9. EVALUATION OF ALTERNATIVES

This section presents the methodology and a summary of the results of the third and final level of evaluation to facilitate the identification of an LPA for the DTOGS project. This section will cite data that is located several appendices to this report because of the volume of details the technical analysis required. **Table 9-1** on the following page presents the refined evaluation criteria used in this analysis, which are based on the DTOGS project's goals and objectives. This third level of analysis also adds a new goal: FTA New Starts Benchmarks. The key performance indicator associated with this goal is the cost effectiveness index (CEI), defined as the cost per new rider. Section 9.2 presents the detailed definition of this additional performance indicator. Following is an outline of Section 9: Evaluation of Alternatives to facilitate review of this section, along with a list of appendices produced for each analysis. Generally, this report presents the methodology first, then a summary of the results next.

- Section 9.1 Transportation and Mobility
  - Appendices: (H) Operating Plan; (I) Ridership Forecast Methodology and Results; (J) BRT and LRT Design Guidelines; (K) BRT and LRT Concept Plans and Typical Sections; and (L) Capital Cost Methodology and Results
- Section 9.2 FTA New Starts Benchmarks
  - Appendix: (M) Cost Effectiveness Index Calculations – Methodology and Results
- Section 9.3 Economic Opportunity and Investment
  - Appendix: (G) Land Use and Economic Impacts of the Gratiot, Michigan, and Woodward Alignments
- Section 9.4 Communities and Environment
  - Appendices: (G) Land Use and Economic Impacts of the Gratiot, Michigan, and Woodward Alignments; (I) Ridership Forecast Methodology and Results; (J) BRT and LRT Design Guidelines; (K) BRT and LRT Concept Plans and Typical Sections
- Section 9.5 Public Involvement
  - Appendices: (A) Interview Summary; (B) Summary of March 2007 Open House; (C) Summary of March 2008 Open House, and (D) Scoping Summary Report

To reiterate, the DTOGS project compares the Build Alternatives (i.e. BRT and LRT) to the TSM Alternatives because the Gratiot and Michigan TSM and Build Alternatives include the segment of Woodward Avenue between downtown Detroit and Grand Boulevard, which the No-Build Alternatives do not.

Table 9-1
Evaluation Criteria and Key Performance Indicators

Transportation and Mobility	
Goal:	**Improve Mobility**
	Performance Indicators:
	Year 2030 Daily Ridership – Alternative
	Year 2030 Daily Ridership – Corridor
	Year 2030 Daily New Riders
	Year 2030 Regional Travel Time Savings Relative to TSM Alternative
	Year 2030 Level of Service – Average Travel Speed for Autos
Goal:	**Cost Effective and Efficient Travel Options**
	Performance Indicators:
	Year 2007 Order-of-Magnitude Capital Cost
	Year 2007 Order-of-Magnitude Operating and Maintenance Cost
	Year 2007 Operating and Maintenance Cost per Revenue Hour
	Year 2007 Operating and Maintenance Cost per Passenger Mile
FTA New Starts Benchmark	
Goal:	**Meet New Starts Recommended Rating**
	Performance Indicator:
	Cost Effectiveness Index (must be less than $23.00)
Economic Opportunity and Investment	
	Performance Indicators:
	Redevelopment Potential
	Transit-Oriented Development Potential at Stations
	Year 2000 Employment within One-Half Mile of Stations
	Year 2007 Population within One-Half Mile of Stations (using *Social Compact*)
	Parking Impacts Relative to TSM Alternative
Communities and Environment	
	Performance Indicators:
	Year 2000 Transit –Dependent Population within One-Half Mile of Stations
	Year 2030 Change in Annual Regional Vehicle Miles Traveled Relative to TSM
	Year 2030 Change in Annual CO_2 Emissions Relative to TSM
	Year 2000 Population Potentially Affected by Noise and Vibration within 100 feet of Alignment
	Potential for Affecting Natural Environment
	Number of Community Facilities within One-Half Mile of Stations
	Multimodal Connections
	Consistency with Plans
	Right-of-Way Impacts
Public Involvement	
	Performance Indicator:
	Community Sentiment

9.1 Transportation and Mobility

As presented in **Table 9-1** on the previous page, the goals of improving mobility and providing cost effective and efficient travel options within the DDOT service area have several performance indicators to determine how well each transit alternative might meet these goals. This section defines each performance indicator, summarizes how the DTOGS project arrived at the value for each measure and alternative; and what the value is for each goal. Section 10: Findings and Recommendations gleans from the various parts of the evaluation of alternatives any conclusions that might facilitate the selection of an LPA.

The major components in assessing the potential transportation and mobility impacts of each alternative are:

- Ridership
- Capital Cost
- Operating and Maintenance (O&M) Cost.

9.1.1 Ridership

Performance Indicators

The evaluation measures related to ridership are:

- Year 2030 Ridership by Alternative and by Corridor – The number of weekday round trips in year 2030 for the alternative (e.g. Gratiot BRT) and for the corridor (e.g. Gratiot Avenue which includes all DDOT and SMART transit service within the corridor)
- Year 2030 Daily New Riders – The number of new transit riders per day generated by the alternative
- Year 2030 Regional Travel Time Savings Relative to the TSM Alternative – This performance indicator relates to incremental change in the number of hours of regional travel generated by a Build Alternative relative to the appropriate TSM Alternative
- Year 2030 Level of Service – This measure estimates the average travel speed for automobile travel within each alignment alternative.

Travel demand models from SEMCOG are the basis of the resulting values for each of these four indicators. Following is a summary of the travel demand and ridership methodology employed for the DTOGS project.

Methodology

The basis of the travel demand and ridership forecasts for the DTOGS project was the SEMCOG Hybrid Model. The Hybrid Model was developed following the general forecasting procedures of the MPO model from SEMCOG (E4 Model) with transit forecasting related model components adapted from the Ann Arbor to Downtown Detroit Transit Alternative Analysis (AA-DD) Model. **Appendix I** presents a comprehensive discussion of the model development process, including mode choice calibration, calibration results, transit ridership summaries, trip generation, trip distribution and highway assignments. The Hybrid Model's transit network included the five transit systems in the SEMCOG area – DDOT, SMART, Ann Arbor Transit Authority, Blue Water and Lake Erie Transit. For the DTOGS project, the Detroit People Mover was added to the network.

Additionally, the travel demand modeling undertaken for the DTOGS project assumes:

- The BRT alternatives would operate in mixed traffic in downtown Detroit
- In downtown Detroit, the LRT alternatives would follow downtown Concept C
- During PE – after an LPA has been selected – downtown alignments and the travel demand modeling will be analyzed further to more accurately reflect the downtown alignment as determined by operational needs and accepted by the various stakeholders, the public, and resource agencies.

Results

The model reflects declines in population and employment between years 2000 and 2030, which account for the low or lack of growth in transit ridership in some of the alternatives. **Table 9-2** on page 9-15 presents the results of the ridership forecasting task for each performance metric under transportation and mobility. Consistent with FTA's New Starts project development process, ridership estimates are presented as linked trips (round trips). Following are highlights of the travel modeling results:

- The TSM Alternatives do not result in significant increases in ridership.

  - For the Gratiot TSM Alternative, the segment of Woodward Avenue between downtown Detroit and Grand Boulevard significantly lengthens the travel times. The skip-stop nature of the service is inadequate in negating the resulting longer route distances.

  - The low amount of transit service currently on Michigan Avenue contributes to the relatively high ridership on the skip-stop route. However, this results in a decrease in ridership on the local route (Route 34).

  - The current and future service frequencies on Route 53 (Woodward Avenue) reflect high levels of service. The skip-stop service does not appear to provide enough incentive for increased ridership.

  - The range of 2030 daily ridership for BRT Alternatives is between 5,200 (Michigan Avenue) and 9,200 (Woodward Avenue). This range reflects an increase in ridership of 7 percent (Woodward Avenue) to more than 100 percent (Michigan Avenue), relative to TSM Alternatives.

  - The range of 2030 daily ridership for LRT alternatives is between 6,400 (Michigan Avenue) and 11,100 (Woodward Avenue). This range reflects an increase in ridership of 29 percent (Woodward Avenue) to 156 percent (Michigan Avenue). The projected 2030 daily ridership for the Gratiot LRT without the Woodward segment is 8,800.

9.1.2 Capital Cost

Key Performance Indicator

The performance measure under this category is:

- Order-of-Magnitude Capital Cost – This is the estimated cost in year 2007 dollars of constructing the various alternatives.

Methodology

The capital cost estimates (**Appendix L**), are based on concept plans (**Appendix K**) developed for the BRT and LRT Alternatives. (Capital costs are also presented in the FTA Standard Capital Cost (SCC) worksheets in **Appendix M.)** No-Build and TSM Alternatives do not require civil construction; as a result concept plans and design criteria were not developed. Capital costs were also based on transit fleet requirements resulting from the ridership estimates (**Appendix I**) and operating plans (**Appendix H**). The concept plans are based on the following BRT and LRT characteristics and design criteria (**Appendix J**):

BRT Characteristics and Design Criteria

- Transitway – BRT vehicles would operate on an exclusive transitway within the street right-of-way. In downtown areas such as the Detroit CBD where travel speeds are generally slower than the mainline, BRT would operate in mixed traffic.

- Vehicles – Although exact vehicle types may vary, the FTA associates specific characteristics with BRT vehicles such as:

  - Streamlined exterior with bullet-shaped front ends and rounded corners, such as the Civis bus used in Las Vegas.

  - Low-floor, articulated buses that facilitate loading and ADA requirements.

  - Large doors on both sides to facilitate boarding and alighting.

  - High-capacity interior design with more standee room. For the DTOGS project, stations are designed to accommodate two BRT vehicle lengths to mimic two-car light rail consists and enhance passenger-carrying capacity.

  - Usually internal combustion engines, although may be electric, dual-powered or hybrid-electric; regardless of the propulsion system, noise reduction is important.

  - Smooth, quite ride at average speeds that may be competitive with automobile travel.

- Vehicle Control – An operator would control each BRT vehicle. The operator will have control over the acceleration, deceleration, braking and passenger door operations. The operator could make passenger announcements or automatically by the transit control center. The transit control center would oversee and direct all BRT operations while in contact with the vehicle operator. Automated signal and communication systems would send operations data to the control center such as speed, location and direction of travel. A traffic control system would coordinate BRT and vehicular traffic including activation of crossing gates and BRT collision and over-speed protection.

- Stations – Individual station designs would depend on ridership forecasts, adjoining land use and neighborhood context. For the DTOGS project, a mid-level of amenities is included in the capital costs – such as shelter, benches, signs, lighting, and trash receptacles. The cost of each station type essentially varies by type or size of station

and whether park-and-ride facilities are included. The next phase of the DTOGS project (PE) will refine station locations, design and amenities.

- Fare Collection – A self-service, proof-of-payment fare collection is proposed. Passengers would purchase individual or multiple tickets from fare vending machines located at each station. Passengers would validate tickets prior to boarding the train. Ticket inspectors would ride trains to perform random proof-of-payment checks from passengers. The absence of positive fare control such as turnstiles and fare boxes and use of cars with multiple, wide boarding doors provide for rapid transit boarding and alighting and minimal delays at stations.

- Traffic Control Systems – At locations where proposed BRT alignments would cross public streets, active traffic control systems devices such as traffic signals, railroad type flashers, bells and gates would be installed to control traffic. In low-speed areas, including downtown Detroit, intersection type traffic signals along with signage would be used. Traffic and pedestrian signals, signs and markings would comply with the current *Manual on Uniform Traffic Control Devices* (MUTCD).

- Maintenance Facility – Currently, DDOT has several maintenance and vehicle storage facilities that might be able to accommodate the new BRT vehicles. However, DDOT currently does not have any articulated buses in its fleet, which are probably the vehicles closest in size, operational characteristics and maintenance needs to the proposed BRT vehicles. Therefore, the DTOGS project BRT cost estimates includes an allowance for the potential construction of a brand new facility for the sole purpose of servicing and storing the BRT vehicles. Additionally, at this level of evaluation, a specific location for a new BRT maintenance facility has not been determined; the study of potential locations has been deferred to PE.

- Accessibility – The design of the BRT system will comply fully with the American with Disabilities Act (ADA) of 1990. The BRT vehicles will be fully accessible with level boarding from accessible platforms and provisions for wheelchair space on all BRT vehicles. Station features include ramps and/or elevators to accommodate mobility-impaired individuals. Proposed park-and-ride sites will include designated handicapped parking spaces.

LRT Characteristics and Design Criteria

The following elements and design characteristics are common to all proposed LRT alternatives.

- Trackway – Light rail vehicles (LRVs) would operate on standard gauge railroad track. The proposed system would be double-tracked, providing separate tracks for each train direction. Generally, a cross-section of at-grade, double track, street-running light rail alignment requires 28 feet wide of right-of-way.

  The minimum vertical clearance used for this level of effort is 18.5 feet from the top of rail to the bottom of the overhead obstruction. The maximum recommended gradient along a vertical alignment is six percent. The radius of track curvature plays a significant role in light rail vehicle operating speed. The absolute minimum turning radius for a typical modern articulated street-running LRV is 82 feet. Crossovers, to allow trains to cross from one track direction of travel to another, are provided at select locations to allow for special operations, e.g. at the Michigan State Fairgrounds on Woodward Avenue. As a cost-saving measure, ballasted track with ballast curbs are proposed along most of the alignment, except at signalized intersections, pedestrian crossings and downtown Detroit where embedded track will be used.

- Vehicles – Light rail vehicles would be double-ended, articulated cars capable of bi-directional operation as a single- or multi-unit train. A pantograph located on the roof of each vehicle provides power collection from the overhead catenary system (OCS) to the LRV traction motors. Each car is approximately 90 feet long with 66 seats and a total capacity of 120 to 170 passengers including standees. Passenger-carrying capacity varies by vehicle manufacturer and seat configuration, as specified by the transit operator. The DTOGS project assumes two-car consists. Light rail vehicles can operate at speeds of up to 55 mph. The posted speeds on the three DTOGS project alignments range from 35 mph to 45 mph, and the proposed light rail system would comply with posted speeds.

  The number of transit vehicles required by each LRT alternative is based on the proposed operating plan and estimated ridership.

