

Gratiot Avenue Transit Study

Tier 2 Evaluation Summary Report

5/31/2016

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1 Executive Summary

The Gratiot Avenue Corridor Study represents a crucial early step in the development of enhanced transit along Gratiot Avenue. This 12-month study is being led by the Regional Transit Authority of Southeast Michigan (RTA); it includes the development and evaluation of multiple rapid transit alternatives between Downtown Detroit and M-59 (Hall Road). The study area spans the 23-mile Gratiot Avenue corridor that serves portions of Wayne and Macomb counties. The corridor communities along Gratiot Avenue include five cities and townships in Wayne and Macomb Counties:

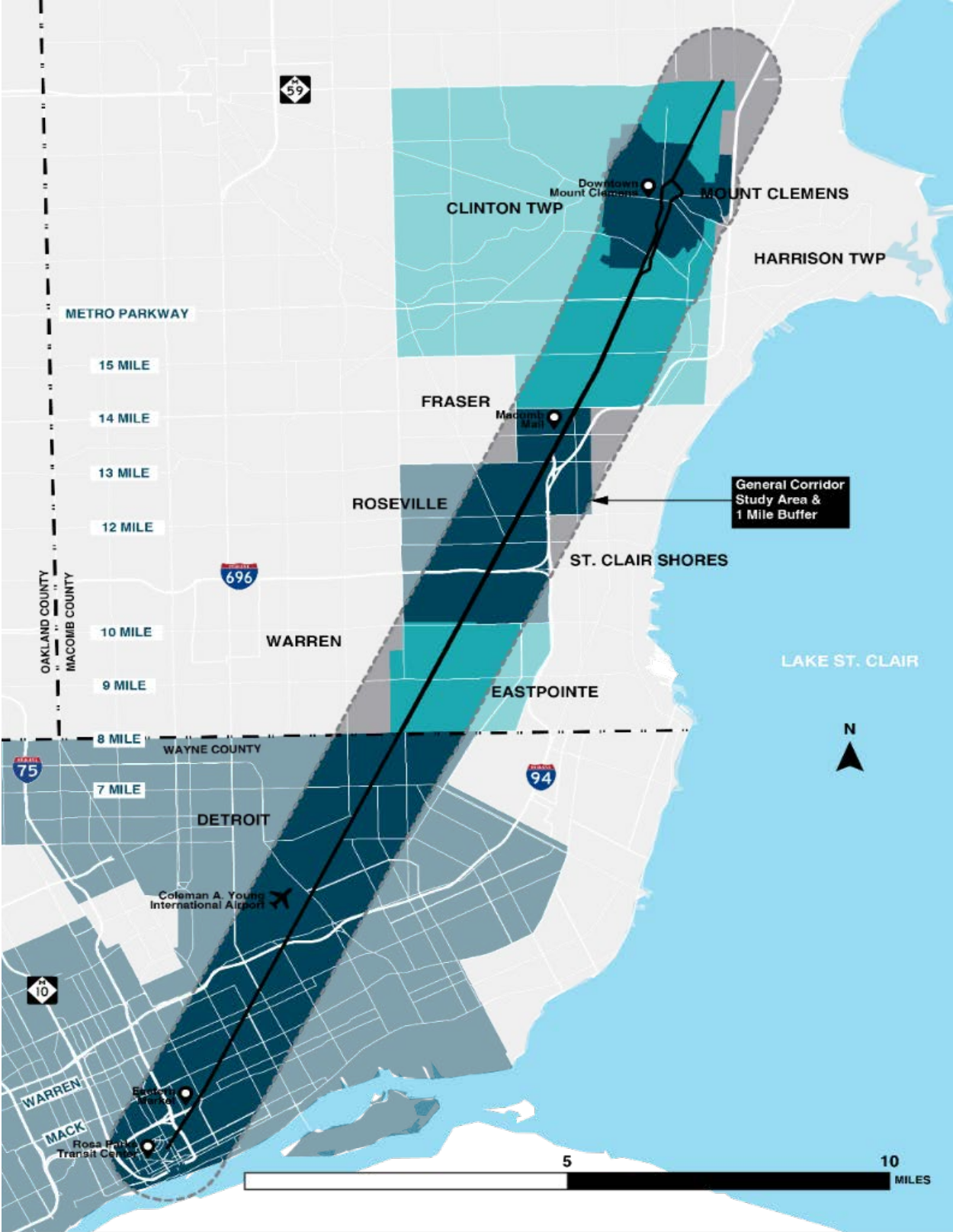
- Clinton Township
- Detroit
- Eastpointe
- Mount Clemens
- Roseville

The study area includes a two-mile wide buffer centered on Gratiot Avenue, as represented in Figure 1-1.

This report summarizes the results of the Tier 2 evaluation, which reviewed different types of transit runningways as well as two different route alignments in the city of Mount Clemens. The report is broken into six different evaluation criteria and there are six supporting technical memorandums further detailing the results in this report. The following six technical memoranda (tech memos) were developed for the Tier 2 Evaluation and summarized for this report, these can be found at the RTA website <http://www.rtamichigan.org/best-projects/gratiot-avenue/> under the Documents section:

1. Tech Memo #1: Transportation
2. Tech Memo #2: Operations and Maintenance Costs
3. Tech Memo #3: Capital Costs
4. Tech Memo #4: Ridership
5. Tech Memo #5: Environmental Analysis
6. Tech Memo #6: Station Area Evaluation

FIGURE 1-1: STUDY AREA



Station locations were evaluated based on population, employment, equity, connectivity to transit, connectivity to the transportation network, development potential, and ridership. Those station locations that had a higher score and/or were generally one-mile apart are recommended to be included in the Locally Preferred Alternative (LPA). These stations include:

1. Hall Rd/M-59
2. Downtown Mt. Clemens
3. South River
4. Metro Parkway
5. 15 Mile Road
6. Macomb Mall
7. 12 Mile Road
8. Utica Road
9. 10 Mile Road
10. 9 Mile Road
11. 8 Mile Road
12. 7 Mile Road
13. McNichols Road
14. Outer Drive
15. McClellan Avenue
16. Warren Road
17. Mack Avenue
18. Eastern Market
19. Bricktown

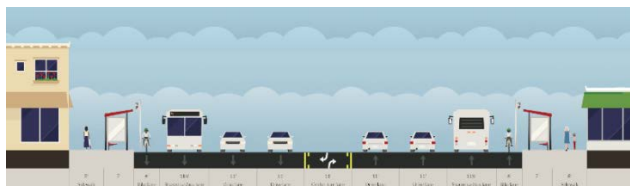
Stations within downtown Detroit have yet to be determined.

Four different transit runningways were evaluated within this Tier 2 report, these include:

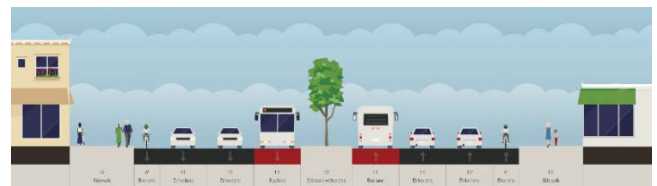
- Mixed Traffic Curb Running
- Dedicated Lane Curb Running
- Dedicated Lane Median Running
- Dedicated Lane Center Running

Figure 1-2 illustrates these different runningway types. The transportation evaluation includes reviewing impacts to vehicular travel times, parking, bicycle and pedestrian impacts, safety, and transit travel times.

FIGURE 1-2: TRANSIT RUNNINGWAY TYPES



Mixed Traffic Curb Running



Dedicated Lane Median Running



Dedicated Lane Curb Running



Dedicated Lane Center Running

In addition to these different runningway types, there were two different route alignments within the city of Mount Clemens. One alignment would stay along Gratiot Avenue and go around downtown Mount Clemens. The other alignment would go into downtown Mount Clemens along Main Street.

Table 1-1 summarizes the different vehicular and transit travel times from M-59/Hall Road to downtown Detroit for the various runningway options. These times are averages of northbound and southbound for both the morning and evening peak hours. It was found that the travel times between the two alignments in Mount Clemens did not differ substantially.

TABLE 1-1: VEHICULAR AND TRANSIT TRAVEL TIMES

Runningway	Vehicular Travel Time	BRT Travel Time
Mixed Traffic Curb Running	51 – 55 min	60 – 77 min
Dedicated Lane Curb Running	53 – 66 min / 52 – 57 min*	55 – 61 min
Dedicated Lane Median / Center Running		52 – 56 min

*Without Traffic Diversion / with Traffic Diversion

There would be fewer safety impacts to vehicles, bicycles and pedestrians with the BRT running either in the median running or center running compared to curb running. The environmental analysis found that there would be little to no impact to the natural, cultural or historic resources along the corridor with any of the alternatives. An evaluation of the population characteristics indicates that there are Environmental Justice populations of minority and low income living along the corridor and does not change with any of the runningways or alignments. Capital, operating and maintenance costs were also evaluated for the different types of transit runningways and alignments. Table 1-2 summarizes these costs.

