

Congestion Management/ Crash Mitigation Process

A Feasibility Study on Implementing HOV, Reversible Lanes and Time-of-Day Parking Strategies



Arterial Roadway HOV Lanes



Arterial Roadway Reversible Lanes



Arterial Roadway Time-of-Day Parking



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Executive Summary for Phase I
September 2012

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Reversible Lanes and Time-of-Day Parking Strategies

Final Report

prepared for

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September 2012

Introduction to Study

The Hillsborough County MPO adopted its *2035 Long Range Transportation Plan* in December 2009 which includes all of the multimodal projects that are necessary to meet projected needs to year 2035. The Plan provides estimated costs for these projects, and illustrates that the anticipated funding revenues will not keep pace with the projected transportation needs. Congestion will be a fact of life in Hillsborough County for many years to come. The Hillsborough County MPO is the transportation planning agency responsible for teaming with partner agencies such as the Florida Department of Transportation, Hillsborough County and the local municipalities to identify solutions to assist our community with addressing congestion and planning for future transportation needs.

Faced with the challenge of looking at all possible solutions to congestion management, the Hillsborough County MPO is interested in identifying communities that have successfully implemented management and operations concepts on arterial roadways to optimize the use of existing infrastructure.

The Hillsborough County MPO has reached out to Departments of Transportation and county and city transportation departments across the country to collect information on successful implementation of three arterial operational strategies:

- Time-of-day parking restrictions,
- Reversible lane applications, and
- High occupancy vehicle (HOV) lane restrictions.

Phase I of this study was to investigate applications of these strategies in other metropolitan areas and to summarize the major lessons learned. This Executive Summary highlights the major findings of phone interviews with nine (9) agencies across the U.S.

Phase II of this study will include identifying specific Hillsborough County arterial corridors that may be candidates for the three strategies mentioned above and examining the physical attributes of the corridors for the feasibility of application of these strategies.

Time-of-Day Parking Restrictions

Time-of-day parking restrictions allow for on-street parking during off-peak traffic conditions, but prohibit parking during peak periods when all lanes are needed to handle traffic demands. Allowing parking during off-peak periods is often seen as a benefit for adjacent businesses and residents.

Three case studies of time-of-day parking restrictions were examined:

- 16th Street, 2900 to 3300 block, Washington, D.C.
- North Miami Avenue, 20th Street to 56th Street, Miami, Florida
- Main Street, 15th Street East to 25th Street East, Richmond, Virginia.

The successes and challenges are summarized for each of these case studies below.

✓ Washington, D.C. - 16th Street Time-of-Day Parking

Discussions with the District of Columbia Department of Transportation staff regarding the implementation of time-of-day parking on 16th Street indicated a very positive result, with high turnover of parking spaces which provides customers opportunities to find parking throughout the day, parking spaces were not left empty confirming there was



16th Street, Washington, DC

parking demand, and a good experience with the convenience of cell phone payment options. The agency noted the importance of a good signing program that clearly displays the restricted hours and fines and a need for strong enforcement, at least until the public becomes familiar with the restrictions. The agency also noted the importance of accommodating delivery vehicles immediately before and after restricted periods by allowing deliveries early in the morning. Support of the local business community has been very positive, as the ability to park during off-peak periods has been a convenience for customers.

✓ Miami, FL – North Miami Avenue, 20th Street to 56th Street

Discussions with Miami-Dade County staff identified a real success story with the application of peak-period parking restrictions. With approximately 30,000 vehicles per day, staff noted that directional peaking in this corridor is very high, with a 75% to

25% directional split in the peak periods. As a result, parking needed to be restricted during peak periods, but could be allowed in off-peak times.

Although there was some initial confusion, after a period of a few weeks, the restrictions were commonly accepted. On-street parking during off-peak periods has been instrumental to improving customer access as many stores had limited provisions for parking.



North Miami Avenue, Miami, FL

✓ **Richmond, VA - Main Street, 15th Street East to 25th Street East**

Discussions with staff from the City of Richmond indicated an overwhelming success. Allowance of off-peak parking has been credited by the community as a critical boost to downtown revitalization of Richmond. It also has reduced the impact of parking on adjacent residential streets for business purposes.



Main Street, Richmond, VA

✓ **Time-of-Day Parking General Conclusions**

All three case studies noted the importance of a strong enforcement program, complimented by, a good signage program indicating times and enforcement is critical, particularly during the initial stages of implementation. Further, the decision to require payment for parking is a separate discussion from simply allowing parking to occur, and it needs to be presented and accepted by the local community. Implementing the most current technology such as cell phone use for payment technology is highly recommended to ensure ease of use and timely payment options.