- Vehicle Control – An operator would control each light rail train. The operator would have control over acceleration, deceleration and braking of the train as well as passenger door operations. The operator could also make passenger announcements, or automatically by the rail control center. The rail control center would oversee and direct all rail operations while in contact with the vehicle operator. Automated train signal and communication systems would send operations data to the rail control center, including speed, location, and direction. The capital cost estimates for the LRT alternatives include an allowance for a traffic control system that would coordinate LRV and automobile traffic such as signal and crossing gate activation, collision and over-speed protection, and track switching operations.

- Stations – Individual station designs would depend on ridership forecasts, adjoining land use and neighborhood context. For the DTOGS project, a mid-level of amenities is included in the capital costs – such as shelter, benches, signs, lighting, and trash receptacles. The cost of each station type essentially varies by type or size of station and whether park-and-ride facilities are included. The next phase of the DTOGS project (PE) will refine station locations, design and amenities.

- Fare Collection – A self-service, proof-of-payment fare collection is proposed, as described for BRT.

- Power System – Traction power substations would be located at regular intervals along the proposed LRT line. Most substations would be located near light rail stations. Generally, substations are a single-story building with an approximate footprint of 40 feet by 20 feet on a 4,000-square-foot limited access site. They would transform and rectify the utility three-phase alternating current to the direct current light rail electrification voltage. The power is then distributed to the trains through the OCS.

- Traffic Control Systems – At locations where the proposed light rail would cross public streets, active traffic control system devices such as traffic signals, railroad-type flashers, bells and gates would be installed to control traffic. (At unsignalized intersections or driveways, no crossings would be allowed across the tracks.) Traffic and pedestrian signals, signs and marking would comply with the current *MUTCD*.

- Yard and Shop – Each of the proposed light rail alternatives requires construction of a new yard and shop (maintenance facility). This facility would be used for light rail

vehicle storage and maintenance. It would also be where light rail administrative staff would report for work and trains would enter and leave revenue service. The interior and exterior of the LRVs would be cleaned and repaired daily at this facility. They would also be inspected and serviced according to a fixed inspection and maintenance schedule to maximize operational safety and reliability. The location of a maintenance facility will be determined during PE.

- Accessibility – The design of the light rail system will comply with ADA guidelines. Light rail vehicles will be fully accessible, with level boarding from accessible platforms (e.g. ramps and elevators) and provisions for wheelchair space on all cars. Park-and-ride facilities will include designated spaces for disabled persons with permits. Stations will include ramps and/or elevators to accommodate mobility-impaired patrons.

Physical Location of Transitway

The BRT and LRT alternatives under consideration would operate within existing street rights-of-way. The existing right-of-way could accommodate a number of transitway configurations:

- Side-running – Both directions of BRT or LRT would operate on one side of the street
- Split side-running – The BRT or LRT guideway would operate on the outside (curb) lanes
- Median-running – The BRT or LRT guideway would operate in the middle of the street.

Section 7: Detailed Definition of Alternatives described each of the three alignment alternatives – Gratiot, Michigan and Woodward Avenues. These roadways are all under MDOT's jurisdiction and share many similar characteristics such as right-of-way width, posted speeds, traffic control and functional classification. As such, this particular discussion of where to locate the guideway within one roadway would apply to the other two.

Several key elements contribute to the success of a rapid transit system operating within a street right-of-way. They include safety, mobility, accessibility and economics. In many

cases, these factors are interrelated. As such, the decision to locate the transitway in the median is based on the sum of these factors vs. their individual merits. Following is the rationale for proposing median-running BRT or LRT operations on Gratiot, Michigan and Woodward Avenues:

Safety

- Median-running rapid transit would maintain existing right turns into and out of driveways and unsignalized side streets. Side-running rapid transit would entail crossing the guideway whether a motorist is making a right or left turn. This presents a conflict point that would be avoided if the rapid transit guideway were located in the middle of the street.

- Median-running rapid transit would have stations located in the middle of the street as well. This means that transit patrons would generally have to cross only one-half of the rapid transit line to access the platform – or only have to look for oncoming traffic in one direction, contributing to safer pedestrian crossings.

Mobility and Accessibility

- Preserve right turn only access to and from cross streets and driveways where there would be no traffic signal control. Side-running operations – whether the guideway is all on one side or along each curb – would remove virtually all access to and from unsignalized intersections and driveways. To provide more access to side streets and driveways, more signals could be installed. However, this would add delay to the rapid transit line operations.

- Median-running light rail would preserve more existing on-street parking spaces than either of the side-running scenarios.

- Median-running light rail or BRT would preserve local buses' use of curb lanes and access to bus stops located on sidewalks. Forcing rapid transit vehicles and local buses to operate on the same lane would degrade travel times for both types of service; e.g. light rail can only operate as fast as the bus in front of it that might stop at every other block. Light rail would then not be the premium service it is intended to be. Additionally, some bus service would continue to operate on Gratiot, Michigan or Woodward Avenue; again, its exact nature would be determine and refined during PE and final design.

Economics

- Median-running rapid transit will preserve on-street parking, an invaluable resource for businesses along the three alignments.
- Immediate disruptions to adjacent businesses would be minimized if sidewalks are left intact as much as possible during rapid transit construction. This would not be the case under side-running operations.
- Curbside rapid transit operations could result in additional and probably unnecessary traffic signals and gates to ensure safety, when operating in the middle of the street would avoid these requirements. These additional installations will increase capital cost.

Capital Cost Elements

Order-of-magnitude capital costs developed for the DTOGS project reflect engineering experience and planning judgment, along with similar experience of transit providers in the United States. Comparable projects include the Central Corridor LRT in the Twin Cities, MN; North-South LRT Extension in St. Louis, MO; East-West Preliminary DEIS in New Orleans, LA; I-205 LRT and Portland Mall Final Design in Portland, OR; and Norfolk LRT Final Design in Norfolk, VA.

Detailed capital cost estimates are included in **Appendix L**, the FTA's Standard Capital Cost worksheets are included in **Appendix M,** and a summary of the Order-of-Magnitude Capital Costs is presented in **Table 9-3**. Capital cost estimates included the following major categories, consistent with the FTA's Standard Cost Categories used in calculating Transportation User Benefits as part of the New Starts project development process:

- Guideway – Track, busway
- Stations – Bus stops and BRT and LRT stations
- Maintenance Facility – Yard and shop for light rail
- Structures – Bridges and retaining walls
- Systems – Light rail electrification, substations, signaling, communications

- Vehicles – Buses and light rail vehicles
- Professional Services – This category is a percentage of the infrastructure cost and includes design fee, permits, administration. It amounts to 32 percent of infrastructure cost.
- Contingency – This category is 20 percent of infrastructure cost.

Right-of-way cost will be determined during Preliminary Engineering. Initial discussions during the DTOGS project identified potential sites for a maintenance facility that are currently owned by the City of Detroit. For the stations and guideway, both BRT and LRT are proposed to operate within the existing street (MDOT) rights-of-way; therefore, minimal right-of-way cost is anticipated. Right-of-way cost should be determined during PE for the substations.

Capital costs for the TSM Alternatives used a methodology consistent with the BRT and LRT Alternatives. The No-Build Alternative assumed no new major transportation investments in addition to those already planned and funded, and additions to DDOT's existing bus fleet which will result in minor capital outlays. The capital costs presented for the TSM, BRT and LRT Alternatives are considered incremental relative to the No-Build Alternative.

Appendix L presents detailed capital cost estimates, these estimates are present in the FTA SCC worksheets in **Appendix M**. As stated in Section 7, the BRT Alternatives assume that in downtown Detroit, BRT vehicles would operate in mixed traffic. Additionally, the order-of-magnitude capital cost estimates presented for the LRT Alternatives include the Concept C alignment, which represents the middle range of capital costs for the three downtown concepts. (Concept A is the least expensive because it is the shortest route, while Concept B is the most expensive because it is the longest route.) Similarly, the ridership results for the LRT Alternatives represent downtown Concept C.

Results

Table 9-3 on page 9-15 presents the order-of-magnitude capital cost estimates for each alternative, in year 2007 dollars. Following are highlights of the capital cost estimating exercise:

- The Michigan No-Build Alternative requires the least capital outlay ($3.1 million) of the three No-Build Alternatives and of all the alternatives. Michigan Avenue currently has very limited transit service such that a small capital investment (additional buses) appears to result in a marked increase in ridership, as shown in Section 9.1.1.

- The range of capital costs for the TSM Alternatives is $14.1 million (Michigan Avenue) to $26.0 million (Gratiot Avenue). The Gratiot TSM Alternative requires the most additional new buses, thus increasing its capital cost.

- The range of capital costs for the BRT Alternatives is $213 million (Woodward Avenue) to $292 million (Michigan Avenue). Woodward Avenue is the shortest route of the three BRT alternatives (8.5 miles). The Gratiot and Michigan BRT Alternatives both include the 2.5-mile segment of Woodward Avenue between downtown Detroit and Grand Boulevard, which adds approximately $52.0 million in capital cost.

- The range of capital costs for the LRT Alternatives is $371.5 million (Woodward Avenue) to $523 million (Gratiot Avenue). Woodward Avenue is the shortest route of the three LRT alternatives (9.5 miles). The Gratiot and Michigan LRT Alternatives both include the 2.5-mile segment of Woodward Avenue between downtown Detroit and Grand Boulevard, which adds approximately $84.7 million in capital cost.

- The capital costs for the Gratiot LRT and Michigan LRT Alternatives are similar -- $523 million and $521 million, respectively. Without the Woodward segment, the Gratiot LRT capital cost is $452.8 million.

- The relatively high capital cost of the Michigan LRT Alternative is also associated with the number of structural modifications required to accommodate the light rail facility under and within existing bridges along the avenue.

- Similarly, the relatively high capital cost of the Gratiot LRT Alternative is also associated with the required grade-separation between light rail and freight tracks near French Road.

Table 9-2
Evaluation Results – Ridership Modeling

Metric	Alternative											
	No-Build			TSM			BRT			LRT		
	Gratiot	Michigan	Woodward	Gratiot	Michigan	Woodward	Gratiot	Michigan	Woodward	Gratiot	Michigan	Woodward
2030 Daily Ridership – Trunk Line	6,700	2,400	8,300	6,400	2,500	8,600	8,200	5,200	9,200	9,900	6,400	11,100
2030 Daily Ridership – Corridor	16,000	5,700	19,600	15,600	5,600	20,000	18,100	8,600	20,900	19,800	9,700	22,800
2030 Daily New Riders	930	220	1,250	680	430	780	3,280	2,530	3,420	4,090	3,140	4,250
2030 Regional Travel Time Savings	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	(1,000)	(600)	(600)	(1,300)	(900)	(1,600)
2030 Level of Service												
Average Travel Speed for Automobiles	25 mph	27 mph	24 mph	25 mph	27 mph	24 mph	19 mph	23 mph	21 mph	19 mph	23 mph	21 mph
Change Relative to TSM	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	(6 mph)	(4 mph)	4 mph)	(6 mph)	(4 mph)	(4 mph)

Table 9-3
Evaluation Results – Year 2007 Costs

Metric	Alternative											
	No-Build			TSM			BRT			LRT		
	Gratiot	Michigan	Woodward	Gratiot	Michigan	Woodward	Gratiot	Michigan	Woodward	Gratiot	Michigan	Woodward
Order-of-Magnitude Capital Cost	$8.9 million	$3.1 million	$8.9 million	$26.0 million	$14.1 million	$14.9 million	$280 million	$292 million	$213 million	$523 million	$521 million	$372 million
Annual O&M Cost												
Trunk Route	$1.7 million	$1.7 million	$2.7 million	$2.6 million	$1.6 million	$1.9 million	$7.7 million	$5.6 million	$5.1 million	$11.0 million	$8.0 million	$7.4 million
Incremental Systemwide (DDOT)*	$10.0 million	$3.6 million	$9.0 million	$15.8 million	$4.3 million	$11.1 million	$11.6 million	$5.0 million	$-1.3 million	$14.9 million	$7.4 million	$0.9 million
Operating Cost per Revenue Hour	$150.25	$150.25	$150.25	$150.25	$150.25	$150.25	$150.25	$150.25	$150.25	$214.00	$214.00	$214.00
Operating Cost per Passenger Mile	$0.82	$5.05	$1.03	$9.35	$0.49	$21.04	$0.58	$0.52	$0.39	$0.70	$0.59	$0.45

*Incremental Systemwide costs are compared to DDOT O&M costs for 2007 of $174.2 million.

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9.1.3 Operating and Maintenance Cost

Key Performance Indicators

The performance measures associated with Year 2007 O&M cost estimates are:

- Annual O&M cost for the alternative – Represents the O&M cost alone of each alternative, e.g. Gratiot BRT
- Annual change in DDOT's systemwide O&M costs – Due to the implementation of the proposed alternative
- Operating cost per revenue hour
- Operating cost per passenger mile – Represents only the O&M cost of an alternative divided by the number of passenger miles associated with the alternative.

Methodology

This section presents the order-of-magnitude O&M cost estimates for each alternative analyzed in the DTOGS project. These costs are based on the operating plans outlined in the previous section of this report and in more detail in **Appendix H**. The cost estimates reflect 2030 ridership forecasts and are expressed in year 2007 dollars. They also use information from the National Transit Database (NTD). The NTD conducts an annual audit of transit agencies in the United States. The audit includes detailed information such as ridership and O&M costs.

Similar to the order-of-magnitude capital cost estimates, the O&M cost estimates developed for the DTOGS project reflect the combined experience of engineering and planning analysis judgment along with the experience of similar transit operations in the United States. As such, the DTOGS project identified peer transit systems to compare and develop potential unit costs. These peer systems include cities with bus, BRT and/or LRT operations such as Dallas, Denver, Minneapolis, Pittsburgh, Portland and St. Louis. The NTD has detailed ridership and O&M cost information for each of these agencies.

To develop the O&M cost estimates for each alternative, the DTOGS project used the cost per revenue hour. This is relevant because labor costs comprise a substantial proportion of overall O&M costs for transit systems around the country. For bus-only service, as DDOT currently provides, the DDOT cost was used ($150.25 per revenue hour). The range of cost

per revenue hour for systems with BRT service as well is approximately $105 to $126.[1] The range of cost per revenue hour for peer cities with light rail service is approximately $154 to $338.[2] The national average is $214.02 per revenue hour.

Further, the NTD indicates that in 2006, the national average bus O&M cost per revenue hour is $104.20. This average includes BRT systems operating within an exclusive guideway (Pittsburgh and Miami). This unit cost is approximately two-thirds of DDOT's expense ($150.25). Given this significant difference, while other studies may place a premium on BRT service, the DTOGS project will use DDOT's current rate and apply it to all alternatives with bus elements, including the LRT feeder bus plans.

