

3. Transportation

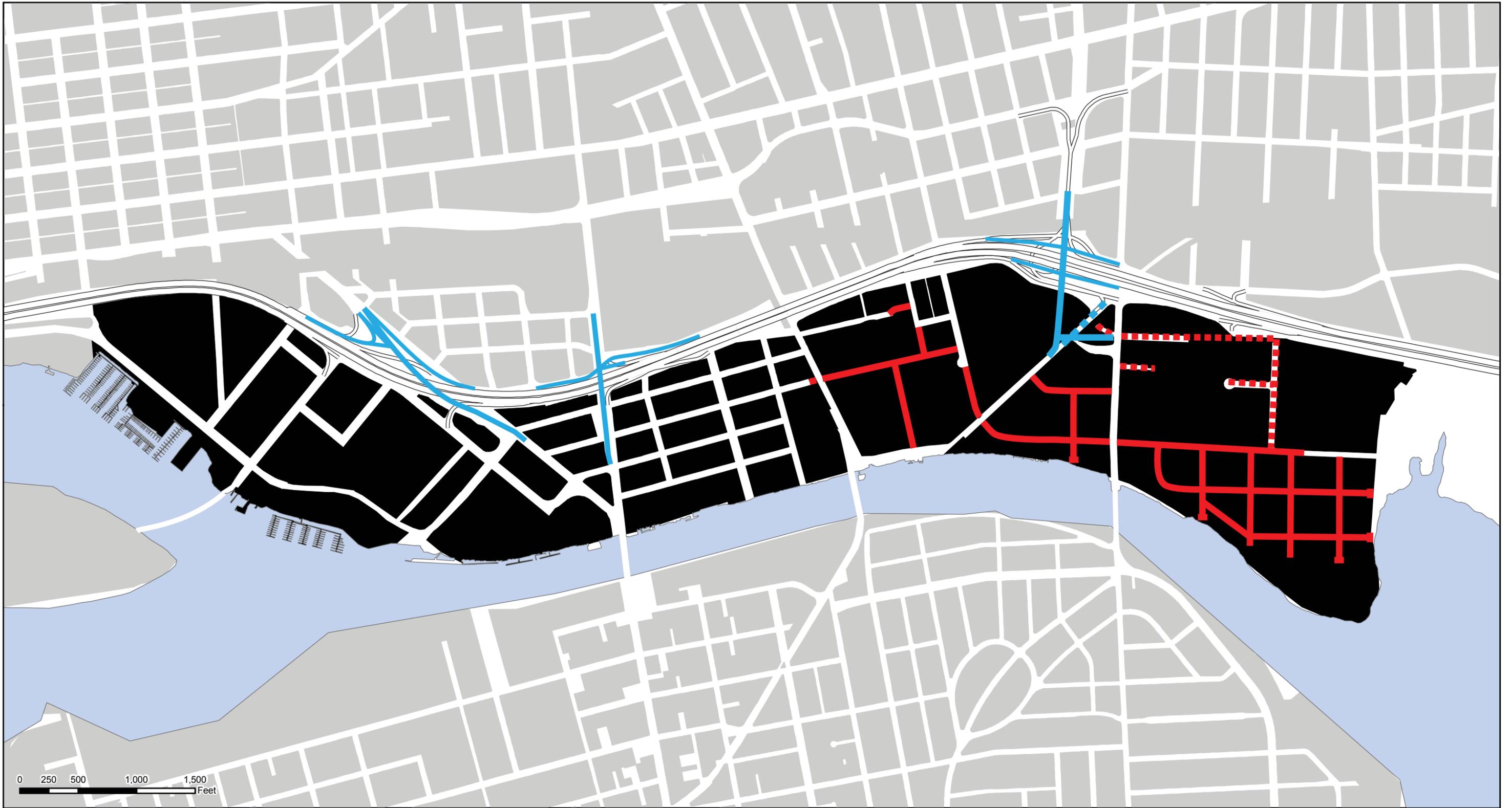
This section presents the Transportation evaluation of the proposed Plan Alternatives. This evaluation covers three broad topic areas:

- Traffic: the potential of each alternative's land use program to generate additional traffic on the internal Plan Area transportation network and external roadway facilities outside the Plan Area such as Interstate 880 (I-880), International Boulevard, High Street, etc.
- Travel Choices: the potential of each alternative to provide access to all travel modes
- Connectivity: the potential of each alternative to provide convenient connections to and through the Plan Area by all travel modes

For each Plan Alternative, a series of indicators were evaluated in each of the topic areas. For measures of vehicle trip generation and vehicle miles traveled (VMT), a quantitative analysis was performed and the results compared across the alternatives. For qualitative indicators such as travel choices and connectivity, the strengths and weaknesses of each alternative are discussed and compared. A summary of the Transportation evaluation is provided at the end of the section.

The street networks included with each alternative were generated along with the proposed land use and parcel changes identified within the Plan Area. The networks are highly conceptual in nature and represent some potential local connections that are possible with each alternative. The networks also illustrate the roadway projects planned for the I-880 corridor and show how each alternative could complement and interface with these improvements. These conceptual networks do not represent a final set of proposed transportation projects.

The redevelopment of the Plan Area will require additional multi-modal transportation improvements to serve the travel demand generated by the proposed land use changes. Any additional improvements should also complement the projects currently planned for the area, as well as help address existing circulation deficiencies. The full set of recommended local and regional transportation network improvements will be generated as the preferred land use alternative is developed through this planning process. The conceptual street networks are illustrated below.



