UNIVERSITY DRIVE MOBILITY IMPROVEMENTS PLANNING STUDY

TIER 1 EVALUATION OF ALTERNATIVES – BICYCLE AND PEDESTRIAN ELEMENTS

12.20.13

Prepared for:

broward MPO
metropolitan planning organization

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1.0 INTRODUCTION

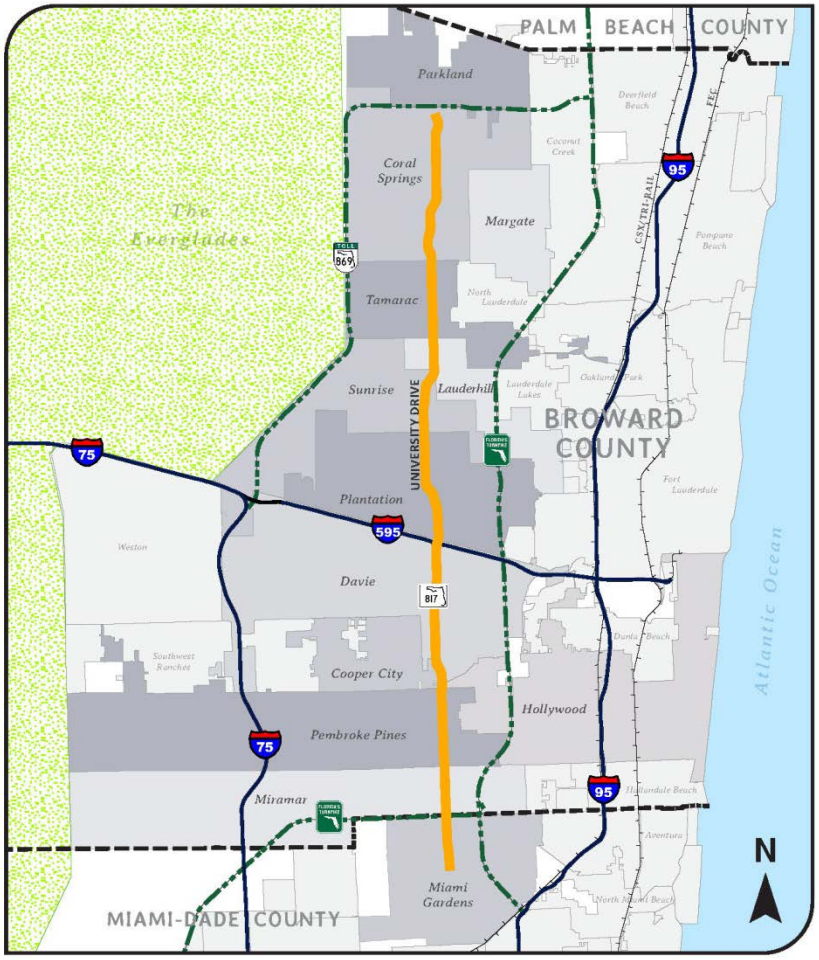
The purpose of this report is to document the methods and results of the Tier 1 evaluation process from the perspective of the pedestrian and bicycle strategies for the University Drive Mobility Improvements Planning Study. This Study is utilizing a multi-tiered screening process to identify the alternatives that perform best in relation to the established purpose and needs of the corridor as outlined in Problem Statement/Purpose and Need report (dated 11.15.13). This Tier 1 analysis is intended to be more qualitative than quantitative in nature, while the Tier 2 analysis will include much more detail.

1.1 Corridor Characteristics

The University Drive corridor was identified in the Broward MPO 2035 Long Range Transportation Plan as a premium transit corridor and the Broward County Transit (BCT) 2009 Comprehensive Operational Analysis (COA) as one of the critical north-south transportation corridors in the county. The purpose of the study is to identify and evaluate short- (approximately 5 years) and long-term (approximately 10 or more years) mobility, congestion management, livability and premium transit options for the study area. This study merges the transit planning and the congestion management/livability planning processes into one study. Likewise, this Study will optimize public involvement in developing multi-modal transportation solutions that complement the movement of people and goods and foster livability. As shown in **Figure 1**, the study area is located along University Drive, from Westview Drive in Broward County to just south of the Broward/Miami-Dade County line at NW 215th Street where Miami-Dade County is implementing a transit terminal.