In summary, the DTOGS project used the following operating cost per vehicle revenue hour to develop O&M costs for the No-Build, TSM, BRT and LRT alternatives:

- Bus (applies to No-Build, TSM and BRT alternatives and feeder buses): $150.25 per revenue hour
- LRT: $214.02 per revenue hour.

The O&M costs are presented as an annual cost, consistent with FTA New Starts requirements. The DTOGS project uses an annualization factor of 307. The annualization factor converts weekend and holiday service to an equivalent weekday service in order to facilitate estimation of an annual O&M cost. The 307 factor used is consistent with DDOT's current service for the three corridors under consideration.

Results

Table 9-3 on page 9-15 presents the O&M cost estimates. Following is a summary of the results:

- Overall, the level of transit service proposed for all of the alternatives on Michigan Avenue is significantly less than those proposed for Gratiot and Woodward Avenues. Current eight- and ten-minute headways for Woodward and Gratiot No-Build

[1] Information presented is for BRT systems in Miami, Pittsburgh and Seattle. Reference: *2006 National Transit Database*, FTA.

[2] Information presented is for LRT systems in Dallas, Denver, Minneapolis, Pittsburgh, Portland and St. Louis. Reference: *2006 National Transit Database*, FTA.

Alternatives, respectively, are significantly higher levels of service compared to 30-minute frequencies of DDOT Route 37 on Michigan Avenue.

- The incremental change in annual O&M cost for the No-Build alternatives ranges from $3.6 million (Michigan Avenue) to $10.0 million (Gratiot Avenue).

- While the range of incremental change in annual O&M cost for the TSM Alternatives is also similar to the No-Build, the difference in O&M costs between the Gratiot and Woodward TSM Alternatives is significant: $15.8 million for Gratiot TSM and $11.1 million for Woodward TSM. (The difference was $1 million under the No-Build Alternatives.) This is because the Gratiot TSM Alternative includes the 2.5-mile segment of Woodward Avenue between downtown Detroit and Grand Boulevard.

- The incremental cost of TSM service relative to the No-Build alternatives for the three alignments ranges from $700,000 (Michigan TSM alternative) to $5.8 million (Gratiot TSM alternative).

- The annual O&M cost of BRT alternatives ranges from $5.1 million (Woodward Avenue) to $7.7 million (Gratiot Avenue). The annual O&M cost of the Michigan BRT alternative is $500,000 more than the Woodward BRT annual O & M cost.

- The annual O&M cost of LRT alternatives ranges from $7.4 million (Woodward Avenue) to $11.0 million (Gratiot Avenue). The annual O&M cost of the Michigan LRT alternative is $600,000 more than the Woodward BRT's. Without the Woodward segment, the annual O&M cost for the Gratiot LRT alternative is $8.3 million.

- Overall, the range of incremental change in DDOT's annual O&M cost is from $-1.3 million (Woodward BRT) to $15.8 million (Gratiot TSM).

9.2 FTA New Starts Benchmarks

Key Performance Indicator

- Cost Effectiveness Index (CEI) – The CEI at this level of effort is defined as the cost per new transit trip. The cost is the annualized capital and O&M cost and is then divided by the number of new transit riders to estimate the CEI. FTA funding guidelines require a New Starts project to receive a Medium rating, equivalent to a CEI less than $23.00.

  The DTOGS project uses the calculation described in the preceding paragraph as a proxy to FTA's more rigorous definition of the CEI, which defines Transportation User Benefits (TSUB). These benefits and costs are determined using SUMMIT software and will be calculated for those alternatives to be included in PE.

Methodology

The calculation of the CEI has three ingredients: capital cost, annual O&M cost and number of 2030 new riders. The O&M cost and ridership by alternative are already expressed in annual terms. The capital cost by alternative must then be expressed in annual terms as well. This is achieved through use of the FTA's SCC worksheets. The worksheets include annualization factors for various elements of the capital cost such as guideway and track, stations and terminals, right-of-way, vehicles, systems, site work, contingencies, finance charges and professional services based on useful life. Following are specific formulas used in the calculation of the CEI for each DTOGS project alternative:

(A) Incremental O&M Cost of Build Alternative = O&M Cost of Build Alternative less O&M Cost of TSM Alternative

(B) Incremental Annual Capital Cost of Build Alternative = Annual Capital Cost of Build Alternative less Annual Capital Cost of TSM Alternative

(C) Incremental Annual Cost of Build Alternative = (A) plus (B)

(D) Incremental Ridership of Build Alternative = Ridership of Build Alternative less Ridership of TSM Alternative

Cost per New Rider (CEI) = (D) divided by (C)

For the purpose of this analysis, the TSM Alternatives are most comparable to the Build Alternatives. Therefore, the CEI is calculated for the Build Alternatives relative to the TSM Alternatives. **Appendix M** presents detailed documentation of the CEI calculations.

Results

Table 9-4 below presents the CEI for the six Build alternatives relative to the TSM alternatives. The CEI for the Gratiot Build alternatives are relative to the Gratiot TSM Alternative, and similarly for the Michigan and Woodward alternatives. Following is a summary of this assessment:

- The range of CEIs for BRT alternatives is from $16.12 (Woodward) to $25.00 (Michigan). Of the three BRT alternatives, Gratiot and Woodward are the two that appear to meet the FTA benchmark for a Medium rating.
- The range of CEIs for LRT alternatives is from $20.69 (Woodward) to $32.79 (Michigan). Of the three LRT alternatives, only Woodward appears to meet the FTA benchmark for a Medium rating.
- Both BRT and LRT alternatives for Woodward appear to meet the FTA benchmark for a Medium rating.
- The high capital cost associated with the Michigan BRT and LRT alternatives and relatively low ridership from low population and employment along the avenue between downtown Detroit and Dearborn limit its ability to yield a cost-effective rapid transit system.
- While the Gratiot BRT Alternative appears to meet the FTA benchmark for a Medium rating, the Gratiot LRT Alternative's high operating and capital costs vis-à-vis the estimated ridership are not cost-effective. Without the Woodward segment, the CEI of the Gratiot LRT alternative is $29.95.

Table 9-4
Cost Effectiveness Index – Build vs. TSM

Metric	Build Alternative					
	BRT			LRT		
	Gratiot	Michigan	Woodward	Gratiot	Michigan	Woodward
Cost Effectiveness Index (must be less than $23 for a Medium rating)	$22.49	$25.00	$16.12	$29.35	$32.79	$20.69

9.3 Economic Opportunity and Investment

The goal and objectives under this heading are to:

- Support investments in infrastructure, business, and community that sustain the heart of the region.
- Create a reliable rapid transit system that:
  - Strengthens transit linkages within the project area that support economic development and redevelopment investments.
  - Equips employers with the confidence that their employees have reliable, fast transit options to travel to and from work.
  - Attracts new residents and promote residential development in the project area.

The key performance indicators developed to assess the economic opportunities and investments for each alternative are:

- Redevelopment potential
- TOD potential at transit stations
- Year 2000 employment within one-half mile of stations – Based on U.S. Census
- Year 2007 population within one-half mile of stations – Based on *Social Compact*, given that 2005 SEMCOG population projections for Detroit are significantly lower than population estimates more recently developed by *Social Compact*
- Parking impacts – Comparison of existing number of on-street parking spaces and estimates associated with each alternative.

Redevelopment and TOD potential are two metrics based on the comprehensive document *Land Use Economic Development Impacts of the Gratiot, Michigan and Woodward Alignments* presented in Appendix G. While each of the three alignments differs in its mix of land uses, current levels of economic development, and concrete planning, future opportunities for TOD exist within each alignment. Even within a given alignment, there are zones or segments that differ in their economic response to a transit investment.

9.3.1 Redevelopment Potential

Key Performance Indicator

- Redevelopment Potential – Assessment of overall market conditions and potential for economic development generated by the alternative.

Methodology

The DTOGS project assessed the redevelopment potential of each alignment by analyzing existing land use, planning and zoning ordinance (as described in Section 7: Detailed Description of Alternatives), and various development trends (residential market, tourism, retail, institutions, office, industrial and community facilities). This information is helpful in considering the overall market demand for new residential, commercial and other uses in each of the three DTOGS project alignments. Then, an evaluation of each alignment and proposed station areas was undertaken following FTA guidance on land use criteria. Finally, each of the three DTOGS project alignments was analyzed according to existing land use, planning and zoning guidance, and potential for economic impacts. For the purpose of this analysis, the redevelopment potential is the same for an alignment, regardless of modal alternative.

FTA Guidance on Transit-Supportive Land Use

As previously noted, the FTA considers transit-supportive land use as a key rating factor when determining funding eligibility under New Starts. According to the latest guidance available, the FTA will examine three major categories of land use analysis, detailed in **Table 9-5** on the following page 9-24. The factors identified in **Table 9-5** apply to both the assessment of redevelopment potential of each DTOGS project alignment and TOD potential of each proposed station area.

Redevelopment and TOD potential are interrelated; therefore, the assessment of redevelopment potential and TOD potential at each station for each alignment are similar. The analysis also assumes that redevelopment potential of each alignment associated with BRT and LRT alternatives are identical. Details of the land use and economic impacts analysis are presented in **Appendix G**.

Table 9-5
FTA Land Use Rating Categories

Category 1: Existing Land Use	
Existing Land Use	Existing alignment and station area development Existing alignment and station area development character Existing station area pedestrian facilities, including access for persons with disabilities
Category 2: Transit-Supportive Plans and Policies	
Growth Management	Concentration of development around established activity centers and regional transit Land conservation and management
Transit-Supportive Policies	Plans and policies to increase alignment and station area development Plans and policies to enhance transit-friendly character of alignment and station area development Plans to improve pedestrian facilities, including facilities for persons with disabilities Parking policies
Supportive Zoning Regulations	Zoning ordinances that support increased development density in transit station areas Zoning ordinances that enhance transit-oriented character of station area development and pedestrian access Zoning allowances for reduced parking and traffic mitigation
Tools to Implement Land Use Policies	Outreach to government agencies and the community in support of land use planning Regulatory and financial incentives to promote transit-supportive development Efforts to engage the development community in station area planning and transit-supportive development
Category 3: Performance and Impacts of Policies	
Performance of Land Use Policies	Demonstrated cases of development affected by transit-supportive policies Station area development proposals and status
Potential Impact of Transit Investment on Regional Land Use	Adaptability of station area land for development Local economic environment

Economic Impacts of Development near Transit

Development of a transit system has the opportunity of creating positive economic impacts in the areas immediately surrounding the transit line and stations. In addition to the transportation-related benefits that will result from a new transit system, a community can realize direct and spin-off economic benefits. Transit can be viewed as a community or infrastructure improvement that adds value to land and makes it more attractive for development:

- Value for commercial and institutional development: provides improved access for employees and customers to visit commercial establishments (i.e., offices, retail stores, service providers, schools, hospitals, etc.)

- Value for entertainment and tourism development: provides improved access for employees and visitors to entertainment and tourist destinations, and reduces automobile-generated congestion for high-attendance events (e.g., sporting venues, arts establishments, casinos, bar / restaurant districts, etc.)

- Value for residential development: provides a transportation alternative to local residents.

As new developments begin to occur in a transit service area, a new community develops. The presence of a mix of uses has a synergistic and multiplicative benefit. As residential units or office buildings develop, retail becomes more viable and retail businesses begin to appear. As more retail and service businesses appear, the area becomes more attractive to prospective residents or office facilities, and more housing units and office space are developed, and so on.

The increased value to land in a transit service area may be realized as early as the point in time when a transit project is announced, in anticipation of its general construction, and may continue well after transit operations begin.

Impacts vary from place to place in degree and timeframe realized, and it is generally agreed that the following factors influence the extent of benefits received include[3]:

- Stage of transit project (proposed, funded, in progress, completed)

- Transit type (i.e., technology implemented: traditional busses, bus rapid transit, light rail, streetcars / trolleys, commuter rail, etc.)

- Transit connectivity, such as access to desirable routes and destinations

- Frequency of service

- Local real estate market conditions

- Land uses in the station area

[3] Fogarty, Nadine and Strategic Economics. "Transit and Value Capture." Presented at Rail-Volution conference, November 2, 2007.

- Local land use policy (i.e., zoning, neighborhood plans, comprehensive plans, etc.)
- Accessibility of station to pedestrians, park-and-ride users, connecting transit users
- Disincentives to driving, such as roadway congestion, rising fuel costs and taxes, and high parking costs and inconvenience.

Value may accrue to a variety of parties as a result of increased land value and subsequent development:

- Property owners: net gains on investment from increased property values
- Developers and landlords: reduced development costs resulting from lower parking requirements and increased density, and ability to charge rental premiums for land or space rental
- Retail and service business owners: increased sales resulting from increased traffic and visibility
- Taxing bodies: incremental tax revenues as a result of increased property value.

Results

Following is a summary of the assessment of the redevelopment potential of each alignment. **Table 9-6** below presents a summary of the assessment of each of the three alignment's redevelopment potential. The Gratiot and Michigan TSM, BRT and LRT alignments both include the segment of Woodward Avenue between downtown Detroit and New Center.

Table 9-6
Redevelopment Potential by Alignment Alternative

Alignment	No-Build	TSM	BRT	LRT
Gratiot	Same as BRT/LRT	Same as BRT/LRT	Medium	Medium
Michigan	Same as BRT/LRT	Same as BRT/LRT	High	High
Woodward	Same as BRT/LRT	Same as BRT/LRT	High	High

- The economic potential along the three alignments (i.e. Gratiot, Michigan and Woodward Avenues) is a function of the existing market trends and the suitability of each station area for TOD. All three alignments provide economic development

potential, but on both of these factors, Michigan Avenue and Woodward Avenue provide more economic potential than Gratiot Avenue.

- Market conditions along the southern portion of Woodward Avenue have the potential to spill over into the adjacent neighborhoods to the north, which contain numerous historic districts filled with intact single-family homes. The existing neighborhoods in the lower half of the corridor feature a growing base of medium-density residential development, and feature a mix of uses suitable for a transit- and pedestrian-oriented district.

- The middle segment of the Gratiot alignment is hampered by a declining base of residential population and a lack of commercial activity. Opportunities along Gratiot Avenue are highest in the growing neighborhoods closer to downtown Detroit or in the more stable residential neighborhoods at the far northern edge of the alignment.