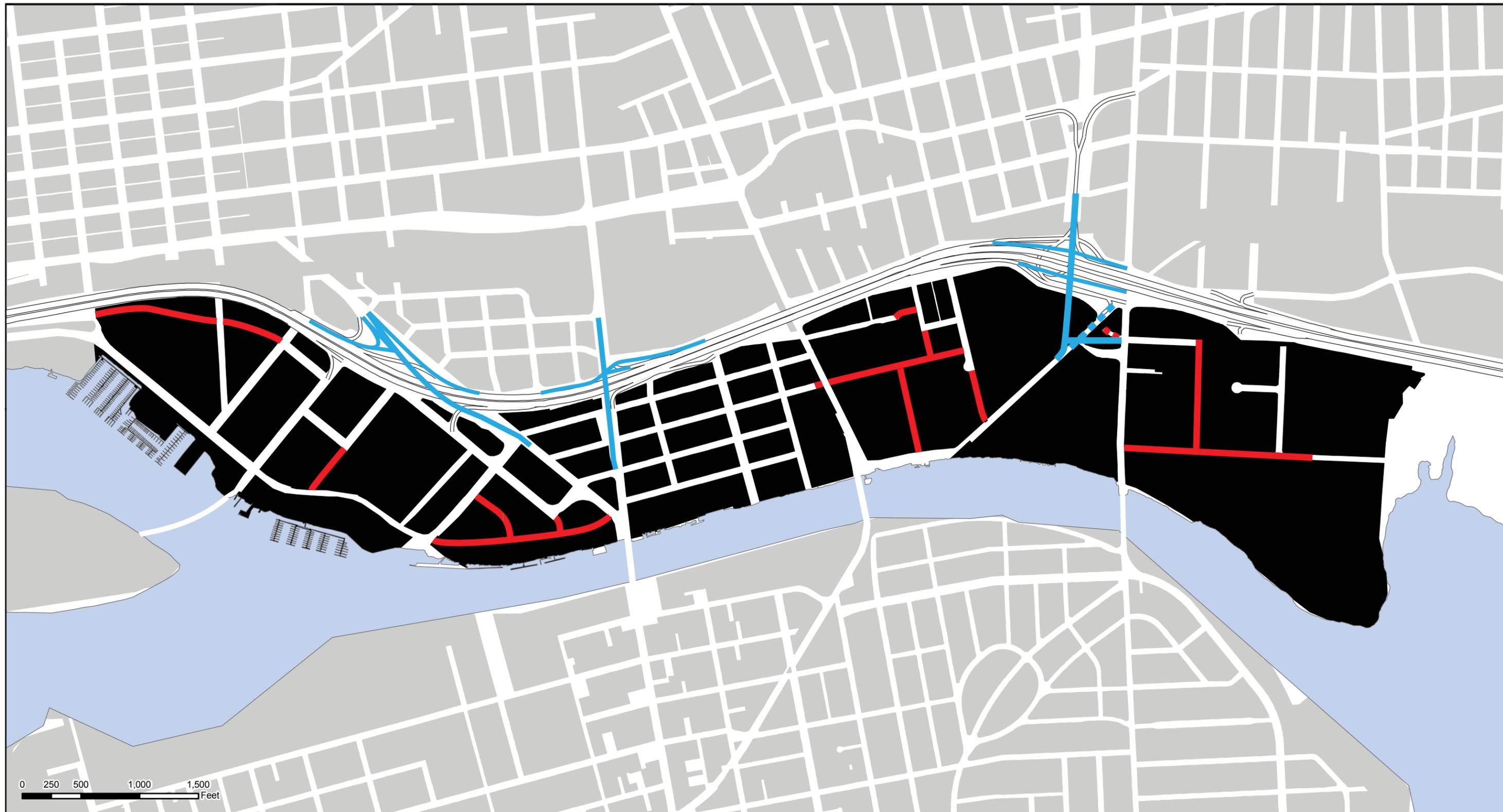
Alternative 1 Circulation Network

August 26, 2009

- New Street
- - - Street to be Removed
- Planned Improvements (Not part of Central Estuary Plan)

Note: Conceptual local street networks. Exact alignments are not meant to be implied.





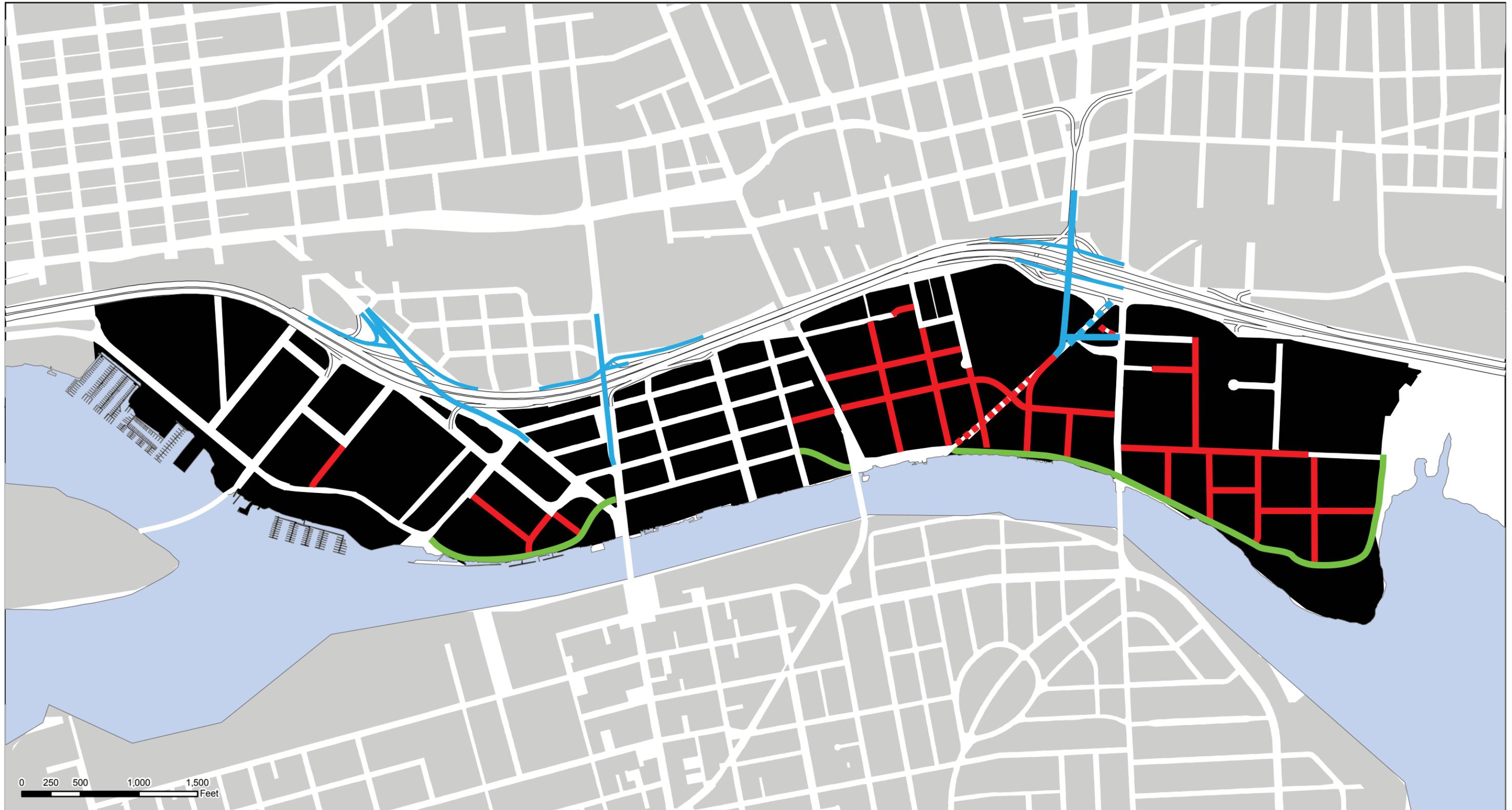
Alternative 2 Circulation Network

August 26, 2009

- New Street
- - - Street to be Removed
- Planned Improvements (Not part of Central Estuary Plan)

Note: Conceptual local street networks. Exact alignments are not meant to be implied.





Alternative 3 Circulation Network

August 26, 2009

- █ New Street
- █ New Boulevard
- ▤ Street to be Removed
- █ Planned Improvements (Not part of Central Estuary Plan)

Note: Conceptual local street networks. Exact alignments are not meant to be implied.