TABLE 1-2: CAPITAL AND O&M COSTS

Runningway	Capital Cost	Operating and Maintenance Costs
Mixed Traffic Curb Running	\$190M - \$193M	\$17,952,940
Dedicated Lane Curb Running	\$237M - \$240M	\$17,947,612
Dedicated Lane Median Running	\$254M - \$257M	\$17,982,805
Dedicated Lane Center Running	\$282M - \$284M	\$17,484,014

Transit ridership was also evaluated as part of the analysis. Three different metrics were reviewed, ridership for the entire system, ridership for all routes along Gratiot Avenue (DDOT, SMART, and BRT), and ridership for the BRT. Table 1-3 summarizes the ridership by runningway type. It was found that ridership between the two alignments in Mount Clemens did not differ substantially. Ridership was also evaluated for service to 23 Mile Road and it was found that there wasn't a substantial increase in ridership to justify additional capital and operating/maintenance cost.

TABLE 1-3: RIDERSHIP

Runningway	System Ridership	Total Gratiot Ridership	BRT Ridership
Mixed Traffic	241,160	16,615	12,270
Dedicated Lane (curb, median or center)	243,305	17,930	13,475

Given the evaluation results and the input from the public and committees, it is recommended that a ***Dedicated Lane Median Lane*** runningway be moved forward for further evaluation. ***Both downtown Mount Clemens options*** are also recommended to be moved forward for further evaluation. We will also continue to evaluate options for serving Downtown Detroit.

2 Introduction

2.1 Overview of the Project Evaluation Process

The Gratiot Avenue study is following a three-step method to develop and identify the Locally Preferred Alternative:

- The first step (“Tier 1: Pass/Fail Analysis”) entailed the assessment of each mode and alignment relative to overall implementation viability.
- The second step (“Tier 2: Detailed Evaluation”) is assessing the mode/alignment pairing that passed the Tier 1 Analysis.
- The alternative(s) that fare(s) best against the detailed criteria in this second step will be identified as Preferred Alternative(s) and further refined in the third step (“Tier 3: Refine the LPA”). The Locally Preferred Alternative will be identified at the conclusion of the third step.

The evaluation criteria associated with each step are a combination of quantitative and qualitative performance measures. The Tier 1 phase applied fewer and broader measures, including information from previous corridor/area studies. The Tier 2 phase has applied more and finer performance measures and will identify the Preferred Alternative(s), and the third step will evaluate the Preferred Alternative(s) against federal criteria to determine the Locally Preferred Alternative. This three-step process will result in the identification of an LPA that not only meets locally-identified project purpose and needs, but is also competitive for federal funding.

2.2 Results of the Tier 1 Evaluation

Each of the modes was evaluated against each of the evaluation criteria on a pass or not pass basis. A mode that received two or more “not pass” rankings was assigned an overall assessment of “defer.” An overall assessment of “defer” means that the overall mode does not meet the stated purpose and need of this study and will not be carried further as an option. However, any mode that is deferred at this time may meet the needs of future studies. The modes that “pass” were carried forward into the Tier 2 Detailed Definition and Evaluation Phase of the project.

Table 2-1 summarizes the overall rating of each of the modes.

TABLE 2-1: ALTERNATIVES FOR THE DETAILED DEFINITION AND EVALUATION OF ALTERNATIVES

Mode	Overall Assessment	Reason for Deferral
Express Bus	Defer	<ul style="list-style-type: none"> • Would not improve on-time performance • Would not improve accessibility • Would not improve economic development • Low potential for mode shift • Would not provide a one-seat ride all day • Would not improve local and regional connectivity • Lower improvement in safety and security • Would not improve connections to other modes
BRT	Pass	--
Premium BRT	Pass	--
Streetcar	Defer	<ul style="list-style-type: none"> • Would not have flexibility • High capital cost to serve the entire corridor
Light Rail	Defer	<ul style="list-style-type: none"> • Would not have flexibility • High capital cost to serve the entire corridor
Commuter Rail	Defer	<ul style="list-style-type: none"> • Would not improve accessibility • Would not improve economic development • Would not have flexibility • Would not provide a one-seat ride all day • Would not improve local and regional connectivity • High capital cost to serve the entire corridor • Would not improve connections to other modes

Based on this evaluation, ***BRT and Premium BRT*** were moved on as the chosen modes along the Gratiot Avenue corridor. Additional route alignments, station locations, and runningway is detailed in this summary report and in supporting documentation. The detailed definition of alternatives is documented under separate cover, and can be found at the RTA website (<http://www.rtamichigan.org/best-projects/gratiot-avenue/>) under the Documents section.

At this planning level, the type of information developed can still be relatively high-level and focused on comparison and order of magnitude. During the environmental review phase, there will be more refined information with preliminary engineering which will utilize some base mapping and utility surveys. As the project continues, more information will be refined and detailed. The following topics are documented in the Detailed Definition of Alternatives report and also in this Tier 2 Evaluation Summary Report:

- Station locations: with review of accessibility, walkability, social equity, connections to other transit facilities for each location
- Routes within Mount Clemens: location either along Gratiot and/or within Downtown Mount Clemens with evaluation of impacts to traffic, parking, non-motorized and transit travel time

- Runningway: location within the roadway with evaluation of impacts to traffic, parking, non-motorized and transit travel time
- Service plan and operations: recommended operations of the new service as well as changes to other bus services surrounding and around the corridor
- Capital cost: cost to build the system based on station locations, routes, and runningway
- Operating and Maintenance Cost: cost to operate and maintain the system as well as any changes to other routes
- Ridership estimates: for the new service as well as to the system as a whole and underlying bus service along the corridor

2.3 Tier 2 Evaluation Criteria and Summary Results

This report is a summary of the technical memoranda (tech memos) that report the results of the Tier 2 Detailed Evaluation of Alternatives, which include:

1. Tech Memo #1: Transportation
2. Tech Memo #2: Operations and Maintenance Costs
3. Tech Memo #3: Capital Costs
4. Tech Memo #4: Ridership
5. Tech Memo #5: Environmental Impacts
6. Tech Memo #6: Station Area

2.4 Summary of Stakeholder Involvement

The primary objective for the Gratiot Avenue Transit Study community engagement has been to involve local and regional stakeholders in a meaningful conversation about developing Gratiot Avenue as one of the three southeast Michigan rapid transit corridors and tying the route into the regional system for optimal travel for all users. The community engagement strategy has included:

- Listening to stakeholder concerns and aspirations
- Reviewing and incorporating existing community development, land use and other plans that may impact transit planning along the corridor and in the surrounding area
- Making the case for the corridor (Gratiot Avenue) and regional transportation by providing information about transit modes, local benefits and long-term value
- Combining local technical and policy expertise with community input to arrive at a Purpose and Need statement that accurately reflects corridor goals and produces a Locally Preferred Alternative (LPA) that can be supported by the FTA and moved toward implementation.

Through inclusive stakeholder engagement tactics, the Study Team has received hundreds of detailed public comments, engaged in many conversations and tallied dozens of polls that were used to change and mold the project to best serve the local population. With public stakeholder involvement we were able to determine specifics, such as:

- Considering a station at McClellan Avenue as opposed to a station at Harper Avenue
- Keeping a station at both Utica Road and 12 Mile Road

- Removing the stations at Common Road and 13 Mile Road
- Consider a station at Van Dyke Avenue in lieu of Warren Avenue
- Looking into shuttle service to and from Lakeside Mall and downtown Mount Clemens
- Looking at a connection to 23 Mile Road
- Choosing the dedicated lane median running as opposed to center lane running to keep landscaping in Macomb County communities

The following public engagement activities have been conducted to date as part of the Gratiot Avenue Transit Study.

