SR 50/UCF CONNECTOR ALTERNATIVES ANALYSIS

APPENDIX

AUGUST 2015

APPENDIX A
Evaluation of Land Development Regulations

Memorandum

To: SR 50 Partner Agency Working Group

From: Tara Salmieri, AICP

Date: July15, 2014

Re: Regulatory Review for SR50/UCF Connector Alternatives Analysis (Phase 1)

Background

The Federal Transit Administration (FTA) has published guidance on how New Starts and Small Starts Evaluation will consider "ratings applied in assessment of land use criterion" (FY2013 Annual (FY2013 Annual Report on Funding Recommendations, Table III-3).

The guidance calls for local jurisdictions to have transit supportive plans and policies that can:

a) Support increased development density in transit station areas;
b) Enhance transit-oriented character of station area development and pedestrian access; and
c) Provide allowances for reduced parking and traffic mitigation

As part of the SR 50/UCF Connector Alternatives Analysis (AA), LYNX and its partner agencies would like to evaluate if existing land development regulations are aligned with this FTA guidance. Aside from helping to position the project for future potential transit funding, this evaluation will also help understand any opportunities to refine policies to promote future transit-oriented development. This memorandum summarizes an audit of existing land development regulations governing areas along the SR 50 study corridor. This audit is not meant to dictate policy, but is instead an effort to understand specific areas that are more or less supportive of the FTA guidance described above.

Understanding the Audit

FTA has not provided specific zoning categories or measurements on how a project would meet these policies. The Study Team identified a set of zoning categories that are commonly regulated in transit supportive zoning policies throughout the country to better understand the current regulations along SR50 and to determine whether or not the current regulations would support transit-oriented development. The audit has five site and building design regulation categories that may support and/or inhibit transit-oriented development- Setbacks, Parking, Vehicular standards, Pedestrian Standards, and Building Features. Each of these major categories can be regulated a variety of ways to meet a municipality's goals and objectives for the areas being regulated. For this evaluation, the focus was to identify these site development regulations in a municipality's zoning code that will enhance or detract from a transit area, because:

1. **Setback (roadway)**
   Buildings, and where they are sited on a parcel provide the greatest site design opportunity to support the pedestrian network. The farther a building is setback from the roadway, the more challenging it is for a pedestrian and transit rider in terms of general walkability and access to surrounding land uses.
2. **Parking Requirements**
   a. **Min/max standards**, *by establishing maximum parking ratios, a development will not exceed typical "minimum" standards. High minimum parking standards are typically associated with more auto-oriented uses and does not encourage the use of other modes.*
   b. **Location,** *regulations that permit buildings to "face" a parking lot can prohibit and limit a pedestrian experience.*
   c. **On-street,** *provides opportunities for a more walkable roadway design*
   d. **Shared,** *permitting shared parking between uses allows for a reduction in parking standards.*
   e. **Bicycle,** *require or allowing bicycle parking in lieu or in addition to vehicular parking.*
3. **Vehicular Standards**
   a. **Block Standards,** *regulating blocks create a walkable area that provides for safe pedestrian access and linkages to and from transit areas.*
   b. **Cross Access** *can also create a more connected network of vehicular and pedestrian access that will allow for movement internal to adjacent sites without access to a more regional road to get to transit.*
   c. **Alleys**, provide *access for automobiles, deliveries, and service vehicles, if buildings frame a street, with minimal access points from a street. This creates a more walkable environment that is ultimately more supportive of transit use.*

4. **Pedestrian Standards**
    a. **Sidewalks**, *placement, size and whether a municipality requires sidewalks will affect the walkability and pedestrian activity along SR50*.
    b. **Connections**, *continuous pedestrian networks within a development or connections to adjacent developments are important to access a transit stop.*
    c. **Lighting,** *well-lit pedestrian walkways and sidewalks improve pedestrian safety by distinguishing the pedestrian walk from the vehicular areas*.
    d. **Landscape,** *along pedestrian walkways can offer a sense of security for pedestrians.*
5. **Building Features**

    The design of a building can provide shelter; visual interest, safety and can increase the legibility of the entire pedestrian network all within an integrated design. The three most popular building features to regulate are:
    a. **Entryways** *that are facing the street, and or the pedestrian connections contribute to a walkable area.*
    b. **Transparency**, *contributes to the walking environment of an area.*
    c. **Façade,** *the add interest to the trip (walk) to transit and can entice people to walk further, provide shelter if needed.*

Cities Evaluated

The following municipalities were included in the land development/policy audit:

- Oakland
- Ocoee
- Orange County
- Orlando
- Winter Garden

Initial Observations

This audit provides a summary of each municipality's regulations along the SR 50 Corridor. Specially, the audit looks at the West SR 50 Corridor Overlay and the underlying zoning regulations along SR 50 for each of the municipalities.

West SR50 Corridor Overlay, Joint Planning Agreement

In 2002, Orange County, Town of Oakland, City of Ocoee and Winter Garden entered into a Joint Planning Agreement for each of their respective areas along SR50. The goal was to coordinate consistent design standards to enhance the appearance of the corridor, minimize regulatory confusion and enhance the visual appearance of entryways to Ocoee, Winter Garden and Oakland. The key categories that were addressed by the corridor overlay:

1. Basic architectural design standards
2. Building orientation standards that required main customer entrances facing SR 50.
3. Setbacks that required buildings to be no closer than 50' from SR 50 right-of-way line
4. Landscape standards that were suburban in nature (large buffers)
5. Signage standards, moving away from pole signs, to a more modern, smaller scale ground-mounted signage and addressing billboard regulations.

Much of the focus of the SR 50 Corridor Overlay has been on "beautification" and the Overlay does not directly address the integration of transportation and land use regulations that would support and promote a transit friendly corridor.

Since the first adoption of the Overlay, both the cities of Winter Garden and Ocoee have modified their overlay standards to reflect more urban policies that could support transit. However, to fully support transit-friendly development patterns, further additional regulatory categories can be included in the updated zoning overlays of Winter Garden and Ocoee to encourage/require enhanced pedestrian environments and land uses that support transit. Orange County and the Town of Oakland have not modified their SR 50 overlay standards.

Underlying Zoning Regulations

All of the municipalities with the exception of the City of Orlando rely solely on the SR 50 Overlay Zoning to regulate design, landscape, and signage.

Included in this memorandum is the detailed evaluation of each municipality's land development regulations and land use density/intensities by zoning districts and future land use policies outside of the SR 50 Zoning Overlay (see Table 1: Evaluation of Land Development Policies Along SR 50

Corridor). The additional sub-categories evaluated in Table 1, have a direct relationship to successful transit corridor overlays and are typical in transit-focused regulations throughout the country.

Overall, each municipality has regulated the following categories with some consistency:

- Parking Standards
- Vehicular Standards
- Pedestrian Standards

Transit Readiness in Existing Policies

The regulations that are currently in place along SR50 are adequate and do not directly conflict with the implementation of premium transit. However, local municipalities can consider strengthening their regulations with a transit focus to leverage the full potential of future transit investment. The regulations can further strengthen land use and zoning polices that regulate and encourage transit supportive development. With transit-specific policies in place, a more cohesive and consistent purpose and intent would be developed for the SR 50 Corridor. A more consistent and transit-focused approach to land development regulations confirms the collective commitment of the multiple SR 50 municipalities to the success of premium transit along the Corridor.

New policies can include long-term land use and zoning targeted around transit station areas and also throughout the corridor along the premium transit line. While fully operating a new form of transit in this corridor is still years away, new development and redevelopment in the corridor will continue to occur. Having transit supportive regulations in place now will ensure that over time, the development and land uses in the corridor will be reshaped to support transit.

The strategy for new policies should be to address station areas and corridors (areas along the transit line in between stations) different and create separate policies for both.

a. Transit Oriented Development Station Area Policies would focus on land within ½ mile radius of a station and provide standards for higher intensity of uses, recommending minimum densities within ½ mile radius of a station. The major sections of new policy related to station areas can include the categories defined in "Understanding the Audit" Section as follows:
    1. Land Use and Intensity- Minimum densities, allowing higher intensity
    2. Uses that are Transit Supportive
    3. Setbacks
    4. Parking (vehicular and bicyclist)
    5. Vehicular Standards

6. Pedestrian Standards
7. General Design Standards

b. Transit Oriented Corridor Policies, will address the parcels that are directly adjacent to the proposed transit alignment. These policies recognize that most land development changes will occur along the transit corridor between stations and that the segments between stations do not warrant the same amount of intensity and design control because they do not have direct transit station access. However, these areas will likely still experience investment related to transit. The major sections addressing corridors consistent with the "Understanding the Audit" section can include the following:
   1. Parking (minimal changes, encourage shared parking, provide bicycle parking)
   2. Vehicular Standards (allowing cross access)
   3. Pedestrian Standards
   4. General Design Standards

Table 1: Evaluation of Land Development Policies Along SR 50 Corridor

	Oakland				
ZONING					
Overlays/Zoning	**Gateway Overlay** (any parcels within 320' of the centerline from SR 50)	**I-1**	**C-1**	**R1-A**	**A-1**
Uses	Vehicle sales /service NTE 20% of linear frontage along SR 50, eating and drinking uses NTE 60% , retail and personal services NTE 70%	Full range of industrial uses	Full range of essential commercial uses	Single- family homes	Citrus, nurseries, single-family homes (per R1-A)
Density/Intensity	No building can be greater than 60,000 sq.ft.	.35 FAR	.35 FAR	2.5-3.5 DU acre	1 unit per 5 acres
Front Setback	Buildings less than 25k sq.ft, require max setback of 100', setback is reduced to 40'	100'	No minimum	25'	50'
PARKING REQUIREMENTS					
Min/Max Standards	No maximum parking standard- typical parking ratios				
Location	No standard				
On-street	No standard				
Shared	Permit reduction for mixed use projects or joint use of off-street parking spaces. Requires Town Council approval.	Not permitted	Permit reduction for mixed-use projects or joint use of off-street parking spaces. Requires Town Council approval	Not permitted	
Bicycle	1 bike rack per 400' of frontage	No requirement			
VEHICULAR STANDARDS					
Block Standards	No requirement				
Cross Access	Cross access between parcels shall be required, the use of "rearage" roads may be required	Non-residential uses shall not be permitted to direct traffic into adjacent residential districts		No requirement	
Alley	Not addressed				
Landscape	Minimum 25' buffer abutting SR50,that requires a range of trees, shrubs and groundcover	Section 18.8 Landscape regulations require landscaping to meet requirements of applicable ordinances and regulations, no standards are found in the zoning ordinance			
PEDESTRIAN STANDARDS					
Sidewalks	Requires a sidewalk, no standards are provided for the design standards of a sidewalk.	No requirement			

Table 1: Evaluation of Land Development Policies Along SR 50 Corridor

	Oakland				
ZONING					
Overlays/Zoning	**Gateway Overlay** (any parcels within 320' of the centerline from SR 50)	**I-1**	**C-1**	**R1-A**	**A-1**
Connections	Required to have a logical layout, code doesn't define how to meet the standard.	All developments shall include measures to reduce auto activity when possible and provide for pedestrian friendly environments			Not addressed
Hardscape, seating, etc.	A minimum of 2 benches and 1 trash receptacle per parcel	Not required			
Lighting	Lights shall be 16' for pedestrian walkways, 24' for parking lot lighting	Not required			
Landscape	2 understory or shades tree per 30 lf. of walkway	Defers to gateway corridor overlay standards			
BICYCLE AND TRANSIT FACILITIES					
Bicycle Racks	Not addressed				
Transit Access Points	Not addressed				
Transit Stops	Not addressed				
BUILDING FEATURES					
Entryways	Primary entrance is required to face SR50	Not addressed			
Transparency(windows)	Not addressed				
Façade	Brick or horizontal or vertical wood siding. Historically correct architectural details shall be provided.	Not addressed			
Submittal requirements	Architectural elevations, colors, materials, building dimensions, screening, site furnishing must be signed and sealed by an architect	Not addressed			

	Ocoee			
ZONING				
	SR 50 Activity Center Special Development Plan	**C-2**	**C-3**	**P-S**
Uses	The overlay prohibits a range of "auto-centric" uses	Intended for personal and business services, general retail business for the community	Highest intensity of uses are permitted	Range of High density residential and/or professional service
Density/Intensity	Underlying Future Land Use (FLU) permits a range, Commercial (COMM)- Max FAR 3.0, High Density Residential (HDR) 8- 16 units per acre			
Front Setback	Flexible, once a plan is adopted, generally 0'-15'	Primary roads (SR50) minimum setback of 50', maximum of 100' for all buildings greater than 25,000 sq.ft		
PARKING REQUIREMENTS	**(Target Area Plan)-Parking**			
Min/Max Standards	Depends on target area, reduced minimum standards, included maximums	Regulated by land use (typical suburban minimums, no maximums)		
Location	Primarily located internal to a block	Large surface automobile parking lots shall be visually and functionally segmented into several smaller lots and comprehensively designed to accommodate landscaping and pedestrian connections. As a general principle, parking areas containing more than 200 spaces shall be visually and functionally segmented as smaller lots.		
On-street	Permitted in street type's A-D. Street Type G (represent's SR 50) does not include on-street parking	Not addressed		
Shared	Not addressed	Permit "Joint parking" only, no reduction by use are permitted, just a co-location of parking. Mixed use projects "may be given flexibility" in parking requirements.		
Bicycle	Required in street type C (5' bike lane)	City reviews all proposed developments for its accommodation of bicycle and pedestrian needs and may require large scale developments to provide parking facilities for bicycles.		
VEHICULAR STANDARDS				
Block Standards	Ranges from 500'- 1000'-depends on the Target Area	Shall not exceed 1,000' between intersections		
Cross Access	No requirement	Traffic access and circulation patterns shall be coordinated between adjoining sites and provide for pedestrian connections. Traffic plans will promote joint access, cross access and sound access management principal		
Alley	Not addressed			
PEDESTRIAN STANDARDS				
Sidewalks	Range of standards (6'-17' depending on street type)	Minimum of 7' along SR 50, within development a minimum of 6' wide sidewalk must be provided from the street sidewalk to the building entrance(s)		
Connections	Block standards meet this requirement	In mixed-use and multi-family developments, i.e. activity centers, site plans will be reviewed to see whether provisions have been made to provide bicycle and/or pedestrian ways connecting residential areas to such developments		
Lighting	Not addressed	Decorative lighting is required along walkways		
Landscape	Street types provide tree standards	None specified, only a vegetative 10' buffer along roadways		

	Ocoee			
ZONING				
	SR 50 Activity Center Special Development Plan	**C-2**	**C-3**	**P-S**
BICYCLE AND TRANSIT FACILITIES				
Bicycle Racks	Provide on each site and or near building entrances			
Transit access points	Designate access points, pick up areas, transit shelters on-site (if determined to be necessary by the city or LYNX)			
Transit Stops	Providing for future transit stops, if determined to be necessary by the city or LYNX, or a project contains new commercial uses totaling more than 100,000 square feet			
BUILDING FEATURES				
Entryways	Required to front street, buildings have a minimum frontage	Buildings shall be located and arranged in order to define a pedestrian-scaled character along building street fronts and pedestrian spaces.		
Transparency(windows)	Not addressed	Not addressed		
Façade	Not addressed	Buildings larger than 25,000 sq. ft shall provide continuous covered pedestrian arcades utilizing awnings or canopies at least 8 feet in width extending for the length of the main entrance facade to provide shade for pedestrians and create human scale		

	Orange County						
ZONING							
Overlays/Zoning	W SR 50 overlay	C-1 (Commercial)	C-2 (Commercial)	C-3 (Commercial)	P-0 (Professional Office)	Residential (R-2, R-3)	A-2 (Agriculture)
Uses	Defers to underlying zoning district	Furnishing of selected commodities and services of retail	Provide for the retailing of commodities and the furnishing of several major services, selected trade shops and automotive repair	Land and structures where more intense commercial activity is located	High quality, functional and attractive professional office centers	R-2 Single family attached and detached	Agricultural uses
Overlay Standards (SR 436/SR 50)	N/A	Prohibit uses: Labor pools, check cashing, tattoo/body art, pawnshops, fortune tellers, bail bond agencies, bottle clubs				N/A	N/A
Density/Intensity	Defers to underlying zoning district	Commercial - 3.0 FAR				4 DU/acre	1 DU per 10 acres
Front Setback	Minimum of 50', no maximum,	25' (however, XV. Major Street Setbacks section requires an additional setback by street type- SR 50's setback is 70' from the centerline for buildings and other structures				20'	35'
PARKING REQUIREMENTS							
Min/Max Standards	Not addressed	Standard parking ratios by land use					
Location	Not addressed	Not addressed					
On street	Not addressed	Not addressed					
Shared	Not addressed	Not permitted unless parking demands are with different use(s) at different timea or part of a unified development application				Not required	Not required
Bicycle	Not addressed	0 if < 20 auto spaces; 2 if >20 auto spaces + 1 for every additional 10 auto spaces				Not required	Not required
VEHICULAR STANDARDS							
Block Standards	Not addressed						N/A
Cross Access	Not addressed in site development, an overall subdivision requirement provides the standard but is silent for "infill" development					Not required	N/A
Alley	Not addressed						N/A
Landscape	7’ for lots up to 150 ft. in depth, five (5) % of lot depth for > than 150 ft up to max of 15’	7' strip between vehicle area and ROW				N/A	N/A
PEDESTRIAN STANDARDS		**Ped standards**					
Sidewalks	5' wide sidewalks must be provide along SR50	Shall be a minimum of five (5) feet wide and be constructed of concrete, stamped or textured concrete, asphalt, or other material as may be approved by the zoning manager				N/A	N/A
Connections	Not addressed	Pedestrian access points shall provide connections to the adjacent public sidewalk system, transit stops and out-parcels				N/A	N/A
Lighting	15' height for pedestrian areas	Specific standards apply depending on use of area: vehicular, pedestrian walkways, bikeways, etc.; maximum height in vehicular areas: 30'; maximum height in pedestrian areas: 15'				N/A	N/A
Landscape	Not addressed	Pedestrian walkways shall utilize shade trees or alternative cover along the full extent of walkways from the site to the external sidewalks				N/A	N/A
BUILDING FEATURES		**Commercial Design Guidelines**					
Entryways	Must provide a main customer entrance facing SR 50	Requires a primary customer entrance				N/A	N/A
Transparency(windows)	Not addressed	Not required but can be provided as part of a design element included in the overall design list for the County's guidelines				N/A	N/A
Façade	Not addressed	Provides for a standard but not required				N/A	N/A

	Orlando			
ZONING				
Overlays/Zoning	Traditional City (T)	AC-1	AC-2	AC-3, AC-3A
Uses	Underlying Zoning Districts provide the permitted uses	Provides for concentrated areas of community-serving commercial, office, residential, recreational and cultural facilities, at higher intensities than in surrounding neighborhoods. Although some Community Activity Centers may be composed of a single type of use, a mixture of land uses is specifically encouraged. These activity centers are intended for locations where a combination of arterials and four lane collectors and mass transit service are available, providing access to other activity centers and surrounding neighborhoods	Concentrated areas of residential, commercial, office, industrial, recreational and cultural facilities serving major sub regions of the Orlando urban area, and at intensities significantly higher than in surrounding neighborhoods. Although some Urban Activity Centers may be composed of a single type of use, a mixture of land uses is specifically encouraged.	Large concentrated areas of residential, commercial, office, industrial, recreational and cultural facilities at a scale which serves the entire metropolitan area, and at the highest intensities to be found anywhere outside of Downtown Orlando. A mixture of land uses is specifically intended—Metropolitan Activity Centers composed of a single type of use shall be strongly discouraged.
Density/Intensity (inside Traditional City-TC)	N/A	Minimum 20 du/ac, mac 40 du/ac. minimum .35 FAR, maximum .70	Minimum- 30 du/ac, maximum 100 du/ac. FAR- minimum- .75, maximum 3.0	AC-3 minimum, 30 du/ac, maximum-200 du/ac. FAR minimum .75, maximum 1.5. AC-
Front Setback	N/A	0'	0'	0'
Streetwall, front setbacks	Within the TC, there are additional variations of setbacks that relate to "main streets" which set a maximum setback and a street wall			
PARKING REQUIREMENTS				
Min/Max Standards	May have alternative parking requirements for certain TC districts	Basic land use requirements, no maximum standards		
Location	Rear of side only except for large scale retailers for AC districts, rear only in MU-1, MU-2	Not addressed outside of the TC		
On Street	Not addressed	Not addressed in the zoning code		
Shared	Not addressed	Permitted for mixed-use developments with additional requirements		
Bicycle	Not addressed	Required by square footage and use. Bicycle parking may also be substituted for vehicular parking. For every 8 bicycle parking spaces one less vehicular space may be provided.		
VEHICULAR STANDARDS				
Block Standards	Not addressed	Maximum block size can not exceed 660'		
Cross Access	Not addressed	Regulated by a connectivity index. The development shall provide multiple direct vehicular and pedestrian connections in its local street system and internal circulation to and between nearby local destinations, such as transit stops, parks, schools, residences, workplaces and shops, without requiring the use of arterial street.		