Traffic

Traffic indicators describe the potential of each Plan Alternative to impact the transportation network surrounding the Plan Area.

For each Plan Alternative, the external vehicle trip generation and vehicle-miles traveled (VMT) are estimated. The trip generation analysis focuses on external vehicle trips because external trips have either an origin or a destination outside the Plan Area. External trips have the potential to impact off-site roadway facilities such as I-880, International Boulevard, High Street and Fruitvale Avenue.

Most vehicle trip generation methodologies start with an estimate of total or “gross” vehicle trips for a given project or site. These estimates typically do not account for the following:

- **Internal trips:** These are trips made by all modes that occur between complementary uses located within the project boundary. Both the origin and destination are located within the project boundary. Internal trips do not leave the site, and thus do not impact external roadway facilities.
- **External trips by non-auto modes:** These are trips to or from the Plan Area made by a non-auto travel mode such as walking or transit. One end of the trip is located within the Plan Area.

The development scale and mix of uses proposed in each Plan Alternative indicates that there is a significant likelihood that activities can be “matched up” within the Plan Area. This would likely generate a large number of internal trips. Internal trips are important because: 1) they do not impact traffic on roadways external to the project, b) they are likely to be shorter (which can lead to lower VMT), and c) they are likely to be made by a non-auto mode such as walking or biking. High internal trip capture can translate into fewer traffic impacts, lower VMT, and a smaller carbon footprint.

External walk and transit trips are also likely to occur because of the large number of jobs in the surrounding area and in the East Bay.

Adjusting gross trips by internal and external walk/transit trips provides a more robust estimate of the net external vehicle trip generation potential for each of the Plan Alternatives. Internal and external walk/transit trip estimates can provide an indication of how the mix and diversity of land uses affect travel behaviors.

The trip generation methodology presented in this section is for comparative purposes only. It is intended only for identifying approximate “orders-of-magnitude” differences between the three Alternatives.

Vehicle Trip Generation

The external vehicle trip generation potential of each Plan Alternative is an indicator of how each development scenario could impact the roadway network outside the Plan Area. This section describes the methodology for estimating the external daily vehicle trip generation potential for each Plan Alternative. The methodology includes a traditional trip generation estimate with adjustments that reflect the internal trip capture and external walk and transit mode share.

Vehicle Trip Generation Background

Transportation planners rely primarily on vehicle trip generation methodologies and data published by the Institute of Transportation Engineers (ITE) in *Trip Generation* and the *Trip Generation Handbook*. ITE trip rates are provided for different land use classifications such as residential, office, retail, and industrial. The majority of ITE trip generation studies were conducted at “free-standing”, single-use, suburban sites with little or no transit service and pedestrian amenities. The ITE trip rates are meant to isolate the trip potential of each individual land use. This allows for a direct comparison of the trip

generation potential of different uses. However, the use of ITE trip rates by themselves will likely overestimate the total trip generation of a project that contains a mix of uses, is located in or close to a major urban center, and is served by transit. ITE recommends using alternative methods for estimating trip generation when a project deviates from the standard single-use suburban description. The land use program proposed for the Plan Area differs considerably from the standard ITE definition.

The ITE trip rates as published do not account for any vehicle trips that might occur between complementary uses within a large study area or trips made by alternative modes (pedestrian, bike, or transit). The ITE provides a methodology to estimate the number of trips that are captured or “internalized” within a mixed-use project. However, the methodology is limited and relies on a very small dataset. The ITE methodology does not provide guidance on estimating non-auto trips.

The size of the Plan Area, mix of land uses proposed for the alternatives, and access to BART and AC Transit service indicate that the ITE methodology should be complemented by a more robust method for estimating the number of internal trips and trips by alternative modes. An emerging body of research on how development density, diversity, and design affect trip making provides one potential source for estimating internal and external non-auto trips. Local Census data and household trip rates from the Bay Area Travel Survey (BATS) provide additional sources for guidance on adjusting ITE trip generation estimates.

The trip generation methodology used to evaluate the traffic generation potential of each Plan Alternative includes the following:

1. Determine the land use changes associated with each alternative. This includes the net change in each land use type that would occur under each alternative, plus the stock of the existing uses that would remain under each alternative. A trip generation estimate of only the net change will not provide enough information to determine the overall ability of the Plan Area to internalize trips.
2. Apply ITE daily vehicle trip rates for each major land use category to the land use totals developed in (1). This yields an estimate of “Gross Vehicle Trips” for each alternative.
3. Develop a “Combined Internal, External Walk/Transit Trip Reduction” estimate. This estimate was developed from multiple sources, including: (1) a new methodology developed by leading travel researchers to estimate internal trip capture, external walk trips, and external transit trips for large mixed-use developments, (2) Census and BATS data, and (3) professional engineering judgment.
4. Apply the Combined Reduction factors calculated in (3) to the Gross Vehicle Trips calculated in (2). This yields “Net External Vehicle Trips.”

This method provides a more realistic estimate of external vehicle trips, while also showing some of the differences associated with each Plan Alternative’s proposed land use program.

Estimation of Gross Vehicle Trips

Table 3.1 provides a summary of the proposed land use program for each Plan Alternative. The uses are aggregated according to standard ITE land use classifications. Table 3.3 shows the existing land use totals, the net change in land use associated with each Plan Alternative, and the final adjusted land use totals.

Table 3.1: Aggregated Land Use Totals by Plan Alternative

Land Use	Units ¹	Net Change by Plan Alternative				Adjusted Totals by Plan Alternative		
		Existing	1	2	3 ²	1	2	3 ²
Residential	du	521	1,928	1,267	3,871	2,449	1,788	4,392
Retail	sq. ft.	299,305	443,791	13,187	37,389	743,097	312,493	336,694
Office	sq. ft.	52,657	549,205	712,300	526,400	601,862	764,957	579,057
Industrial	sq. ft.	3,821,603	-2,053,065	-1,509,482	-2,040,460	1,768,538	2,312,120	1,781,143
Public/Instit.	sq. ft.	334,020	-27,115	-15,152	-187,415	306,905	318,867	146,605

Notes:
 (1) du= dwelling unit; sq. ft. = square feet
 (2) The industrial and retail figures indicated do not reflect the exclusion of redevelopment of PG&E. Because total change in these factors was slight and all subsequent transportation calculations are rough estimates, it was determined unnecessary to recalculate these estimates.
Source: City of Oakland, Community Design + Architecture (2009)

Table 3.2 presents the Gross Vehicle Trip estimate for each alternative. The adjusted land use totals, the ITE trip rates by land use type, and the Gross Vehicle Trip totals are also shown in Table 3.2. Note: non-residential square feet (sq. ft.) are converted to thousand square feet (ksf) to match the ITE definitions.

