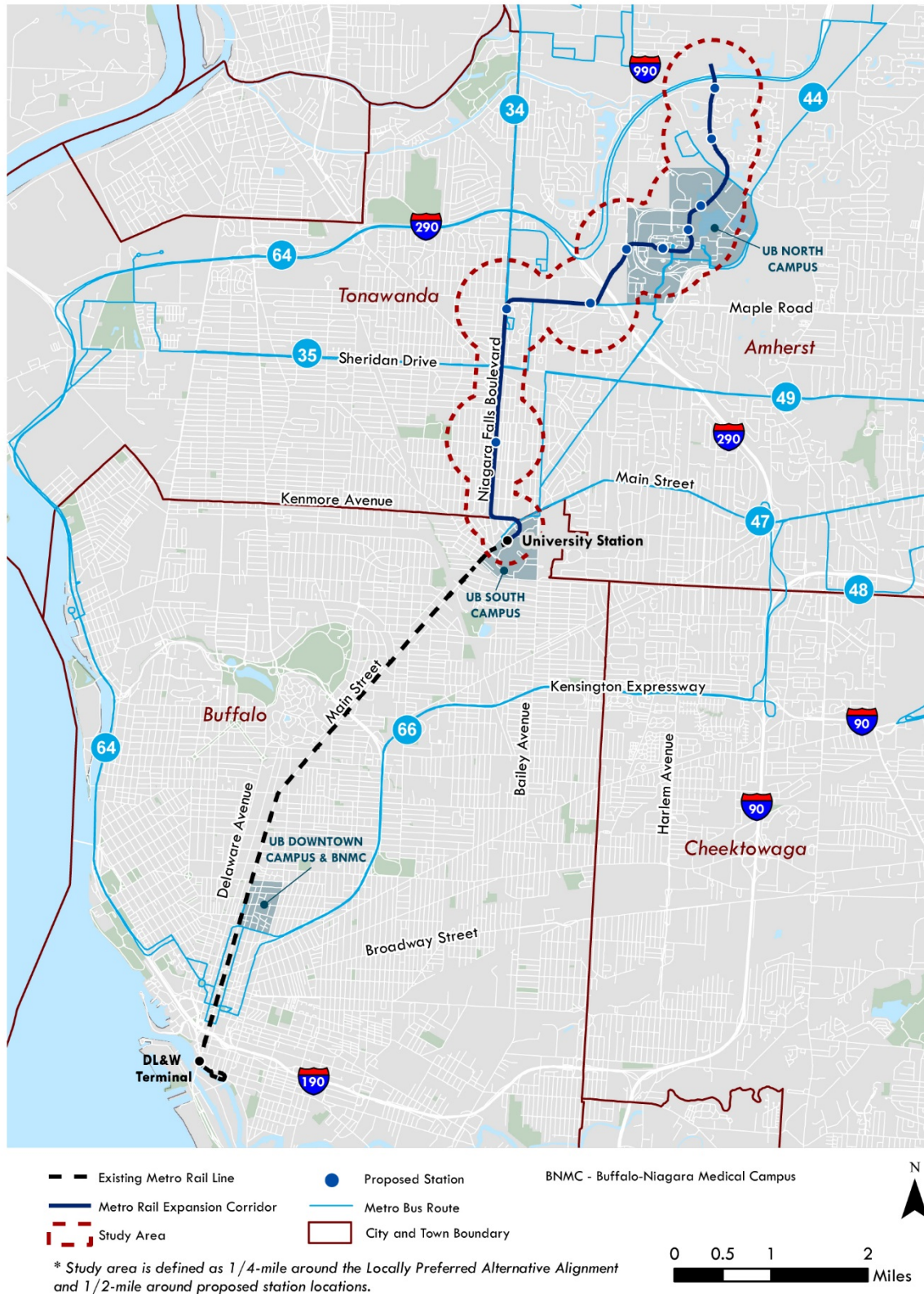
The Metro Rail line is depicted in **Figure 1**. The Metro Rail Expansion study area includes an existing street network and transit service network. The transportation system in the corridor serves a diversity of land uses and activities ranging from the waterfront to the urban center of Downtown Buffalo and the Buffalo Niagara Medical Campus (BNMC), to sporting and entertainment venues, to the large and expanding UB campuses and other colleges, to older established residential neighborhoods and emerging commercial and employment centers.

The AA involved a three-tiered approach which established screening methodology and selection criteria. A Project Steering Committee (PSC) and Project Advisory Committee (PAC) and a robust public participation plan were established to help guide the study and provide input and feedback from community stakeholders. During the study, four public information meetings were held as well as over 75 staff level meetings and presentations to community organizations and stakeholders.

At the onset of the study, thirty-six alternatives were identified as part of a long list for evaluation in Tier 1. The long list consisted of four modes, Light Rail, Bus Rapid Transit, Preferential Bus and Enhanced Bus along with three main alignments south of UB North along Niagara Falls Boulevard, Bailey Avenue, and Millersport Highway. The thirty-six alternatives were narrowed down based on those that could be reasonably built and would not have a significant impact on the community or environment. The result of Tier 1 was fifteen remaining alternatives to be refined and evaluated in more detail in Tier 2.

During the second tier of the AA, conceptual level engineering was applied to the remaining alternatives. The alternatives were also subjected to quantitative assessment and compared across modes to determine the best performing. The result of the Tier 2 analysis was seven alternatives to advance to the third and final evaluation tier.

Figure 1: Metro Rail Expansion Study Area



The third tier of the AA applied measurable categories of evaluation including land use, mobility and cost effectiveness to the remaining seven alternatives. Measurable criteria for each category included travel time, employments served, number of activity centers, operating and maintenance costs, capital cost, growth locations served, projected ridership including University at Buffalo boardings, and operating revenue. The 2015 AA recommended the “Niagara Falls Blvd Alternative 1” from University Station to Crosspoint, as the LPA. Prior to the completion of the AA, the final LPA identified that the I-990 (Lockport Expy)/Audubon Parkway interchange would be the logical termini.

After reviewing the technical results of the AA and considering feedback from the Project Committees and the public, NFTA recommended the Niagara Falls Boulevard LRT alternative as the strongest alternative to advance as the LPA for the Metro Rail Expansion project. The LPA was generally defined as extending light rail from the existing Metro Rail terminus at University Station, extending underground along Bailey Avenue to a portal on Eggert Road where it would continue at grade on Niagara Falls Boulevard to Maple to Sweet Home Road, onto and through UB North Campus to Audubon Parkway where it would terminate near the I-990 interchange.

The GBNRTC initiated a Comprehensive Transit-Oriented Development (TOD) planning effort in the Fall of 2016 as a complement to the AA work. Due to public and local agency feedback during the TOD study, NFTA decided to re-evaluate the southern portion of the LPA alignment. Specifically, two options are being considered. From University Station, the LPA could travel along Bailey Avenue to Eggert Road or along Kenmore Avenue and Niagara Falls Boulevard to a common point at the intersection of Eggert Road and Niagara Falls Boulevard, where the alignment would follow the adopted LPA to the interchange of I-990 and Audubon Parkway. These two alignment options (Bailey Avenue as the LPA and Kenmore Avenue as the refined LPA) are presented in Figure 2 and Figure 3, respectively.

## **1.1 DOCUMENT PURPOSE**

This technical report outlines the evaluation of the LPA options (Bailey Avenue versus Kenmore Avenue). Section 2 outlines the evaluation methodology including the evaluation criteria and metrics. Sections 3 and 4 describe each of the LPA refinement options, outlining opportunities and constraints of each alignment option along with an overall discussion of how the alignment options fared against evaluation criteria/ metric. Section 5 presents the evaluation results and recommendation. The refined LPA will be further evaluated in comparison to a No Build Alternative under the National Environmental Policy Act (NEPA) and State Environmental Quality Review Act (SEQRA).