	Orlando			
ZONING				
Overlays/Zoning	Traditional City (T)	AC-1	AC-2	AC-3, AC-3A
Uses	Underlying Zoning Districts provide the permitted uses	Provides for concentrated areas of community-serving commercial, office, residential, recreational and cultural facilities, at higher intensities than in surrounding neighborhoods. Although some Community Activity Centers may be composed of a single type of use, a mixture of land uses is specifically encouraged. These activity centers are intended for locations where a combination of arterials and four lane collectors and mass transit service are available, providing access to other activity centers and surrounding neighborhoods	Concentrated areas of residential, commercial, office, industrial, recreational and cultural facilities serving major sub regions of the Orlando urban area, and at intensities significantly higher than in surrounding neighborhoods. Although some Urban Activity Centers may be composed of a single type of use, a mixture of land uses is specifically encouraged.	Large concentrated areas of residential, commercial, office, industrial, recreational and cultural facilities at a scale which serves the entire metropolitan area, and at the highest intensities to be found anywhere outside of Downtown Orlando. A mixture of land uses is specifically intended—Metropolitan Activity Centers composed of a single type of use shall be strongly discouraged.
Alley	Not addressed	Permitted, minimum 12' asphalt with a maximum ROW of 16'		
PEDESTRIAN STANDARDS				
Walkways	Not addressed	Walkways are required within all parking lots serving commercial, office and multifamily development. Pedestrian walkways shall have a minimum width of 13' which included 6' sidewalk and 7.5 landscape strip		
Sidewalk	Not addressed	5' sidewalks are required on both sides of street, development also has a provision for sidewalk/bikeway trade off program in lieu of a sidewalk-requires 10' sidewalk/bikeway. Also a Payment in lieu of providing a sidewalk		
Connections	Direct pedestrian access shall be provided from the principal entrance of the building to the sidewalk, provided from the rear parking to ground floor uses. Throughways may be exterior and located between buildings and a minimum of 5' in width.	Refer to "sidewalk provisions"		
Lighting	Not addressed	Not addressed		
Landscape	Not addressed	Streetscape designs in Activity Centers and Mixed Use Corridor Zoning Districts, or where insufficient parkway exists, should be exempt from the minimum planting areas. The streetscape planting design plans and details shall be subject to approval of the Parks Official. Streetscapes in the AC-3A Downtown Metropolitan Core District shall be designed as required in Chapter 61.		
Street Trees	Not addressed	Street trees are required at intervals of not more than 1 tree per 50 lf or less than 1 tree per 100 lf		
BUILDING FEATURES				
Entryways	One entrance shall be oriented towards a main or town street for AC districts only	Not addressed outside of the TC		
Transparency(windows)	15% transparent materials, located between 3'-7' for AC districts only	Not addressed outside of the TC		
Façade	Not addressed	Not addressed outside of the TC		

	Orlando				
ZONING					
Overlays/Zoning	I-G	MU-1	MXD-2	O-2	R1-A, R2-B and R-3
Uses	The I-G district is intended to provide for areas of beneficial use of existing industrial properties, while encouraging upgraded development standards for such properties where they are located adjacent to residential areas. The district is also intended for areas where a range of general and heavy industrial uses may be desirable	The MU-1 district is intended to provide for areas of mixed residential and office uses extending along and oriented to arterial and four (4) lane collectors, at intensities compatible with adjacent neighborhoods. Commercial, public, recreational & institutional uses and conservation uses are also consistent in these areas as part of mixed use development or when otherwise subject to appropriate limitations, conditions and safeguards. A mixture of land uses is specifically encouraged. This district is intended for locations where mass transit service is available or programmed	Provide for areas of high density and high-rise residential development and mixed residential-office development, in close proximity to shopping, employment and public facilities.	Intended to provide for flexibility in building and site design in locations where development or redevelopment of offices or a mixture of offices and housing is desired. The O-2 and O-3 districts are also intended to allow a fringe of declining intensity adjacent to activity centers.	
Density/Intensity (inside Traditional City-TC)	Maximum FAR .70	Minimum 15 du/ac, maximum 30 du/ac, maximum FAR.50	Minimum 30 du/ac, maximum 75 du/ac (conditional 200 du/ac, maximum .35 FAR)	Minimum 12 du/ac, maximum 40 du/ac minimum FAR .30, maximum .70	R2-b, 16du/ac, R-3 is 12 du/ac, R1-a 5.7 du/ac with a maximum FAR .30
Front Setback	50' outside of the TC, 0' inside TC	0' inside TC	20' outside of TC	35' outside of TC, 15' inside TC	20'-15' depending on zoning district
Streetwall, front setbacks	Within the TC, there are additional variations of setbacks that relate to "main streets" which set a maximum setback and a street wall			Within the TC, there are additional variations of setbacks that relate to "main streets" which set a maximum setback and a street wall	
PARKING REQUIREMENTS					
Min/Max Standards	Basic land use requirements, no maximum standards			Basic land use requirements, no maximum standards	
Location	Not addressed outside of the TC			Not addressed outside of the TC	
On Street	Not addressed in the zoning code			Not addressed in the zoning code	
Shared	Permitted for mixed-use developments with additional requirements			Permitted for mixed-use developments with additional requirements	
Bicycle	Required by square footage and use. Bicycle parking may also be substituted for vehicular parking. For every 8 bicycle parking spaces one less vehicular space may be provided.			Required by square footage and use. Bicycle parking may also be substituted for vehicular parking. For every 8 bicycle parking spaces one less vehicular space may be provided.	
VEHICULAR STANDARDS					
Block Standards	Maximum block size can not exceed 660'			Maximum block size can not exceed 660'	
Cross Access	Regulated by a connectivity index. The development shall provide multiple direct vehicular and pedestrian connections in its local street system and internal circulation to and between nearby local destinations, such as transit stops, parks, schools, residences, workplaces and shops, without requiring the use of arterial street.			Regulated by a connectivity index. The development shall provide multiple direct vehicular and pedestrian connections in its local street system and internal circulation to and between nearby local destinations, such as transit stops, parks, schools, residences, workplaces and shops, without requiring the use of arterial street.	

	Orlando				
ZONING					
Overlays/Zoning	I-G	MU-1	MXD-2	O-2	R1-A, R2-B and R-3
Uses	The I-G district is intended to provide for areas of beneficial use of existing industrial properties, while encouraging upgraded development standards for such properties where they are located adjacent to residential areas. The district is also intended for areas where a range of general and heavy industrial uses may be desirable	The MU-1 district is intended to provide for areas of mixed residential and office uses extending along and oriented to arterial and four (4) lane collectors, at intensities compatible with adjacent neighborhoods. Commercial, public, recreational & institutional uses and conservation uses are also consistent in these areas as part of mixed use development or when otherwise subject to appropriate limitations, conditions and safeguards. A mixture of land uses is specifically encouraged. This district is intended for locations where mass transit service is available or programmed	Provide for areas of high density and high-rise residential development and mixed residential-office development, in close proximity to shopping, employment and public facilities.	Intended to provide for flexibility in building and site design in locations where development or redevelopment of offices or a mixture of offices and housing is desired. The O-2 and O-3 districts are also intended to allow a fringe of declining intensity adjacent to activity centers.	
Alley	Permitted, minimum 12' asphalt with a maximum ROW of 16'			Permitted, minimum 12' asphalt with a maximum ROW of 16'	
PEDESTRIAN STANDARDS					
Walkways	Walkways are required within all parking lots serving commercial, office and multifamily development. Pedestrian walkways shall have a minimum width of 13' which included 6' sidewalk and 7.5 landscape strip			Walkways are required within all parking lots serving commercial, office and multifamily development. Pedestrian walkways shall have a minimum width of 13' which included 6' sidewalk and 7.5 landscape strip	
Sidewalk	5' sidewalks are required on both sides of street, development also has a provision for sidewalk/bikeway trade off program in lieu of a sidewalk-requires 10' sidewalk/bikeway. Also allows for a payment in lieu of providing a sidewalk.			5' sidewalks are required on both sides of street, development also has a provision for sidewalk/bikeway trade off program in lieu of a sidewalk-requires 10' sidewalk/bikeway. Also allows for a payment in lieu of providing a sidewalk.	
Connections	Refer to "sidewalk provisions"			Refer to "sidewalk provisions"	
Lighting	Not addressed			Not addressed	
Landscape	Refer to "walkways" and sidewalks for additional requirements			Refer to "walkways" and sidewalks for additional requirements	
Street Trees	Street tree are required at intervals of Not more than 1 tree per 50lf or less than 1 tree per 100 lf			Street trees are required at intervals of not more than 1 tree per 50 lf or less than 1 tree per 100 lf	
BUILDING FEATURES					
Entryways	Not addressed outside of the TC			Not addressed outside of the TC	
Transparency(windows)	Not addressed outside of the TC			Not addressed outside of the TC	
Façade	Not addressed outside of the TC			Not addressed outside of the TC	

	Winter Garden
ZONING	
Overlay	W State RD 50 Commercial Activity Center
Zoning Districts	C-2, R-2, R-3
Uses	C-2 Zoning (Residential uses are prohibited, general uses are: retail eating and drinking establishments, offices, studios, financial institutions, hotels, public buildings, upper story residential for C-1, C-2 says prohibited, MF) R-2, R-3 are multifamily districts
Density/Intensity	.35 FAR for commercial, 10 DU/Acre for R-2, R-3
Front Setback	C-2: normally 40', for SR 50, require 50' minimum, Residential 30'
PARKING REQUIREMENTS	
Min/Max Standards	Minimum standards only, require conventional suburban minimums
Location	Parking areas containing more than 100 parking spaces shall be visually and functionally segmented into smaller lots. Parking in excess of 100 parking spaces shall divided into individual areas containing no more than 100 parking spaces per area. Said area shall be clearly delineated by landscaped or weather-protected pedestrian walkways, significant landscape or geographic features and/or by design components of the proposed building(s). The design of these separators shall consider pedestrian movements, conflict points with vehicles, aesthetics, site distances and angles, security site lighting and safety within the parking lot area
On street	No requirements
Shared	No requirements
Bicycle	Bicycle parking is required in the SR 50 overlay, no amount is specified.
VEHICULAR STANDARDS	
Block Standards	Block lengths shall not exceed 1,400 feet or less than 500 feet
Cross Access	Vehicular cross access shall be provided between adjacent parcels consistent with sound and generally accepted engineering practices and principles
Alley	Encouraged in commercial, industrial districts. Residential areas are discouraged from having alleys. Required width is 20'.
Landscape	Minimum buffer of 10' along SR 50

	Winter Garden
ZONING	
Overlay	W State RD 50 Commercial Activity Center
Zoning Districts	C-2, R-2, R-3
PEDESTRIAN STANDARDS	
Sidewalks	Continuous internal pedestrian concrete walkways, min 6' in width for all non residential establishments on the site. Sidewalks shall be constructed along the entire length of the property frontage adjacent to a public street to facilitate direct pedestrian connections. Providing a sidewalk connection to the front entrance of any adjoining building to transit stops located adjacent to a sit.
Connections	Pedestrian cross access shall be provided between adjacent parcels consistent with sound and generally accepted engineering practices and principles.
Hardscape, seating, etc	25,000 sq. ft. buildings must provide seating areas for pedestrians
Lighting	No requirements
Landscape	No requirements
BICYCLE AND TRANSIT FACILITIES	
Bicycle Racks	Provide on each site and or near building entrances
Transit Access Points	Designate access points, pick up areas, transit shelters on site (if determined to be necessary by the city oo LYNX
Transit Stops	Providing for future transit stops, if determined to be necessary by the city or LYNX, if a project contains new commercial uses totaling more than 100,000 square feet
BUILDING FEATURES	
Entryways	No requirement
Transparency (windows)	No requirement
Façade	No requirement

APPENDIX B
Roadway Segment Evaluation Matrix

Goals Addressed						1b, 3b	2a	2a	2b	2c	2c	2d	2c, 3b	4	5a
Segment	**Alignment**	**Direction**	**Roadway**	**Extents**	**Actual Travel Time (Minutes)**	**Employment Reach**	**% of alignment within a CRA**	**Vacant and Underutilized land within 0.25 mile of alignment (acres/mi, parcels > 1acre)**	**Presence of pedestrian and bicycling infrastructure**	**Transit-Dependent Population**	**Minority people within 0.25 mile of alignment (number per mile)**	**Potential for increasing congestion on currently congested roadways or ROW impacts**	**Population Density within 0.25 mile of alignment (perons/square mile)**	**Regional Transit Connection**	**Presence of existing and planned exclusive lanes along alignment (yes, no)**
1	1A	E/W	SR 50	County line to John Young Pkwy	33.57	Low	Low	High	Medium	High	Medium	Low	Low	Medium	No
2	2A	E/W	SR 50	John Young Pkwy to Parramore Av	4.89	Low	Low	Medium	Medium	High	Low	Low	Low	Low	No
2	2E	E/W	Washington St	John Young Pkwy to Parramore Av	4.84	Low	Medium	Medium	Medium	High	High	Medium	Medium	Low	No
2	2B	E/W	SR 50	Parramore Av to Garland Av	1.96	Low	High	Medium	Medium	High	Medium	High	Medium	Low	No
2	2C	E/W	Amelia St	Parramore Av to Garland Av		Low	High	Medium	High	High	High	Low	Medium	High	Yes
2	2D	E/W	Livingston St	Parramore Av to Hughey Av		Medium	High	Medium	High	High	High	Low	Medium	High	Yes
2	2F	E/W	Washington St	Parramore Av to Garland Av	1.97	High	High	Low	Medium	High	High	High	High	Low	No
2	2G	N/S	John Young Pkwy	SR 50 to Washington St	1.69	Low	Low	High	Medium	High	Low	Low	Low	Low	No
2	2H	N/S	Tampa Av	SR 50 to Washington St	1.33	Low	Low	Medium	High	High	Low	Low	Low	Low	No
2	2I	N/S	Orange Blossom Tr	SR 50 to Washington St	2.73	Low	High	Medium	Medium	High	High	Low	Medium	Low	No
2	2J	N/S	Parramore Av	SR 50 to Washington St	1.82	Low	High	Low	High	High	High	Low	High	Low	No
2	2K	N/S	Terry Av	Amelia St to Livingston St		Low	High	Low	High	High	High	Low	High	Low	Yes
2	2L	N/S	Hughey Av	SR 50 to Washington St	1.59	Medium	High	Medium	Low	High	Medium	Low	High	High	Yes
3	3A	E/W	SR 50	Garland Av to Maguire Bv	6.75	Low	Medium	Medium	High	Medium	Low	Medium	Medium	Low	No
3	3B	E/W	Livingston St	Hughey Av to Magnolia Av		High	High	Medium	High	High	Medium	Low	High	High	Yes
3	3C	E/W	Robinson St	Garland Av to Magnolia Av	1.79	High	High	Medium	High	High	Medium	High	High	High	No
3	3D	E/W	Robinson St	Magnolia Av to Maguire Bv	5.58	Medium	Medium	Low	High	Medium	Low	Low	Medium	Medium	No
3	3E	N/S	Garland Av	SR 50 to Washington St	3.10	High	High	Medium	Low	High	Medium	Low	High	High	Yes
3	3F	N/S	Magnolia Av	Livingston St to Robinson St		High	High	Medium	High	High	Medium	Low	High	High	Yes
3	3G	N/S	Bumby Av	SR 50 to Robinson St	1.25	Low	Low	Medium	Medium	Low	Low	Low	Medium	Low	No
3	3H	N/S	Primrose Dr	SR 50 to Robinson St	1.17	Low	Low	Medium	Low	Low	Low	Low	Low	Medium	No
3	3I	N/S	Maguire Bv	SR 50 to Robinson St	1.92	Low	Low	Medium	Low	Low	Low	Low	Low	Medium	No
4	4A	E/W	SR 50	Maguire Bv to Old Cheney Hwy (west)	2.62	Low	Low	Medium	High	Low	Low	Low	Low	Low	No
4	4B	E/W	SR 50	Old Cheney Hwy (west) to Old Cheney Hwy	1.79	Low	Low	Medium	Medium	Low	Medium	Low	Low	Low	No
4	4D	E/W	Old Cheney Hwy	SR 50 (west) to SR 50 (east)		Low	Low	Medium	Low	Low	Medium		Medium	Low	No
4	4C	E/W	SR 50	Old Cheney Hwy (east) to SR 434	13.13	Low	Low	High	Medium	Low	High	Low	Medium	Low	No
4	4E	N/S	SR 434	SR 50 to McCulloch Rd	6.67	Low	Low	High	Medium	Medium	Medium	Low	Medium	Medium	No
Color Legend/Conditional Formatting Rules						Low: < 700 jobs/sqmi; Medium: 700 to 1300 jobs/sqmi; high: >1300 jobs/sqmi	Green= More than 50%; Yellow= 25% to 50%; Red= less than 25%	Low: <25 ac; medium: 21 to 75 ac; High: >75 ac	High: greater than 75% with SW and bike; Medium: 50 to 75% SW and no bike, or 75% or more SW and no bike; Low: less than 50% SW, or 50 to 75% and no bike	High: green values for AE&AF; Medium: One green value or two yellows; Red: one or both red values with yellow	Low: <600; Medium: between 600 and 1,000; High: Greater than 1,000	Low: Actual TT is less than 100% of reasonable TT; Medium: Between 100 and 120% of reasonable TT; High: Greater than 120% of TT (If there is an existing exclusive transit lane, automatically low)	Low: less than 2,500; Medium: between 2,500 and 3,900; High: Greater than 3,900	High: green values for AV&AW; Medium: One green value or two yellows; Red: one or both red values with yellow	