Table 3.2: Gross Daily Vehicle Trip Estimate by Plan Alternative

Land Use	ITE Land Use Code ¹	Units ²	Daily Trip Rate ³	Alternative 1		Alternative 2		Alternative 3	
				Land Use Total	Daily Trips	Land Use Total	Daily Trips	Land Use Total	Daily Trips
Residential	230	du	5.81	2,449	14,226	1,788	10,388	4,392	25,520
Retail	820	ksf	42.94	743.1	31,909	312.5	13,418	336.7	14,458
Office	710	ksf	11.01	601.9	6,626	765.0	8,422	579.1	6,375
Industrial	110	ksf	6.97	1,768.5	12,327	2,312.1	16,115	1,781.1	12,415
Public/Instit.	710	ksf	11.01	306.9	3,379	318.9	3,511	146.6	1,614
Total Daily Gross Vehicle Trips					68,467		51,855		60,382

Notes:
 (1) ITE land use codes: Residential = 230 (Condo/Townhouse), Retail = 820 (Shopping Center), Office = 710 (General Office), Industrial = 110 (Light Industrial).
 (2) du= dwelling unit; ksf = thousand square feet
 (3) All ITE trip rates use the average rate as published.
Source: Trip Generation, 8th Edition (ITE, 2008)

The Gross Vehicle Trip estimates presented in Table 3 include existing land uses that are not assumed in the proposed redevelopment areas in each alternative. The methodology for developing the Combined Reduction for internal trip and external walk/transit trips used to adjust down the Gross Vehicle Trips estimate is presented in the next section.

Combined Reduction Factor for Internal and External Walk and External Transit Trips

ITE trip rates, when applied in a consistent manner across the Plan Alternatives, represent an indication of the overall land use program and development intensity. However, the ITE-based estimates alone

typically overstate the trip generation of projects that feature a mix of land uses located within a dense urban core. To account for these effects, a Combined Reduction factor was developed that includes an estimate of internal trip capture and external walk and external transit trips. This Combined Reduction adjustment factor will represent a better measure of each alternative’s land use characteristics and the Plan Area’s location within the region.

Developing a Combined Adjustment factor is necessary because it will provide a more realistic estimate of external vehicle trips. Also, it is clear that households within Alameda County, and the Bay Area overall, generate trips at a lower rate than ITE. The best source for local trip rates comes from the 2000 Bay Area Travel Survey (BATS). The 2000 BATS summarizes household trip rates by geographic area, housing structure type, and population density. Many of the central areas in the City of Oakland are classified as “Urban” in BATS. Urban areas in BATS have a population density in the range of 10,000 to 20,000 persons per square mile.

Table 3.3 presents selected trip rates per household as reported from the 2000 BATS and compares them to standard ITE-based trip rates for residential dwelling units.

Table 3.3: Selected 2000 Weekday Trips per Household for the Bay Area

Measure	Total Daily Vehicle Trips per Household or Dwelling Unit ¹
BATS Bay Area	6.750
BATS Alameda County	6.455
BATS Urban Core	3.870
BATS Urban Population Density Category ²	6.343
ITE Single-Family Dwelling Unit (Land Use Code 210)	9.57
Notes:	
(1) BATS daily vehicle trip rate per household is represented as the “In-Vehicle Person” rate. This takes into account vehicle occupancy as the rate includes the vehicle driver plus any passengers. ITE reports residential rates according to dwelling units.	
(2) Urban population density category represents the Bay Area average for areas with a population density in the range of 10,000 to 20,000 persons per square mile.	
Source: 2000 Bay Area Travel Survey (Metropolitan Transportation Commission, 2004); <i>Trip Generation, 8th Edition</i> (ITE, 2009)	

The rates in Table 3.3 indicate that most Bay Area households generate vehicle trips at a rate much lower than the ITE average trip rate for single-family dwelling units. The Bay Area averages are much closer to the ITE condominium/townhouse rate of 5.81 daily vehicle trips per household. The lower vehicle trip rates can be explained by several factors, including more travel destinations closer to residences, greater chaining of trips, greater walk/bike/transit usage, and higher levels of roadway congestion.

Methodologies to adjust ITE-based trip estimates are still an evolving practice within the transportation profession. As stated previously, the ITE internalization methods are based on a very small sample, do not account for land use characteristics, and typically underestimate internal trip capture. Leading travel researchers have been developing an improved methodology for estimating the effects of mixed-use development (MXD) characteristics on internal trip capture, external walk trips, and external transit trips. The latest research and MXD model estimation is published in the study *Traffic Generated by Mixed-Use Developments: Six-Region Study Using Consistent Built Environmental Measures*⁷. This study presents a series of models that use different land use variables and metrics to predict the likelihood of internal trip capture, external walk trips, and external transit trips. The data were collected across 239 MXD sites in

⁷ Ewing, Greenwald, Zhang, et.al., 2009; TRB Annual Meeting 2009 Paper #09-1213.

six major metropolitan regions. The average internal capture rate for these sites was 17.8 percent, the average external walk mode share was 5.8 percent, and the average external transit mode share was 5.6 percent. In total, the average MXD projects generated 29 percent fewer vehicles on the external roadway network compared with stand-alone ITE-based estimates.

It should be noted that the MXD model is still in development and is being reviewed by ITE. The MXD model has not yet been formally adopted by ITE or the City of Oakland. However, given the extensive data collection effort used to develop the MXD model and the limitations of the other methods, it is expected to provide a better estimate of internal and external walk/transit trips. Furthermore, it is being applied for comparison of the alternatives only – the ACCMA travel model will be used for purposes of the environmental analysis. The MXD model calculations are provided in Appendix C.

Census and BATS data provide regional benchmarks that are useful in providing additional insight on mode share estimates. Census Journey-to-Work data is one source of travel information for work-based trips. Table 3.4 presents the breakdown of work-based mode share for residents of the four Census tracts that compose the Plan Area and the City of Oakland. Transit mode share is slightly lower than the City average, but the bike/pedestrian share is slightly higher.

Table 3.4: Census Journey-to-Work Mode Share for the Plan Area and the City of Oakland

Travel Mode	Mode Share Plan Area (%)	Mode Share City of Oakland (%)
Drive Alone	54%	55%
Car Pool	15%	17%
Public Transportation	15%	17%
Bike/Pedestrian	7%	5%
Other	3%	2%
Work From Home	7%	4%
Source: 2000 US Census; Strategic Economics, 2009		

Table 3.5 presents mode share data for home-based work trips and all trips from the 2000 BATS for Alameda County and the Bay Area Urban population density category. These numbers provide mode an indication of mode share for all trips region-wide. This provides another useful benchmark and reality-check on any mode share estimates.