Details of the individual alignment assessment for redevelopment potential are provided as follows:

Gratiot Avenue Alignment

The south end of the Gratiot alignment benefits from a close connection to downtown. A key anchor is the historic Eastern Market, currently in the midst of renovations. Both a tourist and commercial destination, it serves as a positive influence on the largely stable surrounding areas.

Moving northwest, the central segment of Gratiot Avenue between Mount Elliot and Seven Mile Road offers intermittent pockets of viable retail development, with a limited number of shopping centers featuring national or chain establishments. These commercial facilities, including structures as well as parking, are in various states of repair. The character of development is mainly auto-oriented. The residential blocks off Gratiot through this segment of the alignment have experienced decreases in population and a high presence of abandoned structures and vacant/cleared lots. The City of Detroit continues to pursue its program of demolition of dangerous and abandoned structures and some infill new construction or redevelopment has occurred. Population density in this segment of the alignment is comparatively low, with households marked by lower median incomes and higher proportions of youth than other areas of the City, which make marketing to retail developers challenging. For these neighborhoods to support this section of Gratiot Avenue as a

commercial corridor, a comprehensive neighborhood planning approach, including community services, residential redevelopment, schools, and job training will be required. A new retail center adjacent to the Coleman A. Young International Airport is reportedly in planning stages with support from the City and DEGC.

The Coleman A. Young International Airport is a noteworthy anchor for the central segment of the Gratiot Avenue alignment. Expansion of the airport would be required to increase traffic beyond the current levels of general aviation and charter activity. However, current adjacent land uses and Federal Aviation Administration regulations make this concept unlikely to occur in the short term.

The neighborhoods surrounding the far northwest segment of the alignment around Seven Mile Road and Eight Mile Road currently have more stable development. The housing stock in the interior blocks tends to be brick construction rather than wood frame, and has experienced minimal abandonment. The commercial activity along the alignment is more oriented to larger shopping centers with more national or credit tenants. The Gratiot/Eight Mile shopping center at the southwest corner of Gratiot Avenue and Eight Mile Road competes with the auto-oriented centers along Eight Mile and the suburban centers across the Wayne/Macomb County Line.

Michigan Avenue Alignment

The neighborhood planning efforts and proposed/planned projects identified for various districts in the Michigan Avenue alignment suggest compatibility with transit. In particular, commercial and residential development has been occurring on a small but steady scale on the near east end of the alignment. Detroit's Corktown neighborhood immediately west of downtown Detroit is characterized by entertainment uses (a legacy of the Tiger Stadium neighborhood) along Michigan Avenue, with residential uses on the blocks behind. Small independent infill residential projects have been occurring steadily with the support of the Greater Corktown CDC, and a few recent larger-scale rental and for-sale loft conversions have brought new residents to the neighborhood.

In the middle of the alignment, between Livernois and Central Streets in Detroit, there are plans to revitalize the historic commercial district, with focus on retail development and local cultural institutions. The Michigan Department of Transportation has completed a first phase of road improvements to Michigan Avenue and retailers have reported that, upon completion of these efforts, their business has improved. The neighborhoods to the south of Michigan

Avenue, such as Mexicantown and the Vernor Highway corridor, are growing and expanding northward, providing a growing customer base for a transforming Michigan Avenue retail corridor. To the north of Michigan Avenue, residential neighborhoods marked by abandonment have been "reseeded" with new stable housing. In 2005 Habitat for Humanity spearheaded a local campaign that built over 30 new homes, shoring up the local residential population.

The segment of the Michigan Avenue alignment between the proposed Rosa Parks and the Livernois-to-Central district is characterized by a lack of activity and high rates of abandonment. A key exception in this zone is the Clark Street Technology Park, a 72-acre park with approximately 1.2 million square feet of space whose tenants are mainly automotive suppliers. The park is located in an Empowerment Zone.

The western end of the Michigan Avenue alignment in Dearborn is surrounded to the north and south by corporate and institutional campuses: The Henry Ford, University of Michigan-Dearborn, Ford Headquarters, Fairlane Towne Center, Dearborn Civic Center, Ford Community Performing Arts Center, and the Dearborn Amtrak station. These uses are stable economic anchors, and are in many cases both large employment and visitor centers.

Michigan Avenue continues into Dearborn beyond the last station area proposed for the Michigan Avenue alignment in this analysis. Dearborn's "second downtown" is located further west of the terminal station, and offers a vibrant mix of pedestrian-friendly shops, restaurants, offices and various other businesses. The City of Dearborn itself continues to experience population growth, due in part to the growth of new immigrant populations.

Woodward Avenue Alignment

The southern third of the Woodward Avenue alignment between Foxtown and Warren Avenue is expected to experience continued economic growth. Two of the City's major institutional and economic anchors are located in, or adjacent to this segment of the alignment, and both continue to undergo expansion and enhancement of their facilities. The facilities are:

- Detroit Medical Center
- Wayne State University

The enclave community of Hamtramck is located to the east of the middle segment of the Woodward Avenue alignment. While I-75 separates the Hamtramck from Woodward Avenue and may function as a psychological "barrier" to access, Hamtramck has been experiencing downtown development and increasing resident population. Ethnic tourism, "main street" shopping on Joseph Campau Street and Conant Street, and manufacturing/automotive employers draw visitors and workers to Hamtramck. Pedestrian or other local transit connections could link Hamtramck and the Woodward alignment via Holbrook Street or Caniff Street/Trowbridge Street.

Another enclave community, the City of Highland Park, is also located along the Woodward Avenue alignment, located between McNichols Road on the north and Tennyson Street/Tuxedo Street on the south. Highland Park has experienced significant residential and commercial disinvestment in recent decades, including along the Woodward alignment. However, in the last few years, as a result of organized planning efforts and assistance from the State and various civic and non-profit organizations, Highland Park has seen revitalization along the corridor. It has two community shopping centers with both local and national chain stores at McNichols Road, while two other neighborhood shopping centers are under construction:

- The Shops at Woodward Place at 15101 Woodward, with approximately 40,000 square feet of space and several anchor tenants, including Aldi's grocery, have been identified. This $6 million retail development is being built on the former site of a Sears store, and received brownfield tax credits as incentives.

- Highland Point Plaza at 12029 Woodward, with approximately 18,700 square feet; Family Dollar has signed on as an anchor store.

- The Bill Snethkamp Chrysler Jeep dealership is planning an 80,000-square-foot expansion to include Al Deeby Dodge, currently located in Hamtramck.

Additionally, the community has seen job-producing development and enhancements along the alignment or in the project area:

- The former site of the 144-acre Chrysler Group headquarters has become the Oakland Park industrial park.

- Coca-Cola opened a new 176,000-square-foot Metro Detroit Sales and Distribution Center in 2006.

- Visteon/VC-Ram will build a $35 million, 217,000-square-foot plant for manufacturing automobile interior parts, employing 175 people. This project will be assisted by $1.73 million in Standard Single Business Tax Credits from Michigan Economic Growth Authority (MEGA) over seven years.

- A new 200,000-square-foot distribution building ("Oakland Park VII") is being developed by Stuart Frankel Development Company.

While the community still faces challenges, these development projects indicate acceptance by the private market that Woodward Avenue can be a viable corridor for development.

The north end of the Woodward Avenue alignment between Seven Mile Road and the Michigan State Fairgrounds is currently characterized by lower levels of real estate development, largely driven by current and designated land uses on both sides of the road. Palmer Park, the Detroit Golf Club and Woodlawn Cemetery are located on the west side of Woodward Avenue, with a segment of the Palmer Park residential neighborhood touching Woodward between the parks and the cemetery. The Michigan State Fairgrounds front the east side of Woodward for approximately one-half mile, and attracts nearly one million visitors per year. A retail project is planned for a 35-acre site at the southeast corner of Woodward and Eight Mile Road that could be a catalyst for this segment of the alignment within the Detroit city limits. General Growth Properties is planning the Shoppes at Gateway Park, an $80 million, 300,000- to 400,000-square-foot open-air shopping mall which will include J.C. Penney as an anchor.

Woodward Avenue continues north across the Wayne-Oakland County line through Ferndale, Pleasant Ridge, Royal Oak, Huntington Woods, Birmingham and Bloomfield Hills to Pontiac. Woodward Avenue has long served as an active link between the City of Detroit and the suburbs, and a main regional thoroughfare connecting various retail, entertainment, residential and employment destinations in both counties, from its days as a streetcar route to the present-day auto-oriented corridor.

9.3.2 TOD Potential at Transit Stations

Key Performance Indicator

- TOD Potential at Transit Stations – Assessment of the suitability of station areas for TOD.

Transit-oriented development (TOD) refers to residential and commercial development near transit stations which are designed so as to maximize pedestrian access to transit, and transit access to key locations and activities. TOD areas contain a dense mix of uses which facilitate an active street life and allow for a sizable enough residential base to support stores, restaurants and other activities. TOD is an approach to urban planning and design that builds around a community's transit investment. In comparison to development that is merely "transit-adjacent",[4] TOD leverages the relationship between transit and the surrounding land uses. TOD seeks to maximize ridership on the transit system by encouraging development of uses in the transit service area that will bring riders to the area. According to the American Planning Association:

"TOD is essentially a compact development built around transit stops…. The same attributes that define a TND [*traditional neighborhood development*] – higher density, walkable scale, and mix of uses – are good generators of transit usage. The concept includes neighborhood and community levels of TODs to accommodate different land-use mixes and development intensities in conjunction with different transit types. TOD regulations are generally enacted as overlay or special zoning districts with mixed-use standards and pedestrian-oriented street and building design standards that focus on a central transit stop."[5]

TOD can vary in scale according to the type of transit service and conditions in surrounding areas. In some cases, infill development in a transit service area is considered TOD; in other cases, entirely new neighborhoods are developed around the transit stations.

[4] Dittmar, Hank. In "How to Make Transit-Oriented Development Work" by Jeffrey Tumlin and Adam Millard-Bell. Planning, May 2003.

[5] Sizemore, Stephen G, AICP. "Innovations in Local Zoning Regulations." Planning and Urban Design Standards. Emma Sendich, ed., and the American Planning Association Hoboken: John Wiley & Sons, 2006. P. 602.

By integrating transit into the activity of the surrounding area, TOD provides a number of benefits in the following dimensions[6]:

- Community character: opportunities to revitalize neighborhoods and create new public spaces
- Quality of life: reduced automobile dependency, increased range of housing options, closer jobs-housing connections, and enhanced local neighborhoods
- Public health: increased walkability (encouraging exercise) and reduced automobile-generated air pollution
- Environmental quality: alternative to inefficient "sprawl" development
- Economic benefits: improved land values, increased development, rising tax revenues, and development as discussed in the next section below.

Transit service areas are generally considered to include the area within a ten-minute walk from a station area, or approximately one-half mile. Design principles for a successful TOD include[7]:

- Emphasis on pedestrian access
- Incorporating public spaces
- Using design guidelines, quality architecture, and pedestrian-friendly site plans to create a cohesive identity or "sense of place"
- Use of sustainable planning principles, including green site and building design techniques and materials.

[6] Dixon, David, FAIA and Anne Tate. "Transit-Oriented Development." Planning and Urban Design Standards. Emma Sendich, ed., and the American Planning Association Hoboken: John Wiley & Sons, 2006. Pp. 450-452.

[7] Ibid.

Development principles for a successful TOD include:[8]

- Mixing land uses
- Building densely
- Mixing housing types and price-points
- Reducing parking requirements.

Methodology

Based upon existing land uses, local development market trends, available planning guidance, zoning allowances and incentive programs, each of the DTOGS project station areas were evaluated for TOD potential. These ratings were applied to each individual station area:

Low

Station area has little to no prospects for TOD impact, especially in the short-term. This may be a result of existing land uses near the proposed station site being largely incompatible with transit, or that the private development market is unlikely to make major investments even with the presence of transit infrastructure.

Medium

Station are exhibits some potential for TOD investment following transit service. There may be challenges in assembling suitable development sites, or in reconfiguring existing land uses to allow safe and easy pedestrian circulation. Transit supportive development may only be achievable in a portion of the overall station area.

High

Existing development and plans for development in the station area are consistent with TOD. The presence of a dedicated transit station in the district is highly likely to create new economic opportunities, or continue to enhance an already active local market.

[8] Ibid.

Results

Table 9-7 on the next page presents the TOD potential for each station area. Following are highlights of this analysis:

- The economic potential along the three alignments (i.e. Gratiot, Michigan and Woodward Avenues) is a function of the existing market trends and the suitability of each station area for TOD. All three alignments provide economic development potential, but on both of these factors, Michigan Avenue and Woodward Avenue provide more economic potential than Gratiot Avenue.

- Market conditions along the southern portion of Woodward Avenue have the potential to spill over into the adjacent neighborhoods to the north, which contain numerous historic districts filled with intact single-family homes. The existing neighborhoods in the lower half of the corridor feature a growing base of medium-density residential development, and feature a mix of uses suitable for a transit- and pedestrian-oriented district.

- The Michigan alignment contains two high-potential station locations for TOD, and a set of surrounding neighborhoods which are currently experiencing an increase in population, if not yet an increase in development activity. The TOD potential is limited in areas along the corridor where there is a cluster of industrial activity or where low-density suburban development prevails.

- Many of the station areas in the middle of the Gratiot alignment are hampered by a declining base of residential population and a lack of commercial activity. Opportunities along Gratiot Avenue are highest in the growing neighborhood station areas closer to downtown Detroit or in the more stable residential neighborhoods at the far northern edge of the alignment.

Table 9-7
TOD Potential by Alternative and by Station

TOD Potential	Gratiot Avenue Stations	Michigan Avenue Stations	Woodward Avenue Stations - North	Woodward Avenue Stations - South
High	Russell	Schaefer Rosa Parks		Grand Boulevard Warren MLK/Mack Foxtown
Medium	Eight Mile Seven Mile McNichols Harper Chene	Dearborn Civic Center Central Livernois Grand Boulevard	State Fair Grounds McNichols Manchester Glendale Calvert Hazelwood	Piquette (Amtrak)
Low	Fournier Conner Burns Warren Mt. Elliott	Greenfield Village Wyoming	Seven Mile	

Tables 9-8 through **9-10** (see pages 9-37 through 9-39) present the detailed analysis of the land use for each of the stations along each alignment. Along the Gratiot Avenue, the lack of major activity centers and decreasing population limit short-term development opportunities. The highest TOD potential along Michigan Avenue exists in Dearborn, near the center of alignment around Central Street and Livernois Avenue, and near the CBD at Rosa Parks Boulevard. Major industrial areas limit TOD opportunities along the areas in between. The Tiger Stadium redevelopment in Corktown offers opportunities for nearby redevelopment. Finally, Woodward Avenue has been experiencing positive development trends, particularly along the southern half of the alignment, where population is growing and investment is active. Historic, well-preserved residential districts highlight the northern segment of the alignment, offering potential for reinvestment.