APPENDIX C
Detailed Long-List Alignment Evaluation Matrix

COMPARISON MATRIX OF INITIAL ALIGMENTS

Discussion Draft 11.20.13

CORRIDOR NEEDS			1. Enhance Access to Jobs and Educational Opportunities by improving East-West Transit Mobility		2. Encourage Development and Redevelopment that Supports Transit Consistent with Community Goals							3. Increase Corridor Transit Ridership		Potential to Minimize Travel Time	4. Support LYNX Strategic Plan/Regional Transit Network	5. Invest in Transit Improvements that Yield Substantial & Sustainable Returns & are Fiscally Responsible	6. Public Input	Overall Rating
CORRIDOR GOALS			Improve Service for Existing Transit Riders	Improve Access to Jobs and Educational Institutions	Encourage Development of Activity/Mixed-use Nodes		Improve Walkability	Strengthen/Preserve Existing Neighborhoods			Minimize Adverse Environmental Impacts	Serve Existing and Future Activity Centers		Attract Choice Riders	Provide Effective Connections to Regional Transit Network	Invest in Cost-Effective Infrastructure		
MEASURES OF EFFECTIVENESS			Potential for Excess Vehicular Traffic Capacity	Number of Jobs/Square Mile Along the Alignment	Acres of Vacant and Underutilized Land within 1/4 Mile of Alignment	% of Alignment within a CRA	Presence of Pedestrian and Bicycling Infrastructure along the Alignment	Population Density within 1/4 Mile of Alignment	Zero-Car Households Within 1/4 Mile of Alignment	Number of Minority People within 1/4 Mile of Alignment	Potential to Minimize Congestion on Currently Congested Roadways or Minimize Impacts to Adjacent Property or ROW	Population Density within 1/4 Mile of Alignment	Number of Jobs/ Square Mile Along the Alignment	Alignment Travel Time (BRT Mode)	Access to Regional Transit Facilities with Pedestrian Connectivity to the Regional Facilities	Presence of Existing and/or Planned Exclusive Transit Lanes along Alignment		
Alignment	Roadway	Extents																
Segment 1																		
	SR 50	County line to John Young Pkwy	Medium	Low	High	Low	Medium High	Low	Medium	Medium High	Medium	Low	Low		High	No		
Segment 2																		
Alignment A	Tampa Av	SR 50 to Washington St	High	Low	Medium Low	Low	High	Low	Medium	Medium Low	High	Low	Low	23:12	Low	No	Low	Medium Low
	Washington St	John Young Pkwy to Parramore Av	High	Medium Low	Medium Low	Medium	Medium High	Medium High	High	High	High	Medium High	Medium Low		Low	No		
	Washington St	Parramore Av to Garland Av	High	High	Low	High	Medium High	High	High	High	High	High	High		Low	No		
Alignment B	SR 50	John Young Pkwy to Parramore Av	Medium	Low	Medium High	Low	Medium High	Low	Medium	Medium Low	Medium	Low	Low	25:13	Low	No	Low	Medium Low
	Westmoreland Drive	SR 50 to Washington St	Unknown	Low	Low	High	High	High	Medium	High		High	Low		Low	No		
	Washington St	Parramore Av to Garland Av	High	High	Low	High	Medium High	High	High	High	High	High	High		Low	No		
Alignment C	SR 50	John Young Pkwy to Parramore Av	Medium	Low	Medium High	Low	Medium High	Low	Medium	Medium Low	Medium	Low	Low	27:59	Low	No	Low	Medium Low
	Parramore Av	SR 50 to Washington St	High	Low	Low	High	High	Medium High	High	High	High	Medium High	Low		Low	No		
	Washington St	Parramore Av to Garland Av	High	High	Low	High	Medium High	High	High	High	High	High	High		Low	No		
Alignment D	SR 50	John Young Pkwy to Parramore Av	Medium	Low	Medium High	Low	Medium High	Low	Medium	Medium Low	Medium	Low	Low	19:53	Low	No	High	Medium
	Westmoreland Drive	SR 50 to Washington St	Unknown	Low	Low	High	High	High	Medium	High		High	Low		Low	No		
	Livingston St	Parramore Av to Hughey Av	High	Medium High	Medium Low	High	High	Medium High	High	High	High	Medium High	Medium High		High	Yes		
	Livingston St	Westmoreland Dr to Parramore Ave	High	Low	Low	High	High	Medium Low	High	High	High	Medium Low	Low					
	Amelia St	Parramore Av to Garland Av	High	Low	Medium Low	High	High	Medium High	High	Medium High	High	Medium High	Low		High	Yes		
	Amelia St	Westmoreland Dr to Parramore Ave	High	Low	Low	High	High	Medium Low	High	High	High	Medium Low	Low		Low	No		
Alignment E	Tampa Av	SR 50 to Washington St	High	Low	Medium Low	Low	High	Low	Medium	Medium Low	High	Low	Low	23:27	Low	No	High	Medium
	Washington St	John Young Pkwy to Parramore Av	High	Medium Low	Medium Low	Medium	Medium High	Medium High	High	High	High	Medium High	Medium Low		Low	No		
	Parramore Av	SR 50 to Washington St	High	Low	Low	High	High	Medium High	High	High	High	Medium High	Low		Low	No		
	Amelia St	Parramore Av to Garland Av	High	Low	Medium Low	High	High	Medium High	High	Medium High	High	Medium High	Low		High	Yes		
	Livingston St	Parramore Av to Hughey Av	High	Medium High	Medium Low	High	High	Medium High	High	High	High	Medium High	Medium High		High	Yes		
Alignment F	SR 50	John Young Pkwy to Parramore Av	Medium	Low	Medium High	Low	Medium High	Low	Medium	Medium Low	Medium	Low	Low	19:54	Low	No	Medium	Medium High
	Parramore Av	SR 50 to Washington St	High	Low	Low	High	High	Medium High	High	High	High	Medium High	Low		Low	No		
	Livingston St	Parramore Av to Hughey Av	High	Medium High	Medium Low	High	High	Medium High	High	High	High	Medium High	Medium High		High	Yes		
	Amelia St	Parramore Av to Garland Av	High	Low	Medium Low	High	High	Medium High	High	Medium High	High	Medium High	Low		High	Yes		
Segment 3																		
Alignment G	Livingston St	Hughey Av to Magnolia Av	N/A	High	Medium High	High	High	High	Medium	Medium Low	High	High	High	21:29	High	Yes	High	Medium High
	Robinson St	Magnolia Av to Maguire Bv	Medium	Medium High	Low	Medium	High	Medium High	Medium	Low	Medium	Medium High	Medium High		Medium High	No		
	Primrose Dr	SR 50 to Robinson St	High	Medium Low	Medium High	Low	Medium Low	Medium Low	Low	Low	High	Medium Low	Medium Low		High	No		
Alignment H	Livingston St	Hughey Av to Magnolia Av	N/A	High	Medium High	High	High	High	Medium	Medium Low	High	High	High	28:12	High	Yes	High	Medium
	Robinson St	Magnolia Av to Maguire Bv	Medium	Medium High	Low	Medium	High	Medium High	Medium	Low	Medium	Medium High	Medium High		Medium High	No		
	Mills Ave	Robinson St to SR 50	Medium	Medium	Medium Low	Low	High	High	Low	Medium High	Medium	High	Medium		High	No		
	SR 50	Garland Av to Maguire Bv	Low	Medium	Medium Low	Medium	High	Medium High	Medium	Low	Low	Medium High	Medium		Low	No		
Alignment I	Rosalind Ave	Livingston St to SR 50	Medium	High	Medium High	High	High	High	Low	High	Medium	High	High	26:03	High	No	High	Medium
	Orange Ave	Livingston St to SR 51	Medium	High	Medium High	High	High	High	Low	High	Medium	High	High		High	No		
	SR 50	Garland Av to Maguire Bv	Low	Medium	Medium Low	Medium	High	Medium High	Medium	Low	Low	Medium High	Medium		Low	No		

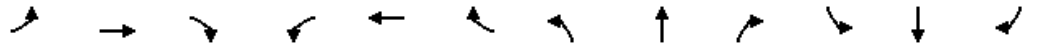
APPENDIX D
Synchro Analysis Results Summary

SR 50 AA BAT Lane Analysis Results Summary
(SR 50 between Bumby Ave and Old Cheney Hwy (W))

Intersection		Existing Conditions					BAT Lane Conditions				
		EB	WB	NB	SB	INT	EB	WB	NB	SB	INT
SR 50 @ Bumby Ave	LOS	D	D	E	E	D	D	D	E	E	D
	Delay	42.9	39.4	57.7	59.1	46.7	43.6	36.8	74.3	74.0	51.3
SR 50 @ Coy Rd	LOS	A	B	E	E	B	B	B	E	E	B
	Delay	6.6	12.1	73.5	73.2	13.6	14.4	11.3	74.8	74.2	17.2
SR 50 @ Primrose Dr	LOS	A	B	E	F	C	B	B	E	F	C
	Delay	8.6	12.7	66.1	147.1	20.5	18.1	15.6	71.5	170.0	27.4
SR 50 @ Maguire Rd	LOS	D	D	F	E	E	E	D	F	F	E
	Delay	46.4	43.0	84.6	70.3	57.4	66.7	49.3	97.1	102.6	73.7
SR 50 @ Fashion Square/Herndon Plaza	LOS	B	B	F	F	C	C	B	F	F	C
	Delay	12.7	18.3	87.6	186.3	23.4	21.4	19.2	81.9	130.0	26.5
SR 50 @ Herndon Ave	LOS	A	C	F	F	B	A	C	F	F	B
	Delay	4.6	23.2	87.0	80.2	15.7	9.1	24.6	112.4	83.2	19.2
SR 50 @ Bennett Rd/Rickenbacker Dr	LOS	B	C	F	E	C	C	B	F	F	D
	Delay	14.7	20.4	100.6	76.8	24.6	34.5	17.6	85.3	115.0	37.0
SR 50 @ Baldwin Lane/Humphries Ave	LOS	D	B	F	E	D	F	A	F	F	F
	Delay	44.5	12.4	87.8	75.9	35.7	129.2	6.9	101.3	153.9	85.6
SR 50 @ Old Cheney Hwy	LOS	D	C	E	E	D	D	C	E	E	D
	Delay	41.3	29.3	63.6	64.8	38.5	53.2	25.2	78.3	78.3	45.1

Below LOS E, the acceptable level-of-service on roadway parallel to a premium transit facility (as adopted by Orange County)

APPENDIX E
Synchro Analysis Reports



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	2693	8	36	1762	72	38	15	33	234	5	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5		6.5	6.5			6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	0.99			1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5083		1770	5055			1799	1583	1770	1593	
Flt Permitted	0.95	1.00		0.95	1.00			0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5083		1770	5055			1799	1583	1770	1593	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	80	2865	9	38	1874	77	40	16	35	249	5	133
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	33	0	109	0
Lane Group Flow (vph)	80	2874	0	38	1949	0	0	56	2	249	29	0
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		3	3	
Permitted Phases									4			
Actuated Green, G (s)	12.0	100.8		6.9	95.7			8.3	8.3	29.0	29.0	
Effective Green, g (s)	12.0	100.8		6.9	95.7			8.3	8.3	29.0	29.0	
Actuated g/C Ratio	0.07	0.59		0.04	0.56			0.05	0.05	0.17	0.17	
Clearance Time (s)	6.5	6.5		6.5	6.5			6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	124	3013		71	2845			87	77	301	271	
v/s Ratio Prot	c0.05	c0.57		0.02	0.39			c0.03		c0.14	0.02	
v/s Ratio Perm									0.00			
v/c Ratio	0.65	0.95		0.54	0.68			0.64	0.02	0.83	0.11	
Uniform Delay, d1	76.9	32.4		80.0	26.4			79.4	77.0	68.1	59.6	
Progression Factor	0.89	1.15		1.33	0.35			1.00	1.00	1.00	1.00	
Incremental Delay, d2	7.4	6.3		6.1	1.1			15.2	0.1	16.8	0.2	
Delay (s)	75.8	43.7		112.1	10.4			94.6	77.1	84.9	59.8	
Level of Service	E	D		F	B			F	E	F	E	
Approach Delay (s)		44.5			12.4			87.8			75.9	
Approach LOS		D			B			F			E	

Intersection Summary			
HCM 2000 Control Delay	35.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	96.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	1436	126	233	1276	94	153	488	342	145	399	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0		6.5	7.0		7.0	7.0	6.5	6.5	6.5	
Lane Util. Factor	1.00	0.91		0.97	0.91		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5024		3433	5033		1770	3539	1583	1770	3503	
Flt Permitted	0.95	1.00		0.95	1.00		0.30	1.00	1.00	0.27	1.00	
Satd. Flow (perm)	1770	5024		3433	5033		561	3539	1583	506	3503	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	1512	133	245	1343	99	161	514	360	153	420	31
RTOR Reduction (vph)	0	6	0	0	5	0	0	0	46	0	3	0
Lane Group Flow (vph)	42	1639	0	245	1437	0	161	514	314	153	448	0
Turn Type	Prot	NA		Prot	NA		pm+pt	NA	pm+ov	pm+pt	NA	
Protected Phases	1	6		5	2		7	4	5	3	8	
Permitted Phases							4		4	8		
Actuated Green, G (s)	7.3	74.9		15.6	83.2		53.0	37.8	53.4	52.0	37.3	
Effective Green, g (s)	7.3	74.9		15.6	83.2		53.0	37.8	53.4	52.0	37.3	
Actuated g/C Ratio	0.04	0.44		0.09	0.49		0.31	0.22	0.31	0.31	0.22	
Clearance Time (s)	6.5	7.0		6.5	7.0		7.0	7.0	6.5	6.5	6.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	76	2213		315	2463		282	786	497	264	768	
v/s Ratio Prot	0.02	c0.33		c0.07	c0.29		c0.05	c0.15	0.06	0.05	0.13	
v/s Ratio Perm							0.13		0.14	0.13		
v/c Ratio	0.55	0.74		0.78	0.58		0.57	0.65	0.63	0.58	0.58	
Uniform Delay, d1	79.7	39.5		75.5	31.0		45.1	60.1	49.9	45.7	59.4	
Progression Factor	1.00	1.00		1.14	0.92		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	8.4	2.3		10.8	1.0		2.8	4.2	2.6	3.1	3.2	
Delay (s)	88.2	41.8		96.9	29.6		47.8	64.4	52.5	48.7	62.6	
Level of Service	F	D		F	C		D	E	D	D	E	
Approach Delay (s)		42.9			39.4			57.7			59.1	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	46.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	27.0
Intersection Capacity Utilization	81.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	19	1781	166	154	1536	24	60	17	114	52	22	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.5	6.0			6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91			1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	1770	5073			1793	1583	1770	1805	
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.76	1.00	0.66	1.00	
Satd. Flow (perm)	1770	5085	1583	1770	5073			1406	1583	1225	1805	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	20	1836	171	159	1584	25	62	18	118	54	23	6
RTOR Reduction (vph)	0	0	37	0	0	0	0	0	106	0	5	0
Lane Group Flow (vph)	20	1836	134	159	1609	0	0	80	12	54	24	0
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA	Perm	Perm	NA	
Protected Phases	1	6		5	2			4			8	
Permitted Phases			6				4		4	8		
Actuated Green, G (s)	5.1	114.1	114.1	20.6	130.1			16.8	16.8	16.8	16.8	
Effective Green, g (s)	5.1	114.1	114.1	20.6	130.1			16.8	16.8	16.8	16.8	
Actuated g/C Ratio	0.03	0.67	0.67	0.12	0.77			0.10	0.10	0.10	0.10	
Clearance Time (s)	6.0	6.0	6.0	6.5	6.0			6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	53	3412	1062	214	3882			138	156	121	178	
v/s Ratio Prot	0.01	c0.36		c0.09	0.32						0.01	
v/s Ratio Perm			0.08					c0.06	0.01	0.04		
v/c Ratio	0.38	0.54	0.13	0.74	0.41			0.58	0.07	0.45	0.13	
Uniform Delay, d1	80.9	14.4	10.0	72.1	6.9			73.2	69.5	72.2	69.9	
Progression Factor	1.07	0.42	0.23	1.22	0.46			1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.2	0.1	0.0	11.5	0.3			5.8	0.2	2.6	0.3	
Delay (s)	89.5	6.1	2.3	99.4	3.5			79.0	69.7	74.8	70.3	
Level of Service	F	A	A	F	A			E	E	E	E	
Approach Delay (s)		6.6			12.1			73.5			73.2	
Approach LOS		A			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	13.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	70.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	1825	52	114	1663	54	84	50	237	81	68	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.5	6.5		6.5	6.5	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	1.00		1.00	0.88		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5064		1770	5061		1770	1632		1770	1825	
Flt Permitted	0.95	1.00		0.95	1.00		0.70	1.00		0.20	1.00	
Satd. Flow (perm)	1770	5064		1770	5061		1308	1632		376	1825	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	34	1901	54	119	1732	56	88	52	247	84	71	11
RTOR Reduction (vph)	0	2	0	0	2	0	0	104	0	0	3	0
Lane Group Flow (vph)	34	1953	0	119	1786	0	88	195	0	84	79	0
Turn Type	Prot	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			4			8	
Permitted Phases							4			8		
Actuated Green, G (s)	6.8	103.8		15.5	112.5		32.2	32.2		32.2	32.2	
Effective Green, g (s)	6.8	103.8		15.5	112.5		32.2	32.2		32.2	32.2	
Actuated g/C Ratio	0.04	0.61		0.09	0.66		0.19	0.19		0.19	0.19	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.5	6.5		6.5	6.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	70	3092		161	3349		247	309		71	345	
v/s Ratio Prot	0.02	c0.39		c0.07	0.35			0.12			0.04	
v/s Ratio Perm							0.07			c0.22		
v/c Ratio	0.49	0.63		0.74	0.53		0.36	0.63		1.18	0.23	
Uniform Delay, d1	79.9	21.0		75.3	15.0		59.9	63.4		68.9	58.4	
Progression Factor	1.14	0.30		1.09	0.46		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.6	0.9		12.3	0.5		0.9	4.2		164.5	0.3	
Delay (s)	96.0	7.1		94.0	7.3		60.8	67.6		233.4	58.7	
Level of Service	F	A		F	A		E	E		F	E	
Approach Delay (s)		8.6			12.7			66.1			147.1	
Approach LOS		A			B			E			F	

Intersection Summary			
HCM 2000 Control Delay	20.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	212	1785	85	350	1453	64	179	636	558	156	507	306
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5		6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5
Lane Util. Factor	0.97	0.91		0.97	0.91		1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5050		3433	5053		1770	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5050		3433	5053		1770	3539	1583	3433	3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	219	1840	88	361	1498	66	185	656	575	161	523	315
RTOR Reduction (vph)	0	3	0	0	3	0	0	0	41	0	0	44
Lane Group Flow (vph)	219	1925	0	361	1561	0	185	656	534	161	523	271
Turn Type	Prot	NA		Prot	NA		Prot	NA	pt+ov	Prot	NA	pt+ov
Protected Phases	1	6		5	2		7	4	4 5	3	8	8 1
Permitted Phases												
Actuated Green, G (s)	16.0	75.5		20.5	80.0		18.5	34.7	61.7	13.3	29.5	52.0
Effective Green, g (s)	16.0	75.5		20.5	80.0		18.5	34.7	61.7	13.3	29.5	52.0
Actuated g/C Ratio	0.09	0.44		0.12	0.47		0.11	0.20	0.36	0.08	0.17	0.31
Clearance Time (s)	6.5	6.5		6.5	6.5		6.5	6.5		6.5	6.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	323	2242		413	2377		192	722	574	268	614	484
v/s Ratio Prot	0.06	c0.38		0.11	c0.31		c0.10	0.19	c0.34	0.05	0.15	0.17
v/s Ratio Perm												
v/c Ratio	0.68	0.86		0.87	0.66		0.96	0.91	0.93	0.60	0.85	0.56
Uniform Delay, d1	74.5	42.5		73.5	34.5		75.4	66.1	52.1	75.8	68.1	49.4
Progression Factor	1.02	0.92		1.22	0.79		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.2	3.5		16.7	1.3		54.0	15.2	22.0	3.8	11.0	1.4
Delay (s)	80.1	42.6		106.3	28.4		129.4	81.3	74.0	79.5	79.1	50.8
Level of Service	F	D		F	C		F	F	E	E	E	D
Approach Delay (s)		46.4			43.0			84.6			70.3	
Approach LOS		D			D			F			E	