Table 3.5: 2000 BATS Mode Share for Alameda County and Urban Population Category

Travel Mode ¹	Alameda County		Urban Population ²	
	Work	Total	Work	Total
Vehicle (Includes Driver and In-Vehicle Passenger)	79%	76%	80%	75%
Transit	15%	8%	14%	9%
Bicycle	2%	2%	2%	1%
Walk	3%	12%	3%	12%
Notes: (1) Travel modes from BATS definitions. (2) Urban population density category represents the Bay Area average for areas with a population density in the range of 10,000 to 20,000 persons per square mile. Source: 2000 BATS (MTC, 2004)				

The Combined Reduction factor was estimated for each Plan Alternative by synthesizing the data presented above with other factors known about the alternatives. In general, the MXD model helped establish a base reduction level. The Census and BATS mode share data were used to further refine the reductions. In particular, the 15 percent transit mode share for work trips from the Census was added into the model to calibrate the part of the model that estimates external transit reductions for home-based work trips. Bike trips were not explicitly accounted for in the estimate because they constitute a relatively small portion of total trips. City staff recommended that the MXD results with adjustments should be rounded down in order to develop a conservative estimate for the Combined Reduction.

Alternative 1 was assigned a Combined Reduction factor of 21 percent, Alternative 2 assigned a factor of 20 percent, and Alternative 3 assigned a factor of 25 percent. These results are considered consistent with the observed averages from the 239 MXD sites included in the MXD model and other projects within the City of Oakland. The higher Combined Reduction for Alternative 3 is an indication of its larger development scale, increased likelihood for matching up trips within the site, and better connectivity.

Net External Vehicle Trip Generation

Table 3.6 provides the Net External Vehicle Trips for each Plan Alternative. Net External Vehicle Trips were calculated by applying the Combined Reduction to the Gross Vehicle Trips. Vehicle trips per capita were calculated by dividing the Net External Vehicle Trips by the service population of each Plan Alternative. Service population is defined as the number of residents plus employees within the Plan Area.

Table 3.6: Net External Daily Vehicle Trips and Trips per Capita by Plan Alternative

	Plan Alternative		
	Alternative 1	Alternative 2	Alternative 3
Gross Daily Vehicle Trips (Unadjusted)	68,467	51,855	60,382
<i>Combined Reduction % (Internal, External Walk/Transit)</i>	<i>21%</i>	<i>20%</i>	<i>25%</i>
Net External Daily Vehicle Trips (Adjusted)	54,089	41,484	45,287
Service Population¹	9,888	9,023	13,883
Vehicle Trips per Capita	5.47	4.60	3.26
<p>Notes: (1) Service population = population + employment. Population and employment totals were estimated using standard factors that convert dwelling units to residents and non-residential square feet to employees. Source: Community Design + Architecture, Arup (2009)</p>			

Alternative 2 generates the fewest Gross and Net External Daily Vehicle Trips. Alternative 3 has the fewest vehicle trips on a per capita basis. Note: All retail trips are included in the trip estimates. However, the service population only includes employees who work in the retail establishments.

Daily Vehicle-Miles Traveled (VMT)

VMT is the total number of miles driven by all vehicles within a given time period and geographic area. Daily VMT consists of all trips generated by residents of the Plan Area and all employees and shoppers attracted to job centers and shopping centers on the site. The calculation of VMT involves applying assumptions regarding trip purpose and length. Table 3.7 summarizes these assumptions.

Table 3.7: VMT Assumptions

Trip Purpose	% of Daily Trips ¹	Trip Length ²
Home-Based Work	22%	12
Home-Based Other (Shopping, Recreation)	78%	7
Notes:		
(1) Association of Bay Area Governments (2004)		
(2) 2000 Bay Area Travel Survey (MTC, 2004)		

The VMT components were calculated as follows:

- Residential VMT: the residential Net External Trips were split between work and non-work trips using the 22/78% proportion shown in Table 9. Work trips were assigned a length of 12 miles, while all other trips were assigned a length of 7 miles.
- Work VMT: the office, industrial, and public/institutional Net External Trips attracted to the site were multiplied by the work trip length of 12 miles
- Retail VMT: the retail Net External Trips attracted to the site were multiplied by the non-work trip length of 7 miles

Total daily VMT was calculated for each Plan Alternative by summing across the three VMT components listed above. In an effort to make VMT more descriptive, VMT is often presented on a per capita or per person basis. Similar to the vehicle trip generation per capita calculation, VMT per capita was calculated by dividing the total daily VMT by the service population.

Note: Retail VMT to and from the Plan Area are included in the VMT retail estimate. However, the service population only includes retail employees and not shoppers. Retail trips and VMT are included in the numerator of the VMT per capita calculation, but shoppers who travel to the Plan Area are not captured in the denominator. This results in a higher VMT per capita for the Plan Area when compared to regional benchmarks. This problem arises when comparing VMT per capita for a relatively small sub-area with a regional total. Comparing VMT per capita across the Plan Alternatives still provides a useful comparison.

Table 3.8 presents the total daily VMT and VMT per capita (using service population) for each alternative.

Table 3.8: Total Daily VMT by Plan Alternative

Land Use Type	Plan Alternative		
	Alternative 1	Alternative 2	Alternative 3
Residential	73,324	54,219	12,4877
Retail	171,413	72,996	73,734
Office	63,343	81,527	57,857
Industrial	117,831	155,998	112,662
Public/Institutional	32,300	33,984	14,648
Total VMT	458,210	398,724	383,778
Service Population¹	9,888	9,023	13,883
VMT per Capita	46.3	44.2	27.6
<p>Notes: (1) Service population = population + employment. Population and employment totals were estimated using standard factors that convert dwelling units to residents and non-residential square feet to employees. Source: Arup (2009)</p>			

Alternative 3 has the lowest daily VMT and VMT per capita. Alternative 3’s lower VMT is the result of fewer work trips attracted to the Plan Area. Alternative 1’s larger number of retail trips (retail has the highest trip rate) and Alternative 2’s larger number of work trips (work trips have the longest trip lengths) result in these alternatives having higher VMT estimates.

Travel Choices

A goal of the Central Estuary Plan is to promote a full range of convenient and attractive travel choices for local residents and workers. Auto travel to and from the Plan Area is currently constrained by traffic congestion on I-880, a limited number of connections over the freeway and the freight tracks, and the limited capacity of the local street network. This section assesses the each Plan Alternative’s ability to support and promote travel by transit, pedestrian, and bicycle modes.

Transit Suitability

This section evaluates the ability of each Plan Alternative to support additional transit service. Enhanced transit service within the Plan Area will offer local residents and workers increased mobility. Existing transit service to the area is provided by BART and AC Transit. While the Fruitvale BART station is less than one-quarter of a mile from the Plan Area boundary, the indirectness of the street network inhibits access to the station.

AC Transit service within the Plan Area is limited, with three routes located on 29th and Fruitvale Avenues. These routes are operate on 30-minute headways and connect areas of Alameda with the Fruitvale Station. One Transbay bus route serves the Park Street Triangle and 23rd Avenue. No local bus service is provided to the West and East sub-areas. Only five transit stops total are located within the Plan Area. However, high frequency bus service is located just outside the Plan Area along the International Boulevard corridor in Oakland. Enhanced transit connectivity to BART and the International Boulevard transit corridor would significantly increase the number of potential destinations for residents and employees of the Plan Area.