University Drive is a 6-lane roadway within a context of new and aging suburban land uses. It is functionally classified as an "Urban- Other Principal Arterial" with a mixture of incomplete and inadequate bicycle and pedestrian accommodations. Walking and bicycling is uncomfortable

Figure 1 – University Drive Study Area



and perceived to be unsafe throughout the corridor. Over 200 pedestrians and bicyclists have been struck by vehicles over the past five years.

The major activity centers along the corridor are various medical centers and hospitals, and shopping malls. There are major destinations along the corridor, including Sun Life Stadium, Calder Race Course, North Perry Airport, Broward Community College, University of Phoenix, and Nova South Eastern University

University Drive provides transportation access for the existing land use of the corridor, which consists of strong commercial activity combined with service and industrial activities. Future transportation plans and land use activity illustrate higher congestion within the existing and committed transportation network as well as the future premium transit corridor.

Presently, BCT operates two bus routes along the corridor: Bus Routes 2 and 102 (the Breeze). Transit Route 2 is one of the best performing transit routes in Broward County. It has a ridership of approximately 7,100 passengers per day. Based on 2012-2013 origin-destination survey data and BCT collected automatic passenger from January to May 2012, boardings and alightings for Route 2 are relatively evenly distributed across the route, with increased activity at or near regional attractors (e.g., Broward Health Coral Springs at Sample Road, Coral Square Mall at Atlantic Boulevard, University Hospital at McNab Road, the various shopping and medical centers at Oakland Park Boulevard, Sunrise Boulevard, and Pines Boulevard, etc.). The busiest locations for boardings and alightings, however, are at BCT's West Regional Terminal, where transfers to other BCT routes are possible, and at NW 207th Avenue, where inter-county transfers are made. Route 102 (the Breeze express route) carries approximately 1,000 people per day.

2.0 ALTERNATIVES CONSIDERED IN TIER 1 SCREENING

To improve conditions for walking and bicycling along the University Drive corridor, a broad spectrum of alternatives were considered. Where the performance of a street facility for drivers is primarily determined by congestion and delay, the experience for pedestrians and bicyclists is affected by a much broader set of factors. Safety (both perceived and actual) is a real consideration for these vulnerable road users. Additionally, aesthetics and comfort, directness of travel, weather, and land use diversity all figure into the attractiveness of walking and bicycling. While some of these factors fall outside the scope of this project, there is significant opportunity to improve conditions for non-motorized travelers on University Drive.

2.1 Pedestrian and Bicycle Strategies

The alternatives analyzed in the Tier 1 screening are summarized in Table 1. Some of the elements are corridor-wide (e.g. sidewalks on both sides of the street) while others are targeted at spot locations, repeatedly along University Drive (e.g. narrow driveway openings). The following sections discuss each alternative in more detail.

Table 1 – Pedestrian and Bicycle Strategies Evaluated

Alternative	Tier 1 Screening Result
Construct missing sidewalks	Yes
Provide 5-foot minimum sidewalk width	Yes
Construct buffer between road and sidewalk	Yes
Plant tree buffer between road and sidewalk	Yes
Relocate transit stops closer to intersections	Yes
Add signalized mid-block pedestrian crossings	Yes
Construct multi-use paths	Yes
Construct separated bicycle facilities	Yes
Combine/share driveways	Yes
Narrow driveways	Yes
Modify traffic signal timing and phasing	Yes

Alternative	Tier 1 Screening Result
Paint all crosswalks with “zebra” markings	Yes
Reconstruct curb ramps	Yes
Remove channelized right turn lanes	Yes
Build improved channelized right turn lanes	Yes
Redesign or eliminate right turn lanes	Yes
Reduce curb radii at intersections	Yes
Install pedestrian-scale lighting	Yes
Build pedestrian tunnels	No
Build pedestrian overpasses	No
Prohibit pedestrian access	No

Construct missing sidewalks

Sidewalks provide the minimum level of accommodation for pedestrians, without which it is difficult or impossible for some to travel along the corridor. Since the overwhelming majority of transit passengers arrive at bus stops after walking some distance, sidewalks are also fundamental to transit service. Sidewalks are required on both sides of the street for the entire length of the corridor.

Along University Drive, approximately 5.3 linear miles of sidewalks are missing and would be constructed under this element.

