Congestion Management

Introduction

Aside from the inconvenience of added delay, traffic congestion can have many negative impacts on a community.

As levels of service worsen, congestion causes traffic to divert onto nearby neighborhood roads, which are not designed to handle large volumes of traffic. Excessive speeds and high traffic volumes on local streets degrade the safety of the street network and create conflicts between "cut-through" traffic and local residents. Roadways that function over capacity generally lead to a hazardous environment for drivers and pedestrians.

Congestion can also hinder economic growth. The proximity of an area to a safe and efficient roadway network is crucial for local companies considering an expansion of their business and the attraction of new industries to the region. Congestion slows the movement of goods and services, which hinders economic development and productivity.

Additionally, congestion is often associated with the deteriorating vitality of an area. Many people who move into the suburbs do so in order to escape the congestion of an urban region. As the congestion moves into the suburbs, it brings with it a declining quality of life. The excessive pollution created by stop-and-go traffic is detrimental to air quality and increases noise levels.

Congestion has a negative impact on highway safety, noise, and air quality, but there are numerous strategies (i.e. Congestion Management, Access Management, Intelligent Transportation Systems (ITS), and Signal Systems) available to assist a community in reducing congestion and its effects.

General Solutions for Relieving Congestion

Depending on the causes of congestion, there are numerous strategies available to mitigate it and its effects.

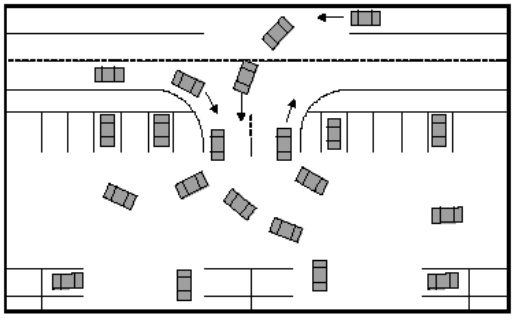
Traffic Signal Coordination

Coordination involves synchronizing traffic signals on a corridor to minimize through traffic delay. Signal coordination can be accomplished either using time-based signal plans or by interconnecting the signals in a system. Coordination can improve

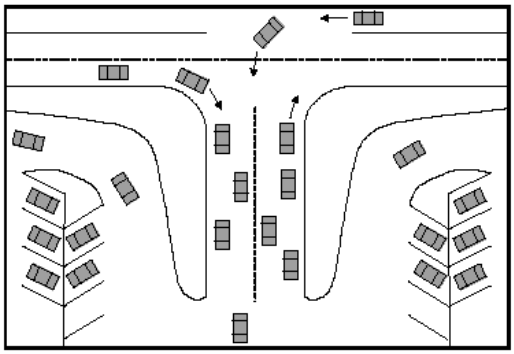
both the operations and safety of a corridor. (Approximate cost: $4,000,000-4,700,000 per 100 signals in system – see TIP)

On-Site Traffic Circulation

One way to reduce traffic congestion is to promote on-site traffic circulation. Pushing back the throat of an entrance, as shown in the figures to the right, helps to avoid spillback onto the arterial. This measure improves both the safety and efficiency of the roadway. Another aspect of on-site traffic circulation involves limiting access points into a development by considering developments with multiple lots and land uses as one property for the purposes of access regulation. Only the minimum number of connections necessary to provide reasonable access should be permitted. For those situations where outparcels are under separate ownership, easements for shared access can be used to reduce the number of necessary connections. Reducing the number of access points also decreases the number of conflict points, making the arterial safer and more efficient. (Approximate cost: $150,000 per application.)