Figure 2: Bailey Avenue Alignment Option

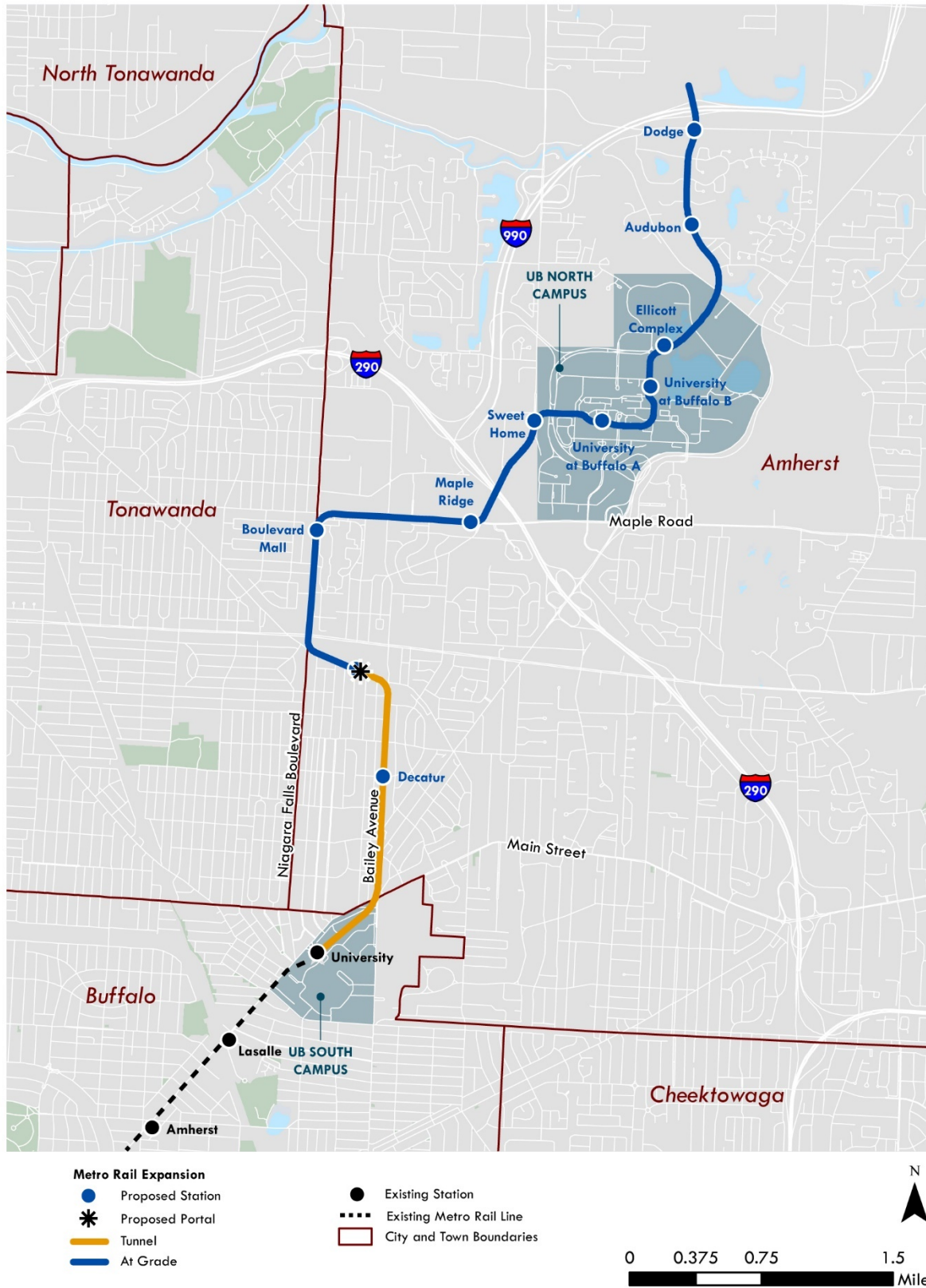
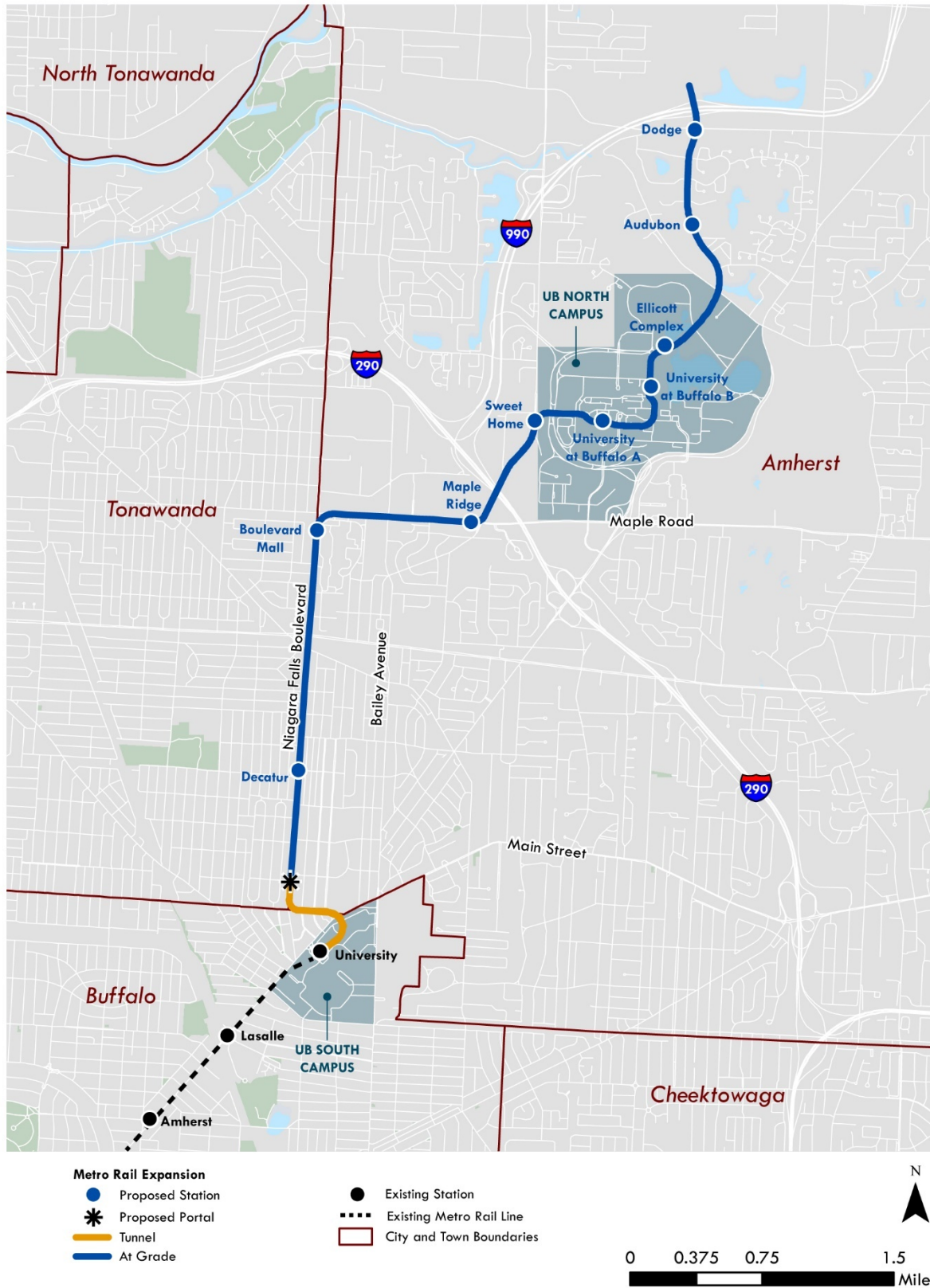




Figure 3: Kenmore Avenue Alignment Option



## 2. Refinement Methodology

A series of evaluation criteria and metrics were developed for the evaluation of the two alignment options. These evaluation criteria/metrics are in line with the Purpose and Need for the project. The Technical Advisory Committee (TAC), consisting of NFTA staff, key stakeholders, and municipal entities provided input in the decision-making process, which was led by the Steering Committee of internal staff from NFTA and GBNRTC.

### 2.1 EVALUATION CRITERIA AND METRICS

NFTA, with guidance from the TAC, established evaluation criteria and metrics to evaluate the two alignment options. Data sources for the evaluation metrics were derived from available GIS data, the Alternatives Analysis, and NFTA produced data, as well as stakeholder input. Table 1 presents these evaluation criteria metrics, based on cost, constructability, travel time, community and economic development, municipal coordination, ridership, accessibility traffic, environmental, safety, and connectivity. The alignment options were evaluated based on the evaluation matrix to determine the best alignment to move forward – Bailey Avenue or Kenmore Avenue. A fully complete evaluation matrix is found in Attachment A.

Table 1: Evaluation Criteria and Metrics

Category	Evaluation Criteria	Evaluation Metrics	
Order of Magnitude Costs	Difference in tunneling length	Minimize the cost of tunneling (based on linear feet of tunneling)	
	Number of underground stations	Minimize cost of station (based on number of at-grade and underground stations)	
	Purchase of ROW		Minimize cost of right-of-way (ROW) needed for purchase to accommodate Metro Rail running outside of ROW (based on acres of ROW easement)
			Minimize cost for easements to accommodate Metro Rail running outside of ROW (based on acres of ROW easement)
			Minimize cost of ROW needed for easement to accommodate Metro Rail running inside ROW to account for station areas and/or intersection widenings (based on acres of ROW easement)
O&M Costs	Minimize cost of Operations & Maintenance		
Overall Constructability	Availability of contractors	Availability of local contractors that can perform work	
	Schedule / Length of construction	Minimize construction schedule	
	Impacts to traffic and business operations	Minimize temporary street and/or driveway closures	
	Utility conflicts	Minimize utility relocations and reconstruction	






Category	Evaluation Criteria	Evaluation Metrics
	ROW impacts	Amount of private property impacted (either by purchase or easement) to accommodate project
Travel Time	Length of time Metro Rail travels from I-990 to University Station	Minimize travel time (in minutes)
Community / Economic Development	Transit-supportive elements in place or can be put in place (zoning, policy, community support, plans, etc.)	Maximize existing transit supportive zoning
	Opportunity for Transit Oriented Development	Opportunity for TOD zoning to be approved
Municipal Coordination	Local and regional stakeholder preference / acceptance	Preferred alignment option of Town of Amherst
		Preferred alignment option of Town of Tonawanda
		Preferred alignment option of other regional, municipal, or other stakeholder entities
Ridership	Maximizes ridership	Maximizes ridership
Accessibility	Impacts to adjacent property (acres)	Minimize number of driveways closed Minimize number of driveways experiencing reduced accessibility (in-ability to make a left turn)
	Accessibility by transit supportive populations	Number of transit dependent population within ½ mile radius of station areas
Traffic	Change to existing travel patterns	Minimize in travel distance or durations for local trips
	Impact to AM/PM Peak period volumes	Minimize increases in Peak period daily volumes (comparing no-build to build)
	Impact to Level of Service	Minimize reductions in LOS of project in build versus no-build
	Impacts to intersection LOS	Minimize reductions of intersection LOS in build versus no-build
Environmental	Minimizes impact on natural and human environments	Minimize acres of environmentally sensitive areas impacted by project
	Ability to reduce auto-dependency	Reduces vehicle miles travelled based on regional travel demand model

Category	Evaluation Criteria	Evaluation Metrics
	Noise sensitive land uses within proximity to alignment	Minimizes impact to noise and vibration sensitive land uses
Safety	Passenger access to station	Minimize distance to station platform from nearest sidewalk
	LRT/vehicular traffic intermixing	Minimize the conflicts of LRT intermixing with general vehicles
Connectivity	Connections with Metro Bus	Improve connectivity to Metro Bus
	Multi-modal opportunities	Improve Metro Bus route transfers
	Increase pedestrian and bicycle connectivity	Improve walkability within ¼ mile of proposed stations
		Improves bicycle lanes within ¼ mile of proposed stations
Improve pedestrian and bicycle usage-ability to provide connectivity with multi-modal		

## 2.2 QUALITATIVE SCORING

Using a 5-tier system, as presented in Table 2, each alignment option was qualitatively evaluated based upon the evaluation metrics. This process did not provide a total numerical score, but rather portrays which alignment options conform best to the evaluation metric. The Steering Committee reviewed these results and decided on a refined LPA, based on the alignment option that best meets all of the evaluation metrics.