Intersection Summary			
HCM 2000 Control Delay	57.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	2308	37	95	1608	71	43	12	144	84	9	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.0		6.0	6.0	6.4		6.4		6.4	6.4	
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00		1.00		1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		0.90		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	
Satd. Flow (prot)	1770	5073		1770	5085	1583		1663		1770	1633	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.91		0.30	1.00	
Satd. Flow (perm)	1770	5073		1770	5085	1583		1529		560	1633	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	75	2482	40	102	1729	76	46	13	155	90	10	46
RTOR Reduction (vph)	0	1	0	0	0	57	0	64	0	0	40	0
Lane Group Flow (vph)	75	2521	0	102	1729	19	0	150	0	90	16	0
Turn Type	Prot	NA		Prot	NA	custom	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			4			8	
Permitted Phases						8	4			8		
Actuated Green, G (s)	12.5	114.3		15.4	116.7	21.9		21.9		21.9	21.9	
Effective Green, g (s)	12.5	114.3		15.4	116.7	21.9		21.9		21.9	21.9	
Actuated g/C Ratio	0.07	0.67		0.09	0.69	0.13		0.13		0.13	0.13	
Clearance Time (s)	6.5	6.0		6.0	6.0	6.4		6.4		6.4	6.4	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	130	3410		160	3490	203		196		72	210	
v/s Ratio Prot	0.04	c0.50		c0.06	0.34						0.01	
v/s Ratio Perm						0.01		0.10		c0.16		
v/c Ratio	0.58	0.74		0.64	0.50	0.10		0.76		1.25	0.08	
Uniform Delay, d1	76.2	18.1		74.6	12.7	65.3		71.5		74.0	65.1	
Progression Factor	1.00	0.57		1.00	0.88	1.30		1.00		1.00	1.00	
Incremental Delay, d2	3.1	0.4		7.1	0.4	0.2		16.0		187.5	0.2	
Delay (s)	79.2	10.8		81.3	11.6	85.3		87.6		261.6	65.3	
Level of Service	E	B		F	B	F		F		F	E	
Approach Delay (s)		12.7			18.3			87.6			186.3	
Approach LOS		B			B			F			F	

Intersection Summary			
HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	18.9
Intersection Capacity Utilization	85.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	46	2363	43	30	1785	45	44	7	22	77	6	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.4	6.4		6.4	6.4	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		0.97	1.00	
Frt	1.00	1.00		1.00	1.00		1.00	0.89		1.00	0.87	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5072		1770	5067		1770	1649		3433	1618	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5072		1770	5067		1770	1649		3433	1618	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	48	2487	45	32	1879	47	46	7	23	81	6	43
RTOR Reduction (vph)	0	1	0	0	1	0	0	22	0	0	41	0
Lane Group Flow (vph)	48	2531	0	32	1925	0	46	8	0	81	8	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases												
Actuated Green, G (s)	7.8	123.4		6.9	122.5		7.4	6.7		8.2	7.5	
Effective Green, g (s)	7.8	123.4		6.9	122.5		7.4	6.7		8.2	7.5	
Actuated g/C Ratio	0.05	0.73		0.04	0.72		0.04	0.04		0.05	0.04	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.4	6.4		6.4	6.4	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	81	3681		71	3651		77	64		165	71	
v/s Ratio Prot	c0.03	c0.50		0.02	0.38		c0.03	0.00		0.02	c0.00	
v/s Ratio Perm												
v/c Ratio	0.59	0.69		0.45	0.53		0.60	0.12		0.49	0.11	
Uniform Delay, d1	79.5	12.8		79.7	10.7		79.8	78.8		78.9	78.0	
Progression Factor	1.13	0.20		0.64	2.08		1.00	1.00		1.00	1.00	
Incremental Delay, d2	7.6	0.4		3.5	0.4		11.9	0.9		2.3	0.7	
Delay (s)	97.7	2.9		54.4	22.7		91.7	79.7		81.2	78.7	
Level of Service	F	A		D	C		F	E		F	E	
Approach Delay (s)		4.6			23.2			87.0			80.2	
Approach LOS		A			C			F			F	

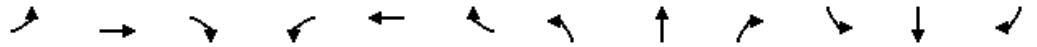
Intersection Summary			
HCM 2000 Control Delay	15.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	24.8
Intersection Capacity Utilization	66.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	2441	28	10	1749	185	65	17	9	397	7	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5		6.5	6.5		6.0	6.0	6.0	7.0	7.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00	1.00	0.97	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5077		1770	5012		1770	1863	1583	3433	1600	
Flt Permitted	0.05	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	98	5077		1770	5012		1770	1863	1583	3433	1600	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	110	2543	29	10	1822	193	68	18	9	414	7	112
RTOR Reduction (vph)	0	0	0	0	6	0	0	0	9	0	98	0
Lane Group Flow (vph)	110	2572	0	10	2009	0	68	18	0	414	21	0
Turn Type	pm+pt	NA		Prot	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6								4			
Actuated Green, G (s)	120.4	110.8		3.1	102.0		8.8	4.9	4.9	25.2	21.3	
Effective Green, g (s)	120.4	110.8		3.1	102.0		8.8	4.9	4.9	25.2	21.3	
Actuated g/C Ratio	0.71	0.65		0.02	0.60		0.05	0.03	0.03	0.15	0.13	
Clearance Time (s)	6.5	6.5		6.5	6.5		6.0	6.0	6.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	186	3309		32	3007		91	53	45	508	200	
v/s Ratio Prot	c0.04	c0.51		0.01	0.40		0.04	c0.01		c0.12	0.01	
v/s Ratio Perm	0.38								0.00			
v/c Ratio	0.59	0.78		0.31	0.67		0.75	0.34	0.01	0.81	0.11	
Uniform Delay, d1	28.6	20.9		82.4	22.7		79.5	81.0	80.2	70.1	65.9	
Progression Factor	1.79	0.55		0.86	0.85		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.8	1.4		4.2	0.9		28.0	3.8	0.1	9.7	0.2	
Delay (s)	55.1	13.0		74.7	20.1		107.5	84.8	80.2	79.9	66.1	
Level of Service	E	B		E	C		F	F	F	E	E	
Approach Delay (s)		14.7			20.4			100.6			76.8	
Approach LOS		B			C			F			E	

Intersection Summary			
HCM 2000 Control Delay	24.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	285	2726	4	21	1600	39	5	0	6	30	0	223
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	6.5		6.5	6.5	6.5		6.5			6.5	6.5
Lane Util. Factor	1.00	0.91		1.00	0.91	1.00		1.00			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.92			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	5084		1770	5085	1583		1681			1770	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.91			0.75	1.00
Satd. Flow (perm)	1770	5084		1770	5085	1583		1569			1397	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	310	2963	4	23	1739	42	5	0	7	33	0	242
RTOR Reduction (vph)	0	0	0	0	0	14	0	6	0	0	0	209
Lane Group Flow (vph)	310	2967	0	23	1739	28	0	6	0	0	33	33
Turn Type	Prot			Prot		Perm	Perm			Perm		Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases						2	4			8	8	8
Actuated Green, G (s)	35.1	122.5		4.5	91.4	91.4		23.5			23.5	23.5
Effective Green, g (s)	35.1	122.5		4.5	91.4	91.4		23.5			23.5	23.5
Actuated g/C Ratio	0.21	0.72		0.03	0.54	0.54		0.14			0.14	0.14
Clearance Time (s)	7.0	6.5		6.5	6.5	6.5		6.5			6.5	6.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	365	3663		47	2734	851		217			193	219
v/s Ratio Prot	c0.18	c0.58		0.01	0.34							
v/s Ratio Perm						0.02		0.00			c0.02	0.02
v/c Ratio	0.85	0.81		0.49	0.64	0.03		0.03			0.17	0.15
Uniform Delay, d1	64.9	15.9		81.6	27.6	18.5		63.4			64.7	64.5
Progression Factor	0.71	2.44		1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	8.7	1.0		7.8	1.1	0.1		0.2			0.4	0.3
Delay (s)	55.1	39.9		89.4	28.8	18.6		63.6			65.1	64.8
Level of Service	E	D		F	C	B		E			E	E
Approach Delay (s)		41.3			29.3			63.6			64.8	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM Average Control Delay	38.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	91.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	2693	8	36	1762	72	38	15	33	234	5	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.5	6.5	6.5	6.5		6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1799	1583	1770	1593	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.97	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1799	1583	1770	1593	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	80	2865	9	38	1874	77	40	16	35	249	5	133
RTOR Reduction (vph)	0	0	3	0	0	28	0	0	34	0	86	0
Lane Group Flow (vph)	80	2865	6	38	1874	49	0	56	1	249	52	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		3	3	
Permitted Phases			6			2			4			
Actuated Green, G (s)	10.6	112.4	112.4	5.6	107.4	107.4		7.0	7.0	20.0	20.0	
Effective Green, g (s)	10.6	112.4	112.4	5.6	107.4	107.4		7.0	7.0	20.0	20.0	
Actuated g/C Ratio	0.06	0.66	0.66	0.03	0.63	0.63		0.04	0.04	0.12	0.12	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5		6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	110	2339	1046	58	2235	1000		74	65	208	187	
v/s Ratio Prot	c0.05	c0.81		0.02	0.53			c0.03		c0.14	0.03	
v/s Ratio Perm			0.00			0.03			0.00			
v/c Ratio	0.73	1.22	0.01	0.66	0.84	0.05		0.76	0.02	1.20	0.28	
Uniform Delay, d1	78.3	28.8	9.8	81.2	24.5	11.9		80.7	78.2	75.0	68.4	
Progression Factor	0.93	1.00	1.00	1.27	0.11	0.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.7	102.2	0.0	13.4	2.2	0.0		35.0	0.1	125.8	0.8	
Delay (s)	78.2	131.0	9.8	116.3	5.0	0.0		115.6	78.4	200.8	69.2	
Level of Service	E	F	A	F	A	A		F	E	F	E	
Approach Delay (s)		129.2			6.9			101.3			153.9	
Approach LOS		F			A			F			F	

Intersection Summary			
HCM 2000 Control Delay	85.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	108.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	1436	126	233	1276	94	153	488	342	145	399	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0	7.0	6.5	7.0	7.0	7.0	7.0	6.5	6.5	6.5	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	3433	3539	1583	1770	3539	1583	1770	3503	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.23	1.00	1.00	0.18	1.00	
Satd. Flow (perm)	1770	3539	1583	3433	3539	1583	431	3539	1583	330	3503	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	1512	133	245	1343	99	161	514	360	153	420	31
RTOR Reduction (vph)	0	0	67	0	0	45	0	0	52	0	3	0
Lane Group Flow (vph)	42	1512	66	245	1343	54	161	514	308	153	448	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	pm+pt	NA	pm+ov	pm+pt	NA	
Protected Phases	1	6		5	2		7	4	5	3	8	
Permitted Phases			6			2	4		4	8		
Actuated Green, G (s)	7.3	83.9	83.9	16.6	93.2	93.2	42.2	28.6	45.2	42.8	28.9	
Effective Green, g (s)	7.3	83.9	83.9	16.6	93.2	93.2	42.2	28.6	45.2	42.8	28.9	
Actuated g/C Ratio	0.04	0.49	0.49	0.10	0.55	0.55	0.25	0.17	0.27	0.25	0.17	
Clearance Time (s)	6.5	7.0	7.0	6.5	7.0	7.0	7.0	7.0	6.5	6.5	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	76	1746	781	335	1940	867	214	595	420	200	595	
v/s Ratio Prot	0.02	c0.43		0.07	c0.38		0.06	c0.15	c0.07	c0.06	0.13	
v/s Ratio Perm			0.04			0.03	0.13		0.12	0.13		
v/c Ratio	0.55	0.87	0.08	0.73	0.69	0.06	0.75	0.86	0.73	0.77	0.75	
Uniform Delay, d1	79.7	38.1	22.7	74.5	28.0	18.0	53.7	68.8	56.9	53.2	67.1	
Progression Factor	1.00	1.00	1.00	1.02	0.96	1.85	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	8.4	6.1	0.2	6.8	1.7	0.1	13.9	15.4	6.5	15.9	8.5	
Delay (s)	88.2	44.1	23.0	83.0	28.7	33.3	67.5	84.2	63.4	69.1	75.7	
Level of Service	F	D	C	F	C	C	E	F	E	E	E	
Approach Delay (s)		43.6			36.8			74.3			74.0	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	51.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	27.0
Intersection Capacity Utilization	90.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	19	1781	166	154	1536	24	60	17	114	52	22	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.5	6.0	6.0		6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1793	1583	1770	1805	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.76	1.00	0.65	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1406	1583	1219	1805	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	20	1836	171	159	1584	25	62	18	118	54	23	6
RTOR Reduction (vph)	0	0	36	0	0	6	0	0	107	0	5	0
Lane Group Flow (vph)	20	1836	135	159	1584	19	0	80	11	54	24	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	1	6		5	2			4			8	
Permitted Phases			6			2	4		4	8		
Actuated Green, G (s)	4.3	115.3	115.3	20.1	131.6	131.6		16.1	16.1	16.1	16.1	
Effective Green, g (s)	4.3	115.3	115.3	20.1	131.6	131.6		16.1	16.1	16.1	16.1	
Actuated g/C Ratio	0.03	0.68	0.68	0.12	0.77	0.77		0.09	0.09	0.09	0.09	
Clearance Time (s)	6.0	6.0	6.0	6.5	6.0	6.0		6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	44	2400	1073	209	2739	1225		133	149	115	170	
v/s Ratio Prot	0.01	c0.52		c0.09	0.45						0.01	
v/s Ratio Perm			0.09			0.01		c0.06	0.01	0.04		
v/c Ratio	0.45	0.77	0.13	0.76	0.58	0.02		0.60	0.08	0.47	0.14	
Uniform Delay, d1	81.7	18.3	9.6	72.6	7.9	4.4		73.9	70.2	72.9	70.6	
Progression Factor	1.13	0.76	0.25	1.35	0.13	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.0	0.8	0.0	10.9	0.6	0.0		7.5	0.2	3.0	0.4	
Delay (s)	96.0	14.7	2.4	108.8	1.7	4.4		81.3	70.4	75.9	71.0	
Level of Service	F	B	A	F	A	A		F	E	E	E	
Approach Delay (s)		14.4			11.3			74.8			74.2	
Approach LOS		B			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	17.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	1825	52	114	1663	54	84	50	237	81	68	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.5	6.5		6.5	6.5	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.88		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1632		1770	1825	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.70	1.00		0.19	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1306	1632		356	1825	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	34	1901	54	119	1732	56	88	52	247	84	71	11
RTOR Reduction (vph)	0	0	20	0	0	18	0	76	0	0	3	0
Lane Group Flow (vph)	34	1901	34	119	1732	38	88	223	0	84	79	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			4			8	
Permitted Phases			6			2	4			8		
Actuated Green, G (s)	6.0	105.8	105.8	14.2	114.0	114.0	31.5	31.5		31.5	31.5	
Effective Green, g (s)	6.0	105.8	105.8	14.2	114.0	114.0	31.5	31.5		31.5	31.5	
Actuated g/C Ratio	0.04	0.62	0.62	0.08	0.67	0.67	0.19	0.19		0.19	0.19	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.5	6.5		6.5	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	62	2202	985	147	2373	1061	241	302		65	338	
v/s Ratio Prot	0.02	c0.54		c0.07	c0.49			0.14			0.04	
v/s Ratio Perm			0.02			0.02	0.07			c0.24		
v/c Ratio	0.55	0.86	0.03	0.81	0.73	0.04	0.37	0.74		1.29	0.23	
Uniform Delay, d1	80.7	26.2	12.4	76.6	18.1	9.4	60.5	65.4		69.2	59.0	
Progression Factor	0.91	0.53	1.00	1.04	0.52	0.28	1.00	1.00		1.00	1.00	
Incremental Delay, d2	6.4	3.2	0.0	16.8	1.2	0.0	0.9	9.1		208.7	0.4	
Delay (s)	79.9	17.2	12.4	96.2	10.5	2.7	61.5	74.5		278.0	59.3	
Level of Service	E	B	B	F	B	A	E	E		F	E	
Approach Delay (s)		18.1			15.6			71.5			170.0	
Approach LOS		B			B			E			F	

Intersection Summary			
HCM 2000 Control Delay	27.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	100.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	212	1785	85	350	1453	64	179	636	558	156	507	306
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	1770	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	1770	3539	1583	3433	3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	219	1840	88	361	1498	66	185	656	575	161	523	315
RTOR Reduction (vph)	0	0	26	0	0	28	0	0	42	0	0	78
Lane Group Flow (vph)	219	1840	62	361	1498	38	185	656	533	161	523	237
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pt+ov	Prot	NA	pt+ov
Protected Phases	1	6	7	5	2	3	7	4	4 5	3	8	8 1
Permitted Phases			6			2						
Actuated Green, G (s)	13.6	84.5	102.0	17.5	88.4	96.7	17.5	33.7	57.7	8.3	24.5	44.6
Effective Green, g (s)	13.6	84.5	102.0	17.5	88.4	96.7	17.5	33.7	57.7	8.3	24.5	44.6
Actuated g/C Ratio	0.08	0.50	0.60	0.10	0.52	0.57	0.10	0.20	0.34	0.05	0.14	0.26
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5		6.5	6.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	274	1759	1010	353	1840	960	182	701	537	167	510	415
v/s Ratio Prot	0.06	c0.52	0.01	0.11	c0.42	0.00	c0.10	0.19	c0.34	0.05	0.15	0.15
v/s Ratio Perm			0.03			0.02						
v/c Ratio	0.80	1.05	0.06	1.02	0.81	0.04	1.02	0.94	0.99	0.96	1.03	0.57
Uniform Delay, d1	76.9	42.8	14.1	76.2	34.0	16.2	76.2	67.1	55.9	80.7	72.8	54.4
Progression Factor	0.95	0.91	0.79	0.97	0.88	1.98	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.9	29.0	0.0	46.9	3.0	0.0	71.1	19.7	36.6	58.6	46.5	1.9
Delay (s)	80.8	67.7	11.2	120.6	32.9	32.0	147.3	86.8	92.5	139.3	119.2	56.3
Level of Service	F	E	B	F	C	C	F	F	F	F	F	E
Approach Delay (s)		66.7			49.3			97.1			102.6	
Approach LOS		E			D			F			F	