Provide 5-foot minimum sidewalk width

The minimum required sidewalk width along FDOT roads is five feet, as required by the FDOT Plans Preparation Manual. This five-foot clearance must be provided after accounting for obstacles, such as utility poles, traffic signal controllers, and other fixed objects. Wider sidewalks should be provided in appropriate locations, such as business districts, near schools, transit stops, or where there are other significant pedestrian attractors.

Approximately 1.5 miles of sidewalk do not meet the five-foot minimum width requirement. Additionally, 16 objects are located within the sidewalk width that must be relocated. Alternatively, the sidewalk should be widened in those specific locations.

Construct buffer between road and sidewalk

Sidewalks located adjacent to higher speed, higher traffic volume roadways such as University Drive create uncomfortable environments. The FDOT Plans Preparation Manual requires a minimum setback of two feet, but additional buffer space is needed to create a place where pedestrians can feel safe and comfortable. Sidewalks along University Drive should be set back from the road 5 to 10 feet along the corridor.

Additional buffer space is needed along 18 linear miles of the corridor.

Plant tree buffer between road and sidewalk

A physical barrier between pedestrians and moving traffic offers protection and significantly improves the perception of safety for vulnerable road users. Trees planted adjacent to the roadway provide this protection and also calm traffic speeds. Trees should be planted along the corridor in locations where a multimodal environment and slower speeds are desired.

Between 400 and 600 additional trees should be planted in target segments along University Drive.

Relocate transit stops closer to intersection

Bus stops along University Drive should be located as close to intersections or other signalized pedestrian crossings as safely possible. Most passengers access transit by foot, which creates pedestrian demand between bus stops and area land uses. Moreover, a trip to access the bus in the morning becomes an egress trip in the afternoon, disembarking across University Drive from the access trip. Locating bus stops away from intersections creates out-of-direction travel, adding delay to the pedestrian journey and encouraging people to cross at unsignalized mid-block locations.

160 bus stops are located more than 150 feet from the nearest signalized crossing.

Add signalized mid-block pedestrian crossings

Signalized pedestrian crossings provide the safest opportunities for people to travel from one side of University Drive to the other. But in some segments of the corridor, signals are spaced up to ½-mile apart or more. Pedestrians desiring to access one mid-block location from another, therefore, are required to travel significant out-of-direction distances and incur considerable delay. Especially problematic are mid-block bus stops, in which a drop-off in the morning is usually accompanied by a pick-up in the evening directly across the street.

Mid-block pedestrian signals should be considered at up to 10 locations along the corridor.

Figure 2 – Sample Pedestrian Trip

A trip between Arrowhead Plaza in Davie and the residences across the street would require a pedestrian to walk almost ½-mile to cross at Nova Drive and add approximately 15 minutes of delay to that journey. A mid-block signal is needed.

Construct multi-use paths

In high-speed environments (greater than 35mph) it is undesirable to build bicycle facilities within the roadway without providing physical protection (e.g. curb or bollards). Due to the conditions for crossing University Drive, this evaluation considers constructing multi-use paths on both sides of the street; though in some locations it may be appropriate to install the path on one side or the other. Multi-use paths are typically 10 to 14 feet wide and are designed to accommodate both bicyclists and pedestrians traveling in both directions. Multi-use paths can be designed in place of or abutting existing sidewalks, and should delineate space for bicycles and pedestrians.

Approximately 10 miles of multi-use paths should be considered along University Drive.

Construct separated bicycle facilities

In high-speed environments (greater than 35mph) it is undesirable to build bicycle facilities within the roadway without providing physical protection. Separated bicycle facilities, such as cycle tracks, place some vertical separation between the cyclist and the nearest vehicle lane. The vertical separation, which can range from flex-post bollards to curbs to parked cars, is not meant to physically restrict a vehicle from encroaching on the bicycle facility. Rather it is a visual cue and low-level physical barrier protecting the cyclists' space. Cycle tracks should be five to seven feet wide, plus one to three feet for the buffer (depending on design). Consideration must be given to cycle track design around bus stops so passengers are given enough room to wait for the bus outside of the cycle track path.

Approximately 8 miles of cycle tracks should be considered along University Drive.