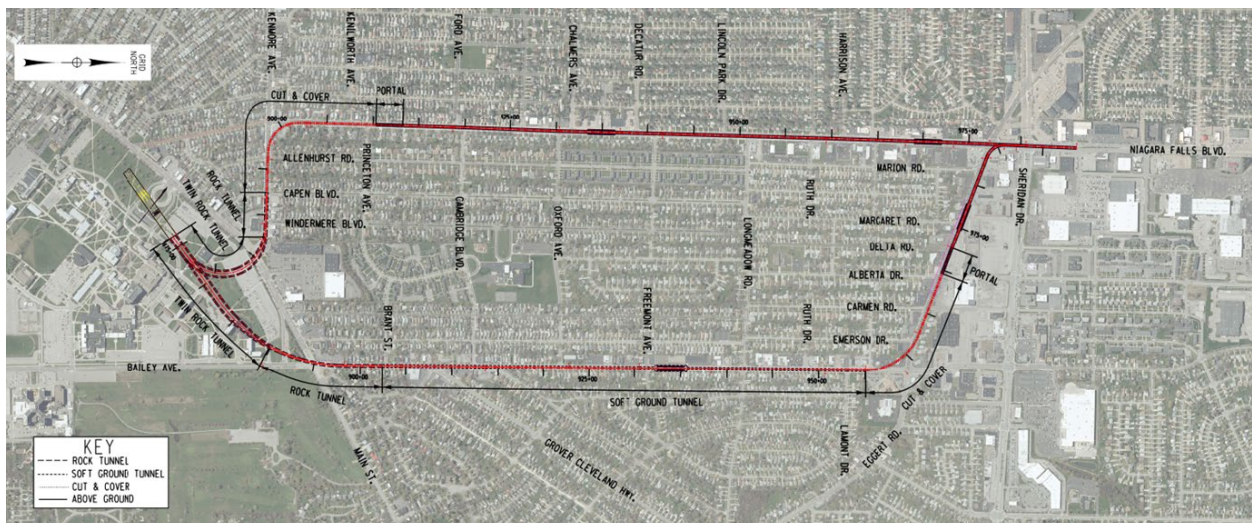
Table 2: 5-tier ranking

	Alignment option fully conforms to criteria/ metric
	Alignment option mostly conforms to criteria/ metric
	Alignment option partially conforms to criteria/ metric
	Alignment option minimally conforms to criteria/ metric
	Alignment option does not conform to criteria/ metric

# 3. Refinement of LPA

Utilizing efforts from the 2012 Alternatives Analysis, conceptual designs were developed to provide input for the evaluation criteria/metrics. The conceptual analysis utilized known geotechnical data relating to soil/ground conditions in order to locate the existing rock line to have an understanding of the type of tunnel construction (rock or soil) needed. Figure 4 depicts the plan view of the two options that conceptual engineering was conducted on.

**Figure 4: Alignment Options Constructability**



## 3.1 BAILEY AVENUE ALIGNMENT OPTION

Figure 5 depicts the alignment exiting the existing underground University Station, as two individual tunnels, utilizing the existing two tail tunnel, and merging into one larger tunnel with a center dividing wall in a 50mph design curve.

Figure 5: University Station / Bailey Avenue Curve

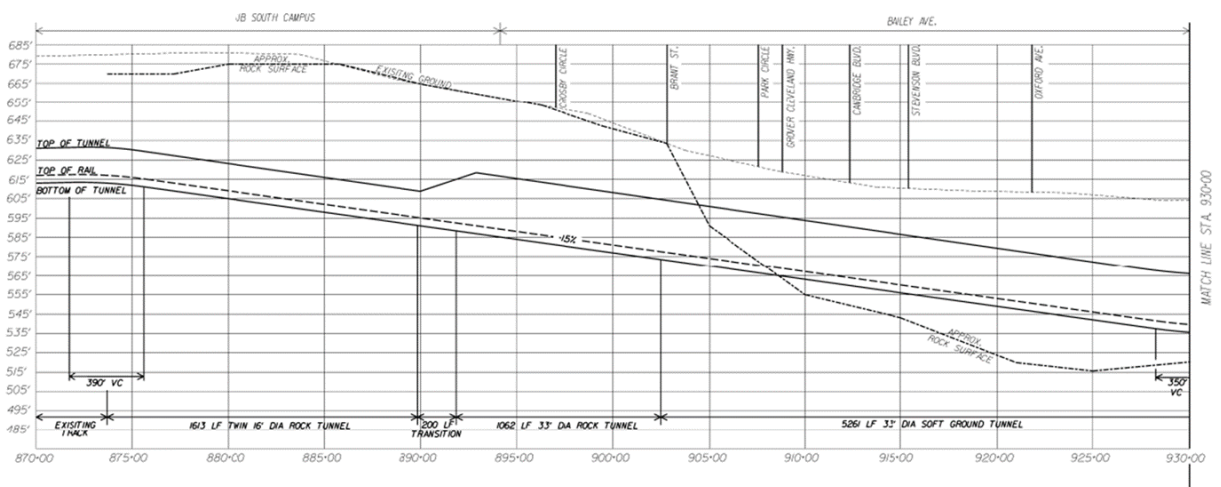


Figure 6 depicts how the single tunnel would be located underneath Bailey Avenue. This segment of the alignment would be constructed utilizing rock tunneling. As the alignment crosses Brant Street, the rock line would end and soft tunneling would be utilized until the alignment nears Eggert Road. Figure 7 depicts the geotechnical profile along the alignment, identifying how the rock line drops at Brant Street. An underground station would be located near Freemont Avenue, which would require purchasing a property for the station facility and providing bicycle and pedestrian connections.

Figure 6: Bailey Avenue Tunnel



Figure 7: Bailey Avenue Geotechnical Profile



Vertical access to the underground platforms would be located within the station facility. In addition, tunnel ventilation would be required at the underground platforms and throughout the tunnel segment, along with vertical emergency egress between stations.

Just south of the intersection of Bailey Avenue and Betina Avenue, as the tracks begin the rise to the surface at the portal, the construction method would switch from soft ground tunneling to cut and cover construction. Figure 8 depicts two design curves, a 50-mph curve and a 40-mph curve, both requiring cut and cover construction. Under the 50-mph curve, multiple properties would be impacted, whereas the 40-mph curve would only impact two properties. With the alignment entering or exiting the proposed at-grade station on Eggert Road, the light rail vehicle would be required to either slow down or begin accelerating, thus not being able to maximize its operating speed. Therefore, a 10-mph difference does not drastically affect travel times. Utilizing a 40-mph curve would reduce impacts and still provide fast and reliable transit service. With the portal location being near Alberta Drive, the LRT system will need to begin ascending at an approximately 4% grade, as shown in Figure 9.