There are several ways to assess the transit supportiveness of each alternative’s land use program. The external transit trip calculation in the trip generation section provides some guidance on the transit suitability of different land use densities and combinations. The external transit mode share model indicates that all three alternatives would generate approximately 6 to 7 percent transit mode share. There is no significant difference between these estimates. Therefore, other measures of transit supportiveness are required.

AC Transit has published service planning standards⁸ that establish route spacing and bus frequencies for different residential densities. AC Transits defines two main route service types:

- **Trunk:** Trunk routes are bus lines located on five primary corridors. These corridors carry over 40 percent of total system ridership.
- **Crosstown:** Crosstown routes connect neighborhoods to trunk routes and BART

Bus lines serving the Plan Area are considered Crosstown routes, while lines along International Boulevard are considered Trunk routes. Table 3.9 presents the AC Transit population density thresholds and service objectives. These are the service models that AC Transit uses as a guide in planning service changes or expansions.

Table 3.9: AC Transit Population Density and Service Objectives

Density Category	Population Density (persons per sq mi)	Route Spacing (distance between lines)	Route Structure	Weekday Base Frequency
High Density (International, Telegraph)	>20,000	1/4 mile	Grid	Trunk: 10 min Crosstown: 15 min
Medium (Oakland, Berkeley)	10,000 – 19,999	1/4-1/2 mile	Grid	Trunk: 10 min Crosstown: 15 min
Low (Hayward, Fremont)	5,000 – 9,999	1/2 mile	Focal Point / Transfer	Trunk: 15 min Crosstown: 30 min
Very Low (Oakland Hills)	<5,000	1 mile	Focal Point / Transfer	No standard
Source: <i>Designing With Transit</i> (AC Transit, 2004)				

The overall population densities for the three alternatives are:

- Alternative 1: 8,340 persons per square mile
- Alternative 2: 6,265 persons per square mile
- Alternative 3: 14,562 persons per square mile

Both Alternatives 1 and 2 are considered Low density areas, which would support transit service similar to what is currently in place (15 to 30 minute headways). Alternative 3 is considered a Medium density service area, which indicates that this land use program could support additional transit service frequency (10 to 15 minute headways). Alternative 3 provides the most transit supportive land use program.

⁸ *Designing for Transit: Making Transit Integral to East Bay Communities, A Handbook for Elected Officials, Local Staff, and Other Community Builders* (AC Transit, 2004)

Additional guidance on transit suitability is provided in the Santa Clara Valley Transportation Authority (VTA) Transit Sustainability guidelines⁹. These guidelines that provide additional detail on the level of residential densities required to support various levels of transit service: local bus, express bus, Bus Rapid Transit (BRT), light rail (LRT), commuter rail (e.g., Caltrain, ACE), and heavy rail (e.g., BART). Table 3.10 summarizes the residential density classifications for local, BRT, and LRT.

Table 3.10: VTA Land Use Characteristics for Local, BRT, and LRT Service

Residential Density Targets Along New Corridors (DUA¹)			
Density Category	Minimum	Target	Optimal
Light Rail (LRT)	20	35	65
Bus Rapid Transit (BRT)	12-16	25-32	30-50+
Local	<12	-	-
Notes: (1) DUA = dwelling units per acre Source: <i>VTA Transit Sustainability Policy</i> (VTA, 2007)			

Table 3.11 presents the population and residential densities for each sub-area across the three Plan Alternatives.

Table 3.11: Sub-Area Residential Densities by Plan Alternative

Residential Densities by Plan Alternative (DUA¹)				
Plan Area Sub-Area	Acres	1	2	3
West	125.60	0.80	9.03	8.15
Central-West	74.22	9.97	7.87	10.64
Central-East	95.20	6.74	0.73	15.31
East	121.0	7.98	0.00	9.27
Total Plan Area	416.0	5.89	4.30	10.56
Notes: (1) DUA = dwelling units per acre Source: <i>VTA Transit Sustainability Policy</i> (VTA, 2007)				

The dwelling units per acre (DUA) for each sub-area indicate that local bus service is the appropriate level of transit for each Plan Alternative. Only Alternative 3 has residential densities across the Plan Area that approach the BRT minimum targets.

Bicycle and Pedestrian Suitability

Overall, the three Plan Alternatives appear to provide sufficient density, mix of land uses, and internal connectivity to support a significant level of pedestrian and bicycle activity. However, there is not enough information at this time to differentiate between the three alternatives and identify which one does a better job promoting walking and biking.

⁹ *VTA Transit Sustainability Policy* (VTA, 2007)

While a rigorous quantitative analysis is difficult, a few broad observations are warranted. All of the Plan Alternatives propose significant increases in mixed-use development throughout the Plan Area. Providing complementary land uses (e.g., residential and retail) within a relatively small area will promote travel by pedestrian and bicycle modes within the Plan Area. Improving connections to the Fruitvale BART station and the City of Alameda should also improve external share of pedestrian and bicycle travel. The Fruitvale station has the second-highest bike mode share¹⁰ in the BART system and the City of Alameda offers a number of shopping destinations a short distance across the Estuary on Park Street. The close proximity of BART and other external destinations should promote travel by pedestrian and bicycle means.

Connectivity

Providing adequate internal and external connectivity for all travel modes is an important aspect of the Central Estuary Plan. A robust street grid with multiple street connections in all directions creates a redundant network with short block lengths. This provides numerous paths for cars to navigate through the area and shortens walking distances. This creates an inviting and safe pedestrian environment and provides sufficient roadway capacity without having to design wide streets with large intersections. Connections and access to I-880 is an important consideration, as well as providing adequate roadway capacity across I-880 and the freight tracks.

The street networks included with each alternative were generated along with the proposed land use and parcel changes identified within the Plan Area. The networks are highly conceptual in nature and represent some potential local connections that are possible with each alternative. The networks also illustrate the roadway projects planned for the I-880 corridor and show how each alternative could complement and interface with these improvements. These conceptual networks do not represent a final set of proposed transportation improvements.

The redevelopment of the Plan Area will require additional multi-modal transportation improvements to serve the travel demand generated by the proposed land use changes. Any additional improvements should also complement the projects currently planned for the area, as well as help address existing circulation deficiencies. The full set of recommended local and regional transportation network improvements will be generated as the preferred land use alternative is developed through this planning process.

The proposed roadway networks for each Plan Alternative are included earlier in the report. As shown in the figures, all three Plan Alternatives benefit from three major projects where I-880 interfaces with the local street network:

- **I-80 Operational and Safety Improvements at the 29th and 23rd Ave Overcrossings:** This project will improve access to and from NB I-880 by combining and closing ramps at both 23rd and 29th Avenues. Local circulation is improved by simplifying some intersections and providing interim improvements at the base of the 29th Avenue bridge where it intersects the Park Street Triangle.
- **High Street Overhead Seismic Retrofit Project:** This project will reconfigure the ramps at 42nd Avenue to create two at-grade intersections on 42nd Avenue that serve the NB 880 on-ramp and

¹⁰ 2008 BART Station Profile Study (BART, 2008)

SB 880 off-ramp. The E 8th Street frontage road will terminate south of 37th Avenue to accommodate the retrofit.