Combine/share driveways

Pedestrians and bicyclists are exposed to the greatest risk where vehicles cross their paths, such as intersections and driveways. Reducing the number of these conflicts minimizes the exposure of vulnerable road users. In many locations along the corridor, properties have more than one driveway access point onto University Drive. Combining/sharing those driveways will help organize traffic patterns and improve bicycle and pedestrian safety without reducing access.

Approximately 20 driveways are candidates for combining/sharing along University Drive.

Narrow driveways

Many driveways along University Drive feature wide openings and facilitate fast turning movements into and out of abutting properties. This design is unsafe both because it encourages high vehicle speeds, but also because it lengthens bicyclists' and pedestrians' exposure to conflict. Narrowing the width of these driveways creates shorter crossing distances and slower vehicle speeds which can reduce the number and severity of crashes with non-motorized travelers.

Up to 45 driveways should be redesigned to facilitate safer bicycle and pedestrian conditions.

Modify traffic signal timing and phasing

Traffic signal cycle timing along University Drive is designed to provide high levels of vehicle capacity while maintaining acceptable levels of delay for autos. Pedestrian accommodations are provided within that context. But this approach typically results in unacceptable conditions for pedestrians. Long cycle lengths (the amount of time required for all signal phases) increase average delay for pedestrians. Moreover, many

crossings have actuated pedestrian signals, which require pedestrians to push a button to receive a walk phase. Depending on when in the cycle this button is pushed, pedestrians may be required to wait more than a full cycle (up to 3 minutes in many parts of the corridor) before receiving a walk sign. Even then, many of the signals in the corridor do not provide adequate walk time for pedestrians to safely cross the street. Signals should be retimed to improve pedestrian conditions, including reducing cycle lengths, making the walk phase automatic, and providing adequate clearance time.

Signal timing should be evaluated for all traffic signals (60+) in the University Drive corridor.

Paint all crosswalks with "zebra" markings

Pedestrian crosswalks (signalized and unsignalized) should be painted to convey pedestrian priority both to drivers and walkers. A crosswalk does not designate right-of-way, rather it reinforces it. "Zebra" style crosswalks are the most visible type and should always be used to enhance pedestrian safety.

Nearly 500 crosswalks along University Drive are missing or should be replaced with high-visibility, "zebra" style markings.

Figure 3 - Zebra Style Pedestrian Crosswalk Markings
Zebra style pedestrian crosswalk markings are the most visible to drivers.

Reconstruct curb ramps

Curb ramps are required at all crosswalks according to the Americans with Disabilities Act (ADA) and the FDOT Plans Preparation Manual (PPM). Ramps should be designed in accordance with PPM guidelines and should direct pedestrians into the crosswalk. Ramps placed immediately at the corner direct pedestrians into the intersection and must be reconstructed. Moreover, ramps and landing areas should be clear of obstructions that may inhibit safe maneuverability by pedestrians in wheelchairs.

Approximately 29 curb ramps need to be constructed or reconstructed along University Drive.

Remove channelized right turn lanes

Channelized right-turn lanes provide vehicles with a free-flowing lane with which to make right turns. This creates a dangerous condition for pedestrians as drivers are traveling at a high speed, unimpeded, and often looking backwards for gaps in traffic. Although many channelized right-turn lanes feature pedestrian crosswalks, yielding compliance among drivers is very low. Where pedestrian crossings of channelized turn lanes are signalized, walk times are generally minimized to provide maximum green time for right turning vehicles. Many vehicle-pedestrian crashes occur while vehicles are making right turns; treatments to increase speeds of these movements should be avoided.

Approximately 30 channelized right-turn lanes are located in pedestrian activity areas along University Drive and should be removed.

Build improved channelized right-turn lanes

Where removing a channelized right-turn lane would have a profoundly unsatisfactory impact on vehicle operations at an intersection, the channelized turn lanes should be redesigned to enhance pedestrian safety. Reducing the turning radius will slow vehicle speeds. Moreover, providing a raised pedestrian crosswalk would enhance pedestrian visibility and further reduce vehicle speeds. A large refuge island should be provided for pedestrians waiting to cross the rest of the intersection.

Of the 30 channelized turn lanes reviewed for removal, any failing to be removed should be considered for redesign.