TABLE 2-2: PUBLIC ENGAGEMENT ACTIVITIES

Location	Date
Macomb County Planning	April 1, 2015
City of Mount Clemens Staff	April 1, 2015
City of Eastpointe Staff	April 2, 2015
Clinton Township Staff	April 9, 2015
City of Roseville Staff	April 16, 2015
Campus Martius Kick-off	May 12, 2015
Washtenaw County	May 18, 2015
Wayne County Community College District	May 19, 2015
Dearborn	May 19, 2015
Macomb Community College	May 20, 2015
Royal Oak Elks Club	May 21, 2015
City of Detroit Public Meeting at Matrix Center	June 9, 2015
Eastern Market	June 13, 2015
Eastern Market	June 16, 2015
Eastern Market	June 23, 2015
Mount Clemens DDA	July 1, 2015
Art of Resilience Festival, Detroit	July 25, 2015
City of Detroit Precinct 5 Neighborhood Meeting	September 2, 2015
City of Detroit Precinct 11 Neighborhood Meeting	September 8, 2015
City of Detroit Department of Neighborhoods	September 16, 2015
Eastern Market Public Meeting	September 30, 2015
Roseville Public Meeting	September 30, 2015
Detroit Matrix Center Public Meeting	October 1, 2015
City of Detroit Precinct 9 Neighborhood Meeting	October 1, 2015
Detroit Economic Growth Corporation	October 30, 2015
Matrix Center Halloween Event	October 30, 2015
East Outer Drive Community Association Meeting	October 31, 2015
DDOT Bus Survey	October 2015
Gratiot Avenue Business Association (GABA)	November 4, 2015
Eastern Market 2025 Public Meeting	November 4, 2015
Joint Mount Clemens / Clinton Township Planning Commission	November 4, 2015
City of Detroit Precinct #5 Neighborhood Meeting	November 4, 2015

Location	Date
Mount Clemens / Clinton Township TOD Workshop	November 9, 2015
Detroit TOD Workshop	November 10, 2015
Eastpointe DDA Meeting	November 10, 2015
Roseville/Eastpointe TOD Workshop	November 10, 2015
Macomb Area Communities for Regional Opportunities (MACRO)	November 12, 2015
Clinton Township Board Meeting	November 16, 2015
Downtown Detroit Commuter Popups	November 17 - 20, 2015
Eastpointe City Council Meeting	November 17, 2015
Advancing Macomb Network Event	November 19, 2015
Detroit Future City	November 23, 2015
Roseville City Council Meeting	November 24, 2015
City of Detroit Planning Department	November 30, 2015
Mt. Clemens DDA	December 9, 2015
Macomb County Planning	December 9, 2015,
Detroit Catholic Pastoral Alliance	December 10, 2015
City of Detroit Precinct #9 Neighborhood Meeting	December 3, 2015
Bingo With Benson	December 11, 2015
RTA Citizens Advisory Committee	December 14, 2015
Downtown Detroit Workshop	December 15, 2015
Mount Clemens City Commission	December 21, 2015
MDOT Meeting	February 12, 2016
MDOT Meeting	February 26, 2016
RTA PSCC Meeting	March 9, 2016
RTA Board Meeting	March 17, 2016
RTA CAC Meeting	March 28, 2016
March 2016 Open Houses	March 29, 2016 – April 2, 2016
Mount Clemens City Commission	April 18, 2016
Eden Gardens Community Meeting	April 21, 2016
Gratiot Woods Community Meeting	April 21, 2016
Clinton Township Board of Trustees Meeting	April 25, 2016
Roseville City Council Meeting	April 26, 2016
RTA PSCC Meeting	May 12, 2016

3 Transportation Evaluation Process and Summary Results

This section includes a summary of the results documented in detail in Tech Memo #1 of the Tier 2 analysis. Five sub-criteria were used to evaluate the transportation-related performance of the rail and BRT alternatives that are under consideration as part of the Tier 2 evaluation. The five transportation evaluation sub-criteria are:

- Vehicular Traffic impacts
- Right-of-way / parking impacts
- Bike and pedestrian impacts
- Safety
- Transit travel times

The corridor is divided into seven segments to enable mixing and matching of running way types based on their performance in the detailed evaluation phase of rapid transit development in the Gratiot Avenue corridor. The segments are:

- Segment A: Downtown Detroit/Rosa Parks Transit Center to I-375
- Segment B: Southern Detroit – I-375 – M-97
- Segment C: Northern Detroit – M-97 to 8 Mile Road
- Segment D: Eastpointe/Roseville – 8 Mile Road to Common Road
- Segment E: Roseville/Clinton Township – Common Road to Remick Drive
- Segment F: Clinton Township/Mount Clemens – Remick Drive to Patterson Street (Downtown Mount Clemens and vicinity)
- Segment G: Mount Clemens/Clinton Township – Patterson Street to M-59 (Hall Road)

Figure 3-1 illustrates these segments along the corridor.

FIGURE 3-1: GRATIOT AVENUE SEGMENTS



3.1 Vehicular Traffic Impacts

3.1.1 METHODOLOGY

The purpose of the traffic analysis will be to identify the potential traffic impacts of the alternatives. A capacity analysis of all 109 intersections was performed using Synchro to determine the delay and level of service (LOS) for each of the alternatives. Signal timings were updated as part of the analysis to accommodate new laneage. Three different BRT alternative footprints were compared to the No Build scenario as briefly described below:

- No Build: No change from existing conditions, used as a baseline for comparison of BRT alternative impacts
- Mixed Traffic Curb Running BRT: Utilizes Transit Signal Priority (TSP) to enhance travel time efficiency, **without dedicated BRT lanes**
- Dedicated Curb/Median/Center Lane BRT with no diversion: Utilizes TSP **with dedicated BRT lanes with no traffic diversion**, in operation during peak hours or 24 hours a day. A lane reduction was included in the following sections:
 - Segment B: Southern Detroit - I-375 – M-97 & Segment C: Northern Detroit - M-97 to 8 Mile Road
 - Segment C: Northern Detroit - M-97 to 8 Mile Road
 - Segment F: Clinton Township / Mount Clemens - Remick Drive to Patterson Street (Downtown Mt. Clemens and vicinity)
- Dedicated Curb/Median/Center Lane BRT with diversion: Utilizes TSP **with dedicated BRT lanes and expected traffic diversion**, in operation during peak hours or 24 hours a day. Approximately 10-30% of traffic was diverted off of Gratiot Avenue due to the lane reduction.

3.1.2 RESULTS

The table below summarizes the number of intersections by segment where there is either a LOS E or LOS F either by direction or total for the intersection for either the AM or PM peak hour.

TABLE 3-1: NUMBER OF INTERSECTION WITH LOS E/F BY SEGMENT

Segment	Existing (2015)	Future (2040)		
		No Build and Mixed BRT	Dedicated BRT with Lane Reduction and No Diversion	Dedicated BRT with Lane Reduction and Diversion
A	2	2	1	0
B	9	6	12	3
C	2	2	7	0
D	5	0	2	2
E	0	0	0	0
F	1	0	4	4
G	1	1	1	1
Total	20	11	27	10

TABLE 3-2: TRAVEL TIME BY SEGMENT

Segment	Existing (2015)	Future (2014)		
		No Build and Mixed BRT	Dedicated BRT with Lane Reduction and No Diversion	Dedicated BRT with Lane Reduction and Diversion
A	1 – 3 min	2 – 3 min	2 – 3 min	2 – 3 min
B	7 – 10 min	8 – 10 min	10 – 20 min	9 – 15 min
C	11 – 12 min	11 – 13 min	12 – 26 min	11 – 18 min
D	9 – 11 min	10 – 12 min	n/a	n/a
E	7 – 10 min	7 – 10 min	n/a	n/a
F	6 – 7 min	7 – 8 min	7 – 9 min	7 – 9 min
G	1 – 3 min	2 – 5 min	n/a	n/a
Total	46 – 51 min	51 – 55 min	53 min – 66 min	52 min – 57 min

3.2 Parking / Right-of-Way Impacts

3.2.1 METHODOLOGY

A qualitative assessment of right-of-way impacts throughout the corridor was performed by overlaying the standard cross section on aerial imagery of the Gratiot corridor in CADD software and identifying areas where right-of-way impacts may occur.

A quantitative assessment of on-street parking impacts throughout the corridor was also performed by collecting an inventory of current on-street parking spaces and assessing the amount of spaces that would be removed or relocated given the spatial requirements of each standard cross section.

3.2.2 RESULTS

Based on the analysis of recent aerial imagery and on-site assessments, the project team was able to determine the total number of parking spaces along Gratiot Avenue. It is important to differentiate between designated/metered parking and undesignated spots. Much of the undesignated parking is due to the large outer lane along Gratiot Avenue south of 8 Mile. This parking is poorly utilized along most of this segment and off-street parking is often available at adjacent businesses.

Table 3-3 shows the potential impact on parking based on each alternative. It was assumed that five (5) parallel spaces would be lost at BRT station locations and 10 angle parking spaces would be lost. Segments D, E, and F along Gratiot Avenue would have no loss to parking as the cross-section has enough width to accommodate parking and a BRT lane. In Segment A, B, and C parking would be removed on one side of the corridor, the side with less existing spaces, to accommodate the new cross-section. If bike-lanes were installed parking would be lost on both sides of the corridor.

TABLE 3-3: POTENTIAL ON-STREET PARKING IMPACTS

Segment	Total Number of Spaces Available	Spaces Taken by BRT Option			
		Mixed Traffic Curb Running	Dedicated Lane Curb Running	Dedicated Lane Median Running	Dedicated Lane Center Running
A	75	10	75	75	75
B	941	50	470	470	470
C	709	20	360	360	360
D	592	0	0	0	0
E	5	5	5	5	5

F (Gratiot)	0	0	0	0	0
F (Mt. Clemens)	152	20	123	123	123
G	0	0	0	0	0
Total	2,474	105	1,033	1,033	1,033

The evaluation of impacts to on-street parking also included an on-site assessment of the availability of off-street parking facilities that are currently allocated for use by properties fronting Gratiot Avenue. It was determined that off-street parking facilities are present in over 90% of all locations where on-street parking exists. Additionally, this assessment acknowledges locations where on-street parking is more heavily utilized and off-street facilities are not as easily accessible, including near Eastern Market, downtown Roseville, and downtown Mt. Clemens. As often as possible, on-street parking was maintained in these areas within each alternative.