Intersection Summary			
HCM 2000 Control Delay	73.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	107.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	2308	37	95	1608	71	43	12	144	84	9	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.0	6.0	6.0	6.0	6.0		6.4		6.4	6.4	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.90		1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1663		1770	1633	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.91		0.34	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1529		628	1633	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	75	2482	40	102	1729	76	46	13	155	90	10	46
RTOR Reduction (vph)	0	0	12	0	0	25	0	56	0	0	39	0
Lane Group Flow (vph)	75	2482	28	102	1729	51	0	158	0	90	17	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	1	6		5	2			4			8	
Permitted Phases			6			2	4			8		
Actuated Green, G (s)	12.0	117.5	117.5	10.0	115.0	115.0		24.1		24.1	24.1	
Effective Green, g (s)	12.0	117.5	117.5	10.0	115.0	115.0		24.1		24.1	24.1	
Actuated g/C Ratio	0.07	0.69	0.69	0.06	0.68	0.68		0.14		0.14	0.14	
Clearance Time (s)	6.5	6.0	6.0	6.0	6.0	6.0		6.4		6.4	6.4	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	124	2446	1094	104	2394	1070		216		89	231	
v/s Ratio Prot	0.04	c0.70		c0.06	0.49						0.01	
v/s Ratio Perm			0.02			0.03		0.10		c0.14		
v/c Ratio	0.60	1.01	0.03	0.98	0.72	0.05		0.73		1.01	0.07	
Uniform Delay, d1	76.7	26.2	8.3	79.9	17.4	9.2		69.9		73.0	63.2	
Progression Factor	1.01	0.39	0.15	1.00	0.60	1.41		1.00		1.00	1.00	
Incremental Delay, d2	0.8	9.7	0.0	67.8	1.4	0.1		12.1		98.5	0.1	
Delay (s)	78.5	20.0	1.3	147.9	11.8	13.0		81.9		171.4	63.4	
Level of Service	E	C	A	F	B	B		F		F	E	
Approach Delay (s)		21.4			19.2			81.9			130.0	
Approach LOS		C			B			F			F	

Intersection Summary			
HCM 2000 Control Delay	26.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	18.9
Intersection Capacity Utilization	103.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	46	2363	43	30	1785	45	44	7	22	77	6	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.4	6.4		6.4	6.4	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.89		1.00	0.87	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1649		3433	1618	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1770	1649		3433	1618	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	48	2487	45	32	1879	47	46	7	23	81	6	43
RTOR Reduction (vph)	0	0	11	0	0	12	0	22	0	0	41	0
Lane Group Flow (vph)	48	2487	34	32	1879	35	46	8	0	81	8	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						
Actuated Green, G (s)	7.7	127.0	127.0	5.6	124.9	124.9	5.6	5.6		7.0	7.0	
Effective Green, g (s)	7.7	127.0	127.0	5.6	124.9	124.9	5.6	5.6		7.0	7.0	
Actuated g/C Ratio	0.05	0.75	0.75	0.03	0.73	0.73	0.03	0.03		0.04	0.04	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.4	6.4		6.4	6.4	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	80	2643	1182	58	2600	1163	58	54		141	66	
v/s Ratio Prot	c0.03	c0.70		0.02	0.53		c0.03	0.00		0.02	c0.00	
v/s Ratio Perm			0.02			0.02						
v/c Ratio	0.60	0.94	0.03	0.55	0.72	0.03	0.79	0.14		0.57	0.12	
Uniform Delay, d1	79.6	18.3	5.6	81.0	12.8	6.1	81.6	79.9		80.0	78.5	
Progression Factor	0.97	0.38	1.00	0.83	1.81	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.1	0.9	0.0	7.0	1.1	0.0	51.1	1.2		5.6	0.8	
Delay (s)	78.6	7.8	5.6	74.1	24.2	6.1	132.8	81.1		85.6	79.3	
Level of Service	E	A	A	E	C	A	F	F		F	E	
Approach Delay (s)		9.1			24.6			112.4			83.2	
Approach LOS		A			C			F			F	

Intersection Summary			
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	24.8
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	2441	28	10	1749	185	65	17	9	397	7	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.0	6.0	6.0	7.0	7.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	3433	1600	
Flt Permitted	0.05	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	97	3539	1583	1770	3539	1583	1770	1863	1583	3433	1600	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	110	2543	29	10	1822	193	68	18	9	414	7	112
RTOR Reduction (vph)	0	0	9	0	0	44	0	0	9	0	103	0
Lane Group Flow (vph)	110	2543	20	10	1822	149	68	18	0	414	16	0
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6		6			2			4			
Actuated Green, G (s)	126.3	117.0	117.0	2.8	110.3	110.3	11.0	4.2	4.2	20.0	13.2	
Effective Green, g (s)	126.3	117.0	117.0	2.8	110.3	110.3	11.0	4.2	4.2	20.0	13.2	
Actuated g/C Ratio	0.74	0.69	0.69	0.02	0.65	0.65	0.06	0.02	0.02	0.12	0.08	
Clearance Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.0	6.0	6.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	165	2435	1089	29	2296	1027	114	46	39	403	124	
v/s Ratio Prot	c0.04	c0.72		0.01	0.51		0.04	c0.01		c0.12	0.01	
v/s Ratio Perm	0.46		0.01			0.09			0.00			
v/c Ratio	0.67	1.04	0.02	0.34	0.79	0.14	0.60	0.39	0.01	1.03	0.13	
Uniform Delay, d1	35.2	26.5	8.4	82.7	21.6	11.6	77.3	81.6	80.9	75.0	73.0	
Progression Factor	1.60	0.28	1.00	0.84	0.73	1.38	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.6	26.1	0.0	3.9	1.6	0.2	8.1	5.4	0.1	52.0	0.5	
Delay (s)	61.1	33.6	8.4	73.1	17.5	16.1	85.5	87.1	80.9	127.0	73.5	
Level of Service	E	C	A	E	B	B	F	F	F	F	E	
Approach Delay (s)		34.5			17.6			85.3			115.0	
Approach LOS		C			B			F			F	

Intersection Summary			
HCM 2000 Control Delay	37.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	108.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	285	2726	4	21	1600	39	5	0	6	30	0	223
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	6.5	6.5	6.5	6.5	6.5		6.5			6.5	6.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.92			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1681			1770	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.85			0.75	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583		1458			1397	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	310	2963	4	23	1739	42	5	0	7	33	0	242
RTOR Reduction (vph)	0	0	1	0	0	10	0	7	0	0	0	229
Lane Group Flow (vph)	310	2963	3	23	1739	32	0	5	0	0	33	13
Turn Type	Prot		Perm	Prot		Perm	custom			Perm		Perm
Protected Phases	1	6		5	2						8	
Permitted Phases			6			2	4	4		8	8	8
Actuated Green, G (s)	32.7	137.3	137.3	4.2	108.3	108.3		9.0			9.0	9.0
Effective Green, g (s)	32.7	137.3	137.3	4.2	108.3	108.3		9.0			9.0	9.0
Actuated g/C Ratio	0.19	0.81	0.81	0.02	0.64	0.64		0.05			0.05	0.05
Clearance Time (s)	7.0	6.5	6.5	6.5	6.5	6.5		6.5			6.5	6.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	340	2858	1279	44	2255	1008		77			74	84
v/s Ratio Prot	c0.18	c0.84		0.01	0.49							
v/s Ratio Perm			0.00			0.02		0.00			c0.02	0.01
v/c Ratio	0.91	1.04	0.00	0.52	0.77	0.03		0.07			0.45	0.15
Uniform Delay, d1	67.2	16.3	3.2	81.9	22.0	11.4		76.5			78.1	76.9
Progression Factor	0.88	2.09	1.51	1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	3.8	18.0	0.0	10.8	2.6	0.1		1.7			4.2	0.8
Delay (s)	62.8	52.2	4.8	92.7	24.6	11.5		78.3			82.3	77.7
Level of Service	E	D	A	F	C	B		E			F	E
Approach Delay (s)		53.2			25.2			78.3			78.3	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM Average Control Delay	45.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	114.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX F
Ridership Forecasting Methodology Report

US 50 / UCF Connector Alternatives Analysis

Ridership Forecasting Methods and Results

Prepared For LYNX

April 2015

Prepared By:
Connetics Transportation Group

Under Contract to:
Kittelson and Associates

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1.0 Background

The SR 50 / UCF Connector Alternative Analysis Study focused on identifying the issues, opportunities, and multi-modal mobility and livability improvements in the Study Corridor. The Study Area (Figure 1.1) is a two-mile wide east-west corridor including a 27-mile stretch following State Road 50 (SR 50), bound by the Orange County / Lake County line on the west side and Alafaya Trail (State Road 434 (SR 434)) to the east. The Study Area also included a three-mile long, two-mile wide north-south corridor including along Alafaya Trail north of SR 50, extending up to UCF and the Seminole County Line.

The study was funded, in partnership with LYNX, through a grant administered by the Federal Transportation Administration (FTA) for the Alternatives Analysis (AA) Program. In 2011, MetroPlan Orlando and LYNX established a partnership (known as Vision 2030) to undertake the examination of 22 high intensity transit corridors within the LYNX service area to estimate future transit demands, determine improvements, and outline priorities. SR 50 ranked as one of the highest priorities for premium transit implementation in the next 20 years and LYNX's 2010 Five-Year Strategic Plan ranked SR 50 as the highest priority for implementing premium transit among its high-capacity transit corridors.

The Federal Transit Administration (FTA) has a range of acceptable approaches to forecasting. Among these are traditional trip-based models, tour-based enumerated models, simplified or data-driven models such as the methods being employed in this report. The FTA also offers project sponsors a simplified model package called Simplified Trips-on-Project Software (STOPS). While the FTA provides a host of detailed guidance on the conduct of travel forecasts, summary guidance from the FTA concerning forecasting methods can be found on the FTA's website (http://www.fta.dot.gov/grants/15681.html) excerpted below:

> *Several FTA project-evaluation measures rely on travel forecasts prepared by sponsors of proposed New Starts and Small Starts projects. In its reviews to ensure their usefulness in project evaluation, FTA considers five aspects of the forecasts:*
>
> 1. *The properties of the forecasting methods;*
> 2. *The adequacy of current ridership data to support useful tests of the methods;*
> 3. *The successful testing of the methods to demonstrate their grasp of current ridership;*
> 4. *The reasonableness of inputs (demographics, service changes) used in the forecasts; and*
> 5. *The plausibility of the forecasts for the proposed project.*
>
> *Project sponsors may choose among three different approaches to prepare ridership forecasts:*
>
> A. *Region-wide travel models;*
> B. *Incremental data-driven methods; and*
> C. *FTA's Simplified Trips-on-Project Software (STOPS).*
>
> *The first two options depend entirely on local efforts both to develop the forecasting methods and to prepare the forecasts. Consequently, for these options, FTA's review will consider all five aspects of the forecasts. The third option relies on the product of FTA efforts to develop a forecasting method. Consequently, for this option, FTA's review needs to consider only the last two aspects of forecasts.*

It is within the general context of FTA's summary guidance that the forecasts presented in this report have been prepared. In many cases, the FTA considers data-driven approaches to be one of the more reliable methods because the forecasts are informed by survey observations of existing travel patterns and market characteristics. It merits some mention as well that while there is no requirement that the forecast prepared for a Locally Preferred Alternative (LPA) be formally approved by FTA, a future New Starts or Small Starts submission will require close FTA review and approval.

For example, results presented in the report pivot off observed ridership collected as part of a "before" survey[1] for SunRail. Before and after surveys are required by FTA, in part, to better understand how model forecasts can be improved when new services are introduced to a region where none existed before. Year 2020 forecasts in this report do not reflect potential interaction with SunRail because;

1. Results pivot on ridership surveys before SunRail was operating.
2. Introducing an estimate of interaction with SunRail would have required off-line methods to extract and adjust trips from the CFRPM estimates and consequently deviate beyond the proposed data-driven methods.

In any event, the methods employed in this report will require further refinement upon a formal New or Small Starts submission and should endeavor to include upcoming "after" survey results associated with the SunRail project, as well as an early dialogue with FTA.

Forecasting efforts effectively began in April of 2013 to support the study's screening exercises. The initial set of alternatives (long-list of alternatives) spanned the entire length of the study area (noted above) and included several alignments, modes and service improvement variations. Screening evaluations resulted in a smaller set of alternatives (short-list of alternatives) along the minimal operating segment (MOS) which were advanced as build alternatives for further analysis.

The Central Florida Regional Planning Model (CFRPM) was used to generate forecasts for screening evaluations. The decision to use the CFRPM for the initial forecasts was based on a review of several locally available forecasting tools at the onset of the forecasting effort, as well as meetings with LYNX, the study team, and the consultant that developed the CFRPM model.

The CFRPM[2,3] was originally developed for the Florida Department of Transportation and used to generate SunRail forecasts. The model essentially uses the identical inputs from the Metropolitan Orlando Urban Area Study Model (OUATS). As such, zone structure, projected 2030 population and employment forecasts, as well as trip generation rates are consistent with MetroPlan's adopted 2030

[1] LYNX (Prepared by AJM Consulting): "Technical Memorandum Describing the Conduct and Results of the "Before" Passenger Survey for the Central Florida Commuter Rail Transit Project." 2011
[2] CFRPM v5.6 Development Notes 12-14-2012, AECOM
[3] CFRPM v5 6 Transit Model Calibration-Validation Notes 12-14-2012, AECOM

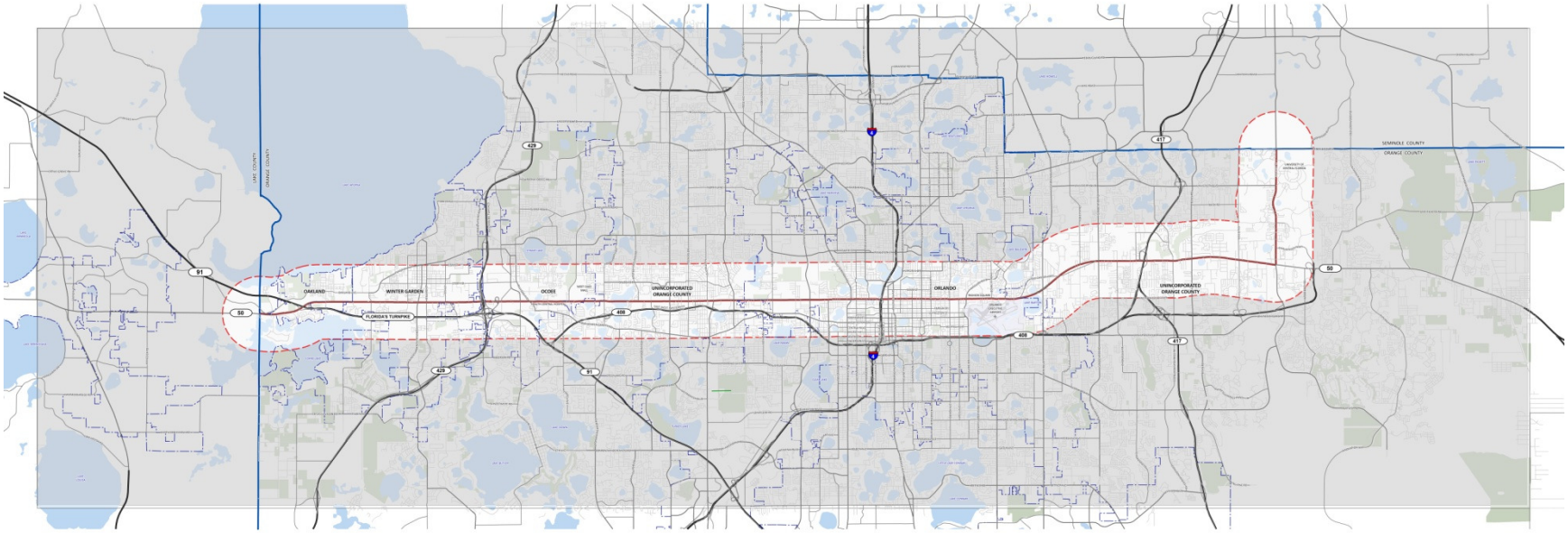
Long-Range Transportation Plan. Moreover, the CFRPM was the only locally available tool that was calibrated and validated with the 2010 Survey data.

This report provides an overview of the methods used to estimate ridership and forecast results for a No Build alternative and the short-list of Build alternatives that advanced from screening evaluations. In general, the approach is based on a data-driven or pivot-point method. Data-driven approaches are most applicable when new transit service is proposed where existing service is substantial and there is a collection of good observed data about the markets and travel patterns of existing riders. To this end, LYNX has provided a substantial Year 2010 LYNX on-board survey[4] (2010 Survey) and high-quality Year 2013 Automatic Passenger Count (APC) data.

Primary report sections include a Methodology Overview, Definition of Alternatives and Forecasts. Subsections discuss elements of the primary sections in larger detail.

[4] LYNX (Prepared by AJM Consulting): "Technical Memorandum Describing the Conduct and Results of the "Before" Passenger Survey for the Central Florida Commuter Rail Transit Project." 2011

Figure 1.1: SR 50 / UCF Connector Alternatives Analysis Study Area



2.0 Methodology Overview

This section of the report provides an overview of the methods that were developed to produce forecasts for the short-list set of alternatives advancing from initial screening evaluations. The forecasts of corridor ridership stems from a data-driven or pivot-point method which is appropriate when new transit service is proposed where there is ample existing service and recent survey data is available. Data-driven processes utilize an existing survey to grasp the market characteristics and current transit travel patterns. From this understanding, data-driven models then estimate how demand in the study corridor is expected to change in relation to demographic forecasts and the transportation system.

Trailing subsections in the overview include more detailed discussions of the following:

- Key assumptions
- 2010 On-Board Survey Review and Delineation of Study Area Routes
- Base Year 2013 Transit Network and Level-of-Service Matrices
- Scheduling at the LYNX Central Station in Downtown Orlando
- Year 2013 Assignments and Confirmation
- Preparation of Future Year 2020 Transit Networks

2.1 Key Assumptions

Key assumptions largely encompass information to support the forecasts and establish the years upon which the forecasts will be predicated. Stemming from several discussions with the study team, key assumptions for estimating ridership in the study corridor include:

- Base and horizon years would be 2013 and 2020, respectively,
- Highway network and auto travel time information would be based on the CFRPM's Year 2010 highway network,
- Transit network coding would reflect current LYNX timetable information,
- Base year transit trips tables would be specified from the LYNX 2010 survey[5] and 2013 Automatic Passenger Count (APC) data collected between August 2013 and January 2014,
- Socio-economic data inputs for future years would be interpolated based on the adopted MetroPlan Year 2030 LRTP as incorporated into the CFRPM,
- The No Build condition would consist of existing bus routes and incorporate SunRail and supporting feeder service, as well as the LYMMO Lime and Grapefruit lines.

[5] LYNX (Prepared by AJM Consulting): "Technical Memorandum Describing the Conduct and Results of the "Before" Passenger Survey for the Central Florida Commuter Rail Transit Project." 2011

2.2 2010 On-Board Survey Review and Delineation of Study Area Routes

The 2010 LYNX On-Board survey was conducted between October and November 2010. The survey collected 6,785 valid trip responses. The survey's expansion process[6] considered known bias, bus trips, direction and time period, as well as automatic passenger count (APC) data collected during the survey period.

As shown in Figure 2.1, LYNX currently operates four local routes (28, 29, 48, and 49) and two limited stop Fast Links (104 and 105). All of these routes share the LCS as an end-of-line terminal point. These routes were selected by the study team to be the focus of the forecasts. For study purposes, 1,151 survey responses were delineated from the full survey collection, roughly (17% of all survey responses) to form a study area dataset. This delineated dataset represents the observed market characteristics and travel patterns of riders who used one of the study routes for at least one leg of their journey from origin to destination.

Study area survey records were then reviewed qualitatively to correct erroneous response coding. In general, this process involved plotting paired origin, destination, boarding and alighting points with GIS software and examining key aspects of each response including but not limited to:

- CFRPM Zonal Demographics and Trip Totals
- Boarding and Alighting Locations
- Walk Distances
- Travel Patterns and Transfer Activity

Although the review found several inconsistencies related to transfers, subsequent adjustment to the original unlinked trip weights were minor and did not materially alter the integrity of the survey. Linked trip weights were computed in relation to the number of transfers made by a particular traveler during the journey.