Redesign or eliminate right-turn lanes

Many intersections along University Drive feature lengthy right-turn lanes to store vehicle queues. These turn lanes widen the road as it approaches intersections, increasing the distance pedestrians must travel to cross University Drive. Moreover, bike lanes are situated to the left of right-turn lanes placing bicyclists between two lanes of traffic, which is uncomfortable even for experienced riders. Removing these lanes frees up additional right-of-way for further bicycle and pedestrian enhancements. Where lanes cannot be removed for traffic operations reasons, the entry tapers should be redesigned to encourage slower, more deliberate vehicle movements. Narrower entries to right-turn lanes slow vehicles down and reduce the conflict distance between vehicles moving into the right-turn lane and bicyclists traveling through the intersection.

Approximately 50 right-turn lanes along University Drive should be redesigned or eliminated.

Reduce curb radii at intersections

Intersection design must adequately meet the needs of motorists, transit riders, bicyclists, and pedestrians. Many intersections feature large turn radii (greater than 50 feet), which facilitates faster vehicle turning movements and increases crossing distance for pedestrians. Since turning movements are involved in most vehicle-pedestrian crashes, this creates an especially undesirable condition for pedestrian safety. Still, radii must be large enough to allow large vehicles to turn safely.

Approximately 116 curbs should be redesigned with smaller radii at intersections along University Drive.

Install pedestrian-scale lighting

Street lights along University Drive are designed to illuminate the entire width of the six-lane arterial. As such, the State installed tall lights with cobra-style arms to shed light across the greatest distance. This design focuses the greatest level of illumination over the street and results in poorly lit sidewalks. Moreover, the scale of the light poles conveys to the driver a high-speed environment. Installing pedestrian-scale lighting, especially at intersections and driveways, will create a safer, more comfortable environment for walking. It will also contribute to the "sense of place" desired by stakeholders along the corridor and will calm traffic.

Pedestrian-scale lighting should be installed at approximately 350 to 500 locations along the University Drive corridor.

Build pedestrian tunnels

Pedestrian tunnels provide a grade-separated option for travelers seeking to cross University Drive. By physically separating pedestrians, the risk of crashes is reduced or eliminated, and traffic operations are not disrupted. Tunnels are very expensive and require significant right-of-way to facilitate ADA requirements. Moreover, tunnels can pose safety risks for pedestrians as they create areas hidden from public view where illicit activity may occur.

Due to the reasons noted above, pedestrian tunnels are not recommended for further consideration.

Build pedestrian overpasses

Like tunnels, pedestrian overpasses physically separate pedestrians crossing University Drive from vehicles, reducing or eliminating the risk of crashes. To accommodate vehicles passing underneath, overpasses must be built with high clearance, which requires pedestrians to climb a significant distance to access the bridge. Bridge construction is also expensive.

Due to the reasons noted above, pedestrian overpasses are not recommended for further consideration.

Prohibit pedestrian access

In rare cases it may be appropriate to prohibit pedestrian access to an area. While this eliminates vehicle-pedestrian conflicts, it restricts access for anyone without a vehicle.

Due to this being in conflict with study goals and objectives to create a livable and walkable environment, prohibiting pedestrian access along the corridor is not recommended.

3.0 METHODOLOGY FOR TIER 1 SCREENING

3.1 Evaluation Criteria

As outlined in the Problem Statement/Purpose and Need report dated 11.15.13, the four needs of the corridor include:

- Improve North-South mobility for transit, bicycle, pedestrian and automobile users
- Improve safety for all users
- Improve livability and walkability in and adjacent to the University Drive corridor
- Invest in transportation solutions that are cost effective

Pedestrian and bicycle strategies support all four of the identified Needs, and are shown in Table 2. Evaluation measures were developed to determine how well each pedestrian and bicycle strategy meets the respective needs, goals, and objectives. These evaluation measures are used as the criteria to identify the most promising congestion management strategies for University Drive shown in Table 2.