3.3 Bicycle and Pedestrian Impacts

3.3.1 METHODOLOGY

The evaluation of non-motorized mobility within the Gratiot Avenue Corridor was sub-divided into the following criteria:

- Impacts to existing and potential future bicycle facilities along the BRT alignments:** Each of the proposed alternatives would incorporate changes to the street corridor that it operates on. The mixed-traffic BRT option would consist of new curbs, signage, and stations, while the dedicated lane alternatives would reconfigure the road right-of-way. This analysis also looks at the potential for new bike lanes and how they will be affected by the construction of a BRT runningway. In certain cases, bike lanes may not be possible due to ROW constraints and would need to be moved to an adjacent street. Ratings are provided for the various segments of the corridor based on the following scale: 0 = no impact to the network, 1 = some positive impacts for bicycles, 2 = major positive impacts for bicycle mobility.
- Impacts to existing and potential future pedestrian facilities:** Sidewalks and other pedestrian facilities may also be impacted by the incorporation of a BRT into the street right-of-way. In certain areas along the corridor, a sidewalk may need to be narrowed to accommodate for stations. The ratings are based on the same scale as the bike facilities analysis: 0 = no impact on pedestrian access, 1 = some positive on pedestrian access, 2 = major positive impacts for pedestrian mobility.
- Compliance with local bicycle and pedestrian plans:** Many of the communities along the Michigan Avenue corridor have conducted planning related to improved bike and pedestrian infrastructure. Local plans for each municipality will be consulted to determine what policies and plans are in place with regards to bike and pedestrian facilities. Ratings for this factor are provided based on whether the proposed changes are consistent with the local plans (Yes or No). A segment may receive a “No” rating if a lesser version of planned bicycle facilities are proposed and/or able to be accommodated after considering BRT.

3.3.2 RESULTS

Currently, no on-road or off-road bicycle facilities exist within the Gratiot Avenue right-of-way. However, several facilities within the region’s bicycle network intersect or are within close proximity to the Gratiot Avenue corridor, including the Dequindre Cut Greenway, the Conner Creek Greenway, Metro Parkway Trail, and the Clinton River Spillway Trail. While no bicycle facilities currently exist on Gratiot Avenue, several studies – including Creating Successful Corridors – Gratiot Avenue Pilot Corridor, Mobilize Macomb, and several local plans – recommend various types of bicycle facilities along the corridor. Additionally, all of the runningway alternatives recommend or include the space to accommodate bicycle

facilities. Additionally, the narrowing of lanes and slowing of traffic will create a less stressful place to ride. These recommendations, in combination, will have some positive impact on the bikeability of the corridor.

Currently, sidewalks exist along most of the 23-mile length of the Gratiot Avenue corridor, with the exception of portions along the NB Gratiot Avenue Loop in Mt. Clemens and portions along Gratiot Avenue between downtown Mt. Clemens and M-59. With transit improvements, sidewalks would be also installed in locations where they do not exist to provide a safe place to walk for transit users. Additionally, in most cases the addition of dedicated BRT lanes to the street improves conditions for pedestrians. Dedicated Lane Median Running and Dedicated Lane Center Running alternatives provide significant positive impacts to pedestrian access because the station platforms add a refuge for those crossing the street. Additionally, the drive lanes would be narrowed to allow for all uses to be present. The narrowing of lanes will help to slow cars down, leading to a safer place to walk.

Table 3-4 below provides a summary of the qualitative evaluation of potential impacts to bicycle and pedestrian facilities, rated on the following scale:

- 0 = no impact on bicycle mobility / pedestrian access
- 1 = some positive impacts for bicycle mobility / pedestrian access
- 2 = major positive impacts for bicycle mobility / pedestrian access
- Yes/No = consistency with local plans

TABLE 3-4: BICYCLE / PEDESTRIAN EVALUATION RESULTS

Runningway Configuration	Impacts on Bicycle Facilities	Impacts on Pedestrian Facilities	Consistency with Local Plans
BRT – Mixed Traffic Curb Running	1	0	Yes
BRT – Dedicated Lane Curb Running	2	1	Yes
BRT – Dedicated Lane Center and Median Running	2	2	Yes

3.4 Safety

3.4.1 METHODOLOGY

Each of the alternatives will be evaluated for the impact that it would have on safety and the reduction of conflict points along the corridor. This methodology will incorporate the runningway configuration and routing alternatives.

- An exclusive transit facility with no access has less conflict points than that of a dedicated lane right next to a regular travel lane.
- A dedicated lane will have less conflict points than that of a shared lane configuration.
- A dedicated lane in either the median (left) lane or the curb (right) lane would have the same number of conflict points.
- A shared lane option has the most conflict points and most interaction between the transit vehicle and vehicular traffic.

The ratings for runningway configuration are as follows: 1 = exclusive facility, 2 = dedicated lane, and 3 = shared lane. The number of signalized (major) intersections along each alternative route will be tallied and multiplied by the rating for the selected configuration. The weighted score results in the lower score being more favorable from a safety standpoint.

3.4.2 RESULTS

The results of the safety analysis by BRT alternative are summarized in Table 3-5 below. The proposed alternatives all follow the same routing path over the length of the corridor, therefore the total number of signals for each alternative is the same. Each alternative has the option within downtown Mt. Clemens to follow Gratiot or to divert into downtown along Main Street.

TABLE 3-5: EVALUATION RESULTS: BRT ALTERNATIVES

Runningway Configuration	Downtown Mount Clemens	Gratiot
Mixed Traffic Curb Running Total Score (weighted 3)	291	297
Dedicated Lane Curb Running Total Score (weighted 2)	194	198
Dedicated Lane Median Running Total Score (weighted 2)	194	198
Dedicated Lane Center Running Total Score (weighted 1)	108	116

The Dedicated Lane Center Running alternative was rated the safest as it operates in an exclusive facility for the majority of the route. This alignment was assigned a weighted score of “1” which was multiplied by the total number of signals. All alternatives within downtown Mt. Clemens received a weighting of “2” as an exclusive facility is not feasible.

The Dedicated Lane Median Running and Dedicated Lane Curb Running received the same weighted score of “2” and operate as the next two safest options. The least favorable option from a safety standpoint is the Mixed Traffic Curb Running alternative that received a weighted score of “3” multiplied by the number of signals.

The downtown Mt. Clemens route along Main Street is slightly more favorable in all alternatives as it has two less signals than the Gratiot Avenue route.

There are two at-grade railroad crossings on Gratiot Avenue. The first is just south of Conner Avenue north of downtown Detroit. Motor vehicles at the single track crossing are controlled by a traffic signal and gates. The second crossing is north of Henry Joy and south of M-59. Gratiot Avenue is a boulevard in this segment creating a separate northbound and southbound rail crossing. Rail signals are in place, however gates are only present on the southbound crossing.

When the BRT vehicle approaches a railroad crossing, the vehicle must come to a complete stop to ensure that it is safe to for the vehicle to cross.

3.5 Transit Travel Times

3.5.1 METHODOLOGY

A base travel time was calculated based on the distance between intersections and the posted speed limit. Signal delay per signaled intersection was added onto the base travel time. This delay per intersection was based on tables found in TCRP Report 118 “Bus Rapid Transit Practitioner’s Guide”. Station delay was based on dwell time at the station which was assumed to be 14 seconds. Acceleration and deceleration rates were not used as the time was nominal and these rates were taken into account with the acceleration and deceleration at the traffic signal. Alternatives that have a dedicated lane has less signal delay than the alternatives that is mixed in traffic. A dedicated curb running alternative would have a slightly longer travel time than a dedicated center/median running option due to the amount of driveways along the corridor.

3.5.2 RESULTS

The results below are a range of morning and evening peak hour BRT travel times for both northbound and southbound vehicles. This range changes based on the amount of vehicular congestion as well as signal timing changes along the corridor.

TABLE 3-6: BRT TRAVEL TIME BY SEGMENT

Segment	Existing* (2015)	Future (2014)		
		Mixed Traffic Curb Running	Dedicated Lane Curb Running	Dedicated Lane Center/Median Running
A	3 – 4 min	2 – 4 min	2 – 3 min	1 – 2 min
B	12 – 16 min	9 – 14 min	8 – 10 min	8 – 9 min
C	15 – 17 min	14 – 19 min	14 – 15 min	13 – 14 min
D	15 – 19 min	13 – 19 min	11 – 15 min	11 – 13 min
E	13 – 14 min	11 – 16 min	9 – 12 min	8 – 11 min
F	8 – 12 min	7 – 9 min	6 – 8 min	6 – 7 min
G	4 – 7 min	3 – 5 min	1 – 3 min	1 – 3 min
Total	76 – 83 min	60 – 77 min	55 – 61 min	52 – 56 min
Average MPH	18 – 19	20 – 21	24 – 25	26 – 27

*Based on SMART Route 560

3.6 Summary

As shown in this analysis, having a BRT operate in mixed traffic as opposed to dedicated lane can substantially slow down the BRT service. In addition, having the BRT operate in Dedicated Lane Curb Running can also be slower than one that runs in a dedicated lane along a median or in the center of a roadway. Having a dedicated BRT lane can provide the most effective and reliable transit service along the corridor.