Before



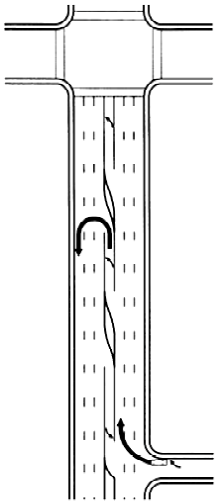
After

Nontraversable Median Treatment

One of the recurring suggestions for improving city roads expressed by the public and the Transportation Plan Oversight Committee was the need for medians. A nontraversable median treatment is a raised or depressed barrier that physically separates opposing traffic flows. Advantages include increased safety due to separation of opposing flows, pedestrian refuge, and restricting left turns to designated locations. Where sufficient storage bays are provided, the removal of left-turning vehicles from through lanes can increase safety and reduce delay to through vehicles. Disadvantages include slowed response time for emergency vehicles, increased travel distance for left turns, and public opposition due to the possibility of detrimental affects on the business community. Nontraversable median treatments should be considered for multilane urban arterials with average daily traffic (ADT) volumes greater than 20,000 and all multilane roadways with high pedestrian volumes, high collision rates, or where aesthetics are a priority. Consideration should be given to providing sufficient space for u-turning vehicles at median openings when nontraversable median treatments are employed. Divided roadway facilities are generally safer than undivided facilities or roadways with a two-way left turn lane (TLWTL). (Approximate cost: $600,000 per mile)

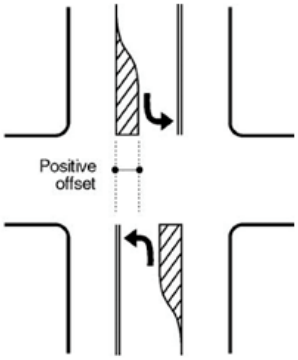
A nontraversable median

Median U-Turn Treatment



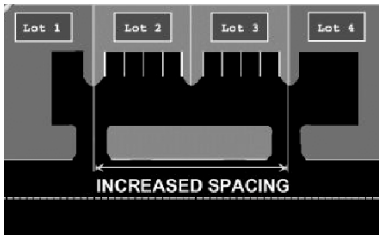
Median u-turn treatments involve the prohibition of minor street direct left turns at signalized intersections in favor of right turns followed by median u-turns, as shown in the adjacent figure. Advantages of this treatment include reduced delay, improved progression, and fewer stops for through traffic as well as fewer and more separated conflict points for vehicles and pedestrians along the arterial. Disadvantages include increased delay, travel distances, and stops for left-turning traffic as well as the potential for driver confusion. These treatments can increase both the safety and efficiency of arterials with high through volumes. However, they should only be used where sufficient space is available for u-turning maneuvers at median openings. Installing median u-turn treatments at multiple locations along a corridor can help to alleviate driver confusion. Much consideration should be given to locations of median openings in order to provide adequate weaving space without creating excessive travel distances for left-turning vehicles. (Approximate cost: $50,000 per median opening.)

Advanced Left Turn Treatment



Traditional exclusive left turn lanes at signalized intersections are generally aligned to the left of one another. Thus, the vision of a left-turning vehicle is obstructed by vehicles in the opposing left turn lane. Advanced left turn treatment, also known as positive offset left turn treatment, involves shifting exclusive left turn lanes toward the center of the intersection and past the opposing left turn lane to provide better sight lines. Where permissive left turn phasing is used, this treatment can improve the efficiency of an intersection by reducing the crossing time for left-turning vehicles and allowing them to see and take advantage of all adequate gaps in the opposing traffic stream. The disadvantage of this treatment is that, where existing median widths are not sufficient, the roadway may need to be widened and additional right-of way may need to be acquired. (Approximate cost: $250,000 per mile.)

Consolidated Driveways



Consolidating adjacent driveways using shared access easements can increase safety and efficiency of corridors by reducing the number of access points and thus conflict points. Additionally, trips between adjacent land uses are then possible without making use of the arterial.