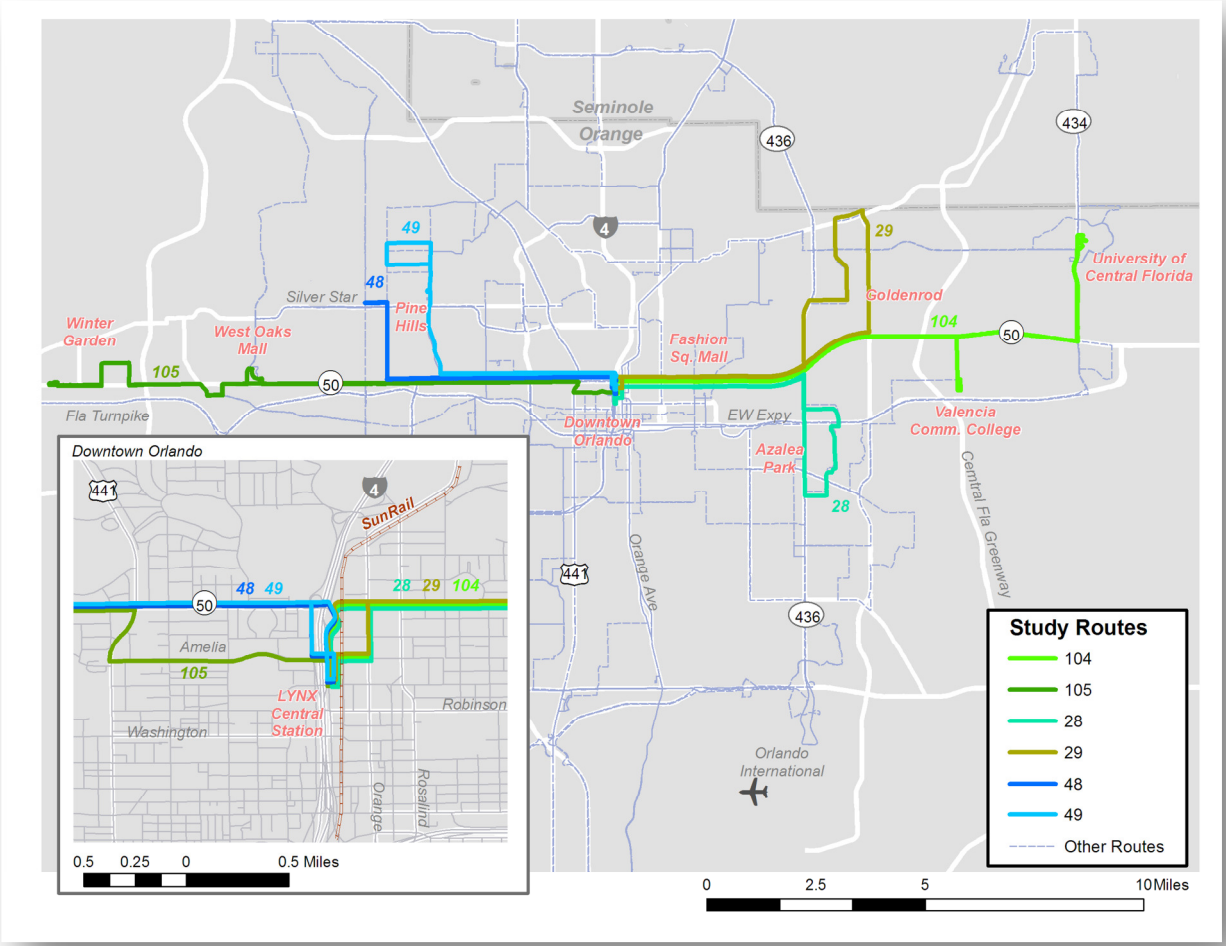
Summary statistics for riders in the study area appear in Table 2.1. Some 41% of study area riders reported having no auto available in their household. These responses formed the basis for subsequent measures of transit dependency. Another 45% reported having only one auto at their household. 53% of the study area's riders reported their annual household incomes were under $10,000. Just 1% reported annual incomes over $40,000. In addition, over 96% of the study area riders reported walking to and from buses while making their journey.

The review and delineation process yielded a table containing one record for each of the 1,151 survey records. Table records featured key attributes for each rider's response to the interview including; the traveler's origin and destination locations, production and attraction locations, boarding and alighting

[6] LYNX (Prepared by AJM Consulting): "Technical Memorandum Describing the Conduct and Results of the "Before" Passenger Survey for the Central Florida Commuter Rail Transit Project." 2011

locations, trip purpose, modes of access and egress, demographic characteristics and both unlinked and linked trip weights.

Figure 2.1: Base Year 2013 Study Area Routes



Note: SunRail was not operating in 2013.

Table 2.1:
Summary Statistics of Study Area Riders from the 2010 LYNX On-Board Survey

Survey Statistics	Measure	Response Percentage
Autos per Household	No Auto	41%
	One	45%
	Two or More	15%
Annual Household Income	Under $10,000	53%
	$10,000 to $19,999	28%
	$20,000 to $29,999	13%
	$30,000 to $39,999	5%
	Over $40,000	1%
Trip Purpose	HB Work	37%
	HB Shop	15%
	College/University	8%
	HB Other	26%
	Non-HB	14%
Mode of Access/Egress	Walked	96.6%
	Bicycled	1.9%
	Other	0.3%
	Carpooled	0.2%
	Drove & Parked	0.1%
	Dropped off	0.9%

2.3 Base Year 2013 Transit Network and Level-of-Service Matrices

Time-based coding for the base year 2013 transit networks was based on the LYNX April 2014 General Transit Feed Specification (GTFS) timetable information. Although GTFS data contained the full LYNX stop-level timetable, stop coding in the transit networks was too coarse for an exact correspondence. As such, network travel times were "hard-coded" by groups of stops (i.e., segments) to match the GTFS timetables.

More specifically, software-related[7] line codes for all routes associated with the study area reflect the use of a run time factor (i.e., RT keyword). The run time factor ensures that in-vehicle travel time results from transit pathbuilding will effectively match the LYNX GTFS timetables for defined segments.

Results from transit pathbuilding yield level-of-service (LOS) matrices that correspond to the journeys reported by each survey respondent. LOS matrices provide network-based measures of time including the time a traveler spends both in the transit vehicle and out of the vehicle. Generally, out-of-vehicle times include the time a person spends waiting for a bus to arrive prior to boarding, the time it takes to walk to the bus stop and from the bus stop nearest their destination and also the time associated with transferring from one bus to another.

2.4 Scheduling at the LYNX Central Station in Downtown Orlando

It merits some mention that special coding for existing operations at the Lynx Central Station (LCS) were applied in replicating the paths and LOS matrices described in the previous section. Table 2.2 summarizes weekday scheduling at the LYNX central station in downtown Orlando. Study area routes are 28, 29, 48, 49, 104 and 105. It is important to understand that none of the study area routes are interlined. As such, through riders for the study area routes experience a 10-minute difference between scheduled arrivals and departures. For example, a rider originating west of LCS and traveling inbound on the 48 bus would arrive 5 minutes after the hour at LCS Bay H. If this rider's ultimate destination was east of the LCS, along SR 50 and depending on that destination, there are three transfer options from which he or she can choose. If this example rider's destination requires a transfer to either the 29 (Bay G) or the 104 (Bay R) then the wait time is 10 minutes between the scheduled arrival and departure. If the rider's destination required a transfer the 28 bus (Bay G), then he or she may have to wait until 30-minutes after the hour (i.e., 25 minutes) before continuing their journey. Reverse and similar trip patterns are comparable.

Path construction assumes a node-specific arrangement whereby all through trips on corridor routes reflect a 10-minute out-of-vehicle time. Although the coding arrangement approximates LCS scheduling, it bears significance in the results for the set of build alternatives. More specifically, all of the build alternatives provide service such that through trips would stop at the LCS but not experience current

[7] Citilabs, Cube 6, version 6.0.2 July 2012

scheduled transfer times. It is questionable whether a rider truly perceives scheduled LCS transfer times as being twice as onerous as in-vehicle time or perhaps a less onerous somewhat equivalent to in-vehicle travel. Moreover, network coding at the LCS assumes FTA agrees that through riders currently perceive the time difference between arrivals and departures as out-of-vehicle time.

Table 2.2: Scheduling at LYNX Central Station

LCS Bay Assignments (August 2014)

Weekday

Amelia Street

	Lane 1 (southbound)				Lane 2 (southbound)				Lane 3 (northbound)			
	Arrive		Depart		Arrive		Depart		Arrive		Depart	
A	:50		:00		**J**	:50		:00		**S**	:50		:00	
	:05		:15			:05		:15			:05		:15	
	:20		:30			:20		:30			:20		:30	
	:35		:45			:35		:45			:35		:45	
B	:00	300*	:00	304*	**K**	:50	8	:00	8	**T**	:25	1792*	:00	1792*
	:05		:15			:05	8	:15	8		:05	1792*	:15	1792*
	:25	304*	:30	300*		:20	8	:30	8		:20	313	:30	3
	:35		:45			:35	8	:45	8		:35	1792*	:45	1792*
C	:55	38*	:00	38*	**L**	:50		:00		**U**	:50	3	:00	313
	:15	38	:20	38		:05	54	:15	25		:05	15	:15	15
	:35	38*	:40	38*		:20	25	:30	54		:20	11	:30	13
						:35	20	:45	25		:35	15	:45	15
D	:50		:00		**M**	:50	25	:00	20	**V**	:50	125	:00	125
	:05		:15			:05	36	:15	21		:10	125*	:20	125*
	:20		:30			:20		:30			:20	125**	:30	125**
	:35		:45			:35	36	:45	21		:30	125*	:40	125*
E	:50	107*	:00	107*	**N**	:45	50*	:55	50*	**W**	:50	102	:00	102
	:05	107	:15	107		:05	50	:15	50		:05	102	:15	102
	:20	107*	:30	107*		:25	50*	:35	50*		:20	102	:30	102
	:35	107	:45	107		:35	50**	:45	50**		:35	102	:45	102
F	:50	106*	:00	106*	**P**	:50	21	:00	36	**X**	:50		:00	
	:05	106	:15	106		:05		:15			:05	13	:15	11
	:20	106*	:30	106*		:20	21	:30	36		:20	51	:30	51
	:35	106	:45	106		:35	40	:45	40		:35	7	:45	11
G	:50	28	:00	29	**Q**	:50	319	:00	319	**Y**	:50	11	:00	7
	:05	29	:15	28		:05	105	:15	105		:05	18	:15	-
	:20	28	:30	29		:20	319	:30	319		:20	-	:30	18
	:35	29	:45	28		:35	105	:45	105		:35		:45	
H	:50	49	:00	49	**R**	:50	441*	:00	441*	**Z**	:50		:00	
	:05	48	:15	48		:05	104	:15	104		:05		:15	
	:20	49	:30	49		:20	441*	:30	441*		:20		:30	
	:35	48	:45	48		:35	104	:45	104		:35		:45	
	Lane 1 (southbound)				Lane 2 (southbound)				Lane 3 (northbound)			

Garland Avenue | **Railroad Tracks**

Livingston Street

* Indicates peak-hour service only (consult schedule for service span)

** Indicates off-peak arrival/departure time

2.5 Year 2013 Assignments and Confirmation

Year 2010 linked transit trips for the survey routes were assigned to the 2013 base year and results were confirmed in relation the survey paths reported the rider, the models ability to reconstruct each reported path, as well as daily station activity and line loads from 2013 APC data.

Comparisons were made for stop groups rather than individual stops since the survey database contained only a sample of total trips and the coarseness of model stop coding impedes exact representation of travel at the actual stop level. Linked trip adjustments made to the survey database during this task, were based on several considerations including the geographic location of the trip production and attraction variables, the purpose of the trip and demographic characteristics of the rider. The process involved several iterations of assignment and path review. Closure yielded favorable stop group comparisons and aggregate boarding totals.

Boarding results of this assignment and adjustment process appear in Table 2.2. As noted, SunRail and the LYMMO Lime and Grapefruit Lines were not operating during FY2013 and therefore not included in the assignment tests. Results suggest that the linked trip adjustments made during the process provide a reasonable equivalence with average FY13 boarding totals for the study area routes.

Table 2.2: Year 2013 Assignment Boardings

LYNX Route	Assigned Year 2013 Boardings			Average Boardings LYNX FY 13	Differences	
	Peak	Off-Peak	Daily		Boardings	%
28	607	1,075	1,682	1,578	104	7%
29	451	1,217	1,668	1,797	-129	-7%
48	533	1,427	1,960	1,888	72	4%
49	660	1,348	2,008	2,078	-70	-3%
104	770	1,590	2,360	2,405	-45	-2%
105	707	1,425	2,132	2,242	-110	-5%
Total	**3,728**	**8,082**	**11,810**	**11,989**	**-179**	**-1%**
Routes 28, 29 and 104 : East of LCS/Downtown			*5,710*	*5,780*	*-70*	*-1%*
Routes 48, 49 and 105 : West of LCS/Downtown			*6,100*	*6,209*	*-109*	*-2%*

Transfer Rates:	*Peak*	*Off-Peak*	*Daily*
	1.38	*1.34*	*1.35*

Notes:
Transit network assumptions exclude SunRail and LYMMO Lime and Grapefruit routes.

2.6 Preparation of Future Year 2020 Transit Networks

As was mentioned previously, minimal operating segments (MOS) emerged from an early screening process for a set of five alternatives. All of the alternatives were considered as bus rapid transit (BRT). Future year networks were prepared in accordance with proposed operating plans for the five MOS segments and are described in the next section.

It merits some mention that the 2020 No Build transit system reflects the base year 2013 transit system plus SunRail and expanded LYMMO service in the downtown. As was mentioned previously, Year 2020 forecasts in this report do not reflect potential interaction with SunRail because;

1. Results pivot off ridership surveys before SunRail was operating.
2. Introducing an estimate of interaction with SunRail would have required off-line methods to extract and adjust trips from the CFRPM estimates and consequently deviate beyond the proposed data-driven methods.

As such, further refinement upon a formal New or Small Starts submission should endeavor to include upcoming “after” survey results associated with the SunRail project.

3.0 Definition of Alternatives

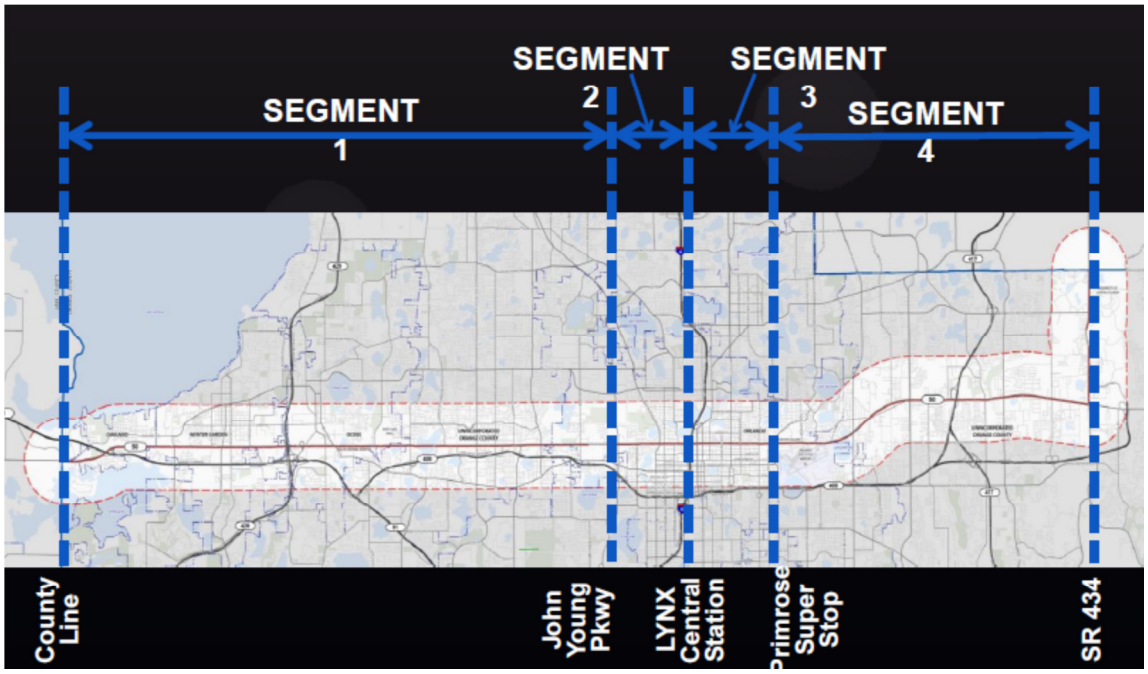
3.1 Background – Alternatives Development / Screening

The Alternatives Analysis process began with a long list of alternative alignments, modal considerations, and physical and technology applications (e.g., queue jumps, transit signal priority treatments and real time passenger information systems) designed to improve travel times, quality of service and passenger travel information. The original list of project alternatives served the entire corridor length along S.R. 50 from the Lake County line to Alafaya Trail (SR 434) and north to the University of Central Florida (UCF) transit center. Four distinct corridor segments where identified to isolate alignment variations. These segments included the following:

- Segment 1: Lake County Line to John Young Parkway
- Segment 2: John Young Parkway to LYNX Central Station
- Segment 3: LYNX Central Station to Primrose Superstop
- Segment 4: Primrose Superstop to University of Central Florida

These segments are depicted in Figure 3.1 Segment 1 exclusively follows the western portion of the S.R. 50 corridor while Segment 4 follows the eastern portion of the corridor along Alafaya Trail and S.R. 50, with a small potential variation near S.R. 436.

Figure 3.1: Study Corridor Segmentation



For the purposes of alternatives development, all alternatives assumed the Segment 1 and 4 alignments (without deviation near S.R. 436). The most significant alignment variations occurred in Segments 2 and 3. Figure 3.2 illustrates a refined set of alignment variations based on public and agency input. The refined set of potential Segment 2 and 3 alignments where analyzed and screened to seven potential alignments, known as the short-list alignments, as depicted in Figure 3.3.