There is several areas along the corridor with right-of-way is a constraint and limits the number of vehicular travel lanes and also dedicated BRT lanes. Between the I-75 connector in the south and M-97 (Grosbeck Highway) in the City of Detroit, there is a substantial amount of vehicular traffic, particularly southbound in the morning and northbound in the evening. In order to provide a dedicated BRT lane, a lane of vehicular traffic would need to be removed in each direction. Removing a lane of traffic would impact vehicular travel time along this section of the corridor. However, it is expected that approximately 20 to 30 percent of traffic would divert off of Gratiot Avenue onto other roadways in the area if a lane of traffic is removed in each direction. With this type of diversion, it is expected that travel times would not increase substantially.

The addition of dedicated BRT lanes has the potential to remove on-street parking in the City of Detroit and some of the on-street parking within downtown Mount Clemens. Almost all of the businesses along Gratiot Avenue in the City of Detroit has off-street parking available. For a dedicated BRT lane in downtown Mount Clemens, most of the on-street parking along Main Street would need to be removed, with the exception of 30 spaces. There is available surface and deck parking available within a five minute walk.

The Dedicated Lane Median or Center Running would have less of an impact to vehicular safety and also impacts to bicycles and pedestrians compared to a BRT running along the curb.

4 Operations & Maintenance Costs Evaluation Process and Summary Results

This section provides a summary of the annual operations and maintenance (O&M) costs developed for the Tier 2 alternatives. The costs are the product of two components – unit costs and operating statistics. All costs presented herein are in 2015 dollars and are the annual cost of operating all facets of the transit services described in the *Tier 2 Detailed Definition of Alternatives* document. Detailed O&M cost information can be found in Tech Memo #2.

Operating costs were estimated for a total of four alternatives: a No Build alternative, one mixed traffic BRT alternative, and three dedicated lane BRT alternatives.

4.1 Operating Statistics

A base bus cost was developed that reflects the resources need to operate and maintain bus service as if it had the same characteristics and cost structure of existing fixed route services in southeast Michigan. For Gratiot Avenue, base bus cost were derived from current costs of the DDOT and SMART systems. The National Transit Database (NTD) was the primary data source. The base costs are used to estimate the incremental change in the cost of any other changes to the regional system made as a part of the alternative (such as implementation of feeder services or the reduction or deletion of redundant parallel service).

For the BRT alternatives, BRT-specific costs are a function of features that are not included in existing regional operations, such as larger vehicles, enhanced stations, dedicated lanes, and other distinct elements of a BRT system. Given the absence of existing comparable BRT service in southeast Michigan, the BRT –specific O&M costs were based on the O&M cost model previously developed for the Woodward Avenue BRT study. The estimates of BRT upcharges and costs were derived from several sources, including the Transit Cooperative Research Program (TCRP) and cost estimates provided by vendors and other agencies operating comparable BRT systems.

O&M estimates are presented as an annualized cost in 2015 dollars. The most recently available NTD data is from 2013, they were adjusted accordingly for inflation. The detailed methodology and cost model is included in Tech Memo #2: Operating and Maintenance Costs. Table 4-1 provides a summary of service-based operating statistics for the BRT alternatives.

TABLE 4-1: ANNUAL BRT OPERATING STATISTICS BY ALTERNATIVE

Operating Statistic	No Build	Mixed Traffic Curb Running	Dedicated Lane Curb Running	Dedicated Lane Median Running	Dedicated Lane Center Running
Revenue Hours	2,895	86,294	84,764	86,294	84,754
Revenue Miles	59,339	1,514,175	1,514,175	1,514,175	1,514,175
Peak Buses	2	17	16	17	16

4.2 Results

Table 4-2 summarizes the estimated annual operating costs of the No Build alternative and the four Build alternatives:

- Mixed Traffic Curb Running
- Dedicated Lane Curb Running
- Dedicated Lane Median Running
- Dedicated Lane Center Running

The No Build alternative, along with the associated local (base) bus service modifications included as part of the Build alternatives, involves SMART operations only. The associated local service improvements associated with BRT are the same for all four Build alternatives.

The overall O&M estimated cost of the Build alternatives, inclusive of new BRT and associated local bus service modifications is similar among the four Build alternatives, ranging from \$17.48 million a year to \$17.95 a year. Exclusive of associated local bus service modifications, the BRT O&M cost estimates range from \$14.82 million a year to \$15.2 million a year.

The operating parameters (route length, service span and frequency) are the same among the Build alternatives. The Mixed Traffic Curb Running has a higher O&M cost compared with the alternatives operating in dedicated lanes. Mixed traffic operation is slower than dedicated lane operation, requiring more service miles, hours and vehicles to provide the same level of service. The O&M costs of the three dedicated lane alternatives are similar, with the Dedicated Lane Center Running alternative the highest and the Dedicated Lane Median Running the lowest.

Additional detail of the O&M cost estimate results is included in Tech Memo #2: Operating and Maintenance Costs.

4.3 Summary

Total O&M costs, including operating increases to the local service providers, were calculated for the No Build alternative and each of the four build alternatives. The total annual costs are between \$17.5 and \$18.0 million per year, depending on runningway type. Table 4-2 presents the BRT O&M costs by alternative in millions of 2015 dollars.

TABLE 4-2: OPERATIONS AND MAINTENANCE COST ESTIMATES (2015\$)

Service	Alternative				
	No Build	Mixed Traffic Curb Running	Dedicated Lane Curb Running	Dedicated Lane Center Running	Dedicated Lane Median Running
BRT	\$0	\$15,288,404	\$15,283,076	\$15,318,269	\$14,819,478
SMART Local	\$510,494	\$2,664,536	\$2,664,536	\$2,664,536	\$2,664,536
TOTAL	\$510,494	\$17,952,940	\$17,947,612	\$17,982,805	\$17,484,014
Difference from No Build		\$17,442,446	\$17,437,118	\$17,472,311	\$16,973,520

5 Capital Cost Evaluation Process and Summary Results

This section includes a summary of the results documented in detail in Tech Memo #3 of the Tier 2 analysis. Capital costs involve the design, engineering and construction of the rapid transit line, including guideway, stations, vehicles and systems.

5.1 Capital Costs

5.1.1 METHODOLOGY

Capital cost estimates were prepared using the Standard Cost Categories (SCC) format developed by the Federal Transit Administration (FTA). The categories cover real estate, guideway, stations, vehicles, systems and support facilities. They also include sitework, special conditions, professional services, contingencies and finance charges. Table 5-1 illustrates the SCC Cost Categories.

TABLE 5-1: SCC COST CATEGORIES

Standard Cost Category	Description
SCC 10	Guideway and track elements
SCC 20	Stations, stops, and terminals
SCC 30	Support facilities
SCC 40	Sitework and special conditions
SCC 50	Systems
SCC 60	Right-of-Way, land, existing improvements
SCC 70	Vehicles
SCC 80	Professional services
SCC 90	Unallocated Contingencies
SCC 100	Finance charges

Units are defined by quantity, size, length, location and conceptual definitions of each alternative depending on the nature of the item. Unit categories include BRT alignment length, number of stations, number of transit vehicles and signalized intersections. Unit cost estimates are derived from multiple sources to identify price ranges for capital items. As recommended by FTA, unit costs are based on several local, state and national references from eight comparable rapid transit projects, including the Woodward Avenue BRT and M-1 Rail (Q Line). Unit price assumptions were reviewed to determine their applicability to the alternatives. Pavement, roadway and related unit costs were derived from the current Michigan Department of Transportation unit price book. Year 2015 is used as the base year for definition of the unit prices. Unit prices by category are included in Tech Memo #3.

5.1.2 RESULTS

Table 5-2 presents the capital cost estimates for the four Build Alternatives:

- Mixed Traffic Curb Running
- Dedicated Lane Curb Running

- Dedicated Lane Median Running
- Dedicated Lane Center Running

The corridor is divided into seven segments to enable mixing and matching of running way types based on their performance in the detailed evaluation phase of rapid transit development in the Gratiot Avenue corridor. The segments are:

- Segment A: Downtown Detroit/Rosa Parks Transit Center to I-375
- Segment B: Southern Detroit – I-375 – M-97
- Segment C: Northern Detroit – M-97 to 8 Mile Road
- Segment D: Eastpointe/Roseville – 8 Mile Road to Common Road
- Segment E: Roseville/Clinton Township – Common Road to Remick Drive
- Segment F: Clinton Township/Mount Clemens – Remick Drive to Patterson Street (Downtown Mount Clemens and vicinity)
- Segment G: Mount Clemens/Clinton Township – Patterson Street to M-59 (Hall Road)

All different types of guideways that comprise the Build Alternatives apply to all segments except Segment A in downtown Detroit. Segment A can physically accommodate either Mixed Traffic Curb Running or Dedicated Center Lane Running. Therefore, the estimated total cost for the entire alignment of the Dedicated Lane Curb Running alternative uses the Segment A cost of Mixed Traffic Curb Running; the estimated total cost for the entire alignment of the Dedicated Lane Median Running alternative uses the Segment A cost of the Dedicated Lane Center Running alternative.