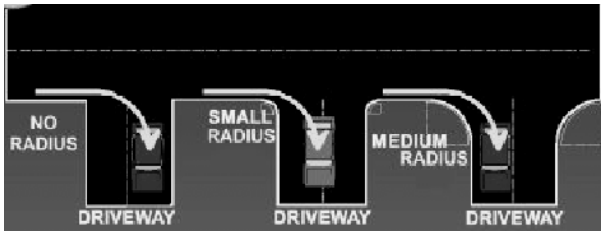
Relocated Driveways

Driveways that are located too close to an intersection can cause operational, safety, and capacity problems resulting from traffic backing up across the driveway entrance or into the intersection from the driveway. Additionally, the distance between the driveway and the intersection may not provide a sufficient

weaving distance. Relocating driveways that are too close to intersections can improve both safety and efficiency of the intersection by separating conflict points and lengthening weaving distances.

Improved Intersection Turning Radii at Intersection/Driveways

Driveways with short turning radii force vehicles to encroach on adjacent lanes when entering or exiting the driveway. Intersections with short radii also force vehicles onto the roadside causing potential damage to curb and gutter and sidewalks. Long turning radii allow drivers to make turning maneuvers more easily, which enhances the operations and safety of the roadway.



Signalize Retail Driveway Leg at Existing Signalized T-Intersection

For high volume retail driveways, a signal head may improve operations and safety of the minor street turning maneuvers. There may be some increase in delay to major street through traffic as well as an increase in rear-end collisions. However, it is likely that a signal would greatly reduce minor street delay as well as angle collisions. (Approximate Cost: $10,000)

Left Turn Storage Bays at Major Driveways

Left turn storage bays can be used at high volume retail driveways in order to remove left-turning vehicles from the through lanes. Adequate storage bays enhance the safety of a corridor and decrease delay to through vehicles. Additional right-of-way and roadway widening may be needed in order to provide storage bays.

Exclusive Left Turn Lane on Minor Approach

At signalized intersections where left turns from a minor approach are significant, an exclusive left turn lane can promote optimal signal phasing.

Emergency Vehicle Preemption

Emergency vehicle preemption involves changing the indication at traffic signals to favor the direction of detected emergency vehicles. Preemption improves emergency vehicle response time and the safety of the responders by stopping conflicting movements. (Approximate Cost: $10,000 per application)

Types of Corridors and Potential Solutions

Some congestion management strategies are better suited to one corridor type than another. Listed below are three popular cross-

sections and the potential congestion management strategies that fit them best.

Five-Lane with Two-Way Left Turn Lane (Example: Ash Street at Berkeley Boulevard)

- On-Site Traffic Circulation
- Nontraversable Median Treatment
- Median U-Turn Treatment
- Advanced Left Turn Treatment
- Consolidated Driveways
- Relocated Driveways
- Improved Intersection Turning Radii at Intersections/Driveways
- Signalize Retail Driveway Leg at Existing Signalized
- T-Intersection
- Added Exclusive Left Turn Lane on Minor Approach
- Emergency Vehicle Preemption

Four-Lane Divided with Landscaped Median (Example: Existing US 70 Bypass, US 13, and US 117)

- On-Site Traffic Circulation
- Median U-Turn Treatment
- Advanced Left Turn Treatment
- Consolidated Driveways
- Relocated Driveways
- Improved Intersection Turning Radii at Intersections/Driveways
- Signalize Retail Driveway Leg at Existing Signalized T-Intersection
- Left Turn Storage Bays at Major Driveways
- Added Exclusive Left Turn Lane on Minor Approach
- Emergency Vehicle Preemption

Four-Lane Undivided (Example: Ash Street)

- On-Site Traffic Circulation
- Nontraversable Median Treatment
- Median U-Turn Treatment
- Prohibited left turns
- Consolidated Driveways
- Relocated Driveways

- Improved Intersection Turning Radii at Intersections/Driveways
- Signalize Retail Driveway Leg at Existing Signalized T-Intersection
- Left Turn Storage Bays at Major Driveways
- Added Exclusive Left Turn Lane on Minor Approach
- Emergency Vehicle Preemption

Goldsboro Congestion Management Stratagies

Goldsboro currently does not have wide-spread, debilitating congestion problems. However, localized traffic congestion can cause considerable loss of time, driver irritation, and safety concerns. It is important that the problem spots along highways be addressed so that future growth does not have a negative impact on the system. With the proper steps taken now, Goldsboro will encourage future growth, accommodate the increase in traffic, and collectively provide a better overall transportation system.