Figure 8: Bailey Avenue / Eggert Road Curve

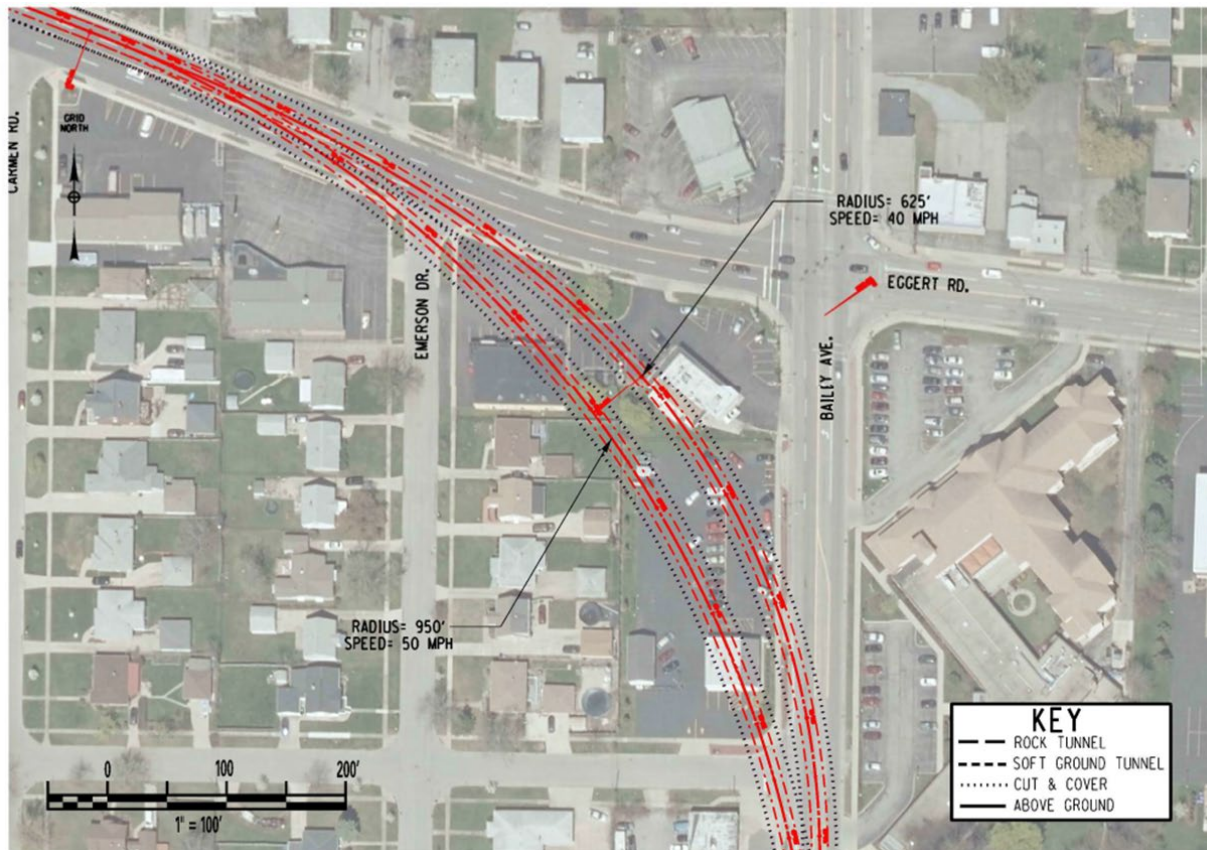
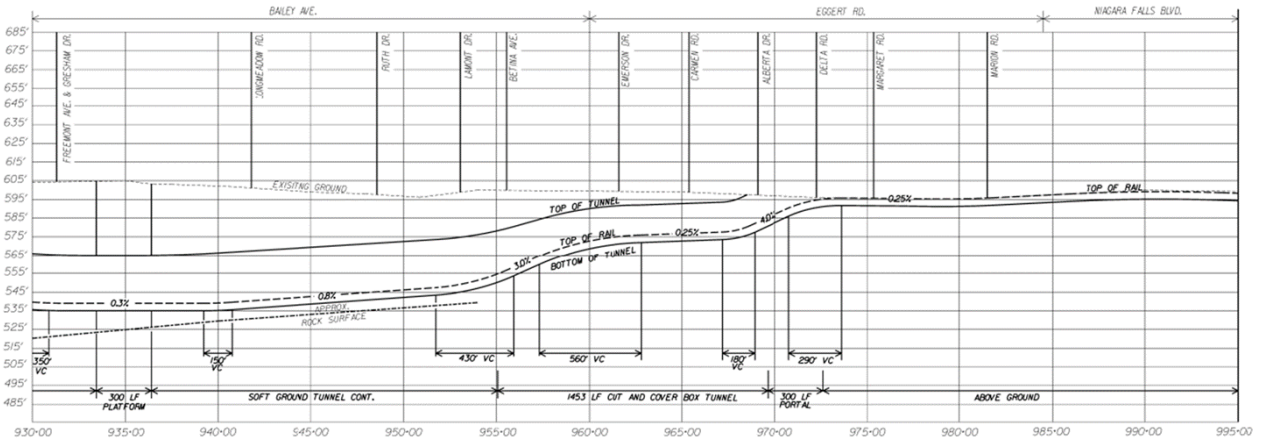


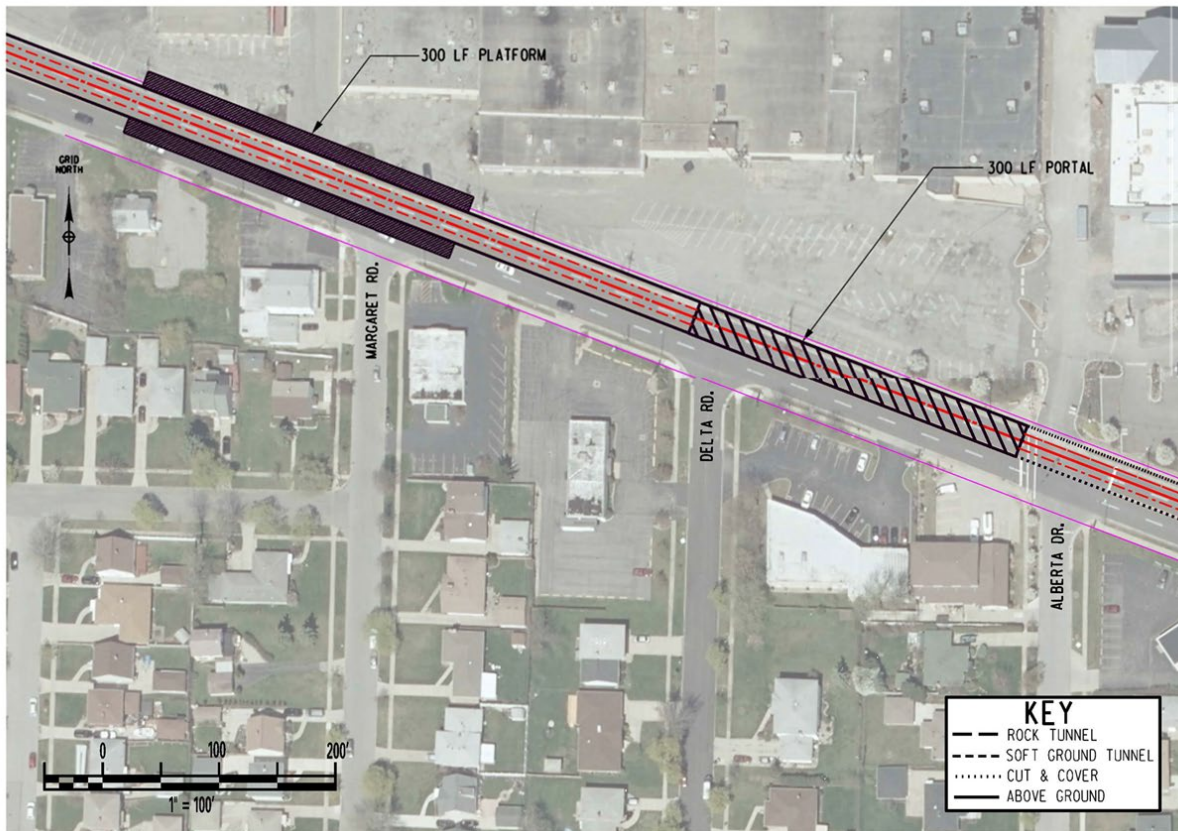


Figure 9: Eggert Road Geotechnical Profile



The portal would be located between Alberta Drive and Delta Drive, with a proposed at-grade station at Margaret Road, as depicted in Figure 10.

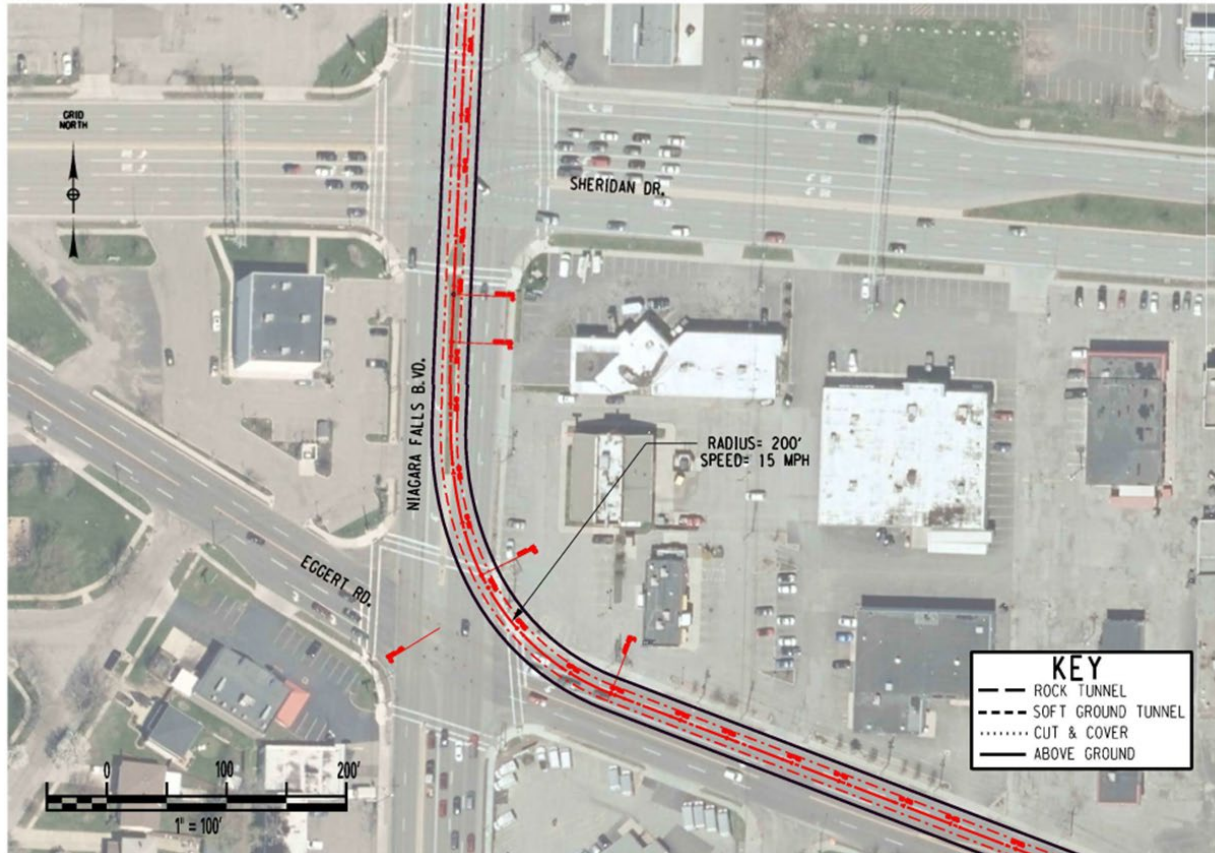
Figure 10: Eggert Road Portal and At-Grade Station



As the alignment transitions from Eggert Road to Niagara Falls Boulevard at-grade, there are physical constraints on the northeast corner, as well as an increase in travel lanes on Niagara Falls

Boulevard. The corridor north of Eggert Road changes in both land use types and vehicular volumes. In order to minimize property impacts, the at-grade alignment would need to operate on a 15-mph curve as shown in Figure 11, which is not very conducive for light rail operations. This tight curve would impact travel times and increase the cost for operations and maintenance, as well as introduces wheel squeal concerns. Current NFTA design criteria prohibits curves on mainline revenue track with design speeds less than 40 mph. Under this design scenario, a design exception would be required.