The estimated total costs of the Build alternatives ranges from \$190 million to \$285 million. The detailed costs by category for each of the segments by alternative are included Tech Memo #3.

5.2 Summary

TABLE 5-2: CAPITAL COST ESTIMATE FOR ROUTES ALONG GRATIOT AVENUE

Segment	Alternative			
	Mixed Traffic Curb Running	Dedicated Lane Curb Running	Dedicated Lane Median Running	Dedicated Lane Center Running
A	\$13,855,261	\$14,046,300	\$14,046,300	\$14,046,300
B	\$39,694,309	\$40,710,666	\$50,633,717	\$54,372,473
C	\$20,370,694	\$20,249,421	\$26,826,657	\$29,551,408
D	\$45,601,676	\$69,562,535	\$67,909,438	\$78,001,480
E	\$36,928,306	\$57,272,624	\$56,486,735	\$65,368,165
F	\$25,683,713	\$27,335,221	\$27,335,221	\$27,335,221
G	\$10,175,757	\$10,849,540	\$13,582,600	\$15,680,828
TOTAL COST	\$192,309,716	\$240,026,307	\$256,820,668	\$284,355,875
Cost per Mile (\$M):	\$7.79	\$9.72	\$10.40	\$11.51

TABLE 5-3: CAPITAL COST ESTIMATE FOR ROUTES GOING TO DOWNTOWN MT. CLEMENS

Segment	Alternative			
	Mixed Traffic Curb Running	Dedicated Lane Curb Running	Dedicated Lane Median Running	Dedicated Lane Center Running
A	\$13,855,261	\$14,046,300	\$14,046,300	\$14,046,300
B	\$39,694,309	\$40,710,666	\$50,633,717	\$54,372,473
C	\$20,370,694	\$20,249,421	\$26,826,657	\$29,551,408
D	\$45,601,676	\$69,562,535	\$67,909,438	\$78,001,480
E	\$36,928,306	\$57,272,624	\$56,486,735	\$65,368,165
F	\$23,632,364	\$24,807,169	\$24,861,836	\$25,228,978
G	\$10,175,757	\$10,849,540	\$13,582,600	\$15,680,828
TOTAL COST	\$190,258,367	\$237,498,255	\$254,347,283	\$282,249,632
Cost per Mile (\$M)	\$7.93	\$9.90	\$10.60	\$11.76

6 Ridership Evaluation Process and Summary Results

This section includes a summary of the results documented in detail in Tech Memo #4 of the Tier 2 analysis. Ridership was evaluated using the Southeast Michigan Council of Government travel demand forecasting model. This model utilizes population and employment characteristics of the region to determine the amount of ridership by route.

Two different runningways were evaluated by the model, a mixed in traffic runningway and a dedicated lane runningway. The model is not sensitive enough to various types of dedicated lane runningways. Various station locations were also evaluated with the model to determine specific ridership at each station location. However, to compare the different types of runningways, the optimum station locations were utilized. No more than one station was coded within ½ mile of each other in order to determine the highest potential for ridership. Feeder bus routes were optimized for each of the station locations. Park and ride lots were added to all stations along the corridor and narrowed to only a few based on the highest ridership potential.

The following station locations were coded into the model, with those noted as park and ride locations.

TABLE 6-1: STATION LOCATIONS

Station Location	Park and Ride
23 Mile	
Hall Rd/M-59	X
Downtown Mt. Clemens	
South River	
Metro Parkway	X
15 Mile	
Macomb Mall	X
12 Mile	
Utica	
11 Mile	X
10 Mile	
9 Mile	
8 Mile	X
7 Mile	
McNichols	
Outer Drive	
McClellan	X
Warren	
Mack	

Eastern Market	
Bricktown	

Both the downtown Mount Clemens alignments were evaluated with the ridership model. Transit travel times were adjusted within the model for the dedicated lane scenario. There was also a scenario which evaluated extending the BRT to 23 Mile Road as well.

6.1 Ridership Results

Table 6-2 summarizes the ridership results from the model for the entire transit system, the total ridership along Gratiot Avenue (includes DDOT, SMART, and BRT) and the BRT ridership alone along Gratiot Avenue.

TABLE 6-2: RIDERSHIP SUMMARY RESULTS

Runningway	System Ridership	Total Gratiot Ridership	BRT Ridership
Mixed Traffic along Gratiot Avenue around Downtown Mount Clemens	241,160	16,615	12,270
Mixed Traffic to Downtown Mount Clemens	240,600	16,520	12,195
Dedicated Lane along Gratiot Avenue around Downtown Mount Clemens	243,305	17,930	13,475
Dedicated Lane to Downtown Mount Clemens	242,255	17,710	13,425
Dedicated Lane to Downtown Mount Clemens with extension to 23 Mile Road*	242,110	17,825	13,590

* BRT in mixed traffic between M-59/Hall Road and 23 Mile Road

7 Station Area Evaluation Process and Summary Results

This section includes a summary of the results documented in detail in Tech Memo #6 of the Tier 2 analysis. Seven sub-criteria were used to evaluate station areas under consideration as part of the Tier 2 evaluation. The seven sub-criteria are:

- Population Density
- Employment Density
- Equitable Access to the Transit Investment
- Connectivity to the Transit Network
- Connectivity to the Regional Transportation Network
- Development Potential
- Ridership

7.1 Population and Employment Density

7.1.1 METHODOLOGY

Population and employment density was measured by developing estimates of the number of population and employment within a half-mile radius of each station. This analysis was conducted consistent with FTA guidance, which instructs these estimates to be created by assigning population and employment totals to each station area based on the pro-rated amount of area that falls within the half-mile radius of each station, assuming that these metrics are evenly dispersed throughout the traffic analysis zone (TAZ) where the data originated.

Population density totals at each station were evaluated against each other on a scale from one (1) to five (5), as thresholds were developed in alignment with the results of this analysis. Employment density totals at each station were evaluated against each other on a scale from one (1) to five (5), as thresholds were developed in alignment with the results of this analysis.

7.1.2 RESULTS

This analysis indicated that population concentrations exist near downtown Mt. Clemens, downtown Roseville, Eastpointe, the northern portion of Detroit, and in downtown Detroit. Areas of lower population densities exist in Clinton Township and in various portions of Detroit. Employment densities were concentrated in fewer locations, specifically near downtown Mt. Clemens and downtown Detroit with a modest concentration of employment near Macomb Mall. The remaining stations had very little employment density, all scoring within the lowest threshold.

7.2 Equitable Access to the Transit Investment

7.2.1 METHODOLOGY

Equitable access to the transit investment was measured by determining the number of zero-car households within a half-mile of each station. This analysis was conducted consistent with FTA guidance, which instructs these estimates to be created by assigning household totals to each station area based on the pro-rated amount of area that falls within the half-mile radius of each station, assuming that these metrics are evenly dispersed throughout the block group where the data originated.

Equitable access characteristics at each station were evaluated against each other on a scale from one (1) to five (5), as thresholds were developed in alignment with the results of this analysis.

7.2.2 RESULTS

Equitable access to the transit investment was measured by determining the number of zero-car households within a half-mile of each station. This analysis was conducted consistent with FTA guidance, which instructs these estimates to be created by assigning household totals to each station area based on the pro-rated amount of area that falls within the half-mile radius of each station, assuming that these metrics are evenly dispersed throughout the block group where the data originated.

Equitable access characteristics at each station were evaluated against each other on a scale from one (1) to five (5), as thresholds were developed in alignment with the results of this analysis.

7.3 Connectivity to the Transit Network

7.3.1 METHODOLOGY

Connectivity to the transit network was measured by analyzing the number of existing transit routes that intersect or align with Gratiot Avenue within a half-mile of each station. This analysis was conducted by utilizing current transit provider route data and determining the number of routes that fall within the half-mile radius of each station.

Connectivity to the transit network at each station were evaluated against each other on a scale from one (1) to seven (7), as thresholds were developed in alignment with the results of this analysis.

7.3.2 RESULTS

This analysis indicated that stations with the highest concentration of connections to the existing transit network exist within Detroit, with nearly every station scoring in the highest threshold. Stations located in Macomb County typically are not in areas where multiple routes intersect or align with Gratiot, as service is more dispersed, but stations in Roseville provide the most opportunity for connections to multiple routes of the existing transit network.

7.4 Connectivity to the Regional Transportation Network

7.4.1 METHODOLOGY

Connectivity to the regional transportation network was measured by determining the number of regional highway interchanges and park-and-ride facilities within a half-mile of each station. This analysis was conducted by utilizing current MDOT data and determining the number of facilities that fall within the half-mile radius of each station.