Table 9-8
Gratiot Avenue Alignment Station Areas - Land Use Data and Trends

Station Name/ Location	Existing Land Use & Development Types	Activity Centers/ Notable Features
Eight Mile Road (Regional Connection Station)	Stable residential neighborhoods, with auto-oriented shopping centers north and south of Eight Mile.	Shopping centers Auto sales lots Gas stations Banks
Seven Mile Road	More active retail north of Seven Mile than south, vacant commercial parcels mixed between active users. Relatively stable single-family neighborhoods surrounding.	Shopping centers Banks Gas stations
McNichols Road	Residential areas a mixture of intact and high-vacancy blocks. Higher stability north and west of Gratiot. Commercial alignment exhibits high vacancies, unused lots.	Church Parking lots Beauty supply stores Gas stations
Fournier Street	Residential areas a mixture of intact and vacant blocks. Low activity/occupancy in adjacent commercial/retail alignment. Station area almost entirely residential.	Fast food restaurants Gas stations
Conner Avenue (Coleman A. Young International Airport)	Airport, rail right-of-way and adjacent industrial prominent in southwest portion of station area. Relatively stable, intact neighborhoods north and east of Conner.	Coleman Young Airport Gethsemane Cemetery Fast food restaurants Gas stations
Harper Avenue	Station area adjacent to I-94 interchange, large shopping center at NW corner of Harper and Gratiot. Active retail near I-94 interchange.	I-94 Interchange Shopping centers Fast food restaurants Gas stations
Burns Avenue	Numerous vacant or empty parcels along Gratiot. Residential blocks missing many original houses.	Auto sales lot Convenience stores Fast food restaurants
Warren Avenue	Somewhat active auto-oriented commercial near Warren, Grand and Forest. City park in immediate station area. Residential areas have low occupancy, large numbers of vacant parcels.	Dueweke Park Banks Auto parts store Dollar store
Mt. Elliott Street	High vacancy in auto-oriented commercial alignment. Surrounding residential neighborhood to north consists of largely vacant blocks/ parcels.	Gas stations Fast food restaurants
Chene Street	High vacancy in commercial corridor. Sidewalk-oriented commercial buildings at intersection with Chene. Surrounding residential neighborhood to north consists of largely vacant blocks/parcels.	Pharmacy Small retail/local offices
Russell Street	District adjacent to downtown Detroit and nearby entertainment districts. Commercial/office uses in immediate station area.	Eastern Market Lafayette Park Historic District Ford Field Comerica Park

Table 9-9
Michigan Avenue Alignment Station Areas - Land Use Data and Trends

Station Name/ Location	Existing Land Use & Development Types	Activity Centers/ Notable Features
Greenfield Village (Regional Connection Station)	Forested area to the north and fenced parking lots to the south.	University of Michigan-Dearborn Greenfield Village Fairlane Towne Center
Dearborn Civic Center	Wider right-of-way, including median and restricted access	Ford Headquarters Dearborn Civic Center Ford Community Performing Arts Center Dearborn Amtrak Station
Schaefer Road (Dearborn City Hall)	Active street life, pedestrian infrastructure, intact street wall. Sidewalk-fronting commercial properties with rear parking. Vacant parcels or structures offer potential redevelopment opportunity.	Dearborn City Hall complex Montgomery Ward (vacant) Arab-language stores/offices New townhome developments along Schaefer Road
Wyoming Avenue (Detroit/Dearborn boundary)	Large industrial uses and truck lots to the north and south along Wyoming.	Freight truck/container yard I-94 Interchange Gas stations Restaurants Ford-Wyoming Drive-In Theater
Central Street	Auto dealerships and other auto-oriented commercial west of Central, more pedestrian-oriented commercial structures east. Dense neighborhoods of one- to two-story homes surrounding alignment.	Banks Restaurants/Bars Adult Entertainment
Livernois Avenue	Major intersection, active street, occupied buildings. Latino-oriented stores and community centers. Less cohesive neighborhoods, numerous vacant parcels east of station site.	Gas stations Strip malls Olympic Steel plant
Grand Boulevard	High-vacancy commercial buildings and lots. Industrial areas east and west of Grand Boulevard. Residential areas exhibit high vacancy and abandonment.	United Community Hospital (vacant) Clark Technology Park
Rosa Parks Boulevard	Active commercial area of restaurants and bars. New residential development/ conversions south, highly vacant neighborhoods north of I-75.	Corktown historic district Old Tiger Stadium (vacant) Central Depot (vacant)

Table 9-10
Woodward Avenue Alignment Station Areas - Land Use Data and Trends

Station Name/ Location	Existing Land Use & Development Types	Activity Centers/ Notable Features
State Fairgrounds	Large open space/cemetery west of Woodward, Fairgrounds to the east. Residential population primarily north of Eight Mile Road (outside City of Detroit).	Woodland Cemetery State Fair Grounds Shoppes at Gateway Park (planned shopping center)
Seven Mile Road	Wide arterial right-of-way, commercial uses not contiguous, large open spaces south and east. Lower density neighborhoods north of Seven Mile.	Palmer Park and Golf Course Palmer Woods Historic District Auto-oriented retail (fast food, gas stations)
McNichols Road (Highland Park/Detroit boundary)	Municipal boundary between Detroit and Highland Park. Cluster of medium- to high-density houses and apartment buildings north of McNichols. Car lots, shopping centers along Woodward.	Palmer Park Apartment Buildings Historic District (Detroit) Medbury's-Grove Lawn Subdivisions Historic District (Highland Park)
Manchester Street (Highland Park)	Located in Highland Park, surrounding area is commercial and industrial to the east, residential subdivisions and apartment buildings west. Very large retail parking lots in immediate station area.	Historic Ford Administration Building Highland Park Town Center (new subdivision) Model T Plaza (shopping center) Shops at Woodward Place (under construction)
Glendale Street (Highland Park)	Inert commercial corridor, surrounded by single-family residential.	Highland Heights-Stevens' Subdivision Historic District Highland Park City Hall McGregor Library (closed)
Calvert Street	Non-contiguous commercial uses along street, mixed with churches, schools and residences. Station site surrounded by largely intact, historic single-family residential district.	Boston-Edison Historic District (Detroit) Blessed Sacrament Cathedral Pharmacies, gas stations
Hazelwood Street	Numerous churches and schools along Woodward. Surrounded by largely intact, historic single-family residential district.	Boston-Edison Historic District (Detroit) International Academy (Detroit Public Schools) Detroit Academy for Science and Math
Grand Boulevard	New Center district has largest cluster of office/ commercial buildings outside downtown. High-vacancy commercial north of Grand Blvd.	Fisher Building Government offices Henry Ford Hospital Pedestrian-oriented retail at Grand/Woodward intersection
Piquette Street (Amtrak Station)	Station area bisected by rail right-of-way and adjacent industrial parcels. Auto-oriented commercial uses fronting Woodward. Very little residential in immediate station area.	Amtrak Station Fast food Auto sales lots
Warren Avenue	Cultural and University district, characterized by major institutional development north of Warren, residential south. New residential developments adjacent to University.	Detroit Medical Center Wayne State University Detroit Institute of Arts Detroit Public Library South University Village
MLK Boulevard/ Mack Avenue	Expanding residential district includes recent townhome construction and loft conversions. Numerous vacant lots remain along Woodward.	Detroit Symphony Orchestra Ellington Lofts Parking garages
Foxtown/Stadium	Vibrant entertainment district; includes theaters, bars, restaurants and two major sports stadia.	Comerica Park Ford Field Fox Theater Grand Circus Park

9.3.3 Year 2000 Employment Within One-Half Mile of Stations

Key Performance Indicator

- Year 2000 employment within one-half mile of stations – Estimated number of jobs within one-half mile of stations using data from the U.S. Census.

Methodology

The following methodology was used to apply the 2000 employment data in traffic analysis zone (TAZ) format from SEMCOG to the proposed DTOGS station areas, defined as a half-mile radius from station area locations at key intersections along the proposed alignments.

- All TAZs within the circular area with one-half mile radius from the proposed stations (station areas) were identified.
- Most station areas are located wholly within the City of Detroit; however, several station areas are located wholly or partially in the adjacent or enclave communities of Dearborn, Ferndale, Highland Park, Eastpointe, or Warren.
- The area of the TAZs falling within a given station area was measured in square feet.
- The proportion of the TAZs portion area compared to the total area of the TAZs was defined as a percentage and applied to the total number of jobs within the TAZs.

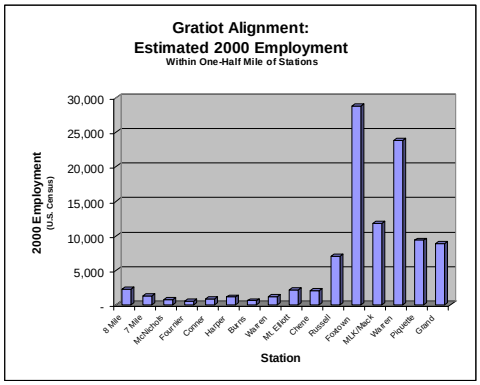
Results

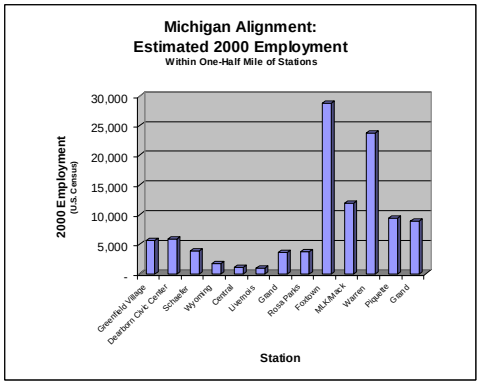
Tables 9-11 through **9-13** (see pages 9-42 through 9-44) present year 2000 employment within one-half mile of each station along each alignment. Following is a summary of the analysis:

- Fournier and Burns stations of the Gratiot alignment have low existing employment. As the alignment approaches downtown Detroit, existing employment figures improve; however, they are dwarfed by those along the Woodward segment of the alignment between Foxtown and Grand Boulevard.

- For the Michigan alignment, existing employment around stations in Dearborn are better than the Gratiot alignments. Current employment around stations between Dearborn and downtown Detroit is similar to the Gratiot alignment (low).

- Similar to the other two alignments, a few of the stations along the Woodward alignment have low employment, specifically the Calvert and Seven Mile Stations.





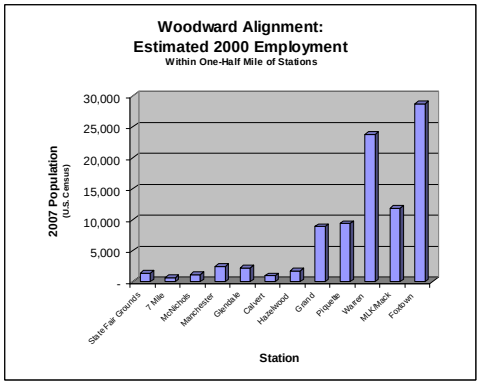


Table 9-11
Year 2000 Employment within One-Half Mile of Stations – Gratiot Alternative

Station	2000 Employment[9]
Eight Mile Road (Regional Connection Station)	2,300
Seven Mile Road	1,370
McNichols Road	770
Fournier Street	560
Conner Avenue	900
Harper Avenue	1,180
Burns Avenue	630
Warren Avenue	1,250
Mt. Elliott Street	2,190
Chene Street	2,140
Russell Street	7,050
Woodward Avenue/Foxtown/Stadium	28,730
Woodward Avenue/MLK Boulevard/ Mack Avenue	11,860
Woodward Avenue/Warren Avenue (Wayne State University)	23,800
Woodward Avenue/Piquette Street (Amtrak Station)	9,380
Woodward Avenue/Grand Boulevard	8,910
Total Employment, Gratiot Alignment[10]	**94,600**

9 Source: U.S. Census Bureau and SEMCOG.

10 Due to station area overlap, the sum of employment figures for each of the stations may not add up to the totals for the alignment.

Table 9-12
Year 2000 Employment within One-Half Mile of Stations – Michigan Alignment

Station	2000 Employment[11]
Greenfield Village (Regional Connection Station	5,670
Dearborn Civic Center	5,840
Schaefer Road	3,850
Wyoming Street	1,460
Central Street	1,100
Livernois Street	910
Grand Boulevard	3,660
Rosa Parks Boulevard	3,770
Woodward Avenue/Foxtown/Stadium	28,730
Woodward Avenue/MLK Boulevard/ Mack Avenue	11,860
Woodward Avenue/Warren Avenue (Wayne State University)	23,800
Woodward Avenue/Piquette Street (Amtrak Station)	9,380
Woodward Avenue/Grand Boulevard	8,910
Total Employment, Michigan Alignment[12]	**101,400**

[11] Source: U.S. Census Bureau and SEMCOG.

[12] Due to station area overlap, the sum of employment figures for each of the stations may not add up to the totals for the alignment.

Table 9-13
Year 2000 Employment within One-Half Mile of Stations – Woodward Alignment

Station	2000 Employment[13]
State Fair Grounds (Regional Connection Station)	1,390
Seven Mile Road	690
McNichols Road	1,190
Manchester Street	2,500
Glendale Street	2,220
Calvert Street	970
Hazelwood Street	1,740
Grand Boulevard	8,910
Piquette Street (Amtrak Station)	9,380
Warren Avenue (Wayne State University)	23,800
MLK Boulevard/Mack Avenue	11,860
Foxtown/Stadium	28,730
Total Employment, Woodward Alignment[14]	**85,000**

[13] Source: U.S. Census Bureau and SEMCOG.

[14] Due to station area overlap, the sum of employment figures for each of the stations may not add up to the totals for the alignment.

9.3.4 Year 2007 Population Within One-Half Mile of Stations (Social Compact)

Key Performance Indicator

- Year 2007 population within one-half mile of stations – Estimated population within one-half mile of stations using Social Compact projections.