Figure 11: Eggert Road / Niagara Falls Boulevard Curve



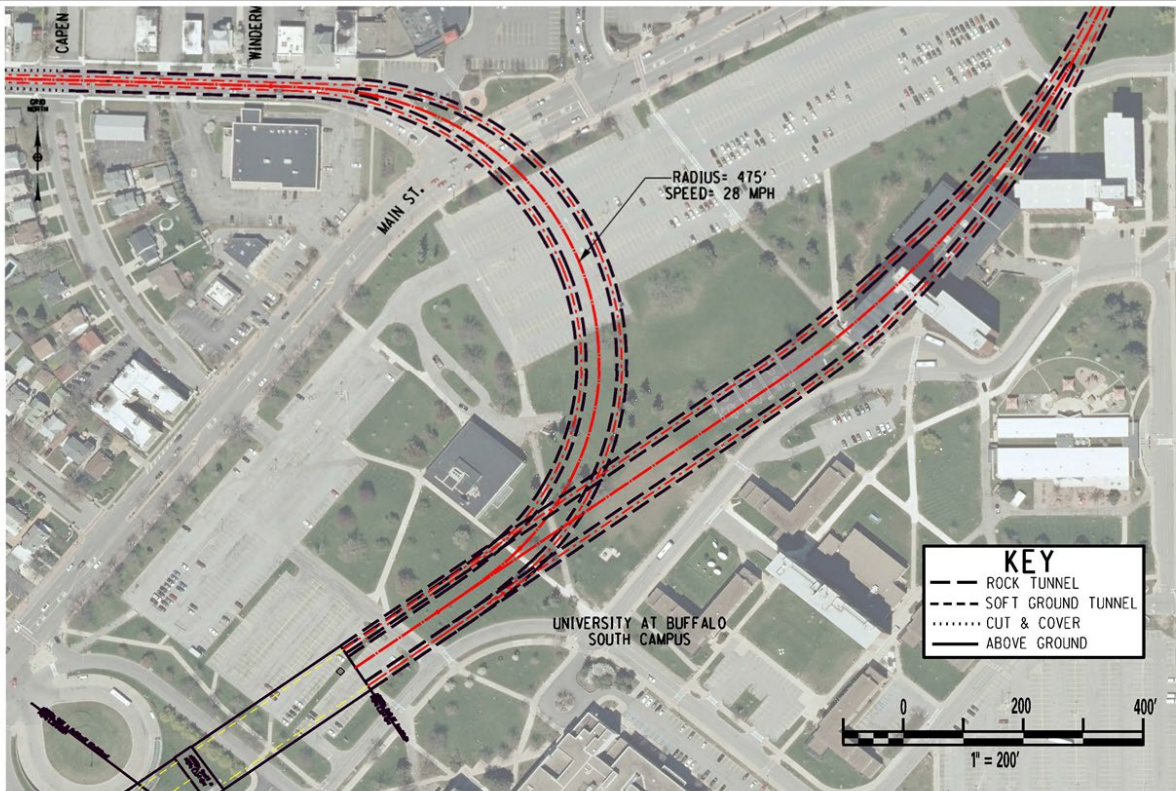
Once the alignment enters the median of Niagara Falls Boulevard north of Eggert, the alignment would be located along Maple Road, Sweet Home Road, through the University at Buffalo North Campus, and along Audubon Parkway to the end of line at I-990.

### 3.2 KENMORE AVENUE ALIGNMENT OPTION

Based on stakeholder input, analysis of an alignment option that exits the University Station and enters Niagara Falls Boulevard earlier than Eggert Road was requested to be investigated. As with the Bailey Avenue alignment option transitioning from Eggert Road to Niagara Falls Boulevard, the curve exiting the University Station would require a design exception since the curve would need to be a 28-mph curve in order to traverse under Kenmore Avenue; as shown in Figure 12. However, the benefit to a tighter curve at this location, compared to the curve from Eggert Road to Niagara Falls

Boulevard, would be the proximity to a station. As the vehicle travels southbound towards the University Station, the vehicle would normally have to decelerate as it nears the station to stop at the station. Therefore, the vehicle would begin decelerating earlier to enter the curve and continue to decelerate as it continues through the curve and enters the station. For the northbound route, as a vehicle exits a station it needs to accelerate to achieve normal operating speeds. Under this situation, the vehicle will accelerate at a lower rate to traverse through the curve.

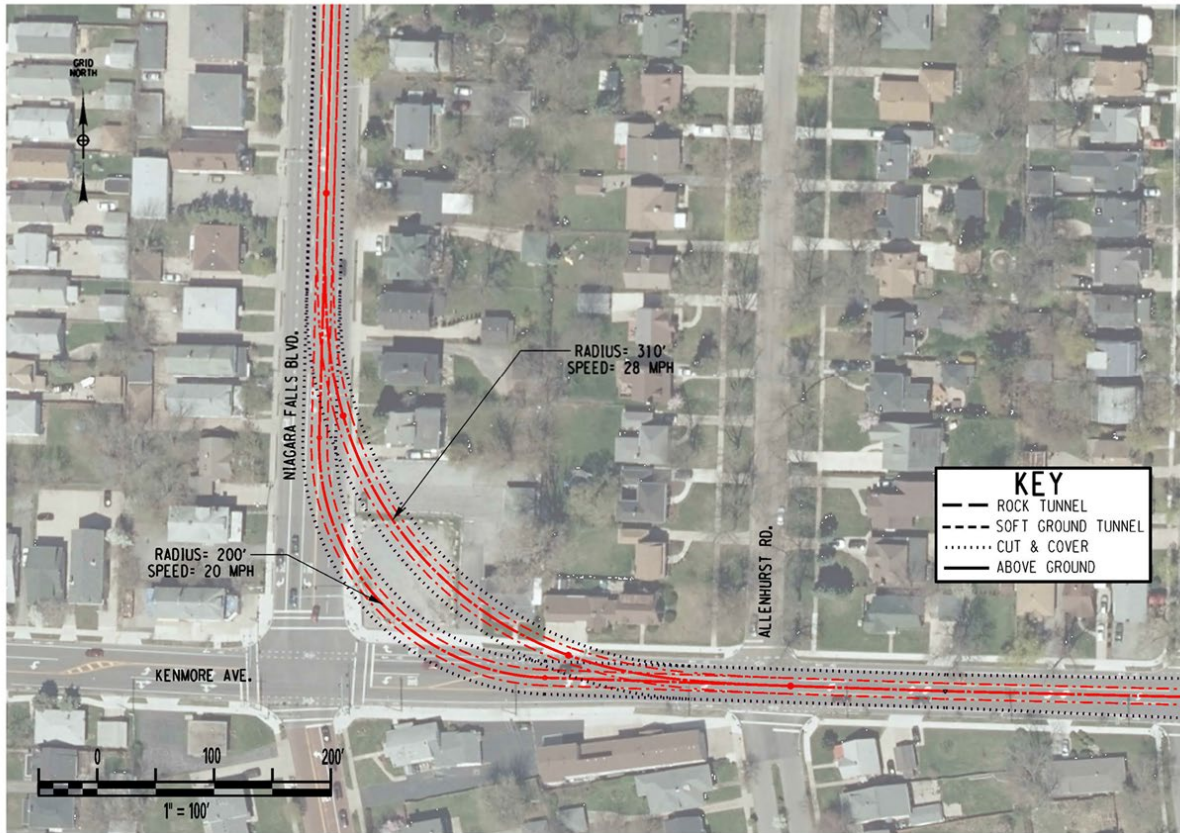
**Figure 12: University Station / Kenmore Avenue Curve**



Since this alignment traverses for approximately 3,400 linear feet underground, the construction method would be a combination of traditional underground rock excavation (blasting) and shallow cut and cover construction. Due to a shorter length of rock tunneling required (the location of the rock line is between Capen Boulevard and Allenhurst Road) and the need to merge the two tunnels into a single tunnel at the transition to cut and cover, a boring construction method would not be applicable and traditional mining methods would be more cost efficient. Once past Allenhurst Road, traditional cut and cover construction would occur along both Kenmore Avenue and Niagara Falls Boulevard.

As the alignment traverses onto Niagara Falls Boulevard, via cut and cover, the preferred curve would again be a 28-mph design curve. This curve would impact two to three properties, as shown in Figure 13. Two of the properties on the northeast corner could be acquired by the Town of Amherst to provide access for temporary construction, and then providing community space or development opportunities once construction is complete.

Figure 13: Kenmore Avenue / Niagara Falls Boulevard Curve



The location of the portal on Niagara Falls Boulevard would be just north of Kenilworth Avenue and Princeton Avenue, as shown in Figure 14. The reason for this location is that there is an emergency response station on Kenilworth Avenue and it is highly preferable for that intersection to operate as a full access intersection.

Figure 15 depicts the profile of the alignment, the location of the rock line, and portal location. From this point north, the alignment would operate in the median of Niagara Falls Boulevard. Under this scenario, it is assumed that one travel lane in each direction along Niagara Falls Boulevard could be eliminated in order to account for median running light rail, as shown in Figure 16 and Figure 17. Further traffic analysis will be conducted as part of the environmental documentation process to determine impacts and mitigation measures as well as assist with further design work.