Connectivity to the regional transportation network at each station were evaluated against each other on a scale from one (1) to three (3), as thresholds were developed in alignment with the results of this analysis.

7.4.2 RESULTS

This analysis indicated that stations with the highest concentration of connections to the regional transportation network exist at M-59, Metro Parkway, 11 Mile (I-696), 8 Mile, and near downtown Detroit. The remaining stations provide very few connections to the regional transportation network, all scoring within the lowest threshold.

7.5 Development Potential

7.5.1 METHODOLOGY

Development potential was measured by evaluating local development and zoning policies, the number of major trip generators, the number of recent and approved developments, and development potential within a half-mile of each station. This analysis was conducted through qualitative and quantitative analyses that match the local support for transit-supportive development with the amount of developable land in each location.

Development potential at each station were evaluated against each other on a scale from one (1) to ten (10) as a cumulative score of each metric listed above.

7.5.2 RESULTS

This analysis indicated that stations with the most development potential exist near downtown Mt. Clemens, downtown Roseville, and downtown Detroit. Stations with a moderate level of development potential exist near Macomb Mall, Eastpointe, the northern portion of Detroit, and near I-94 in Detroit. Beyond these locations, relatively low levels of development potential exist.

7.6 Ridership

7.6.1 METHODOLOGY

Ridership was evaluated by the use of the Southeast Michigan Council of Government travel demand forecasting model. This model utilizes population and employment characteristics of the region to determine the amount of ridership by route. To determine ridership by station location, each station was coded into the model with the dedicated lane scenario in order to determine the highest potential for ridership. No more than one station was coded within ½ mile of each other in order to determine the highest potential for ridership. Feeder bus routes were optimized for each of the station locations. Park and ride lots were added to all stations along the corridor and narrowed to only a few based on ridership scores. Ridership at each station were evaluated against each other on a scale from one (1) to ten (10), as thresholds were developed in alignment with the results of this analysis. Those with the lowest boardings/alightings received a lower score, while those with higher boardings/alightings received a higher score.

7.6.2 RESULTS

The highest ridership figures were seen within the City of Detroit, 10 Mile Road, 12 Mile Road, and the Macomb Mall. The station at Sandpiper Road and also 23 Mile Road in the north did not have high ridership. The station at Warren Avenue had higher ridership than one at Van Dyke Avenue. In addition, the station at Harper Avenue had slightly higher ridership than McClellan Avenue.

7.7 Summary of Results

Following the individual analyses of each evaluation criteria, the scores were aggregated to determine the stations that met the desired threshold to be advanced for further evaluation as part of the locally preferred alternative (LPA). Through extensive coordination with participating communities and the study's advisory committee, it was determined that the stations scoring in the highest thresholds aligned with the preferences of each municipality. Additionally, several locations that scored in the middle

threshold meet the desired 1-mile spacing requirements of the study and were preferred by the participating communities.

The results of this analysis indicate that 19 of the 26 station locations will be advanced as part of the LPA. The results of this analysis are shown in Table 7-1, with the 19 stations currently expected to advance as part of the LPA highlighted.

TABLE 7-1: STATION AREA RESULTS

	Population	Employment	Equity	Transit	Transportation	Development Potential	Ridership	Total
23 Mile	1	1	1	1	2	2	1	8
M-59	1	1	1	1	3	2	2	11
Sandpiper	1	1	1	1	1	3	1	9
Downtown Mt. Clemens	3	3	2	1	1	8	3	21
South River	2	3	1	1	1	3	3	14
Metro Parkway	2	1	1	1	2	2	4	13
15 Mile	2	1	1	2	1	3	3	13
Macomb Mall	2	2	1	2	1	5	7	20
13 Mile	3	1	1	4	1	3	2	15
Common Rd.	3	1	2	2	1	1	3	13
12 Mile	4	1	2	1	1	3	7	19
Utica	4	1	2	2	1	7	3	20
11 Mile	4	1	2	1	2	2	4	16
10 Mile	4	1	2	1	1	2	7	18
9 Mile	5	1	2	2	1	6	9	26
8 Mile	5	1	2	3	2	5	10	28
7 Mile	4	1	3	4	1	4	10	27
McNichols	4	1	2	4	1	4	4	20
Outer	3	1	2	6	1	4	2	19
Harper	2	1	2	4	1	3	10	23
McClellan	3	1	3	5	1	5	9	27
Van Dyke	3	1	3	6	1	3	3	20
Warren	2	1	2	6	1	3	7	22
Mack	1	1	2	6	1	3	5	19
Eastern Market	4	5	5	6	2	9	3	34
Bricktown	4	5	5	7	2	9	4	36

8 Environmental Evaluation Process and Summary Results

This section includes a summary of the results documented in detail in Tech Memo #5 of the Tier 2 analysis. Environmental impacts were evaluated across four sub-categories, including:

- Natural Resources
- Cultural and Historic Resources
- Environmental Justice
- Right of Way / Parking Impacts (shown in Section 3.2 of this report)

8.1 Natural Resources

8.1.1 METHODOLOGY

An analysis of the Study Area was completed to identify the natural resources within one-mile of the alternative alignments. Natural resources were compiled from various sources including; the Natural Resource Conservation Service (NRCS), the State of Michigan, the US Fish and Wildlife Service (USFWS), Federal Emergency Management Agency (FEMA), and the US Environmental Protection Agency (EPA). The following types of natural resources were identified and mapped:

- Farmland
- Coastal Zone
- Wetlands
- Streams
- Floodplains
- Migratory Birds
- Endangered Species
- Hazardous Waste
- Water Quality

8.1.2 RESULTS

Analyzing the potential impacts of any BRT alternative within the study area revealed the following key conditions that will be evaluated in more detail as part of the environmental review phase:

- 16,954 acres of prime and unique farmland
- Two (2) coastal zones
- Seventy (70) wetland areas totaling 570 acres
- Three (3) streams, including one (1) stream crossing
- Twenty-six (26) migratory birds
- Six (6) proposed, threatened, and endangered species
- 1,169 hazardous waste sites
- Ten (10) NPDES permits

8.2 Cultural and Historic Resources

8.2.1 METHODOLOGY

An analysis of the Study Area was completed to determine the cultural and historic resources within one-mile of the alternative alignments. Cultural and historic resources were compiled from various sources, including the National Register of Historic Places (NRHP) and Google Maps. The following types of cultural and natural resources were identified and mapped:

- Cultural/Social: Concert Venues, Museums, Zoos, City Halls, Churches, Cemeteries, Schools, and Outdoor Markets/Farmer's Markets
- Historic (NRHP): Buildings, Structures, Objects, Sites, Districts, and Building Complexes
- Parks, Recreation and Open Space

8.2.2 RESULTS

Cultural/social resources were identified in the study area. Table 8-1 lists the number of resources by type.

TABLE 8-1: MAJOR CULTURAL AND SOCIAL RESOURCES

Resource Type	Number of Resources
Employers	6
Shopping	4
Medical	5
Recreation	11
Education	10
Community Services	10

In addition, within the study area there are 100 historic resources including eighty-three (83) buildings, four (4) structures, two (2) objects, and eleven (11) historic districts listed on the NRHP. The type of historic resources are listed in Table 8-2.

TABLE 8-2: HISTORIC RESOURCES

Resource Type	Number of Resources
Structures	4
Objects	2
Districts	11
Buildings	83
Total	100

8.3 Environmental Justice

8.3.1 METHODOLOGY

The project team used US Census Bureau, American Community Survey, 2009-2013, 5-Year Estimate data collected at the block group or census tract level to identify minority and low-income populations within the Study Area. A tiered approach was used to determine if Environmental Justice populations are present within the one-mile buffer of each of the alignments. The thresholds are:

- Minority and/or low-income populations meaningfully greater than the surrounding jurisdictions (Wayne and Washtenaw Counties and the State of Michigan)
- Minority population exceeding 50 percent or low-income population exceeding 20 percent

Data was also collected on LEP populations and compared to the surrounding jurisdictions to determine if the percent of LEP persons in the Study Area was meaningfully greater.

8.3.2 RESULTS

An evaluation of the population characteristics indicates that there are Environmental Justice populations of both categories living within the study area. Ethnicity and race characteristics are shown in Table 8-3, and income levels and poverty status profiles are shown in Table 8-4.