Methodology

The following methodology was used to apply the 2007 Social Compact demographic data measured at the Census Block Group level to the proposed DTOGS station areas, defined as a one-half mile radius from station area locations at key intersections along the proposed alignments:

- All Census Block Groups within the circular area with one-half mile radius from the proposed stations (station areas) were identified
- Most station areas are located wholly within the City of Detroit; however, some station areas are located wholly or partially in the adjacent or enclave communities of Dearborn, Ferndale, Highland Park, Eastpointe, or Warren
- The area of the Census Block Groups falling within a given station area (Census Block Group portion) was measured in square feet
- The proportion of the Census Block Group Portion area compared to the total area of the Census Block Group was defined as a percentage (Census Block Group Area Percentage)
- Population was assumed to have a uniform density throughout the Census Block Group
- The population in each Census Block Group Portion was calculated by applying the Census Block Group Percentage to the total population for the Census Block Group.
- The populations of all Census Block Group Portions in the station areas were added to arrive at an estimated population for the station area
- The source of 2000 population data for the Detroit census block groups was U.S. Census Summary File 3 (SF3) for 2000

- The source of 2000 population data for Dearborn, Ferndale, Highland Park, Eastpointe and Warren census block groups was the US Census Summary File 3 (SF3) for 2000

- The source of 2007 population data for the Detroit census tracts was Social Compact

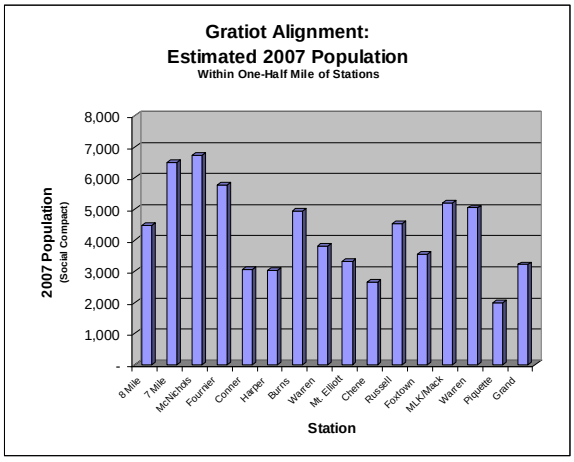
- To arrive at population estimates for Dearborn, Ferndale, Highland Park, Eastpointe and Warren census block groups, population growth rates for the period 2000-2007 as estimated by Claritas, Inc. for each of these cities were applied to the 2000 Census figures for the block groups

Results

Population information for the Gratiot and Michigan alignments include the 2.5-mile segment of Woodward Avenue between downtown Detroit and Grand Boulevard. As previously stated, the DTOGS project uses the updated population for 2007 prepared by Social Compact to present a more accurate estimate of population than that developed by the U.S. Census.

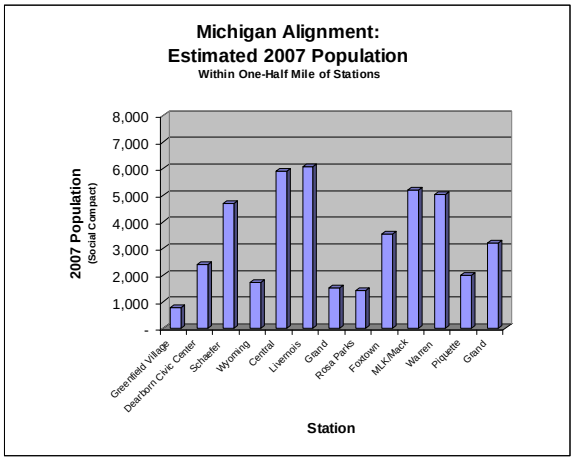
Tables 9-14 through **9-16** (see pages 9-48 through 9-50) present the results of the analysis for each alternative alignment. Following is a summary of the analysis.

- What the Gratiot alternatives lack in employment around the proposed stations it makes up for in overall consistency in population around the proposed transit stations. This is especially true for the stations on the northern part of the alignment – on Eight Mile, Seven Mile, and McNichols Roads – as well as those proximate to downtown Detroit.



- Population around stations along the Michigan alignment appears more variable than those along the Gratiot alignment. Population around the proposed Wyoming, Central and Livernois Street stations is highest.

- Similar to the Gratiot alignment, population around proposed stations along the Woodward alignment appear consistent. The lowest populations are around the State Fair Grounds and Piquette Street stations. The State Fair Grounds station and its proximity to Woodlawn Cemetery, Palmer Park and the Detroit Golf Club explain the low population around this area. The Piquette Station is a high employment area.



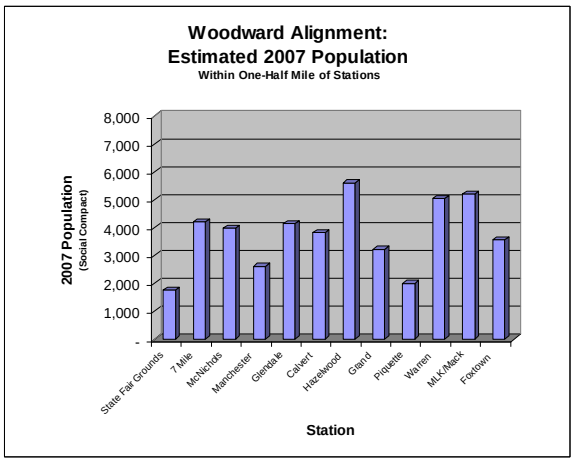


Table 9-14
Year 2007 Employment within One-Half Mile of Stations – Gratiot Alignment

Station	2000 Population[15]
Eight Mile Road (Regional Connection Station)	4,480
Seven Mile Road	6,490
McNichols Road	6,730
Fournier Street	5,770
Conner Avenue	3,060
Harper Avenue	3,030
Burns Avenue	4,940
Warren Avenue	3,810
Mt. Elliott Street	3,310
Chene Street	2,660
Russell Street	4,540
Woodward Avenue/Foxtown/Stadium	3,560
Woodward Avenue/MLK Boulevard/ Mack Avenue	5,200
Woodward Avenue/Warren Avenue (Wayne State University)	5,040
Woodward Avenue/Piquette Street (Amtrak Station)	2,000
Woodward Avenue/Grand Boulevard	3,220
Total Population, Gratiot Alignment[16]	**60,600**

[15] Source: 2007 Social Compact.

[16] Due to station area overlap, the sum of population figures for each of the stations may not add up to the totals for the alignment.

Table 9-15
Year 2007 Population within One-Half Mile of Stations – Michigan Alignment

Station	2000 Population[17]
Greenfield Village (Regional Connection Station	790
Dearborn Civic Center	2,400
Schaefer Road	4,680
Wyoming Street	1,710
Central Street	5,890
Livernois Street	6,080
Grand Boulevard	1,510
Rosa Parks Boulevard	1,410
Woodward Avenue/Grand Boulevard	3,560
Woodward Avenue/Piquette Street (Amtrak Station)	5,200
Woodward Avenue/Warren Avenue (Wayne State University)	5,040
Woodward Avenue/MLK Boulevard/ Mack Avenue	2,000
Woodward Avenue/Foxtown/Stadium	3,220
Total Population, Michigan Alignment[18]	**40,000**

[17] Source: 2007 Social Compact.

[18] Due to station area overlap, the sum of population figures for each of the stations may not add up to the totals for the alignment.

Table 9-16
Year 2007 Population within One-Half Mile of Stations – Woodward Alignment

Station	2000 Population[19]
State Fair Grounds (Regional Connection Station)	1,770
Seven Mile Road	4,210
McNichols Road	3,990
Manchester Street	2,620
Glendale Street	4,140
Calvert Street	3,820
Hazelwood Street	5,610
Grand Boulevard	3,220
Piquette Street (Amtrak Station)	2,000
Warren Avenue (Wayne State University)	5,040
MLK Boulevard/Mack Avenue	5,200
Foxtown/Stadium	3,560
Total Population, Woodward Alignment[20]	**40,400**

[19] Source: 2007 Social Compact.

[20] Due to station area overlap, the sum of population figures for each of the stations may not add up to the totals for the alignment.

9.3.5 Parking Impacts

Key Performance Indicator

Parking impacts associated with each alternative is measured by the following:

- Resulting estimated total number of on-street parking spaces
- Resulting estimated change in the number of on-street parking spaces
- Resulting percent change in the estimated total number of on-street parking spaces.

Methodology

The location and number of on-street parking spaces impacted was determined by field review and concept plans developed for each BRT and LRT alternative (Appendix K). Following are the assumptions used in estimating the existing and proposed number of parking spaces for each alternative:

- No parking at existing bus stops and within 30 feet of intersections.
- Each on-street parking space is assumed to be 22 feet long and eight feet wide.
- For the BRT and LRT alternatives, there will be no on-street parking in areas where the existing right-of-way is 100 feet, to accommodate two lanes of traffic, the transitway and transit stations. This assumption applies to a few areas, including Woodward Avenue in Highland Park and Michigan Avenue in East Dearborn. This assumption is consistent with the design guideline to minimize right-of-way impacts along any of the alignment alternatives.
- There will be no on-street parking on any bridges or underpasses.

In addition, modifications to existing DDOT routes could result in the elimination of bus stops along an alignment. This could, in turn, result in a higher number of on-street spaces associated with a Build alternative than presented in this document. Moreover, the exact number of existing on-street spaces will be determined during PE for the LPA.

Results

Tables 9-17 (below) through **9-19** (see page 9-53) present the estimated parking impacts associated with each alternative. The Gratiot and Michigan No-Build Alternatives do not include the 2.5-mile segment of Woodward Avenue between downtown Detroit and Grand Boulevard. Following are highlights of the parking impact analysis:

- Generally, there is no significant difference in parking impacts between the BRT and LRT alternatives for a particular alignment.

- Overall, the greatest parking impact is associated with the Woodward Build Alternatives. The estimated losses in on-street parking are 940 and 950 spaces for the BRT and LRT alternatives, respectively – approximately two-thirds of spaces currently available on Woodward Avenue between the proposed Foxtown Station and the Michigan State Fair Grounds. The loss in on-street spaces is associated with the 100-foot-wide right-of-way between Grand Boulevard and Manchester Street through Highland Park, which is a 2.8-mile segment.

- Relative to the Michigan and Woodward Build alternatives, the Gratiot Build alternatives have the least impact on on-street parking due to its relatively wide right-of-way. The right-of-way of Gratiot Avenue between Broadway and Eight Mile Road varies from 120 feet to 135 feet. The Woodward Avenue segment is generally 120 feet wide.

Table 9-17
Estimated Parking Impacts – Gratiot Alternatives

Alternative[21, 22]	Number of On-Street Parking Spaces	Impact	Impact as Percent of Total
Gratiot No-Build	2,110	Not applicable	Not applicable
Gratiot TSM	2,670	Not applicable	Not applicable
Gratiot BRT	1,820	(850)	(32 percent)
Gratiot LRT	1,780	(890)	(33 percent)

Table 9-18
Estimated Parking Impacts – Michigan Alternatives

Alternative[23, 24]	Number of On-Street Parking Spaces	Impact	Impact as Percent of Total
Michigan No-Build	960	Not applicable	Not applicable
Michigan TSM	1,510	Not applicable	Not applicable
Michigan BRT	860	(650)	(43 percent)
Michigan LRT	860	(650)	(43 percent)

Table 9-19
Estimated Parking Impacts – Woodward Alternatives

Alternative	Number of On-Street Parking Spaces	Impact	Impact as Percent of Total
Woodward No-Build	1,420	Not applicable	Not applicable
Woodward TSM	1,420	Not applicable	Not applicable
Woodward BRT	480	(940)	(66 percent)
Woodward LRT	470	(950)	(67 percent)

[21] The Gratiot No-Build Alternative does not include the 2.5-mile segment of Woodward Avenue between downtown Detroit and Grand Boulevard.

[22] Impacts of BRT and LRT alternatives are relative to the TSM alternative, which includes the 2.5-mile segment of Woodward Avenue between downtown Detroit and Grand Boulevard.

[23] The Michigan No-Build Alternative does not include the 2.5-mile segment of Woodward Avenue between downtown Detroit and Grand Boulevard.

[24] Impacts of BRT and LRT alternatives are relative to the TSM alternative, which includes the 2.5-mile segment of Woodward Avenue between downtown Detroit and Grand Boulevard.

9.4 Communities and Environment

This category of evaluation examined the potential environmental and community impacts of each alternative. This section is organized by evaluation measure defined for this level of assessment, namely:

- Transit-dependent population
- 2030 change in daily regional vehicle miles traveled
- 2030 change in daily carbon dioxide (CO_2) emissions
- Population within 100 feet of alignment potentially affected by noise and vibration
- Potential for affecting natural environment
- Community facilities within one-half mile of stations
- Multimodal connections
- Consistency with plans
- Right-of-way impacts.

9.4.1 Transit-Dependent Population

Key Performance Indicator

This measure is defined as:

- Transit-dependent population within one-half mile of each station per alternative – Applies to the TSM, BRT and LRT alternatives.

Methodology

Transit-dependent population within one-half mile of each station for each alternative was determined using 2000 Census data and the methodology included in the April 2006 Census

Transportation Planning Package 2000 Status Report.[25] Generally, the calculation factors in the number of persons eligible to drive and the number of vehicles available for households.

Since the data is available by block group, this analysis followed a methodology similar to the determination of population and employment within one-half mile of each station by first identifying the block groups (or TAZs) within one-half mile of a station and then prorating the transit-dependent population by the percentage of the geographic area of the block group or TAZ within one-half mile of a station. The total number of transit-dependent population associated with each alternative is presented in the following section.

Results

Because the proposed transit stations are identical for the TSM and Build alternatives for each alignment, the estimated transit-dependent populations for these alternatives by alignment are also identical, as presented in **Tables 9-20** through **9-22** (see pages 9-56 through 9-58). In summary:

- The proportion of transit- dependent population by alignment is consistent with the proportion for the whole DTOGS project area – approximately one-third of the population within one-half mile of stations. Therefore, all three alignments appear to have similar impacts on transit-dependent population.
- Conversely, the three alignment alternatives would serve similar proportions of transit-dependent population.
- The Gratiot TSM and Build Alternatives have eleven of their sixteen stations with above-average number of transit-dependent population relative to total stations along the entire alignment. Five of these stations are on the segment of Woodward Avenue between downtown Detroit and Grand Boulevard.
- The Michigan TSM and Build Alternatives have seven of their thirteen stations with above average number of transit-dependent population relative to all stations along the entire alignment. Five of these stations are on the segment of Woodward Avenue between downtown Detroit and Grand Boulevard.