Figure 14: Niagara Falls Boulevard Portal Location

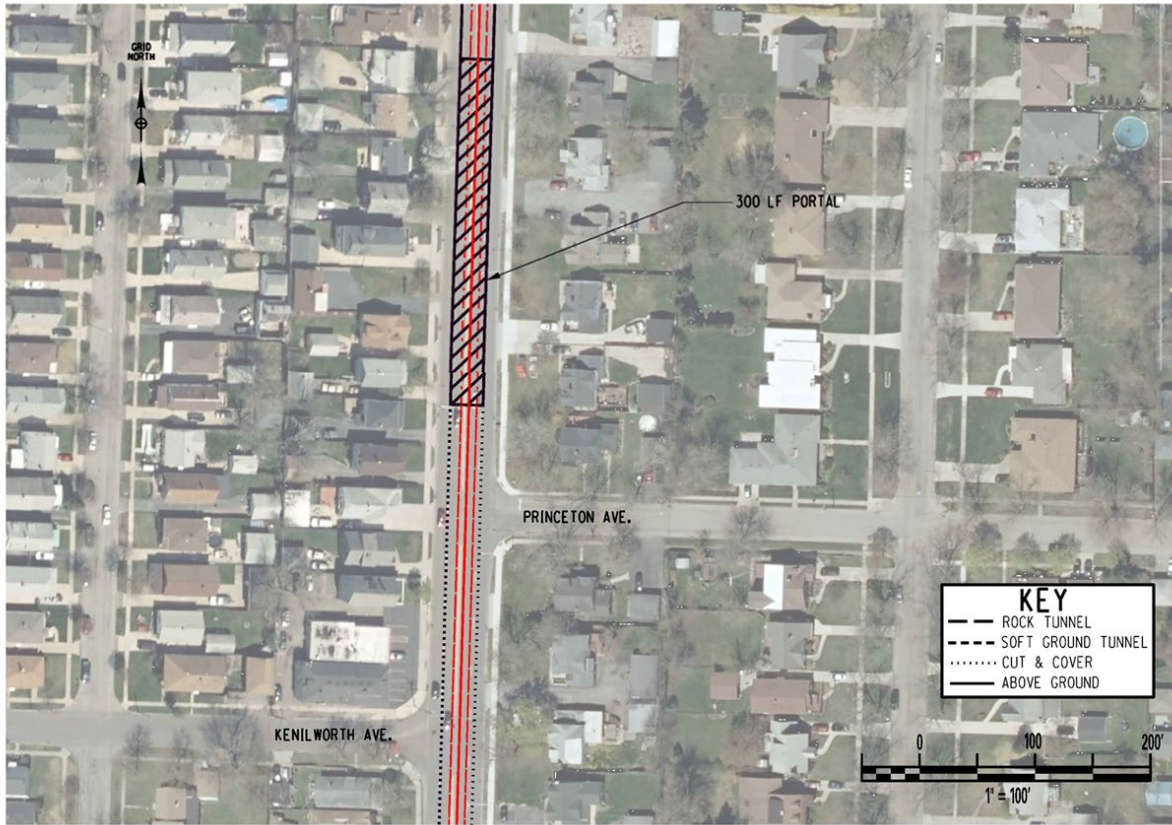
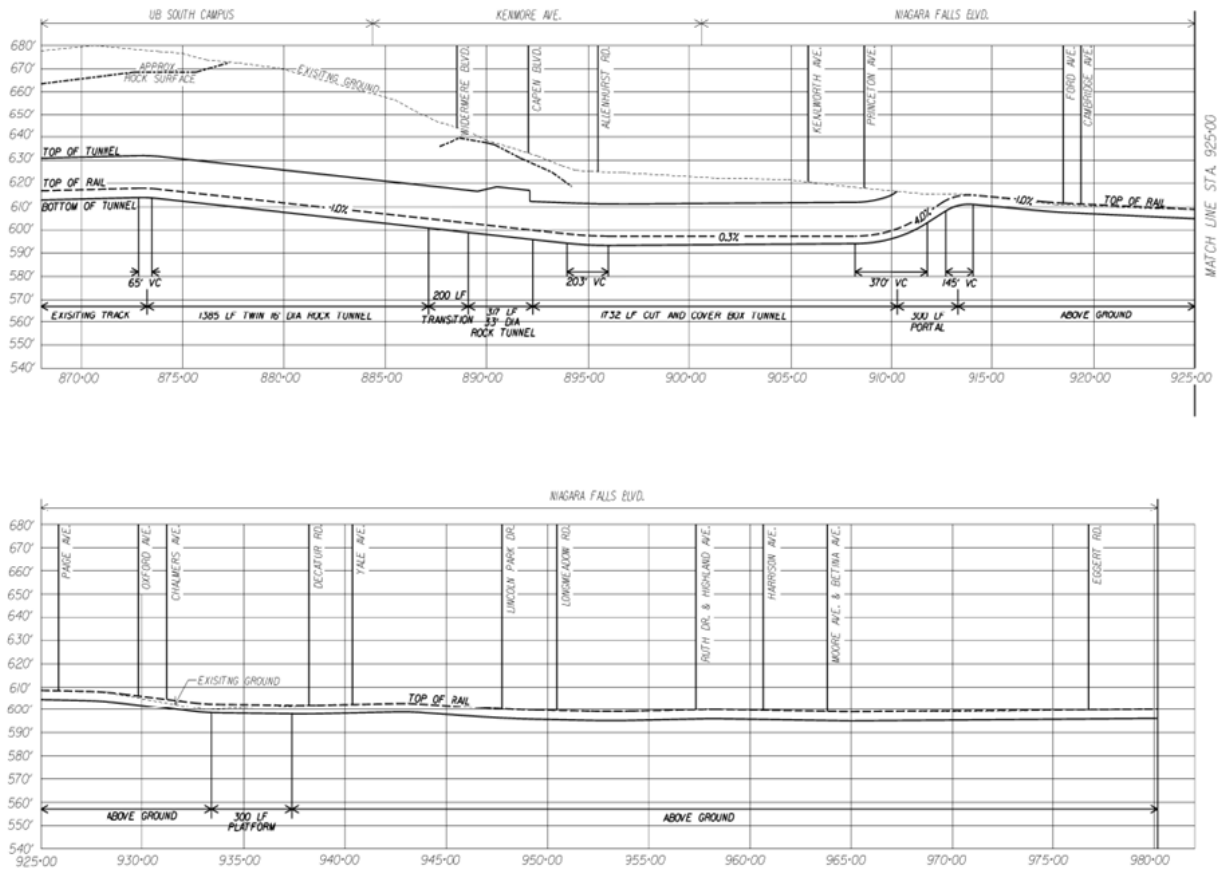


Figure 15: Niagara Falls Boulevard Profile



# 4. Evaluation Results

## 4.1 RESULTS FROM ALIGNMENT EVALUATION

The evaluation discussed in Section 2 above concluded that the Kenmore Avenue to Niagara Falls Boulevard option has more benefits with fewer impacts than the originally identified LPA. Many of the evaluation criteria categories resulted in similar grades between the two alignment options. Results per category are as follows:

### Order of Magnitude Costs

The 2015 AA LPA was estimated to cost \$1.206 billion (in 2014 dollars).

**Bailey Avenue Alignment Option:** this alignment would contain approximately 10,000 linear feet of underground tunneling, require one underground station, and potentially impact up to four parcels (underground station, location of portal on Eggert Road, and the need for constructing the alignment curve at the intersection of Bailey Avenue and Eggert Road)

**Kenmore Avenue Alignment Option:** this alignment would contain approximately 4,000 linear feet of underground tunneling, and potentially impact up to three parcels (the need for constructing the alignment curve at the intersection of Kenmore Avenue and Niagara Falls Boulevard). The construction cost utilizing this option is estimated to be about \$200 million less (2014 dollars), primarily due to the reduced tunneling and the replacement of the underground station with a surface station.

### Overall Constructability

**Bailey Avenue Alignment Option:** this alignment would require the use of a boring machine due to the length of the tunnel in soft ground beneath the roadway. This would most likely require national contractors due to the need for specialized equipment. Tunnel construction and the underground station would also lengthen the construction duration.

**Kenmore Avenue Alignment Option:** since this alignment would contain much less of an underground segment, traditional construction methods would be utilized, thus reducing the length of construction and increasing the opportunities for local contractors. There would be an increase in potential utility relocations since cut/cover construction would be utilized for a majority of the alignment, thus impacting utilities since they are normally no deeper than six feet below ground level.

### Travel Time

**Bailey Avenue Alignment Option:** Operating within a tunnel segment would provide the LRT vehicle to operate at maximum speed of 50mph, and 40mph through the Bailey Avenue/Eggert Road curve; however, the operating speed through the Eggert Road/Niagara Falls Boulevard curve would be

limited to 28mph or less in order to reduce ROW impacts. The alignment is also longer in length. Travel times from I-990 to University Station would be just over 22 minutes.

Kenmore Avenue Alignment Option: Due to the tight curves required for exiting University Station through Kenmore Avenue and onto Niagara Falls Boulevard, LRT would have to operate at 28mph, but once at-grade along Niagara Falls Boulevard could operate at 40mph. Due to the alignment being shorter, the travel time from I-990 to University Station would be just over 21 minutes.

### Community / Economic Development

Bailey Avenue Alignment Option: The current zoning along this alignment provides approximately 13M sq. ft. of transit supportive uses. During the GBNRTC TOD Study, the Towns of Amherst and Tonawanda were concerned about possible supported for TOD development along Bailey Avenue due to the existing development patterns.