Figure 3.2: Segment 1 & 4 Alignments

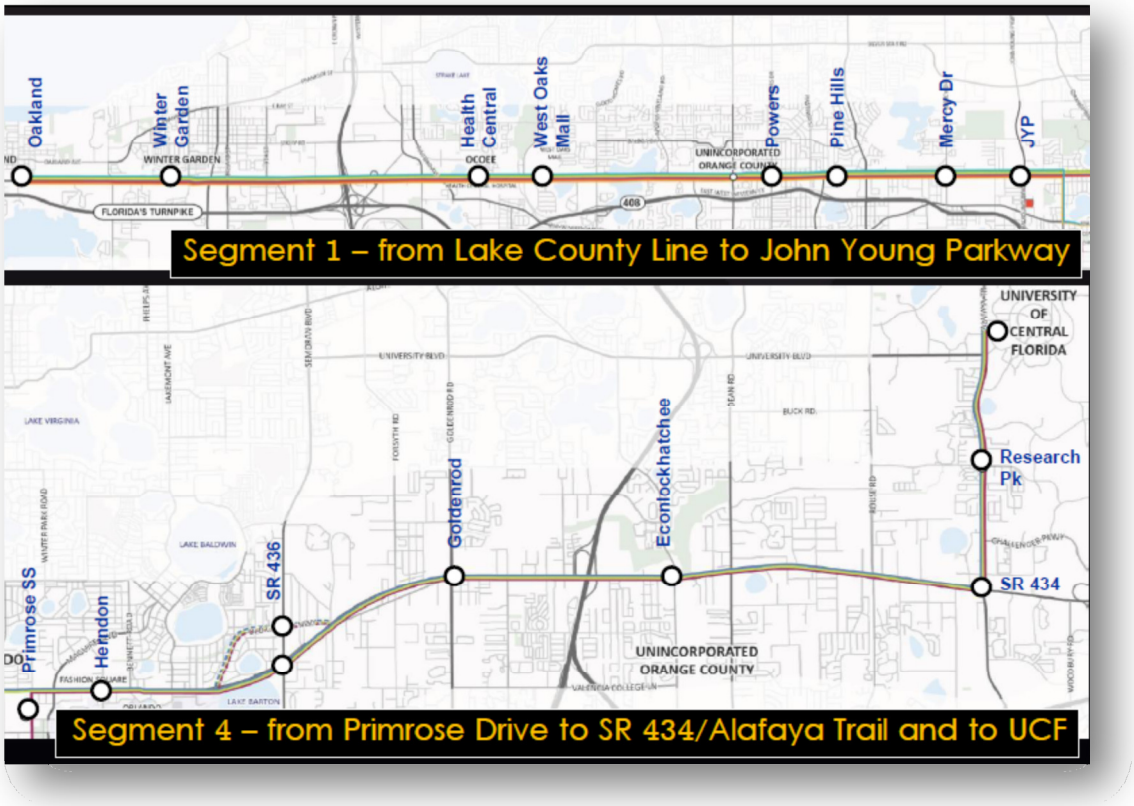
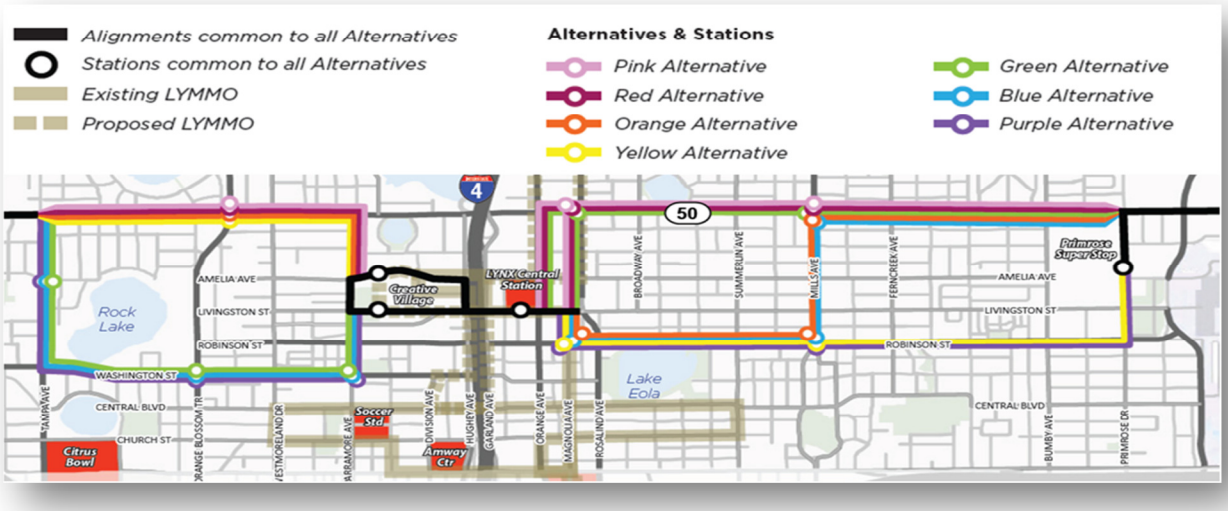


Figure 3.3: Refined Segment 2 & 3 Alignments



Operational scenarios where developed (i.e., travel time estimates and operating plans) applying four potential transit modes: streetcar, enhanced bus, bus rapid transit (BRT), and BRT operating in "Business Access and Transit" (BAT) lanes. Table 3.1 identifies the short-list of Alternatives and transit modes applied to each. Streetcar was applied only to the Pink Alternative (same alignment as the Red alignment) as a means to evaluate this mode (e.g., cost effectiveness and ridership demand) within the corridor.

Table 3.1: Shortlist of Alternatives and Transit Modes

Alternatives	MODE
Pink	**Streetcar**
Red	Enhanced Bus
Red	BRT Mixed
Red	BRT BAT (Bumby to SR 436)
Orange	Enhanced Bus
Orange	BRT Mixed
Orange	BRT BAT (Bumby to SR 436)
Yellow	Enhanced Bus
Yellow	BRT Mixed
Yellow	BRT BAT (Primrose to SR 436)
Green	Enhanced Bus
Green	BRT Mixed
Green	BRT BAT (Bumby to SR 436)
Blue	Enhanced Bus
Blue	BRT Mixed
Blue	BRT BAT (Bumby to SR 436)
Purple	Enhanced Bus
Purple	BRT Mixed
Purple	BRT BAT (Primrose to SR 436)

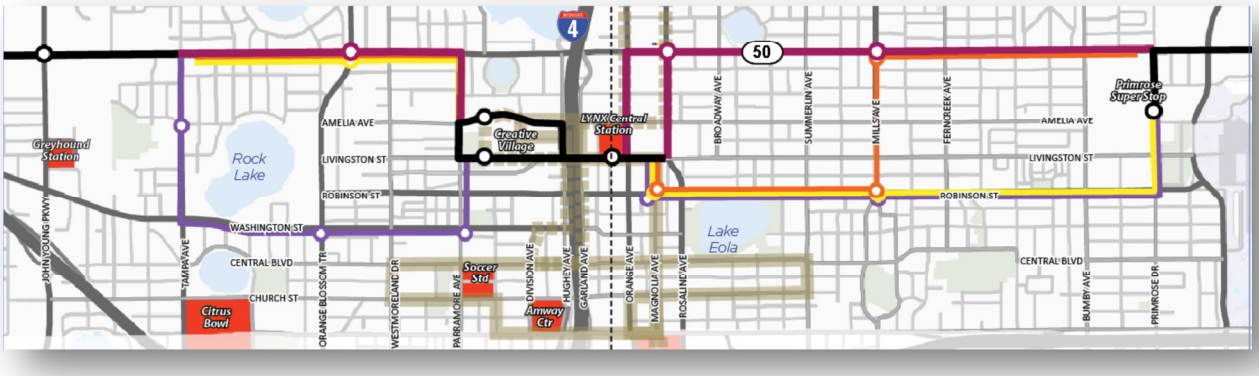
After this evaluation, streetcar transit within this corridor was eliminated as a result of poor cost-effectiveness in relation to bus and BRT modes. Common improvement elements among all alignments and operating scenarios include: enhanced transit stations, transit signal priority treatments, off-board fare collection and queue jumps (exception: streetcar). Transit modal analysis resulted in advancement of bus rapid transit in mixed traffic operations for all alternatives, except the Pink Streetcar Alternative. In addition, BAT lane assumptions were eliminated as part of the screening evaluation. Further analysis was conducted on the short-list of alternative alignments concluding in the advancement of the Red, Orange, Yellow and Purple alignment alternatives as depicted in Table 3.2 and Figure 3.4.

Table 3.2: Shortlist of Alignment Alternatives

CORRIDOR NEEDS	1. Enhance Access to Jobs and Educational Opportunities by improving East-West Transit Mobility			2. Encourage Development and Redevelopment that Supports Transit Consistent with Community Goals			3. Increase Corridor Transit Ridership				5. Invest in Transit Improvements that Yield Substantial and Sustainable Returns and are Fiscally Responsible				6. Implement Alternatives that Have Public Support
CORRIDOR GOALS	Improve Access to Jobs and Educational Institutions			Encourage Development and Redevelopment of Activity/Mixed-use Nodes			Serve Existing and Future Activity Centers with Transit				Invest in cost-effective infrastructure				Minimize Public Opposition
MEASURES OF EFFECTIVENESS	Number of Jobs Served	Addt'l. SunRail Area Jobs reached by SR 50 Area Res.	% of Additional SunRail Jobs Served	Retailing Activity	Acreage of CRAs, NIDs, BIDs, Main Streets Served	Serves Planned Redevelop. Areas	Corridor-Wide Ridership				Corridor-Wide Costs ($ Million)		MOS Costs ($ Million)		Level of Public Support
							Total Corridor Linked Trips	% of Corridor Ridership - Transit Dependent	Time Savings Per Rider (mins)	# of New Transit Riders Served	Capital Costs	Addt'l. Annual O&M Costs	Capital Costs	Addt'l. Annual O&M Costs	
Pink	75,510	2,450	150%	High	1,500	High	14,600	47%	8.8	900	713	15	276	16	High
Red	75,510	2,450	150%	High	1,500	High	14,300	46%	7.0	600	93	2	36	2	High
Orange	90,650	2,490	150%	High	1,560	High	14,200	48%	4.0	500	93	2	36	2	Medium
Yellow	89,620	2,490	150%	Medium	1,560	High	14,200	48%	5.0	500	93	2	36	2	Low
Green	78,010	2,480	150%	High	1,780	Low		49%			93	2	36	2	Medium
Blue	93,130	2,510	150%	High	1,840	Low		49%			93	2	36	2	Low
Purple	92,110	2,520	150%	Medium	1,850	Low	14,000	49%	3.0	300	93	2	36	2	Low

Note: Ridership statistics based on Year 2030 CFRPM applications.

Figure 3.4: Final Shortlist of Alignment Alternatives (Segment 2 & 3)



3.2 Determining the Minimal Operating Segment

Once potential alignment alternatives where screened, travel demand estimates where developed to determine station and route segment level service effectiveness and cost effectiveness. Minimum operating segment (MOS) alternatives focused on the most productive portions of the study corridor which generally fell in the center of the alignment radiating from the downtown core both east and west. Figure 3.5 identifies potential MOS segments analyzed in further detail. Each Alternative MOS was analyzed utilizing a series of service effectiveness metrics and overall cost effectiveness, as depicted in Table 3.3 below. The preferred MOS segment selected was between the Goldenrod Station and the Hiawassee / Powers Station (highlighted in Figure 3.3 below).

Figure 3.5: MOS Alternatives

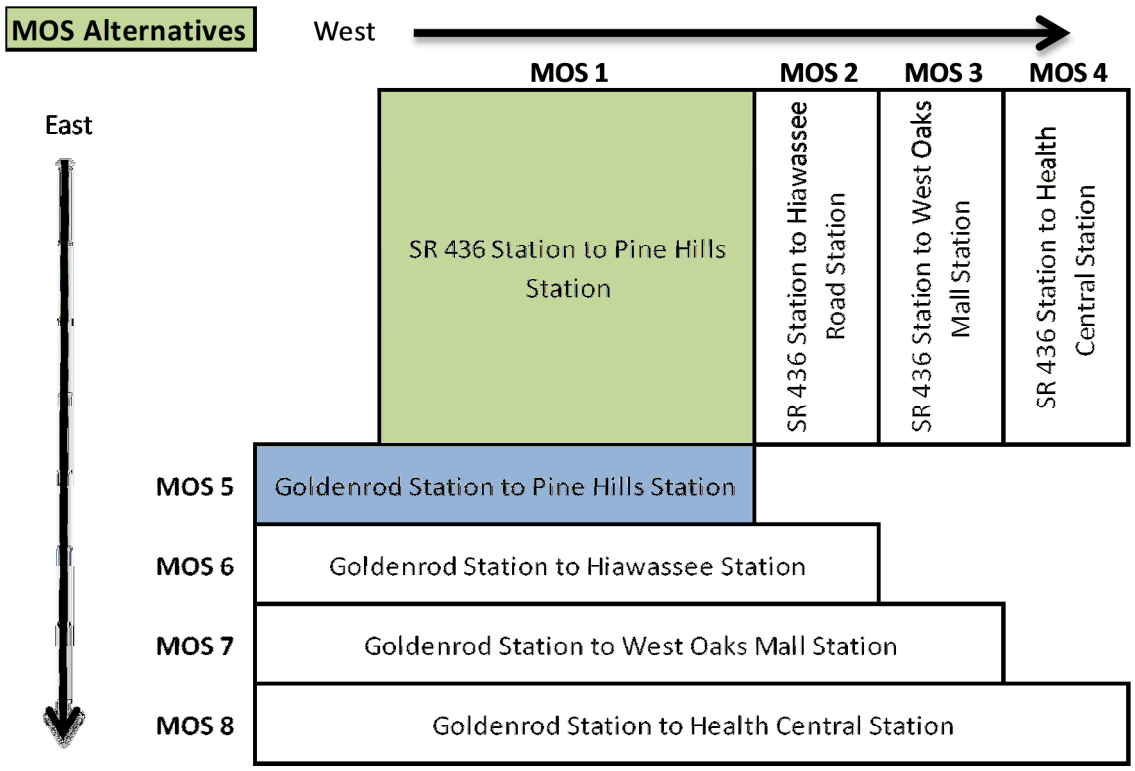


Table 3.3: Selected MOS Alternative

Station to Station	Service Effectiveness					Cost Effectiveness
	Riders / Corridor Mile	MOS to MOS Incremental Expansion Comparison	Incremental Rider/ Corridor Mile	Transit Dependent Rider/ Corridor Mile	Incremental Transit Dependent Rider/ Corridor Mile	Annual Operating Cost/ Annualized Rider
SR 436 Station to Pine Hills Station (Base MOS)	522	n/a	n/a	348	n/a	$0.69
SR 436 Station to Hiawassee/Powers Station	516	1 to 2	473	335	242	$0.80
SR 436 Station to West Oaks Mall Station	444	2 to 3	124	282	49	$1.05
SR 436 Station to Health Central Station	429	3 to 4	236	268	81	$1.01
Goldenrod Station to Pine Hills Station	480	1 to 5	231	311	90	$0.85
Goldenrod Station to Hiawassee/Powers Station	481	5 to 6	487	304	248	$0.95
Goldenrod Station to West Oaks Mall Station	422	6 to 7	125	262	49	$1.11
Goldenrod Station to Health Central Station	411	7 to 8	240	250	82	$1.11

3.3 Operating Plan Development / Evolution

After the initial round of ridership estimation and analysis it was determined there is a strong relationship between origins off the study alignment (S.R. 50) along portions of existing neighborhood circulation provided by Routes 28, 29, 48 and 49, and destinations along S.R. 50 as well as the downtown Orlando core and LYNX Central Station. The initial operating plan design included the traditional corridor level service with local fixed routes reconfigured into feeder routes. The study team concluded this approach may not be the most appropriate in the S.R. 50 corridor given the travel patterns identified in the on-board survey. The traditional corridor trunk service with feeder bus routes appeared to increase the number of transfers and travel times to select communities adjacent to the corridor. Therefore, an alternative approach was developed called the "Through Route Network" which allowed corridor level service to continue beyond the trunk portion of the corridor to serve these specific communities, thus eliminating the forced transfer associated with the trunk and feeder network design. The Through Route Network design resulted in greater ridership and improved performance. This network design improved connections between residential development (home based trips) off the corridor to commercial / business development along the corridor (work and other trip destinations) resulting in improved service levels, reduced transfers, and faster travel times.

The study team then examined three alternative "Through Route Network" operating plan approaches and applied them to the Red Alternative to determine the best performing approach. Following this exercise the Alternative 2 operating plan scenario was applied to the remaining Orange, Yellow and Purple Build Alternatives in combination with the downtown deviations illustrated in the previous section (i.e., Figure 3.4).

Red Alternative 1

The first approach, called the Red Alternative 1, operates 10 minute peak and 15 minute off-peak BRT service along the S.R. 50 corridor, with two branch patterns at both the west and east ends of the MOS segment. On the west end of the corridor, BRT service would depart the corridor with half the service (20 minute peak and 30 minute off-peak) serving the existing Route 48 route alignment, and the other half of service serving the Route 49 route alignment. On the east side of the corridor, BRT service would depart the corridor with half the service (20 minute peak and 30 minute off-peak) serving the existing Route 28 route alignment, and the other half of service serving the Route 29 route alignment. Service deviations for all four routes (i.e., 28, 29, 48 and 49) would provide local stop service on route alignments off the S.R. 50 corridor. Under this alternative, the existing Route 105 on the west side of the corridor and the Route 104 on the east side of the corridor would be converted to local stop service along the entire length of each route, providing 30 minute all day local service underlying the limited stop BRT service along the MOS portion of the corridor.

Acknowledging potential increased travel times for trips originating east and west of the MOS segment that result from the conversion of Routes 104 and 105 to local routes their entire length, the study team developed an alternative approach called Red Alternative 2 described below.

Red Alternative 2

The second approach, called the Red Alternative 2, operates 10 minute peak and 15 minute off-peak BRT service along the S.R. 50 corridor, continuing as local stop routes beyond the eastern and western MOS segment limits. On the west end of the corridor, BRT service would continue half the service (20 minute peak and 30 minute off-peak) as local stop service along the existing Route 105 alignment to Winter Garden. The remaining half of service would be short-turned and return back along the BRT MOS alignment eastbound. On the east side of the corridor, BRT service would continue half the service (20 minute peak and 30 minute off-peak) as local stop service along the existing Route 104 alignment to the University of Central Florida (UCF) transit center. The remaining half of service would be short-turned and return back along the BRT MOS alignment westbound.

Under this alternative, the existing Routes 48 and 49 on the west side of the corridor and the Routes 28 and 29 on the east side of the corridor would continue to operate as local stop service along the entire length of each route, providing 15 minute all day local service underlying the limited stop BRT service along the MOS portion of the corridor, and 30 minute service beyond the MOS limits.

Red Alternative 3

The third approach, called the Red Alternative 3, operates 10 minute peak and 15 minute off-peak BRT service along the S.R. 50 corridor, continuing as local stop routes beyond the eastern and western MOS segment limits. On the west end of the corridor, BRT service would depart the corridor with half the service (20 minute peak and 30 minute off-peak) serving the existing Route 48 route alignment, and the

other half of service serving the Route 49 route alignment. The remaining half of service would be short-turned and return back along the BRT MOS alignment eastbound. On the east side of the corridor, BRT service would continue half the service (20 minute peak and 30 minute off-peak) as local stop service along the existing Route 104 alignment to the University of Central Florida (UCF) transit center. The remaining half of service would be short-turned and return back along the BRT MOS alignment westbound.

Under this alternative, the existing Route 105 on the west side of the corridor and Routes 28 and 29 on the east side of the corridor would continue to operate as local stop service along the entire length of each route, providing 30 minute and 15 minute all day local service, respectively along the entire length of each route.

Figures 3.6, 3.7,3.8, 3.9 illustrate No Build (existing) and proposed Red Alternative 1, 2, and 3 operating plan service levels and service alignments.