[25] The CTPP 2000 Status Report was prepared by the United Stated Department of Transportation, Federal Highway Administration, Bureau of Transportation Statistics, and Federal Transit Administration, in cooperation with the Transportation Research Board Census Subcommittee.

- Overall, transit stations along the Woodward Avenue alignment have the highest proportion of transit-dependent population of the three alignments (36 percent). Of the twelve stations, six have a higher proportion of transit-dependent populations within one-half mile of stations than the average for the Woodward alignment.

Table 9-20
2000 Estimated Transit-Dependent Population within One-Half Mile of Station – Gratiot Alignment[26]

Station	Transit-Dependent Population	Percent of Total Population
Eight Mile Road (Regional Connection Station)	110	2 percent
Seven Mile Road	1,910	28 percent
McNichols Road	2,510	35 percent
Fournier Street	1,940	30 percent
Conner Avenue	880	30 percent
Harper Avenue	1,100	36 percent
Burns Avenue	1,890	35 percent
Warren Avenue	1,540	39 percent
Mt. Elliott Street	1,230	38 percent
Chene Street	920	38 percent
Russell Street	770	19 percent
Foxtown/Stadium	1,200	45 percent
MLK Boulevard/Mack Avenue	2,180	44 percent
Warren Avenue (Wayne State University)	1,990	39 percent
Piquette Street (Amtrak Station)	620	41 percent
Grand Boulevard	1,020	41 percent
Total[27]	**21,810**	**33 percent**

[26] Source: U.S. Census Bureau.

[27] Due to station area overlap, the sum of transit-dependent population figures for each of the stations may not add up to the totals for the alignment.

Table 9-21
2000 Estimated Transit-Dependent Population within One-Half Mile of Station – Michigan Alignment[28]

Station	Transit-Dependent Population	Percent of Total Population
Greenfield Village (Regional Connection Station)	160	19 percent
Dearborn Civic Center	550	22 percent
Schaefer Road	1,410	29 percent
Wyoming Avenue	400	23 percent
Central Street	340	6 percent
Livernois Avenue	1,590	28 percent
Grand Boulevard	570	37 percent
Rosa Parks Boulevard	360	31 percent
Foxtown/Stadium	1,200	45 percent
MLK Boulevard/Mack Avenue	2,180	44 percent
Warren Avenue (Wayne State University)	1,990	39 percent
Piquette Street (Amtrak Station)	620	41 percent
Grand Boulevard	1,020	41 percent
Total[29]	**12,390**	**30 percent**

[28] Source: U.S. Census Bureau.

[29] Due to station area overlap, the sum of transit-dependent population figures for each of the stations may not add up to the totals for the alignment.

Table 9-22
2000 Estimated Transit-Dependent Population within One-Half Mile of Station – Woodward Alignment[30]

Station	Transit-Dependent Population	Percent of Total Population
State Fair Grounds (Regional Connection Station)	150	8 percent
Seven Mile Road	1,310	35 percent
McNichols Road	1,390	33 percent
Manchester Street	950	33 percent
Glendale Street/McLean Street	1,360	30 percent
Calvert Street/Trowbridge Street	1,360	33 percent
Hazelwood Street/Holbrook Street	2,120	39 percent
Grand Boulevard	1,020	45 percent
Endicott Street	620	44 percent
Warren Avenue	1,990	39 percent
Martin Luther King Boulevard./Mack Avenue	2,180	41 percent
Foxtown/Stadium	1,200	41 percent
Total[31]	**15,650**	**36 percent**

[30] Source: U.S. Census Bureau.

[31] Due to station area overlap, the sum of transit-dependent population figures for each of the stations may not add up to the totals for the alignment.

9.4.2 2030 Change in Daily Regional Vehicle Miles Traveled

Key Performance Indicator

- Year 2030 Change in Daily Regional Vehicle Miles (VMT) Traveled – Applies to BRT and LRT alternatives relative to TSM alternatives.

Methodology

The estimated 2030 regional daily VMT for each alignment were obtained from the travel demand model used to develop 2030 transit patronage forecasts. The change in VMT is relative to the appropriate TSM alternative for each of the three alignments.

Results

Tables 9-23 (below) through **9-25** (on page 9-60) present the results of the analysis by alignment and alternative. Following is a summary of the analysis:

- Generally, the reduction in 2030 daily regional VMT relative to the TSM alternatives is higher for LRT than BRT alternatives.
- The Woodward LRT Alternative has the highest estimated change in daily 2030 regional VMT for all Build and LRT alternatives.
- Similarly, the Woodward BRT Alternative has the highest estimated change in daily 2030 regional VMT for all BRT alternatives.

Table 9-23
2030 Change in VMT – Gratiot Alternatives

Alternative	Total 2030 Daily Regional VMT[32]	Change Relative to TSM Alternative
Gratiot TSM	134,431,800	Not applicable
Gratiot BRT	134,413,100	(18,700)
Gratiot LRT	134,399,900	(31,900)

[32] Figures shown are relative to TSM alternatives. Source: SEMCOG Hybrid Model and URS.

Table 9-24
2030 Change in VMT – Michigan Alternatives

Alternative	Total 2030 Daily Regional VMT[33]	Change Relative to TSM Alternative
Michigan TSM	134,435,200	Not applicable
Michigan BRT	134,413,900	(21,300)
Michigan LRT	134,406,200	(29,000)

Table 9-25
2030 Change in VMT – Woodward Alternatives

Alternative	Total 2030 Daily Regional VMT[34]	Change Relative to TSM Alternative
Woodward TSM	134,435,500	Not applicable
Woodward BRT	134,410,000	(25,500)
Woodward LRT	134,401,800	(33,700)

9.4.3 2030 Change in Annual CO_2 Emissions

Key Performance Indicator

- Year 2030 Change in Annual CO_2 Emissions – Applies to BRT and LRT alternatives relative to TSM alternatives. Measured in tons.

Methodology

The results of this measure are based on the FTA's New Starts Template 6: Environmental Benefits Worksheet. The change in annual regional VMT associated with each Build alternative relative to the Baseline alternative – in this case, the TSM alternative – is entered into the worksheet, which automatically calculates the estimated change in CO_2 emissions.

[33] Figures shown are relative to TSM alternatives. Source: SEMCOG Hybrid Model and URS.

[34] Figures shown are relative to TSM alternatives. Source: SEMCOG Hybrid Model and URS.

Results

Table 9-26 (below) presents the results of the analysis by alignment and alternative. Following is a summary of the analysis:

- All six Build alternatives result in a reduction in annual CO_2 emissions.
- The Gratiot BRT alternative has the lowest change in annual CO_2 emissions of all three BRT alternatives. Conversely, the Woodward BRT alternative has the highest change in annual CO_2 emissions of all three BRT alternatives.
- The Michigan LRT alternative has the lowest change in annual CO_2 emissions of all three LRT alternatives. Conversely, the Woodward LRT alternative has the highest change in annual CO_2 emissions of all three LRT alternatives.
- The Woodward LRT alternative has the highest change in annual CO_2 emissions of all six Build alternatives.

Table 9-26
2030 Change in Annual CO_2 Emissions – Build Alternatives

Alternative	Change in Annual CO_2 Emissions
Gratiot BRT	(2,320 tons)
Gratiot LRT	(3,955 tons)
Michigan BRT	(2,640 tons)
Michigan LRT	(3,595 tons)
Woodward BRT	(3,160 tons)
Woodward LRT	(4,180 tons)

9.4.4 Noise and Vibration

Key Performance Indicator

- 2000 Population within 100 Feet of Alignment Potentially Affected by Noise and Vibration.

Methodology

Using the 2000 Census data, the number of persons living within 100 feet of either side of each of the three alignments was determined. Estimates of population within 100 feet of each alignment generally followed a similar methodology as the calculation of population and employment within one-half mile of transit stations.

Results

Table 9-27 (below) presents the existing population within 100 feet of each of the three alignments that could be potentially affected by noise and vibration. Figures shown are for the TSM and Build Alternatives.

- The Gratiot alignment has the highest potential of affecting populations within 100 feet. However, all three alignments are within the same order-of-magnitude of population within 100 feet (2,200 to 2,600).

Table 9-27
2000 Population within 100 Feet of Alignment – TSM and Build Alternatives

TSM/BRT/LRT Alignment	Estimated Population within 100 ft of Alignment
Gratiot	2,590
Michigan	2,300
Woodward	2,185

9.4.5 Potential for Affecting Natural Environment

Key Performance Indicator

- Potential for affecting natural environment – applies to each alternative. Identifies water resources and cultural resources (defined as parkland, open space and historic sites and historic districts) adjacent to each alignment.

Methodology

- Water Resources – Based on a review of Federal Emergency Management Agency (FEMA) and US Soil and Water Conservation National Wetland Inventory (NWI) maps, the following critical water resources were identified.

- Cultural Resources – Based on existing mapping from various sources such as the City of Detroit's GIS database, parklands, open space and historic districts adjacent to each alignment were identified. These are the areas that might require Section 4(f)/Section 6(f) analysis during environmental documentation of the LPA.

Results

Table 9-28 on the following page presents parkland, open space and historic districts adjacent to the TSM and Build alternatives for each of the three alignments that could be affected transit improvements. Following is a summary of the findings of this analysis.

- Water Resources – The Michigan TSM and Build alignment crosses the 100-year floodplain of the Rouge River and crosses the Rouge River on an existing bridge. The Rouge River is channelized at this location. Neither the Gratiot TSM/BRT/LRT alignment nor the Woodward TSM/BRT/LRT alignment crosses any FEMA or NWI water resources.

- Cultural Resources – Each TSM/BRT/LRT alignment appears to a similar number of resources that might be affected by transit improvements.

- Overall, the Gratiot and Woodward TSM/BRT/LRT alignments are likely to have relatively lower potential for affecting their natural environments than the Michigan TSM/BRT/LRT alignment, mainly due to crossing the Rouge River and Rouge River floodplain.

Table 9-28
Cultural Resources Adjacent to TSM/BRT/LRT Alignments[35]

Parkland	Open Space/ Recreation	Historic District	Historic Sites
Gratiot TSM/BRT/LRT Alignment			
Dueweke Park Grand Circus Park	Gethsemane Cemetery	Lafayette/Mies Vanderrohe Virginia Park New Center New Amsterdam East Ferry Avenue Warren-Prentis West Canfield Brush Park Peterboro-Charlotte Grand Circus Park Lower Woodward Washington Boulevard Madison-Harmonie	Assumption of the Blessed Virgin Mary Church Complex St. David School and Convent Church of Our Savior Engine House No. 18 Engine House No. 11 Third Precinct Police Station Sidney D. Miler Middle School Muer's Oyster House, Inc. Shulte House Detroit Memorial Hospital Stroh's Brewery St. John's-St. Luke's Evangelical Church Trinity Evangelical Lutheran Church Complex
Michigan TSM/BRT/LRT Alignment			
Lower Rouge Parkway Roosevelt Park Grand Circus Park	Tournament Players Club of Michigan Recreation field at Greenfield Road Open space at Maple Street	Corktown West Corktown Virginia Park New Center New Amsterdam East Ferry Avenue Warren-Prentis West Canfield Brush Park Peterboro-Charlotte Grand Circus Park Lower Woodward Washington Boulevard Madison-Harmonie	Henry Ford Museum and Greenfield Village Navin Field Briggs Stadium Tiger Stadium Mary Bell's Millinery-John Allen's Café Zion Evangelical Lutheran Church
Woodward TSM/BRT/LRT Alignment			
Palmer Park Grand Circus Park	Woodlawn Cemetery Michigan State Fairgrounds Palmber Golf Course	Boston Edison Arden Park-East Boston Boulevard Virginia Park New Center New Amsterdam East Ferry Avenue Warren-Prentis West Canfield Brush Park Peterboro-Charlotte Grand Circus Park Lower Woodward Washington Boulevard Madison-Harmonie	First Mile of Concrete Highway Highland Park Ford Plant

[35] Data source: City of Detroit.

9.4.6 Community Facilities

Key Performance Indicator

- Community Facilities within one-half mile of stations – For the purpose of analysis, the following were defined as community facilities:
  - High schools
  - Colleges/universities
  - Hospitals and medical centers
  - Theatres/concert halls
  - Sports facilities
  - City hall offices
  - Police/fire stations
  - Libraries
  - Museums.

Methodology

This analysis used data from the City of Detroit's Department of Planning and Economic Development from 2007, supplemented with other information gathered for the economic development analysis completed for the DTOGS project.

Results

Table 9-29 on page 9-68 presents the results of this analysis. Overall, the three TSM/BRT/LRT alignments have similar numbers of community facilities within one-half mile of stations, and detailed as follows:

- High Schools – The list includes Detroit Public Schools, Dearborn Public Schools, Highland Park Public Schools, and other private high schools along the alignment.

- Colleges and Universities – The following five major college and university campuses are located along the alignments:
  - Wayne State University
  - College for Creative Studies
  - University of Michigan-Dearborn
  - Wayne County Community College (two Detroit campuses)
  - Henry Ford Community College (Dearborn).
- Theatres/Concert Halls – Detroit has a lively performing arts and theater culture. Facilities along the alignments include:
  - Bonstelle Theatre, 3424 Woodward Avenue
  - Century Theatre, 333 Madison Avenue
  - City Theatre, 2301 Woodward Avenue
  - Detroit Film Theatre at the Detroit Institute of Arts
  - Detroit Masonic Temple Theater, 500 Temple Avenue
  - Detroit Repertory Theatre, 13103 Woodrow Wilson St. no
  - Fisher Theater, 3011 West Grand Blvd.
  - Fox Theatre, 2211 Woodward Avenue
  - Gem Theatre, 333 Madison Avenue
  - Hilberry Theatre, 4841 Cass Avenue
  - Michigan Opera Theater, 1526 Broadway
  - Orchestra Hall, 3711 Woodward Avenue
  - State Theatre, 2115 Woodward Avenue
  - Ford Community & Performing Arts Center, 15801 Michigan Avenue (Dearborn).