Eastern Regional ITS Deployment Plan

Evaluate the Signal System — Currently, Goldsboro does not have a coordinated signal system. Uncoordinated signals often cause drivers to experience multiple stops at signals along a particular corridor which, ultimately, leads to loss travel time and driver irritation. Signal systems are used to aid in the progression of traffic, reducing delay, fuel consumption, and improving the air quality. HNTB prepared the **Signal System Feasibility Study** for the City of Goldsboro in 1997. The study recommended that a System C, closed loop system be installed at a cost of $3,478,000. The study was well received and a coordinated signal system was placed as a high priority in the 1999 LRTP.

Recommendation — The need for a System C, Closed Loop System should be revisited to ensure its application is still valid.

The **Eastern Regional ITS Deployment Plan**, completed in 1999, by Kimley-Horn and Associates, recommended that the Eastern Region of North Carolina focus on implementing ITS strategies to aid in hurricane evacuation and the distribution of travel and tourist information. A signal system is a vital part in this process and would give the City of Goldsboro the ability to expand its resources with strategies such as closed circuit television (CCTV) camera installation, website with travel information, dynamic message sign (DMS) coordination, real-time radio information updates, etc.

Signal System Feasibility Study

As Goldsboro grows in population and traffic, additional signals will be added to the transportation network. The City of Goldsboro currently maintains approximately 106 traffic signals.

Recommendation — Because of the number of traffic signals, it is now recommended that a centrally distributed system be implemented for this network. The centrally distributed system will be able to accommodate future growth and expansion in the Goldsboro signal network.

Recommendation — It is also recommended that a transportation management center (TMC) be established to set up, house, and operate the centrally distributed system. The total estimated capital cost for the signal system and TMC is estimated to be between $7,500,000 to $8,500,000, however, if total funding cannot be found it is suggested that the project be implemented in phases with the higher priority corridors, such as Ash Street and Berkeley Boulevard employed first. To implement the signal system and TMC would require the following elements:

Example of TMC from Greensboro, NC

- Fiber optic high performance communications network,
- Development and implementation of comprehensive signal timing plans,
- Dedicated room to house equipment,
- Dedicated operator,
- Dedicated engineer focused on timing updates,
- Regular coordination with Transportation Division office, Police, and Highway Patrol, and
- Potential deployment of related ITS strategies.

Improve Congested Corridors (Pilot Projects) — Ash Street and Berkeley Boulevard were identified by the public and the Transportation Plan Oversight Committee as congested corridors in need of improvements to alleviate traffic capacity deficiencies. Both corridors have significant development and minimal right-of-way to accommodate additional travel lanes. These corridors were analyzed in detail and the following specific strategies were developed.

Ash Street Pilot Project

Ash Street is currently an east/west principal arterial providing a vital link between US 117 from the west to US 70 in the east. Ash Street is heavily developed with commercial property and frequent driveways, which impact safety and cause congestion and associated delay throughout the corridor. Currently, the corridor is three lanes with a two way left turn lane (TWLTL) from existing US117 bypass to Virginia Street, five lane with a TWLTL from Virginia Street to William Street, four lane undivided from William Street to Jefferson Street, five lane with a TWLTL from Jefferson Street to Clairborne Street, and three lane with TWLTL from Clairborne Street to US 70. There are several signalized and unsignalized intersections along the corridor that have very high crash frequencies. It is imperative that Ash Street be improved to alleviate congestion and increase safety to maintain the integrity of the corridor as a friendly environment for its residents. Several specific recommended improvements are described and can be seen in **Figure 8.1**.

Ash Street High Density Driveways between US117 bypass and Slocumb Street

Ash Street from existing US117 bypass to Slocumb Street has a high frequency of driveways as can be seen in the adjacent figure. These driveways impact safety and cause congestion.