Kenmore Avenue Alignment Option: The current zoning along this alignment provides approximately 15M sq. ft. of transit supportive uses. During the GBNRTC TOD Study, the Towns of Amherst and Tonawanda support the need for TOD development, updating zoning ordinances, and expanding TOD opportunities along the entire length of Niagara Falls Boulevard. Since the completion of the TOD study, both Towns are engaging in reviewing and updating zoning to enhance TOD opportunities within the corridor.

### Municipal Support

Bailey Avenue Alignment Option: The alignment has received limited support since the Alternatives Analysis was completed.

Kenmore Avenue Alignment Option: The alignment has received strong support and is the preferred alignment to move forward with through the environmental documentation process.

### Ridership

Bailey Avenue Alignment Option: The FTA ridership model is currently being updated to incorporate recent NFTA and UB ridership to utilize a more recent update to the STOPS model. Within the GBNRTC Metropolitan Transportation Plan, there are approximately 33,800 people residing within ½ mile of the alignment in 2015 with very minimal growth projected by 2040.

Kenmore Avenue Alignment Option: Within the GBNRTC Metropolitan Transportation Plan, there are approximately 33,700 people residing within ½ mile of the alignment in 2015 with a slight increase to 34,000 projected by 2040.

### Accessibility

Bailey Avenue Alignment Option: Since a majority of this alignment would be underground, the small segment that would operate along Eggert Road could potentially impact approximately 27 driveways. With the alignment operating within the median of Eggert Road, those driveways would not be closed, but drivers would need to conduct a U-turn at a signalized intersection for access. There are approximately 1,815 zero car households within a ¼ mile of the alignment.



Kenmore Avenue Alignment Option: Since this alignment operates at-grade along Niagara Falls Boulevard, there could be potential impacts to approximately 205 driveways. With the alignment operating within the median of Niagara Falls Boulevard, those driveways would not be closed, but drivers would need to conduct a U-turn at a signalized intersection for access. There are approximately 1,920 zero car households within a ¼ mile of the alignment.

### Traffic

Bailey Avenue Alignment Option: In sections where the LRT would operate underground along Bailey Avenue, there would be no post construction impact to existing travel patterns, level of service (LOS) along Bailey Avenue, nor intersection operations other than providing pedestrian access to the underground station. In sections where the LRT would operate within the median of Eggert Road, there could be potential reduction of LOS at intersections along Eggert Road, left turn movements would need to be protected movements at signalized intersections, with signal phasing adjusted to account for longer left turn movements. Prohibiting left turn movements along a corridor would require drivers to travel further, go around the block, or wait at signalized intersections to make a U-turn.

Kenmore Avenue Alignment Option: With the alignment along Kenmore Avenue operating underground, there would be no post construction impact to existing travel patterns, LOS along Kenmore Avenue, or intersection operations. As the alignment enters the median of Niagara Falls Boulevard near Kenilworth Avenue, there could be potential reduction of LOS at intersections along Niagara Falls Boulevard, and left turn movements would need to be protected movements at signalized intersections, with signal phasing adjusted to account for longer left turn movements. Prohibiting left turn movements along a corridor would require drivers to travel further, go around the block, or wait at signalized intersections to make a U-turn.

### Environmental

Bailey Avenue Alignment Option: There were no critical environmental areas, habitat areas, or surface/ ground water features found along this alignment.

Kenmore Avenue Alignment Option: There were no critical environmental areas, habitat areas, or surface/ ground water features found along this alignment.

### Safety

Bailey Avenue Alignment Option: Some passengers accessing the underground station would be required to cross both travel lanes on Bailey since the entrance would be located on the western side of the street with a below grade mezzanine level. With an underground operation, there would be no conflicts with the general vehicles along Bailey Avenue. The station on Eggert Road would be at-grade and most likely within the median. Passengers would have to cross one direction of traffic to access the median station. Since the alignment operates at-grade for a portion of Eggert Road, the median operation would limit the conflict points with general vehicles to specific signalized intersections, which would contain gates, signals, and pre-emption to eliminate conflicts.

Kenmore Avenue Alignment Option: With an underground operation along Kenmore Avenue, there would be no conflicts with the general vehicles. The station on Niagara Falls Boulevard would be at-

grade and most likely within the median. Passengers would have to cross one direction of traffic to access the median station. Since the alignment operates at-grade for a major portion of Niagara Falls Boulevard, the median operation would limit the conflict points with general vehicles to specific signalized intersections, which would contain gates, signals, and pre-emption to eliminate conflicts.

### Connectivity

Bailey Avenue Alignment Option: Connections to existing NFTA fixed bus routes would continue, and bicycle and pedestrian connections would be enhanced to access stations.

Kenmore Avenue Alignment Option: Connections to existing NFTA fixed bus routes would continue, and bicycle and pedestrian connections would be enhanced to access stations.

## **4.2 ALIGNMENT CONFIGURATION ASSESSMENT**

A key element of where and how the alignment would operate and establish high-quality transit is the location within the roadway right-of-way (ROW). An important aspect of LRT operations is to provide exclusive guideway (i.e. not sharing lanes with other traffic) for rail. This goal may be achieved by:

- Widening the roadway cross-section to accommodate a transit guideway in addition to the existing travel lanes;
- Removing existing travel lanes to provide exclusive space for transit; or
- Utilizing existing right-of-way alongside the proposed corridor to provide an exclusive transit guideway.

To understand the most appropriate way to fit light rail in the Niagara Falls Boulevard, Maple Road, and Sweet Home Road corridors, an alignment assessment was conducted to determine the impacts of the potential alignment configurations.

### **4.2.1 Alignment Configuration Options**

Light rail can achieve short travel time and reliable service when it operates in an exclusive or semi-exclusive guideway separated from vehicular traffic. The semi-exclusive guideway can be incorporated in a number of different configurations as shown in Figure 16 and described as follows:

#### **Center-Running**

- A center-running configuration is a semi-exclusive guideway located in the median of a roadway.
- Center-running guideway is separated from potential driveway conflicts.
- Left-turns across the center transit lanes are either restricted or accommodated at signalized intersections with separate phases to prevent conflicts with light rail vehicles.
- Stations with center-running guideway are easily accessed by pedestrians on both sides of the roadway using crosswalks.

- Examples of this configuration are in Charlotte, NC: Charlotte Area Transit System (CATS) LYNX Blue Line; Minneapolis, MN: METRO Green Line; Salt Lake City, UT: TRAX Red Line.

### **Parallel**

- A parallel configuration is exclusive guideway fully separated but adjacent to the roadway.
- Stations in parallel guideway are easier to access from one side of the roadway than the other.
- Right-turning general vehicular traffic into driveways have potential conflicts with light rail vehicles running in exclusive guideway.
- Accommodations for bicycles should be designed to prevent conflicts with light rail vehicles.
- Example of this configuration is the TRAX Red Line in Salt Lake City, UT.

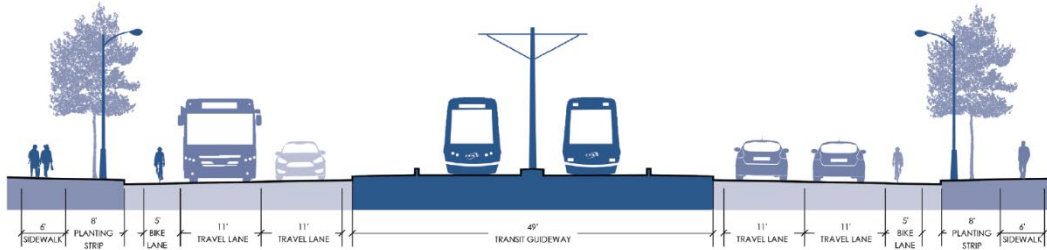
### **Independent**

- An independent corridor is an exclusive guideway that is apart from a roadway and/or incorporated into a development.
- Accommodations for pedestrian and bicycle can be achieved with an adjacent multi-use path.

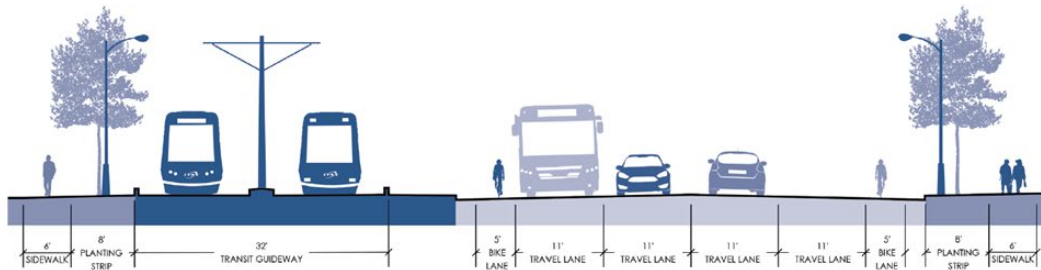
There are some examples of side-running (also referred to as curbside) configuration, which is an exclusive guideway located adjacent to both outside travel lanes. This configuration is typically seen in downtown environments, such as in Denver, CO with the RTD Routes D, F, H and L; Metro Rapid in Austin, TX; and TriMet in Portland, OR. Given the character and number of driveways on Niagara Falls Boulevard and Maple Road, side-running configuration was deemed inconsistent and removed from further consideration. Further traffic analysis will be conducted as part of the environmental documentation process to determine impacts and mitigation measures as well as assist with further design work.

Figure 16: Cross-Section Configurations

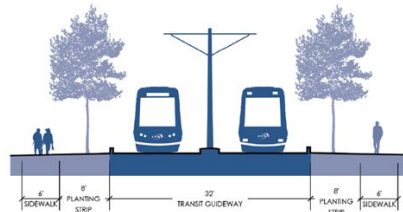
### Center-Running



### Parallel



### Independent



#### 4.2.2 Configuration Assessment

Consideration was given to the light rail configuration options to quantify the impacts and determine the most appropriate way for light rail to “fit” into the Niagara Falls Boulevard, Maple Road, and Sweet Home Road corridors.