- **42nd Avenue/High Street Access Improvements:** This project, when combined with the 42nd Avenue interchange improvements included as part of the High Street Overhead project, will improve the overall east-west street connectivity across I-880. These changes will result in 42nd Avenue serving as a parallel route to High Street that connects to Alameda Avenue. The bridge work associated with the High Street project referenced above will allow High Street to be widened to eight lanes under 880. This will allow for two full left-turn lanes in both directions and two through travel lanes.

These three projects, which are unrelated to the Central Estuary Plan, significantly improve the overall external circulation and access to I-880. They also greatly improve circulation and connectivity across the freeway and rail tracks. Several options for fixing the circulation issues at the Park Street Triangle have also been proposed as part of the I-880 Operational and Safety Improvements Project. These projects also provide additional opportunities for providing north-south bicycle and pedestrian connections from the Plan Area across I-880 and the railroad tracks.

A summary of the external and internal connectivity and circulation issues are presented below.

External Connections

- The three projects that improve I-880 at the local street interface provide significant capacity and east-west connectivity at 23rd Avenue, 29th Avenue, and High Street. The 42nd Avenue / High Street Access project generates a new connection under I-880 between Alameda Avenue and 42nd Avenue. All of the Plan Alternatives benefit from these projects.
- The three projects consolidate freeway ramps and provide improved on and off-ramps serving I-880 in both directions.
- Because all these improvements are independent of the Central Estuary Plan, they are assumed to provide the same degree of capacity and safety enhancements across each of the Plan Alternatives.

Internal Connections

- Plans for reconfiguring the Park Street Triangle will be included as part of the preferred alternative. Any improvement should take into account the new 23rd and 29th Avenue overcrossings and freeway ramps that will be in place before the Plan Area redevelops. Any Triangle plans should make pedestrian/bicycle connectivity and safety and Bay Trail access a priority.
- Alternative 2 and 3 propose extending Embarcadero to the Park Street Triangle. Any proposed reconfiguration at the Triangle should consider the feasibility of a new street connection.
- Alternative 3 takes the Embarcadero extension one step further and connects it to Glascock Street. This new north-south connection would serve as a continuous boulevard through the Plan Area and provide a potential route for future transit service expansion.
- Both Alternatives 1 and 2 propose a new east-west connection across Fruitvale Avenue at Chapman Street. This connection is proposed a relatively minor access point.
- Alternative 3 proposes extending the Embarcadero-Glasscock boulevard to a new connection with the Fruitvale Avenue / Alameda Avenue intersection. This additional connection provides a true north-south route along the Estuary shoreline for almost the entire length of the Plan Area.

- Alternative 3 provides additional flexibility to reroute Alameda Avenue east of Fruitvale Avenue. Realigning Alameda Avenue will provide an additional internal street connection across Alameda Avenue, which will have local circulation benefits.
- Each Plan Alternative circulation network contains a sufficient internal street grid to support the proposed land use programs.
- Alternatives 1 and 3 provide the best opportunities to create additional pedestrian and bicycle connections to the Bay Trail and Estuary shoreline. Most of these opportunities occur in the proposed residential development areas in the East sub-area.

These projects and improvements will help enhance external and internal connectivity throughout the Plan Area. Overall, Alternative 3 provides the most opportunities for improving the internal street network.

Transportation Summary

A summary of the trip generation and VMT results are presented in Table 3.12. Figures 3.1 through 3.5 summarize the quantitative traffic indicators.

Note: This analysis was conducted with the assumption that in Alternative 3, the PG&E site would be redeveloped into light industrial and incubator space. At the outset of the planning process and after initial discussions with PG&E representatives, it appeared that this large site could become available for partial redevelopment within the Plan's 25-year planning horizon. However, in a letter to staff and testimony at the December 2009 Planning Commission hearing on the preferred alternative, a PG&E representative indicated that redevelopment or more intensive use of the site was not compatible with PG&E's goals. With the elimination of this change and the movement of the incubator to elsewhere in the Plan Area, there is a net loss of 300,000 sq. ft. of industrial land and associated job implications in Alternative 3. To maintain the integrity of these analyses, which preceded the change described above, the calculations and conclusions here have not been modified.

Table 3.12: Transportation Alternative Analysis – Trip Generation and VMT

Transportation Indicators	Central Estuary Plan Alternative		
	1	2	3
Gross Daily Vehicle Trips (before internal and external adjustments)	68,467	51,855	60,382
Combined Reduction (Internal Trips, External Walk/Transit Mode Share)	21%	20%	25%
Net External Daily Vehicle Trips	54,089	41,484	45,287
Net External Vehicle Trips per Capita	5.47	4.60	3.26
Total Vehicle-Miles Traveled (VMT)	458,210	398,724	383,778
VMT per Capita	46.3	44.2	27.6
Source: Arup (2009)			