Reversible Lanes Strategies on Non-Limited Access Roadways

Reversible Lane strategies have been implemented when there is high-directional peaking and minor flow underutilized lanes can be converted to assist in the peak directional flow. Safety concerns and driver expectations need to be carefully evaluated. Hillsborough County has experienced the use of reversible lane technology dating back to the early 1970s. At that time the directional split in traffic volumes on the Howard Frankland Bridge/Interstate 275 was severe enough that overhead illuminated lane usage signs were used to provide for assignment of lanes. More recently, the Selmon Expressway was converted to an elevated reversible lane facility between Tampa and Brandon.

Three reversible lanes applications were reviewed for this study:

- Connecticut Avenue in Washington, D.C.
- Tyvola Road, Charlotte, NC
- 7th Street and 7th Avenue, Phoenix, AZ

The successes and challenges are summarized for each of these case studies below.

✓ Washington, D.C. – Connecticut Avenue

The District of Columbia Department of Transportation (DCDOT) converted a portion of Connecticut Avenue to a reversible lane facility many years ago due to the highly-directional traffic flows that existed in this corridor. Because of high-density and lack of building setbacks, a traditional widening project was an impractical solution. The reversible-lane strategy was selected as the most feasible option to handling congestion.



Connecticut Avenue, Washington, DC

DCDOT staff reported that the reversible-lane project has been highly-effective at improving peak-period traffic flow, with very modest cost of only a few million dollars where the right of way and construction cost of a traditional widening could easily reach \$50 million in this corridor. Disadvantages for this particular corridor were also noted: 1) the emphasis on moving traffic efficiently has created a perception of less concern about pedestrians and the safety of the local residents; 2) because all lanes

are used and there are no medians, left turns can be problematic – in some areas left turns are prohibited, sometimes giving rise to neighborhood traffic impacts due to cut-through traffic. In an ITE Journal Report, “*Reversible Lane Operation for Arterial Roadways: the Washington DC, USA Experience*,” May 2011, an analysis of this corridor noted a higher incidence of crashes, particularly head-on and sideswipe crashes, than comparable facilities. These concerns can be addressed with well-designed pedestrian crosswalks and signals and clearer marking of the lanes when the reversible direction is being deployed.

✓ **Charlotte, N.C. – Tyvola Road**

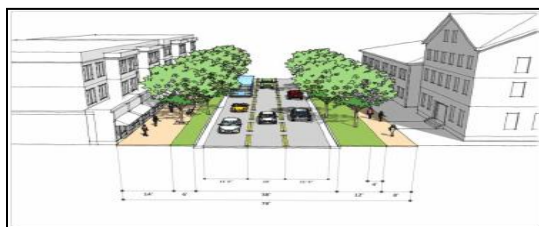
The City of Charlotte implemented a reversible lane system to accommodate the heavy-directional traffic demand associated with a sports arena. Due to the infrequent use of the lanes and the use of the overhead changeable message signs only during sporting events,



Tyvola Road, Charlotte, NC

the system was staffed with up to 20 police officers that would place cones and direct traffic to ensure smooth operations. City staff noted that even though this system required a significant increase in manpower, it was highly-effective at moving peak direction flows of traffic during special events, without the tremendous right-of-way that would have been necessary to offer a symmetric facility with the same peak direction capacity.

Reversible lanes were implemented in other sections of the City of Charlotte. Parkwood Avenue was discontinued due to high speeds and high crash statistics. That system has been replaced with a median divider. The City does, however, continue to operate a successful reversible lane system on Seventh Street.



Seventh Street, Charlotte, NC Schematic



Seventh Street, Charlotte, NC

✓ Phoenix, AZ – 7th Street and 7th Avenue

The City of Phoenix converted 7th Street and 7th Avenue to reversible lane facilities many years ago to serve the directional traffic flows that exist each morning and afternoon for these parallel facilities. Due to the mature nature of the land use and lack of building set-backs in many of the blocks, traditional widening projects would



7th Avenue, Phoenix, AZ

have been impractical. The system has been highly effective at moving peak traffic flows, with a very modest cost and ease of implementation.

Over the years, opposition had been growing from local residents and businesses for several reasons: 1) reversible lanes reduced access to businesses; 2) safety issues were evident related to left turns into businesses, particularly at midblock locations; and 3) neighborhood cut-through traffic was high due to prohibited left turns at some intersections. The City has conducted a study with the community to identify the pros and cons of keeping the system. Due to a significant increase in congestion (at least 30 minutes) if removed, the City and residents opted to keep the reversible lanes. The City found no significant difference in crash rates for the reversible road projects when compared to other facilities.