Figure 3.6: No Build (Existing) Service Operating Plan Configuration

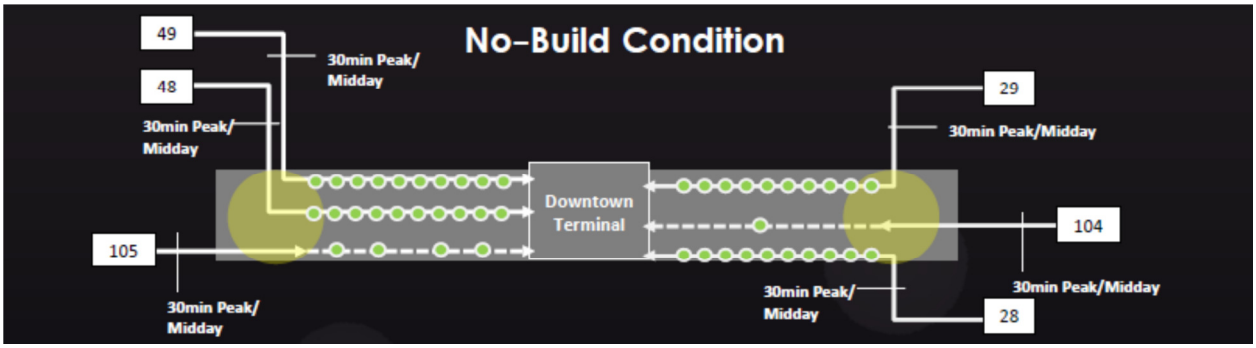


Figure 3.7: Red Alternative 1 Service Operating Plan Configuration

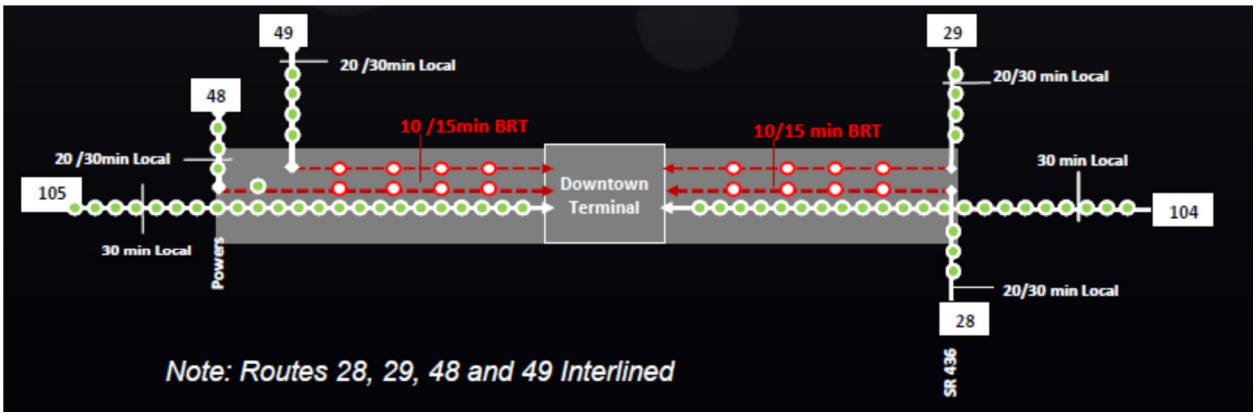


Figure 3.8: Red Alternative 2 Service Operating Plan Configuration

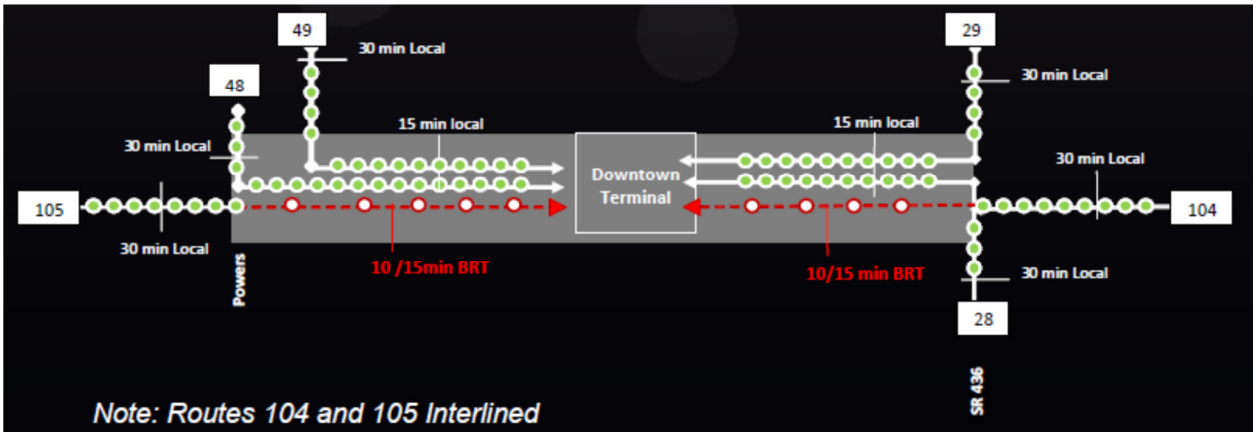
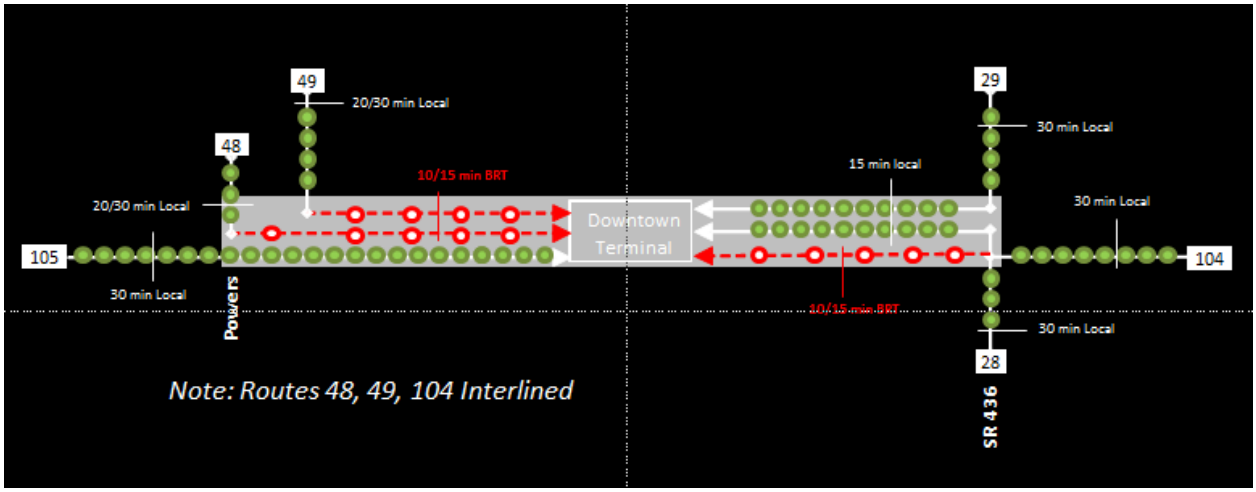


Figure 3.9: Red Alternative 3 Service Operating Plan Configuration



3.4 Alternatives Modeled using Data-Driven Methods

Following the initial round of alternatives development, analysis and screening, alternatives were reduced in length (i.e., Powers Drive to S.R. 436) and technology (i.e., bus rapid transit – BRT) to the following alternatives for further analysis:

- No Build Alternative (Existing Service)
- Build Alternative: Red 1
- Build Alternative: Red 2
- Build Alternative: Orange
- Build Alternative: Yellow
- Build Alternative: Purple

As was mentioned previously, the Orange, Yellow and Purple Build Alternatives assume a similar operating plan scenario as the Red 2 Build Alternative in combination with the downtown deviations illustrated in an earlier section (i.e., Figure 3.4).

4.0 Forecast Applications

This section of the report presents the results of the ridership forecasts for each of the alternatives described in the previous section. In this section, the initial discussion concerns key assumptions in the conduct of the forecasts including the logit model parameters and growth-related variables. The last section present results of the forecasts.

4.1 Key Assumptions

The parameters used in formulating generalized cost and logit utilities are consistent with FTA guidelines. No bias assumptions were used in estimating ridership (i.e., mode-specific constants) because proposed service changes under the definition of alternatives did not appear to offer the type of guideway-related improvements that are commonly associated with mobility benefits from unmeasured attributes[8] (e.g., screening elimination of BAT lanes). Future refinements of the forecasts should engage FTA early in the planning process to determine an appropriate assumption regarding modal bias. In-vehicle and out-of-vehicle weights were assumed as follows:

- In-Vehicle Time coefficient on minutes = -0.025
- Walk and wait time weight = 2.25 minutes of in-vehicle time
- Transfers = 2.25 of minutes of in-vehicle time

Given the near-term nature of the 2020 horizon year, highway and transit travel time assumptions are based exclusively on year 2010. Growth rates are based on zone-level person trip growth obtained from the CFRPM, twice interpolated for the base year 2013 and the forecast Year 2020. Mode share percentages for applying incremental logit formulae were obtained from the CFRPM Year 2010 forecast, wherein CFRPM stratifications were fitted to survey records based on model year, production and attraction geographies, trip purpose, mode and demographic characteristics.

As mentioned previously, the CFRPM essentially uses the identical inputs from the Metropolitan Orlando Urban Area Study Model (OUATS). As such, zone structure, projected 2030 population and employment forecasts, as well as trip generation rates that are consistent with MetroPlan's 2030 Long-Range Transportation Plan.

Forecasts in this report do not reflect potential interaction with SunRail largely because results pivot off ridership surveys before SunRail was operating and introducing an estimate of interaction with SunRail would require off-line methods to extract and adjust trips from CFRPM estimates of trip interaction inviting additional uncertainty by deviating beyond the proposed data-driven methods as a consequence. Although results are thought to be conservative in this regard, further refinement to the forecasts should incorporate the upcoming "after" survey effort for SunRail.

[8] FTA guidance A04 ASEs Modal Bias, October 2008

Results of the forecasts are prepared in terms of:

Corridor Transit Boardings

- The number of trips that board each bus route in the corridor. This measure indicates the degree to which buses associated with the project are used by travelers to make trips. In cases where riders transfer to make a complete journey, each boarding counts towards the total transit boarding statistic.

Linked Transit Trips

- Linked trips count the entire journey from origin to destination as one trip, regardless of how many transfers are made. As such, linked trips provide the best indication of projects increases system-wide market share because the measure is not affected by transfers.

- Linked trips reflect any trip used by one of the existing study area routes or alternative routes. This includes regional riders; not just those traveling in the corridor. While this definition is broadly reflective of the FTA definition for trips on the project, it assumes the FTA agrees to include riders for the corridor as whole. Regardless, using different definitions for which rider counts as a corridor passenger would perhaps foster a less meaningful comparison than using all corridor routes side-by-side.

4.2 Forecast Results

Tables 4.1 and 4.2 summarize average weekday boardings for the corridor for each forecast year respectively (i.e., 2013 and 2020). Tables 4.3 and 4.4 summarize boardings for each corridor route for the two forecast years respectively. Results show how transit ridership is expected to change as the corridor grows from the 2013 base year to the 2020 forecast year. This daily boarding measure also suggests how each alternative will change the number of boardings under the respective forecast year.

Tables 4.1 and 4.2 also delineate ridership in terms of transit dependency (i.e., non-dependent and dependent riders). This conveys the general nature of demand in the corridor. Weighted ridership is also computed to provide a measure similar to current FTA definitions for trips on the project. Specifically, the computation is two times the number of dependent riders plus non-dependent riders. This measure assumes the FTA agrees to include riders for the corridor as whole.

As shown in Table 4.1, unweighted ridership for Year 2013 is 11,810 per day and consists of 5,422 non-dependent riders and 4,795 dependent riders, roughly 60% and 40% respectively. Table 4.1 also shows how the set of alternatives would effectively change Year 2013 boardings. Without trip growth, changes largely reflect the service enhancements provided by the alternatives.

Results in Table 4.2 introduce growth in combination with service improvements. For example, Year 2013 boardings total 11,810 while the No Build boardings grow to 12,688 roughly 7% more than Year 2013. Although the No Build introduces both SunRail and two new LYMMO expansions, no off-model techniques were done to augment trip interaction with SunRail. As such, the 7% increase in trips between base year service and Year 2020 No Build service is largely reflects demographic and trip growth in the corridor.

In terms of each alternatives ability to attract dependency, weighted results for the Year 2013 assignments suggest the Red 1 Alternative attracts the most boardings (18,187 per day). This alternative also attracts the most boardings relative to all Year 2020 forecasts.

Table 4.1: Year 2013 Average Weekday Corridor Transit Boardings

Average Weekday Boarding Estimates	Year 2013 Existing	Year 2013 Alternatives				
		Red 1	Red 2	Orange	Yellow	Purple
Boardings by Non-Dependents	5,422	7,008	7,469	7,333	7,209	6,345
Boardings by Transit Dependents	4,795	5,589	5,323	4,888	4,886	5,557
Total Weekday Boardings	11,810	12,597	12,792	12,221	12,095	11,902
Weighted Dependents (Dependent Boardings x2)	9,590	11,179	10,647	9,776	9,773	11,114
Dependent-Weighted Boarding Total	15,012	18,187	18,115	17,109	16,981	17,459

Note: Transit dependents reflect boardings by riders living in Zero-Car Households

Table 4.2: Year 2020 Average Weekday Corridor Transit Boardings

Average Weekday Boarding Estimates	Year 2013 Existing	Year 2020 Alternatives					
		No Build	Red 1	Red 2	Orange	Yellow	Purple
Boardings by Non-Dependents	5,422	7,408	7,806	7,888	8,120	7,893	7,413
Boardings by Transit Dependents	4,795	5,280	5,851	5,741	5,233	5,359	5,872
Total Weekday Boardings	11,810	12,688	13,657	13,629	13,353	13,252	13,285
Weighted Dependents (Dependent Boardings x2)	9,590	10,560	11,701	11,482	10,466	10,717	11,744
Dependent-Weighted Boarding Total	15,012	17,968	19,507	19,370	18,586	18,611	19,157

Notes:
No Build Transit Alternative reflects the same service as exiting.
Transit dependents reflect boardings by riders living in Zero-Car Households

Table 4.3: Year 2013 Average Weekday Corridor Transit Boardings by Study Route

Existing Year 2013		Alternatives Year 2013									
Route	Boardings	Red 1 Routes	Boardings	Red 2 Routes	Boardings	Orange Routes	Boardings	Yellow Routes	Boardings	Purple Routes	Boardings
28	1,682	28/48/49	1,840	28	1,419	28	1,420	28	1,397	28	1,468
29	1,668	29/48/49	1,732	29	1,149	29	1,147	29	1,112	29	1,217
48	1,960	48/28/29	2,303	48	1,357	48	1,351	48	1,294	48	1,459
49	2,008	49/28/29	2,743	49	1,892	49	1,821	49	1,785	49	1,820
104	2,360	104	2,091	104/105	5,196	104/105	4,882	104/105	4,892	104/105	4,546
105	2,132	105	1,889	Red	1,780	Yellow	1,600	Yellow	1,615	Purple	1,392
Total	**11,810**	**Total**	**12,597**	**Total**	**12,792**	**Total**	**12,221**	**Total**	**12,095**	**Total**	**11,902**
Transfer Ratios			1.30		1.30		1.31		1.30		1.30
Change from Existing			*787*		*982*		*411*		*285*		*92*
% Change			*7%*		*8%*		*3%*		*2%*		*1%*

Table 4.4: Year 2020 Average Weekday Corridor Transit Boardings by Study Route

Existing Year 2013		Alternatives Year 2020											
Route	Boardings	No Build Routes	Boardings	Red 1 Routes	Boardings	Red 2	Boardings	Orange Routes	Boardings	Yellow Routes	Boardings	Purple Routes	Boardings
28	1,682	28	1,780	28/48/49	2,027	28	1,509	28	1,510	28	1,509	28	1,498
29	1,668	29	1,728	29/48/49	1,943	29	1,209	29	1,232	29	1,213	29	1,229
48	1,960	48	1,724	48/28/29	2,371	48	1,322	48	1,370	48	1,335	48	1,342
49	2,008	49	2,047	49/28/29	3,053	49	1,976	49	1,955	49	1,953	49	1,945
104	2,360	104	2,601	104	2,244	104/105	5,530	104/105	5,502	104/105	5,345	104/105	5,388
105	2,132	105	2,807	105	2,020	Red	2,082	Yellow	1,785	Yellow	1,897	Purple	1,883
Total	**11,810**	**Total**	**12,688**	**Total**	**13,657**	**Total**	**13,629**	**Total**	**13,353**	**Total**	**13,252**	**Total**	**13,285**
Transfer Ratios			1.34		1.30		1.30		1.31		1.30		1.30
Change from Existing			*878*		*1,847*		*1,819*		*1,543*		*1,442*		*1,475*
% Change			*7%*		*16%*		*15%*		*13%*		*12%*		*12%*
Change from No Build					*969*		*941*		*665*		*564*		*597*
% Change					*8%*		*8%*		*6%*		*5%*		*5%*

Note: No Build Transit Alternative reflects the same service as exiting.

Tables 4.5 and 4.6 summarize average weekday linked trips for the corridor under each of the forecast years, as well as the incremental change relative to the No Build Alternative. As noted previously, linked trips reflect any trip used by one of the existing study area routes or alternative routes. This includes regional riders; not just those traveling in the corridor. While this definition is broadly reflective of the FTA definition for trips on the project, it assumes the FTA agrees to include riders for the corridor as whole. Moreover, using different definitions for which rider counts as a corridor passenger would perhaps foster a less meaningful comparison than using all corridor routes side-by-side.

As shown in Table 4.5, Year 2010 linked trips for the No Build amount to 8,748 on a typical weekday. The weighted measure for transit dependency amounts to 12,247 trips. Measured incrementally relative to the No Build, percent changes range from a low 3% for the Purple Alternative to 8% and 9% for the Red 1 and red 2 Alternatives. The Red 2 Alternative would increase the No Build by 1,063 trips per day if running today. Note too that the incremental measure does not reflect dependency weighting.

Table 4.6 shows the change in linked trips in terms of combined growth and service changes. As shown, the No Build is forecasted to attract 9,494 total linked trips, of which 3,892 (41%) are characterized as transit dependent. Multiplying this dependency by 2 yields a weighted dependency value of 13,386 for No Build linked trips. It is interesting to note that the Red 1 Alternative is expected to attract the most riders in the Year 2020 in terms of linked trips, whereas the Red 2 Alternative attracted the most riders in the Year 2010 projection. Incrementally, the Red 1 Alternative would add just over 1,000 linked trips relative to the No Build.

Table 4.5: Year 2013 Average Weekday Corridor Linked Trips and Incremental Change

	Year 2013 Linked Trips					
	No Build	**Red 1**	**Red 2**	**Orange**	**Yellow**	**Purple**
Weekday Non-Dependent Linked Trips	5,249	5,481	5,788	5,647	5,581	4,937
Weekday Dependent Linked Trips	3,499	4,220	4,023	3,703	3,720	4,206
Total Weekday Linked Trips	8,748	9,700	9,811	9,350	9,301	9,143
Weighted Dependent Linked Trips (x2)	*6,999*	*8,439*	*8,045*	*7,405*	*7,441*	*8,412*
Weighted Corridor Linked Trips	*12,247*	*13,920*	*13,834*	*13,052*	*13,021*	*13,349*
Incremental Change in Total Weekday Trips		952	1,063	602	553	395
		8%	9%	5%	5%	3%

Table 4.6: Year 2020 Average Weekday Corridor Linked Trips and Incremental Change

	Year 2020 Linked Trips					
	No Build	**Red 1**	**Red 2**	**Orange**	**Yellow**	**Purple**
Weekday Non-Dependent Linked Trips	5,601	6,099	6,115	6,130	6,120	5,959
Weekday Dependent Linked Trips	3,892	4,417	4,338	4,087	4,080	4,141
Total Weekday Linked Trips	9,494	10,516	10,453	10,216	10,200	10,100
Weighted Dependent Linked Trips (x2)	*7,785*	*8,833*	*8,676*	*8,173*	*8,160*	*8,282*
Weighted Corridor Linked Trips	*13,386*	*14,933*	*14,791*	*14,303*	*14,280*	*14,241*
Incremental Change in Total Weekday Trips		1,049	891	388	375	497
		9%	7%	3%	3%	4%

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