Figure 3.1: Daily Vehicle Trip Generation Comparison

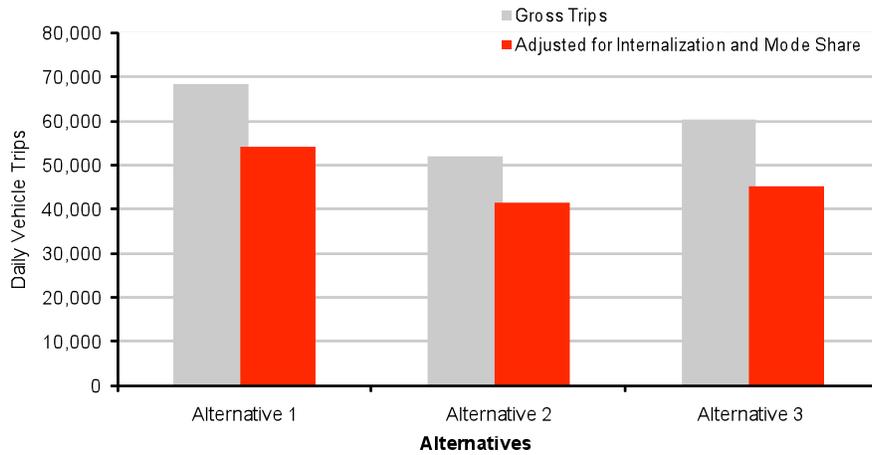


Figure 3.2: Net External Vehicle Trip Generation by Land Use Type

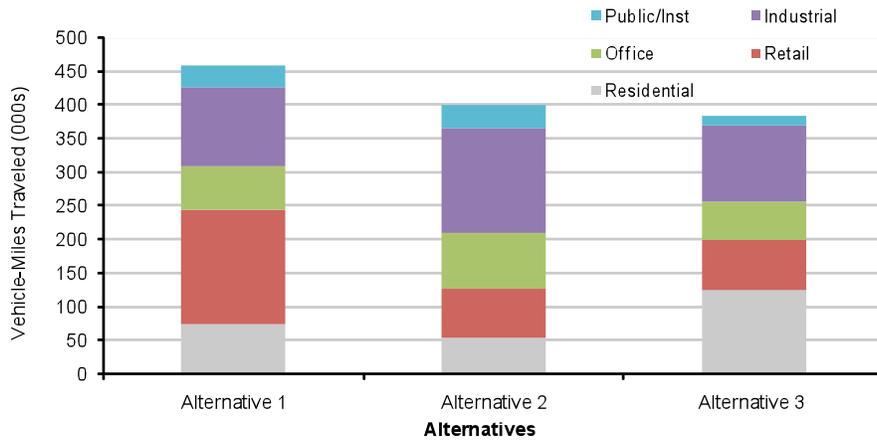


Figure 3.3: Daily Trip Generation per Capita

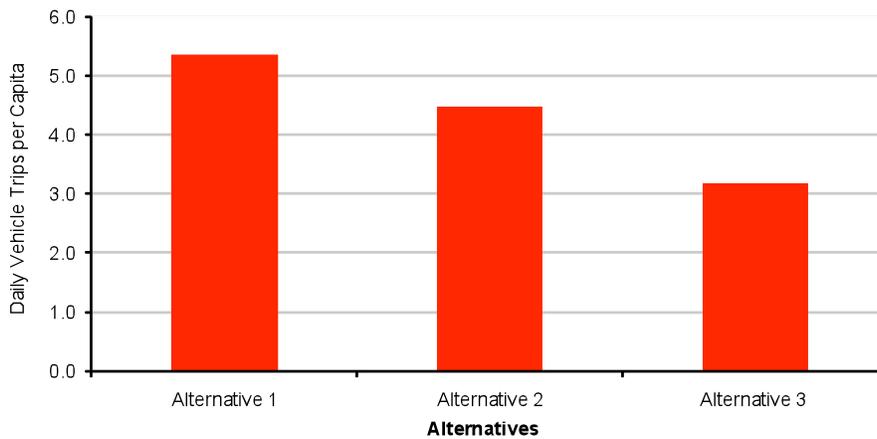


Figure 3.4: Total VMT by Land Use

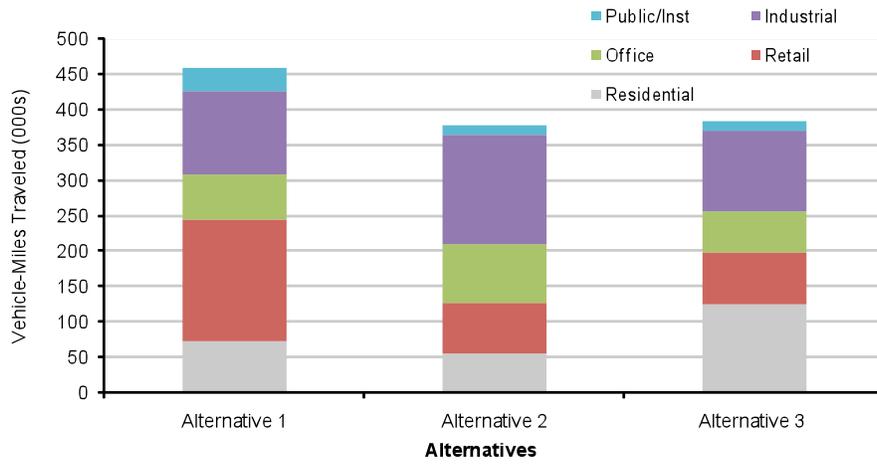
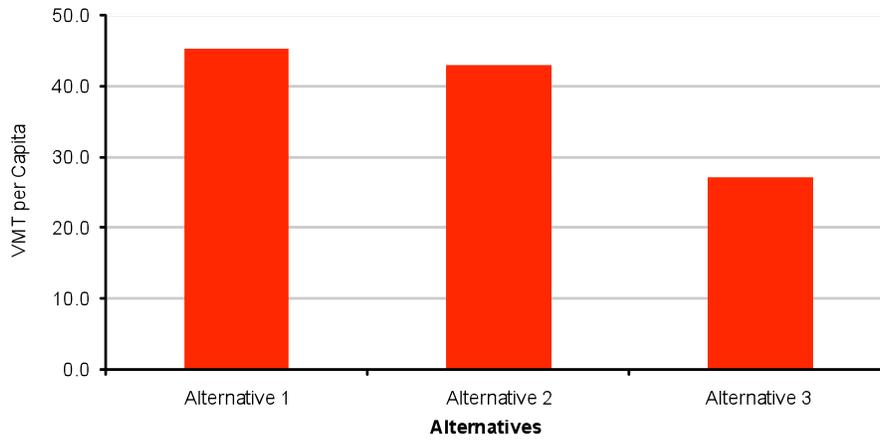


Figure 3.5: VMT per Capita



The potential effect of each Plan Alternative on three topic areas, traffic, travel choices, and connectivity, are summarized in the table below.

Table 3.13: Impact on Transportation

Transportation Topic Area	Alternative 1	Alternative 2	Alternative 3
Traffic			
Gross Daily Vehicle Trips	-	-	-
Combined Reduction: (Internal Capture, External Walk/Transit Mode Share)	0	0	+
Net External Daily Vehicle Trips	-	-	-
Vehicle-Miles Traveled (VMT)	0	0	+
VMT per Capita	0	0	+
Travel Choices			
Transit Suitability	0	0	+
Pedestrian and Bicycle Suitability	+	+	+
Connectivity			
External Connections	0	0	0
Internal Connections (Includes Bicycle/Pedestrian Access)	0	0	+

++ = Significantly Improved

+ = Improved

0 = Unchanged

- = Decreased

All of the Plan Alternatives will generate additional traffic on the surrounding roadway system. Alternative 2 would still generate the fewest external daily vehicle trips, while Alternative 3 would generate the fewest vehicle trips on a *per capita* basis. Alternative 3, which has the greatest overall development density and the largest number of new residential units, has the greatest potential to capture internal trips and support a higher transit mode share.

Alternative 3 would generate the lowest VMT and VMT per capita of the three alternatives. Alternative 1's larger number of retail trips (retail has the highest trip rate) and Alternative 2's larger number of work trips (work trips have the longest trip lengths) result in these alternatives having higher VMT estimates.

Alternative 3 is the most transit-supportive overall, as it includes the greatest residential densities across the Plan Area. All of the alternatives would provide enhanced opportunities for bicycle and walking usage. While the preferred transportation network has yet to be developed, all of the conceptual transportation networks illustrated in this evaluation should enhance and improve external connections to the Plan Area. Alternative 3 would provide the most opportunities to enhance local connections for all modes because it includes the greatest level of redevelopment across the Plan Area.