Table 2 – Tier 1 Evaluation Measures for Pedestrian and Bicycle Strategies

Needs	Goals/Objectives	Tier 1 Evaluation Measure
Improve North-South mobility for transit, bicycle, pedestrian and automobile users	Increase non-motorized accessibility to transit	Number of stops where access is improved
Improve safety for all users	Increase the safety and accessibility of transit stops	Number of stops with improved safety
	Decrease potential of pedestrian and bicycle crashes	Potential for reducing the number of conflict points (high, medium, low)
Improve livability and walkability	Improve the pedestrian environment with buffers, landscaping, building form, etc.	Quality of pedestrian and bicycle environment
	Increase transportation choices	Using key destinations, how many modes provide reasonable access (high, medium, low)
Invest in transportation solutions that are cost-effective	Implement alternatives that have cost effective capital investments	Order of magnitude capital costs
	Implement transportation investments consistent with Regional and County goals	Consistent with Long Range Transportation Plan and Regional Transportation Plan

Each pedestrian and bicycle strategy listed in Table 1 was analyzed against the evaluation measures listed in Table 2 to identify strategies for further evaluation in Tier 2. Each strategy was rated against each evaluation measure to determine whether it should advance.

4.0 RESULTS OF TIER 1 SCREENING/RECOMMENDATIONS FOR TIER 2 ALTERNATIVES

Each pedestrian and bicycle strategy was rated against the evaluation measures outlined above. The results of the evaluation are summarized in Table 3.

Table 3 – Tier 1 Screening Results for Pedestrian and Bicycle Strategies

Strategies	Evaluation Measure							Advance to Tier 2 Evaluation?
	Non-Motorized Accessibility	Safety at Transit Stops	Reduce Conflict Points	Pedestrian/ Bicycle Environment	Transportation Choices	Cost-Effectiveness	Regional Plan Consistency	
Construct missing sidewalks	20	20	Medium	High	High	Medium	Yes	Yes
Provide 5-foot minimum sidewalk width	6	6	Low	High	High	Medium	Yes	Yes
Construct buffer between road and sidewalk	72	72	Low	Medium	Medium	High	Yes	Yes
Plant tree buffer between road and sidewalk	72	72	Low	High	High	High	Yes	Yes
Relocate transit stops closer to intersections	160	160	Low	Medium	Medium	Medium	Yes	Yes
Add signalized mid-block pedestrian crossings	10	10	Medium	Medium	Medium	Medium	Yes	Yes
Construct multi-use paths	40	40	Low	High	High	Medium	Yes	Yes
Construct separated bicycle facilities	32	32	Medium	High	High	Medium	Yes	Yes
Combine/share driveways	20	20	High	Medium	Medium	High	Yes	Yes
Narrow driveways	45	45	High	Medium	Medium	High	Yes	Yes
Modify traffic signal timing and phasing	16	16	Low	Medium	Medium	High	Yes	Yes
Paint all crosswalks with “zebra” markings	50	50	Medium	Medium	Medium	High	Yes	Yes
Reconstruct curb ramps	20	20	Low	Medium	Medium	Medium	Yes	Yes
Remove channelized right turn lanes	30	30	High	High	Medium	Medium	Yes	Yes
Build improved channelized right turn lanes	30	30	Medium	Medium	Medium	Medium	Yes	Yes
Redesign or eliminate right turn lanes	50	50	Medium	Medium	Medium	High	Yes	Yes
Reduce curb radii at intersections	110	110	High	High	Medium	High	Yes	Yes
Install pedestrian-scale lighting	100	100	Low	High	Medium	Medium	Yes	Yes
Build pedestrian tunnels	8	8	High	Low	Low	Low	No	No
Build pedestrian overpasses	8	8	High	Low	Low	Low	No	No
Prohibit pedestrian access	0	0	High	Low	Low	High	No	No

5.0 CONCLUSION

To improve conditions for walking and bicycling along the University Drive corridor, a variety of potential pedestrian and bicycle strategies were considered. Based on the potential performance of these different strategies against the identified purpose and needs for the corridor, 18 strategies are recommended to be advanced to Tier 2 for more detailed analysis:

1. Construct missing sidewalks
2. Provide 5-foot minimum sidewalk width
3. Construct buffer between road and sidewalk
4. Plant tree buffer between road and sidewalk
5. Relocate transit stops closer to intersections
6. Add signalized mid-block pedestrian crossings
7. Construct multi-use paths
8. Construct separated bicycle facilities
9. Combine/share driveways
10. Narrow driveways
11. Modify traffic signal timing and phasing
12. Paint all crosswalks with “zebra” markings
13. Reconstruct curb ramps
14. Remove channelized right turn lanes
15. Build improved channelized right turn lanes
16. Redesign or eliminate right turn lanes
17. Reduce curb radii at intersections
18. Install pedestrian-scale lighting