✓ Reversible Lanes Strategies General Conclusions

Reversible lane strategies can be very effective and a low cost way to achieve increased capacity on roadways with highly-directional traffic. Reversible lanes can be implemented quickly with little or no construction or right-of-way requirements. Good signage is important so drivers can understand the system, yet overhead electronic signals can be expensive and difficult to maintain. As in the case of Phoenix, reversible lane systems can generate neighborhood concerns related to emphasis on speed at the sacrifice of pedestrian and neighborhood businesses and amenities. They can also contribute to neighborhood traffic issues in areas where left turns are restricted from the primary facility. This can manifest itself in drivers utilizing neighborhood streets to circumvent the disallowed left turn. Some citizens will also find it inconvenient that they cannot make a left turn from the designated side streets. A study to show the benefits of improved congestion with a full-vetting of community issues is recommended prior to implementing this concept.

High Occupancy Vehicle (HOV) Lanes on Non-Limited Access Roadways

High Occupancy Vehicle (HOV) Lanes are reserved for carpools, vanpools, buses and motorcycles to provide priority to people traveling by these modes. HOV restrictions are generally applied during designated time periods of travel, such as during morning and afternoon commuting periods, though some HOV facilities restrict travel throughout the day. Presently, there are approximately 100 instances where HOV lanes are in use nationwide. Many of these HOV lanes are located on interstate facilities within urban areas. Others are located along arterial streets carrying high volumes of commuting automobile and transit vehicle traffic. It is this use of arterial HOV lanes that is being examined for applicability to corridors in Hillsborough County.

The arterial corridors that were selected as case study for this project are:

- Washington Street, Patrick /Henry Streets (NB/SB one-way pair), Alexandria, VA
- Santa Fe Drive (U.S. 85), Denver, Englewood and Littleton, CO
- Downtown Dual “Diamond Lane” Network, Houston, TX

The successes and challenges are summarized for each of these case studies below.

✓ Alexandria, VA - Washington, St and Patrick/Henry Streets

The City of Alexandria implemented two arterial HOV corridors to facilitate commuting between Fairfax County and Washington D.C. Several regional roadways bring commuting traffic into Alexandria from the south. North of the City, U.S. 1 and the George Washington Memorial Parkway are the only two routes



NB Washington St, Alexandria, VA

connecting Alexandria to Washington. Within Alexandria, U.S. 1 operates as a multi-lane, one-way pair (Patrick Street in the northbound direction and Henry Street in the southbound direction); the George Washington Memorial Parkway becomes Washington Street, a two-way multilane urban street. As direct connections between the commuter routes north and south of the city, these streets were converted to peak hour arterial HOV operations to provide continuity of traffic flow during major commuting hours while providing on-street parking during the remainder of the day. Multi-agency

coordination was a critical component of this project and rather complicated due to the involvement of the City of Alexandria, the Virginia DOT, and the National Park Service. Because the arterial HOV lane operates in the right lane, the HOV lane must also accommodate right turning vehicles. Left turns opposing the HOV lane are prohibited in some locations for safety considerations. Although successful in the specific corridor, regional continuity is not improved as there are no HOV lanes on these routes outside of Alexandria, limiting their overall effectiveness.

✓ **Denver, CO – Santa Fe Drive (U.S. 85)**

Santa Fe Drive is a multilane commuter route located south of Denver. In the 1980s, the Colorado DOT implemented arterial HOV treatments to facilitate the flow of commuting traffic to and from communities south of Denver. The Santa Fe Drive Arterial HOV facility is about 7.5 miles long northbound and 5.7 miles long southbound and travels through three municipalities.