**Table 3: Configuration Assessment**

Pros	Center-Running	Parallel	Independent
	<ul style="list-style-type: none"> <li>• Separated from potential driveway conflicts in the subarea with the most driveways.</li> <li>• Stations with center-running guideway are easily accessed by pedestrians on both sides of the roadway through enhanced pedestrian crosswalks.</li> <li>• Encourages TOD development on both sides of the corridors.</li> </ul>	<ul style="list-style-type: none"> <li>• Separated from potential driveway conflicts on one side of the roadway.</li> </ul>	<ul style="list-style-type: none"> <li>• Opportunities for enhanced development within large parcels (such as Boulevard Mall).</li> <li>• Separated from vehicular traffic; stations can be located in pedestrian and bicycle friendly environments.</li> <li>• Dependent on project timeline and property buyers, could potentially have opportunity for incorporating LRT into development.</li> </ul>
Cons	<ul style="list-style-type: none"> <li>• Addition of left-turns restrictions are needed to prevent conflicts resulting in modified access to residence and businesses along the corridors.</li> </ul>	<ul style="list-style-type: none"> <li>• Modified driveway access is needed to prevent potential right-turn conflicts.</li> <li>• Addition of left-turn restrictions are needed to prevent conflicts resulting in modified access to businesses.</li> <li>• Focuses TOD development on only one side of corridors.</li> <li>• The roadway creates a potential barrier to pedestrians walking to the stations from the opposite side.</li> <li>• Potential for property and building impacts due to the setback requirements for parallel operations.</li> </ul>	<ul style="list-style-type: none"> <li>• Need for purchasing property to construct independent alignment.</li> <li>• Cost for project could increase due to need to purchase property.</li> </ul>

There will be fewer impacts to the adjacent parcels if the cross-section does not require to be widened to accommodate light rail. For the Metro Rail Expansion, a decision was made to eliminate both the parallel and independent options and operate within the median of Niagara Falls Boulevard, Maple Road, and Sweet Home Road. This configuration provides the least amount of direct impacts to parcels and driveways, provides equal access to stations from either side of the roadways, and maximizes the TOD development potential along the corridor.

### 4.3 RECOMMENDATION

As a result of the evaluation, the alignment utilizing Kenmore Avenue and Niagara Falls Boulevard was recommended as the Locally Preferred Alignment. This was due to the following factors:

- Cost savings of reducing the length of the underground tunnel portion by approximately 2/3 of the length
- Creating a greater opportunity for local contractors
- Meeting desired travel times along the entire LRT line
- Maximizing mobility and TOD opportunities for both the Town of Tonawanda and Town of Amherst
- Minimizing potential private property impacts due to ROW needs

This option of the LPA would meet the goals and objectives of the project. Figure 17 and Figure 18 depict how LRT could be implemented along Niagara Falls Boulevard in the median while conforming LRT operations into the existing ROW.

Figure 17: Niagara Falls Boulevard Cross-Section

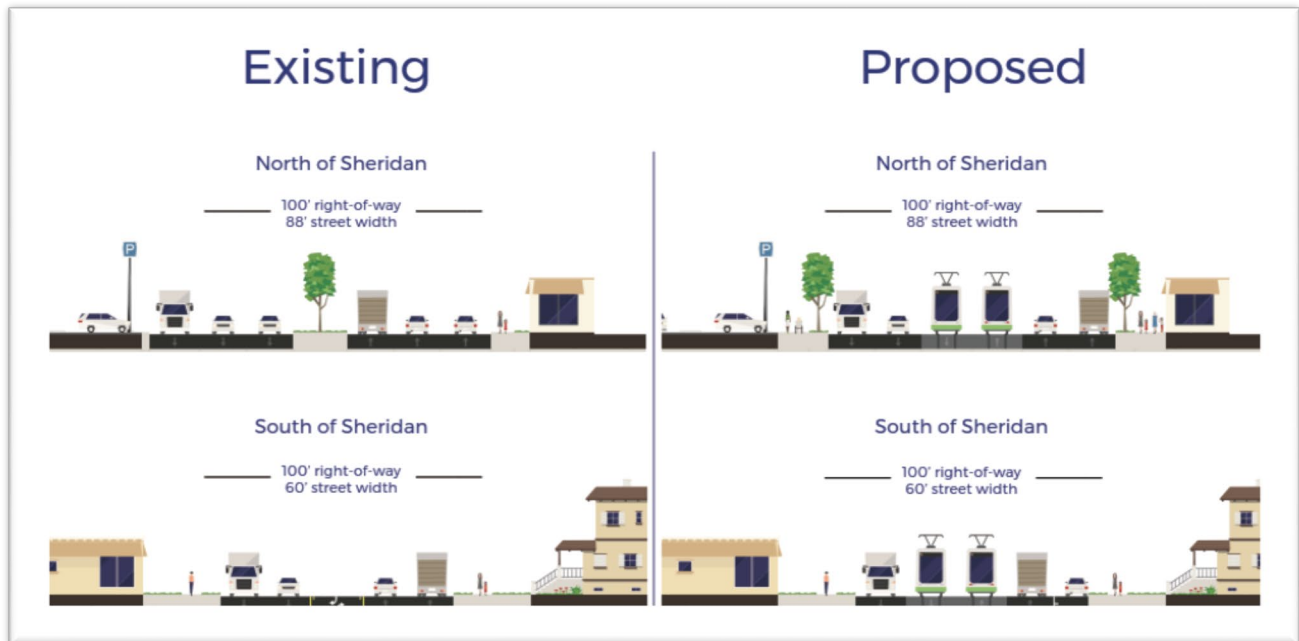


Figure 18: Niagara Falls Boulevard Rendering



## ATTACHMENT A



# Metro Rail Expansion Project

## LPA Alignment Evaluation Criteria/ Metrics

Evaluating LPA alignment from University Station to the intersection of Niagara Falls Boulevard and Eggert Road

Key/ Legend

	Alignment option fully conforms to criteria/ metric
	Alignment option mostly conforms to criteria/ metric
	Alignment option partially conforms to criteria/ metric
	Alignment option minimally conforms to criteria/ metric
	Alignment option does not conform to criteria/ metric

Category	Evaluation Criteria	Evaluation Metrics	Alignment Option	
			*Bailey Ave* (LPA)	*Niagara Falls Blvd*
Order of Magnitude Cost	Difference in tunneling length	Minimize the cost of tunneling (based on linear feet of tunneling)		
	Number of underground Stations	Minimize cost of stations (based on number of at-grade and underground stations)		
		Purchase of ROW	Minimize cost of ROW needed for purchase to accommodate Metro Rail running outside of ROW (based on acres of ROW purchase)	
	Minimize cost for easements to accommodate Metro Rail running outside of ROW (based on acres of ROW easement)			
	Minimize cost of ROW needed for easement to accommodate Metro Rail running inside ROW to account for station areas and/or intersection widenings (based on acres of ROW easement)			
	O&M costs	Minimize cost of Operations & Maintenance		
Overall Constructability	Availability of contractors	Availability of local contractors that can perform work		
	Schedule/ length of construction	Minimize construction schedule		
	Impacts to traffic and business operations	Minimize temporary street and/or driveway closures		
		Minimize utility reconstruction/ relocation		
	ROW Impacts	Amount of private property impacted (either by purchase or easement) to accommodate project		
Travel Time	Length of time Metro Rail travels between UB North (either Ellicott Complex station or Lee Road station) and University Station	Minimize travel time (in minutes)		
Community/ Economic Development	Transit-supportive elements in place or can be put in place (zoning, policy, community support, plans, etc.)	Maximize existing transit-supportive zoning		
	Opportunity for Transit-Oriented Development	Opportunity for TOD zoning to be approved		
Municipal Coordination	Local and regional stakeholder preference/ acceptance	Preferred alignment option of Town of Amherst (based on input from town officials or passage of a resolution or MOU)		
		Preferred alignment option of Town of Tonawanda (based on input from town officials or passage of a solution or MOU)		
		Preferred alignment option of other regional, municipal, or other stakeholder entities (based on input from officials or identified in plans)		
Ridership	Maximizes ridership	Maximizes ridership		
Accessibility	Impacts to adjacent property access	Minimize number of driveways closed		
	Accessibility by transit supportive populations	Minimize number of driveways experiencing reduced accessibility (in ability to make a LT) Number of transit dependent population within 1/8 mile radius of station areas		
Traffic	Change to Existing Travel Patterns	Minimize in travel distance or durations for local trips		
	Impact to AM/PM Peak Period Volumes	Minimize increases to peak period daily volumes year compared to no-build project based on traffic model		
	Impacts to Level of Service	Minimize reductions in LOS of project in build year compared to future year no-build project based on traffic model		
	Impacts to intersection LOS	Minimize reductions of intersection LOS of project in build year compared to no-build		
Environmental	Minimizes impact on natural and human environments	Minimize acres of environmentally sensitive areas impacted by project		
	Ability to reduce auto-dependency	Reduces vehicle miles travelled, based on regional traffic model		
Safety	Noise sensitive land uses within proximity to alignment	Minimize impact to noise or vibration-sensitive land uses		
	Passenger access to stations	Minimize distance to station platform from nearest sidewalk		
	LRT/ vehicular traffic intermixing	Minimize the conflicts of LRT intermixing with general vehicles		
Connectivity	Connections with Metro Bus	Improve connectivity to Metro Bus routes		
	Multi-modal opportunities	Improve Metro Bus routes transfers		
		Improve walkability within 1/8 mile of proposed stations		
		Improve bicycle lanes within 1/8 mile of proposed stations		
Increase pedestrian and bicycle connectivity	Improve pedestrian and bicycle usage- ability to provide connectivity with multimodal			