TABLE 8-3: ETHNICITY AND RACE ASSESSMENT

Population Characteristic	Study Area	Wayne County	Macomb County	Michigan
Total Persons	279,047	1,790,078	849,344	9,889,024
Total Minority Population	51.8%	50.2%	17.9%	23.9%
White Population (Non-Hispanic)	48.2%	49.8%	82.1%	76.1%
African American Population (Non-Hispanic)	45.7%	39.5%	9.8%	13.8%
American Indian Population (Non-Hispanic)	0.4%	0.3%	0.3%	0.5%
Asian Population (Non-Hispanic)	1.3%	2.8%	3.3%	2.6%
Pacific Islander Population (Non-Hispanic)	0.0%	0.0%	0.0%	0.0%
Other Race Population (Non-Hispanic)	0.3%	0.2%	0.2%	0.1%
Two or More Races Population (Non-Hispanic)	2.1%	2.0%	2.0%	2.2%
Hispanic Population (All Races)	2.1%	5.5%	2.4%	4.6%

Source: US Census Bureau, ACS 2010 – 2014 5-Year Estimate

The minority population in the study area is approximately 52 percent, which is consistent with Wayne County (50 percent) but significantly higher than Macomb County (18 percent) and the State of Michigan (24 percent).

TABLE 8-4: ECONOMIC CHARACTERISTICS COMPARISON

Economic Characteristic	Study Area	Wayne County	Macomb County	Michigan
Median Household Income	\$34,603	\$41,421	\$54,059	\$49,087
Per Capita Income	\$18,392	\$22,643	\$27,145	\$26,143
Percent Below Poverty Level	31.2%	24.8%	12.8%	16.9%

Source: US Census Bureau, ACS 2010 – 2014 5-Year Estimate

The percentage of individuals living below the poverty level in the Study Area is 31 percent, significantly higher than Macomb County (13 percent) and the State of Michigan (17 percent) and even slightly higher than Wayne County (25 percent). Likewise, the median household income and per capita income are much lower in the Study Area than any of the compared geographies.

In addition to the presence of Environmental Justice populations, there are also populations with limited English proficiency present in the Study Area as shown in Table 8-5. However, the proportion of LEP individuals is much lower in the Study Area (1 percent) than it is in Wayne County (5 percent), Macomb County (6 percent) and the State of Michigan (3 percent).

TABLE 8-5: ENGLISH PROFICIENCY

Characteristic	Study Area	Wayne County	Macomb County	Michigan
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Population 5 Years and Older	262,156	1,673,516	802,111	9,310,047
Percent with Limited English Proficiency	0.9%	4.8%	5.8%	3.2%

Source: US Census Bureau, ACS 2010 – 2014 5-Year Estimate

8.4 Summary

While all of the alternatives would be constructed and operated within an existing transportation corridor, the potential for impacts to environmental resources and historic/cultural resources exists in areas where additional right-of-way may be needed for the proposed BRT stations. In fact, realization of any of the alternatives could result in improved access to the natural resources and historic/cultural resources in the Study Area.

Additionally, no division of neighborhoods, relocations, or adverse impacts to Environmental Justice populations living within the Study Area are expected as a result of any transit alternative, as all would be constructed and operated within an existing transportation corridor. In fact, the majority of Environmental Justice populations would benefit directly from the improved mobility that a transit investment would provide. Additionally, economic development and other parallel investments resulting from the transit investment could provide an indirect benefit to these communities.

9 Findings and Next Steps

9.1 Tier 2 Findings

The Tier 2 Evaluation analyzed the multitude of different criteria to help determine the recommended alternative for further screening the Tier 3 Evaluation, including Capital Cost, travel time, operations and maintenance costs, ridership, population and employment, minority and environmental justice populations, and development potential. The following Bus Rapid Transit alternative is being recommended to advance to the Tier 3 analysis:

- Downtown Detroit to 8 Mile Road (Segments A through C)
 - Dedicated Lane Median Running with 2 vehicular travel lanes in each direction and either one parking lane or bike lanes, left-turn lanes at signalized intersections
- 8 Mile Road to Common Road (Segment D)
 - Dedicated Lane Median Running with 3 vehicular travel lanes in each direction and on-street parking as it exists currently
- Common Road to Remick Drive (Segment E)
 - Dedicated Lane Median Running with 4 vehicular travel lanes in each direction
- Remick Drive to Patterson Street (Segment F)
 - Dedicated Lane Curb Running along Gratiot Avenue around Downtown Mount Clemens
 - Dedicated Lane Median Running along Main Street within Downtown Mount Clemens
 - Both Mount Clemens options are moving forward into Tier 3
- Patterson Street to M-59 / Hall Road (Segment G)
 - Dedicated Lane Median Running with 2 vehicular travel lanes in each direction and left-turn lanes at signalized intersections

Results of the Tier 2 Evaluation are summarized in Tables 9-1 and 9-2.

9.2 Next Steps

The results of Tier 2 analysis and the recommended alternatives will be considered and presented to the various committees advising the RTA. The recommended alternatives will then be continued forward into the Tier 3 analysis, where they will be further refined based upon public and stakeholder feedback as well as opportunities for federal funding through FTA New Starts / Small Starts.

TABLE 9-1: EVALUATION RESULTS BY ALTERNATIVE

	BRT (Operating Plans)							
	Along Gratiot Avenue				Downtown Mount Clemens			
	Mixed	Dedicated			Mixed	Dedicated		
Curb		Median	Center	Curb		Median	Center	
Transportation								
Length of Alternative (miles)	24.7				24			
Number of Stations	20				19			
Average Speed (mph)	20 - 21	24 - 25	26 - 27		20 - 21	24 - 25	26 - 27	
Travel Time (minutes)	60 - 77	55 - 61	52 - 56		60 - 77	55 - 61	52 - 56	
Environmental								
Sensitive Lands (acres)	16,954				16,954			
Cultural & Historic Resources (count)	146				146			
Operations & Maintenance Costs								
Annual Cost (millions)	\$18.0	\$18.0	\$18.0	\$17.4	\$18.0	\$18.0	\$18.0	\$17.4
Capital Costs								
Total Cost (millions)	\$192	\$240	\$257	\$284	\$190	\$237	\$254	\$282
Cost per Mile (millions)	\$7.79	\$9.72	\$10.40	\$11.51	\$7.93	\$9.90	\$10.60	\$11.76
Station Area Evaluation								
Population (sum tot. pop. w/in .5 mi of stations)*	88,394				88,394			
Employment (sum tot. employ. w/in .5 mi of stations)*	81,035				81,035			

*Some double counting occurs due to station area overlap

TABLE 9-2: EVALUATION RESULTS FOR CORRIDOR SEGMENTS

	BRT (Segments)																																			
	A: Downtown - I-375				B: I-375 - M-97				C: M-97 - 8 Mile Road				D: 8 Mile Road - Common Road				E: Common Road - Remick Drive				F1: Remick Drive - Patterson Street (Gratiot)				F2: Remick Drive - Patterson Street (Main)				G: Patterson Street - M-59							
	Mixed	Dedicated			Mixed	Dedicated			Mixed	Dedicated			Mixed	Dedicated			Mixed	Dedicated			Mixed	Dedicated			Mixed	Dedicated			Mixed	Dedicated						
Transportation	Mixed	Curb	Median	Center	Mixed	Curb	Median	Center	Mixed	Curb	Median	Center	Mixed	Curb	Median	Center	Mixed	Curb	Median	Center	Mixed	Curb	Median	Center	Mixed	Curb	Median	Center	Mixed	Curb	Median	Center				
Travel Time (minutes)	2 – 4	2 – 3	1 – 2	1 – 2	9 – 14	8 – 10	8 – 9	8 – 9	14 – 19	14 – 15	13 – 14	13 – 14	13 – 19	11 – 15	11 – 13	11 – 13	11 – 16	9 – 12	8 – 11	8 – 11	7 – 9	6 – 8	6 – 7	6 – 7					3 – 5	1 – 3	1 – 3	1 – 3				
# of Intersections with LOS E / F	0	0	0	0	0	0	4	4	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Parking (% spots removed)*	100%	100%	100%	100%	50%	50%	50%	50%	51%	51%	51%	51%	0%	0%	0%	0%	100%	100%	100%	100%	0%	0%	0%	0%	54%	81%	81%	81%	0%	0%	0%	0%				
Impact to Bike Facilities (avg)**	pos	sig pos			pos	sig pos			pos	sig pos			pos	sig pos			pos	sig pos			pos	sig pos			pos	sig pos			pos	sig pos						
Impact to Ped Facilities (avg)**	no chg	sig pos			no chg	sig pos			no chg	sig pos			no chg	sig pos			no chg	sig pos			no chg	sig pos			no chg	sig pos			no chg	sig pos						
Station Evaluation																																				
Population (sum tot. pop. w/in .5 mi of stations)*	4,185				22,261				14,219				26,648				10,485				5,890				5,890				4,706							
Employment (sum tot. pop. w/in .5 mi of stations)*	39,047				11,607				3,982				10,113				6,183				6,717				6,717				3,386							
Transit Dependent Households (sum tot. HH w/in .5 mi of stations)*	948				3,191				1,188				1,494				590				376				376				170							
Development Potential																																				
Average of Segment Station Scores	9				4.3				4.3				3.5				3.3				5.5				5.5				2.3							

* In these areas, depending on final design, there is potential for localities to choose between bike facilities or on-street parking spaces
 ** no change (no chg), some positive impact (pos), significant positive impact (sig pos)
 *** Some double counting occurs due to station area overlap
 **** % of total population within one mile of segment