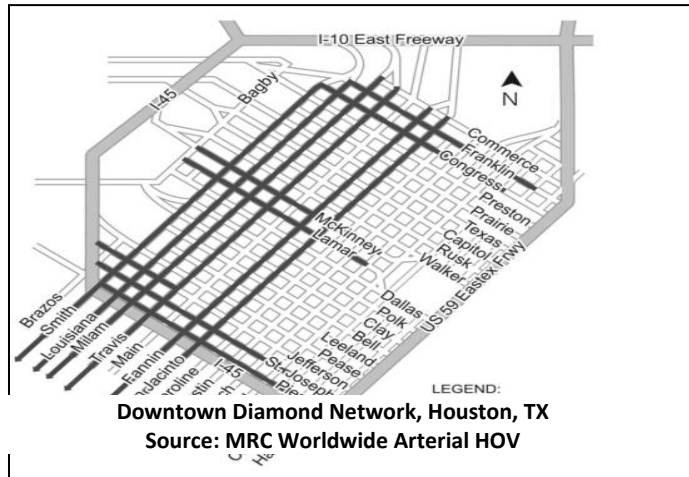


Santa Fe Drive, Denver, CO

Staff indicates maintenance is problematic since the HOV restricted lanes are on the left side of the arterial and the associated HOV signs and lighting are located on the median barrier. The location of the HOV signs and lighting, the use of the HOV lanes by all traffic outside the restricted hours, and the narrow left roadway shoulder make it difficult to perform maintenance operations without blocking the left lane. Enforcement is uneven along the HOV facility since it crosses through three communities with different levels of commitment to the HOV operation. Traffic turning left at signalized intersections has to cross HOV lanes to enter the left turn lane. Lack of state standards for the facility has led to the absence of clearly marked crossing areas, increasing enforcement difficulties and leading to apathetic enforcement. Staff urged that future arterial HOV lanes include the following: 1) consider carefully which side of the road should be used for an HOV lane to facilitate operational and maintenance needs; 2) include appropriate pavement marking and signing standards; and 3) adopt and implement regulatory and design standards as part of the process.

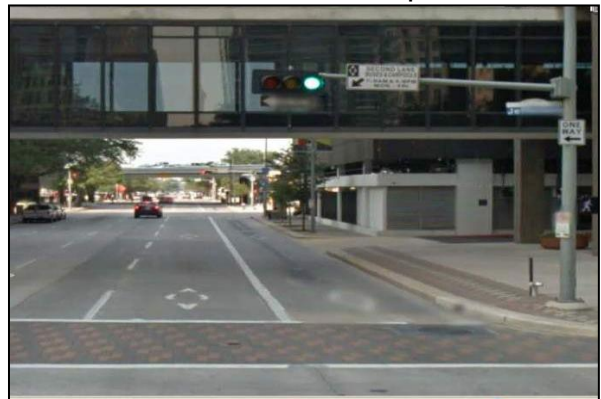
✓ Houston, TX - Downtown Dual “Diamond Lane” Network

The central business district of Houston has a gridded network of multilane one-way roadway pairs. The total length of the system is over 20 miles, covering over 320 city blocks on three north-south one-way pairs and three east-west one-way pairs. Metro, Houston’s Transit Agency, operates and maintains the arterial and freeway HOV facilities. METRO distinguishes between HOV lanes (barrier separated lanes) and “Diamond Lanes” (non-barrier separated lanes). Since they are not barrier separated lanes, the Arterial HOV lanes are classified as “Diamond Lanes”.



METRO operates two types of Diamond Lanes on the downtown arterials. The curb lane is marked with a solid diamond is designated for use by transit vehicles only, while the adjacent second lane is a time restricted HOV lane marked with a Dashed Diamond.

In the 1980s, the City of Houston, Texas DOT and METRO implemented the bus-only lanes in the curb lane on major one-way street pairs and HOV lanes for cars and buses in the next adjacent lane during restricted time periods. The agencies noticed that the frequent bus service bringing commuters downtown caused curb lane pavement to deteriorate more quickly than the other lanes. The diamond lanes were improved as part of a major downtown infrastructure project.



Houston, TX Typical HOV Signing and Markings

The project was complex, involving multiple facilities: HOV lanes, storm sewers, sidewalk widening, water lines, sanitary sewers, and traffic signal optimization. To minimize maintenance down time and enhance the congestion relief provided by the bus service, a more durable pavement section was constructed in the curb “Bus Only” diamond lanes. The curb lane was designed for constant bus traffic. It has a 9-inch reinforced concrete section. Repair

work on the curb lane requires full replacement of the pavement section rather than partial replacement or patching overlays.

✓ **High Occupancy Vehicle (HOV) Lanes General Conclusions**

Arterial HOV lanes are adaptable under a number of circumstances, and can be effective for moving traffic. It can be difficult to enforce the use of arterial HOV lanes without compromising their effectiveness. Stopping violators adjacent to or within the HOV lane reduces or eliminates its effectiveness in managing congestion. Enforcement is often flexible, with warnings issued instead of citations and latitude given to drivers using the HOV lane to position themselves to turn at a downstream intersection. Design maintenance, and enforcement concerns must be identified and addressed with all participating agencies before the treatment is implemented. Effective signage and pavement markings are critical.

Overall, the HOV lanes are considered a success in meeting the different goals of the agencies in each location, providing context appropriate congestion relief during peak travel periods, encouraging carpooling, and improving transit access and operations.