- Sports Facilities – The active major league sports facilities in the study area include:
  - Comerica Park (Detroit Tigers baseball)
  - Ford Field (Detroit Lions football)
  - Joe Louis Arena (Detroit Red Wings hockey)
  - Wayne State Stadium.
- City Hall Offices – These facilities include the main City Halls for Detroit, Highland Park and Dearborn, and also a set of local neighborhood City Hall offices within the City of Detroit.
- Police/Fire Stations – These facilities include the stations for the cities of Detroit, Highland Park and Dearborn.
- Libraries – These facilities include the public libraries for the cities of Detroit, Highland Park and Dearborn.
- Museums – Facilities in or near the proposed alignments include:
  - Charles H. Wright Museum of African American History, 315 E. Warren Avenue
  - Children's Museum, 6134 Second Ave
  - Detroit Historical Museum, 5401 Woodward Avenue
  - Detroit Institute of Arts, 5200 Woodward Avenue
  - Detroit Science Center, 5020 John R Street
  - Motown Historical Museum, 2648 W. Grand Avenue
  - Museum of Contemporary Art in Detroit, 4454 Woodward Avenue
  - The Henry Ford/Greenfield Village (Dearborn).

Table 9-29
Community Facilities within One-Half Mile of Stations[36]

Community Facility	Gratiot TSM/BRT/LRT	Michigan TSM/BRT/LRT	Woodward TSM/BRT/LRT
High Schools	9	10	10
Colleges/Universities	2	3	2
Hospitals/Medical Centers	6	9	6
Theatres/Concert Halls	12	12	13
Sports Facilities	3	3	3
City Hall Offices	2	2	2
Fire Stations	8	6	5
Police Stations	4	3	4
Libraries	4	3	3
Museums	6	6	7
Total Served	**56**	**57**	**55**

[36] Data source: City of Detroit, Department of Planning and Economic Development, 2007.

9.4.7 Multimodal Connections

Key Performance Indicator

- Multimodal Connections – Defined as potential number of available modal transfers between an alternative and bus routes, Amtrak, proposed commuter rail service between Detroit and Ann Arbor, airport (Detroit-Wayne County International Airport and Coleman A. Young International Airport), and major bicycle facilities.

Methodology

Identification of potential multimodal connections associated with each alternative is based on review of various sources of transportation information including but not limited to existing DDOT and SMART route information, the City of Detroit Master Plan of Policies, and SEMCOG 2030 Plan.

Results

Table 9-30 below presents the number of potential modal transfers for each TSM/BRT/LRT alternative alignment. The three alignments have similar orders-of-magnitude of the number of potential modal transfers, given that they are all major routes and all include the segment of Woodward Avenue between downtown Detroit and New Center. This segment of Woodward Avenue provides access to the existing Amtrak depot and future commuter rail service between Detroit and Ann Arbor.

Table 9-30
Number of Potential Modal Transfers by Alignment[37]

Alignment	Number of Potential Modal Transfers					
	Bus Routes	Amtrak	Proposed Commuter Rail	Airport[38]	Major Bicycle Facilities	Total
Gratiot TSM/BRT/LRT	39	1	1	1	0	**42**
Michigan TSM/BRT/LRT	33	2	2	1	1	**39**
Woodward TSM/BRT/LRT	36	1	1	1	1	**40**

[37] Data source: City of Detroit and URS.

[38] Figure includes current and proposed access to existing airport facilities, such as the proposed Detroit to Ann Arbor commuter rail service to DTW.

9.4.8 Consistency with Plans

Key Performance Indicator

- Consistency with Plans – Applies to each alternative. This measure is a qualitative assessment of an alternative's consistency with existing, adopted guidance regarding transportation, land use, and development.

Methodology

This assessment entailed a review of existing and adopted guidance regarding transportation, land use and development as part of the economic development assessment of each alignment. Review of information from non-profit groups such as the University Cultural Center Association, New Center Council, HP Devco (Highland Park), Greater Corktown Development Corporation, and the Michigan Avenue Business Association have taken the lead on planning in the DTOGS corridors was included in this assessment.

Results

Table 9-31 on the next page presents a comparative summary of this assessment for each TSM/BRT/LRT alignment. Following are highlights of this assessment:

- Gratiot Avenue has a deficit of planning activity and is zoned as a more auto-oriented commercial corridor. The alignment has not been the subject of any major redevelopment planning efforts.

- Michigan Avenue has existing plans in place for key areas along the alignment, including Corktown and the area between Central St. and Livernois Ave. Planning and zoning guidance from the City is focused on preserving the historic commercial businesses in these portions of the alignment.

- The entire Woodward Avenue alignment is a major focus area for redevelopment, both for the City government and the non-profit sector. These planning efforts are built around making Woodward Avenue a mixed-use and pedestrian oriented "main street" through Detroit and Highland Park.

Table 9-31
Comparative Summary of Planning and Zoning Guidance[39]

Gratiot TSM/BRT/LRT Alternatives	Michigan TSM/BRT/LRT Alternatives	Woodward Avenue TSM/BRT/LRT Alternatives
Lack of cohesive planning efforts in place for the corridor Largely zoned as auto-oriented commercial along Gratiot frontage **Woodward Avenue Segment:** Major redevelopment planning and streetscape efforts led by non-profit groups in Midtown, New Center "Main Street" zoning overlay district (City of Detroit) in place to improve aesthetics, pedestrian amenities	MABA retail plan for historic commercial segment between Livernois and Central "Main street" zoning overlay district (City of Detroit) in place near Corktown to improve aesthetics, pedestrian amenities **Woodward Avenue Segment:** Major redevelopment planning and streetscape efforts led by non-profit groups in Midtown, New Center "Main Street" zoning overlay district (City of Detroit) in place to improve aesthetics, pedestrian amenities	Major redevelopment planning efforts led by Highland Park and non-profit groups in Midtown, New Center Numerous historic residential districts "Main Street" zoning overlay district (City of Detroit) in place to improve aesthetics, pedestrian amenities
Overall Rating: Medium	**Overall Rating: High**	**Overall Rating: High**

9.4.9 Right-of-Way Impacts

Key Performance Indicator

- Right-of-Way Impacts – Associated with implementation of a BRT or LRT alternative, relative to TSM alternatives.

Methodology

Conceptual plans developed for each of the six Build alternatives assume median-running BRT or LRT within the existing right-of-way. These plans were also defined to minimize right-of-way impacts or the need for right-of-way acquisition. For example, the segment of Woodward Avenue between Grand Boulevard and Manchester Street – which is currently 100 feet wide – does not include on-street parking to accommodate the BRT guideway, stations and four lanes of traffic.

[39] Source: URS.

Results

Each Build alternative generally has similar right-of-way requirements. Rapid transit elements that might require acquisition of right-of-way include:

- Maintenance Facility – A new maintenance facility will be required by any of the LRT alternatives. A new maintenance facility may not be required by a BRT alternative, depending on factors such as BRT vehicle and DDOT's current capabilities for service and storage of such a vehicle. Ideally, a maintenance vehicle facility would be located in the middle of an alignment to minimize deadhead.

- Park-and-Ride Facility – Potential sites for park-and-ride facilities associated with each alignment and build alternative are currently located on public land. If during preliminary engineering additional facilities are determined to be needed, potential sites and their suitability will be evaluated.

- Substations – Light rail alternatives would require a substation approximately every mile along an alignment. As stated earlier in this section, most substations would be located near light rail stations. Generally, substations are a single-story building with an approximate footprint of 40 feet by 20 feet on a 4,000-square-foot limited access site. Sites for required substations for the LPA (if the LPA is a light rail alternative) would be identified and evaluated during PE.

9.5 Public Involvement

Community sentiment was garnered at two sets of public meetings – in March 2007 and during scoping meetings in July 2007, **Appendices B** and **D**, respectively, present details of these two public meetings. Community sentiment was also gathered through stakeholder interviews, summarized in **Appendix A**. In summary, the overall community sentiment favors of light rail on Woodward Avenue.

9.6 Summary of Evaluation Results

Table 9-32 on the next page presents the results of the evaluation. The following section of this report presents the findings and recommendations of the evaluation.

Table 9-32
Summary of Evaluation of Alternatives

Project Goal / Evaluation Criteria	No-Build			Transportation System Management			Bus Rapid Transit			Light Rail Transit		
	Gratiot (Route 34)	Michigan (Route 37)	Woodward (Route 53)	Gratiot (with Woodward)	Michigan (with Woodward)	Woodward	Gratiot (with Woodward)	Michigan (with Woodward)	Woodward	Gratiot (with Woodward)	Michigan (with Woodward)	Woodward
FTA New Starts Benchmark												
Cost Effectiveness Index (needs to be less than $23.00)[A]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	$22.49	$25.00	$16.12	$29.35	$32.79	$20.69
Transportation & Mobility												
Improve Mobility												
2030 Daily Ridership												
Daily Ridership - Trunk Line[C]	6,700	2,400	8,300	6,400	2,500	8,600	8,200	5,200	9,200	9,900	6,400	11,100
Corridor Total	16,000	5,700	19,600	15,600	5,600	20,000	18,100	8,600	20,900	19,800	9,700	22,800
New Riders	930	220	1,250	680	430	780	3,280	2,530	3,420	4,090	3,140	4,250
2030 Regional Travel Time Savings Relative to TSM[D] (hours)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	(1,000)	(600)	(600)	(1,300)	(900)	(1,600)
2030 Level of Service - Average Travel Speed for Autos (MPH)	25	27	24	25	27	24	19	23	21	19	23	21
Change (Relative to TSM)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	(6)	(4)	(4)	(6)	(4)	(4)
Cost Effective & Efficient Travel Options												
Order-of-Magnitude Capital Cost[B] (Year 2007 Dollars)	$8.9 million	$3.1 million	$8.9 million	$26.0 million	$14.1 million	$14.9 million	$280 million	$292 million	$213 million	$523 million	$521 million	$371 million
Annual Operating and Maintenance Cost (Year 2007 Dollars)												
Trunk Route (Alternative)[E]	$ 1.7 million	$ 1.7 million	$ 2.7 million	$2.6 million	$ 1.6 million	$ 1.9 million	$7.7 million	$5.6 million	$5.1 million	$11.0 million	$8.0 million	$7.4 million
Change in Systemwide O&M Cost (DDOT)[E]	$10.0 million	$3.6 million	$9.0 million	$15.8 million	$4.3 million	$11.1 million	$11.6 million	$3.3 million	$1.3 million	$14.9 million	$5.7 million	$3.5 million
Operating Cost per Revenue Hour (Year 2007 Dollars)	$150.25	$150.25	$150.25	$150.25	$150.25	$150.25	$150.25	$150.25	$150.25	$214.00	$214.00	$214.00
Operating Cost per Passenger Mile (Year 2007 Dollars)[F]	$0.82	$5.05	$1.03	$9.35	$0.49	$21.04	$0.58	$0.52	$0.39	$0.70	$0.59	$0.45
Economic Opportunity and Investment												
Redevelopment Potential	Medium	High	High	Medium	High	High	Medium	High	High	Medium	High	High
Transit-Oriented Development Potential at Stations												
Low - Number of stations with low TOD potential	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	5	2	1	5	2	1
Medium - Number of stations with medium TOD potential	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	6	5	7	6	5	7
High - Number of stations with high TOD potential	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	5	6	4	5	6	4
2000 Employment within One-Half Mile of Stations (US Census)	Not applicable	Not applicable	Not applicable	94,600	101,400	85,000	94,600	101,400	85,000	94,600	101,400	85,000
2007 Population within One-Half Mile of Stations (Social Compact)	Not applicable	Not applicable	Not applicable	60,600	41,000	40,400	60,600	41,000	40,400	60,600	41,000	40,400
Parking Impacts - Estimated Number of On-Street Spaces	2,110	960	1,420	2,670	1,510	1,420	1,820	860	480	1,780	860	470
Change (relative to TSM)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	(850)	(650)	(940)	(890)	(650)	(950)
Percent Change (relative to TSM)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	(32)	(43)	(66)	(33)	(43)	(67)
Communities and Environment												
Year 2000 Transit-Dependent Population (within one-half mile of stations)	Not applicable	Not applicable	Not applicable	21,810	12,390	15,650	21,810	12,390	15,650	21,810	12,390	15,650
2030 Change in Daily Regional Vehicle Miles Travelled (Relative to TSM)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	(18,700)	(21,300)	(25,500)	(31,900)	(29,000)	(33,700)
2030 Change in Annual CO2 Emissions in Tons (Relative to TSM)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	(2,320)	(2,640)	(3,160)	(3,955)	(3,595)	(4,180)
Population Potentially Affected by Noise & Vibration within 100' of Alignment	2,590	2,300	2,180	2,590	2,300	2,180	2,590	2,300	2,180	2,590	2,300	2,180
Potential for Affecting Natural Environment	Low	Low	Low	Low	Medium	Low	Low	Medium	Low	Low	Medium	Low
Number of Community Facilities within One-Half Mile of Station	56	57	55	56	57	55	56	57	55	56	57	55
Multimodal Connections (Bus Routes, Amtrak Station, Bicycle Trail)	42	39	40	42	39	40	42	39	40	42	39	40
Consistency with Plans	Medium	High	High	Medium	High	High	Medium	High	High	Medium	High	High
Right-of-Way Impacts	None	None	None	For park-and-ride facilities			For park-and-ride and maintenance facilities			For park-and-ride and maintenance facilities		
Public Involvement												
Community Sentiment - Through July Scoping Meetings												
Alignment Preference	Medium	Medium	High	Medium	Medium	High	Medium	Medium	High	Medium	Medium	High
Mode Preference	Low	Low	Low	Low	Low	Low	Medium	Medium	Medium	High	High	High

[A] Cost Effectiveness Index = Incremental Annual Capital and Operating Costs per New Rider, relative to the TSM Alternative. The $23 breakpoint corresponds with the Federal Transit Administration's Medium rating.
[B] Capital cost for TSM and Build Alternatives are incremental over No-Build.
[C] Includes DDOT routes only. TSM Alternatives include both the trunk and proposed skip-stop routes.
[D] Change in Vehicle Hours Traveled relative to TSM Alternative. Negative number indicates travel time savings.
[E] No-Build Alternatives: Applies to DDOT Routes 34, 37 and 53. TSM Alternatives: Applies to DDOT Routes 34, 37, 53 and skip-stop routes 34T, 37T and 53T. Build Alternatives: Applies to BRT and LRT routes.
[F] Daily Operating Cost of alternative divided by Daily Transit Passenger Miles of alternative.

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