Recommendation — It is recommended that developments be encouraged to consolidate their driveways. As mentioned previously, this improvement would alleviate congestion by consolidating the turning movements and controlling accessibility of site access.

Recommendation — It is recommended that the left turn storage bay be extended to accommodate queuing vehicles at Ash and Herman. The portion of the Ash Street corridor between Lionel Street and Herman Street is heavily traveled because of the Health Services Building in this vicinity. The adjacent figure shows the two intersections at Lionel Street and Herman Street. Traffic is regularly backed up due to eastbound left turns along the corridor. The intersection at Ash Street and Herman Street currently has a left turn storage bay; however, the bay length is not adequate to accommodate all of the left turning vehicles. This causes "spill-back" into the through lanes which blocks the through movement and creates added congestion and potentially dangerous situations.

Recommendation — It is recommended that a left turn lane be constructed at Ash and Lionel to alleviate delays to the through movement and increase travel safety. Similarly, vehicles turning left onto Lionel Street create "spill-back" problems and safety

hazards because there currently is no left turn lane at this location.

Additionally, Ash Street and Jefferson currently has a high level of traffic volumes and safety problems. This intersection is offset which causes driver confusion and major safety concerns. Jefferson Avenue has one of the highest crash frequencies (35 crashes in the past 3 years) in Goldsboro. Driver confusion exists due to the gas station that is located at the offset of Jefferson Avenue. Drivers find it difficult to anticipate vehicle movements when exiting the gas station because the signal is out of view; this can be seen in the adjacent picture.

Gas Station on Jefferson Avenue

Recommendation — It is recommended that this intersection be improved by considering the following:

- Signalize gas station driveway to alleviate confusion,
- Build left turn pockets on Ash Street to ease congestion on the mainline,
- Add skip marks through the offset to provide assistance to drivers,
- Add side street signal actuation to help minimize delay, and
- Reduce driveways on Ash Street to consolidate turning movements.

Ash Street between Best Street and Spence Street is cluttered with site driveways which lead to congestion and hazardous conditions.

Recommendation — It is recommended that the following improvements be considered to help alleviate these problems:

- Build a nontraversable median along Ash Street to control access which will increase safety and ease congestion, and
- Consolidate driveways along Ash Street to combine turning movements which will increase safety, limit driver confusion, and ease congestion.

Insert Figure 8.1 (Ash Street Congested Corridor)

The intersection at Ash Street and Berkeley Boulevard had the highest frequency of crashes (46) in Goldsboro over the three-year period from January 2000 to December 2002. It was determined through a site investigation and from public input that the biggest issue plaguing this intersection is driver confusion due to the intersection offset.

Recommendation — It is recommended that skip marks be added at the intersection to limit driver confusion and congestion and increase safety.

The area surrounding the intersection of Ash Street and Oak Forest Road has great potential to be developed. Its close proximity to US70 and downtown Goldsboro makes this area attractive for development. Therefore, it is likely that the surrounding area's land use will intensify.

Recommendation — It is recommended that the current signal be upgraded to accommodate the increased traffic volumes associated with the future development if and when they should occur.

Berkeley Boulevard Pilot Project

Berkeley Boulevard is a north/south urban principal arterial that currently has portions of the corridor operating at an unacceptable level of service. Berkeley Boulevard is an existing six lane landscaped divided section from Elm Street to Ash Street, five lane with a TWLTL from Ash Street to Royall Avenue, four lane with a TWLTL (two northbound lanes and one southbound lane) from Royall Avenue to New Hope Road, three lanes with a TWLTL from New Hope Road to Green Drive, and two lane undivided from Green Drive to the end of the congested corridor at Tommy's Road. The Berkeley Boulevard congested corridor can be seen in **Figure 8.2**.

Insert Figure 8.2

Berkeley Boulevard between Ash Street and Royall Avenue is fully developed and has a great deal of congestion because of the high frequency of driveways. The high frequency of driveways is also responsible for the dangerous intersections along the corridor. The corridor could greatly benefit from better access management. This would help limit congestion and increase safety throughout the corridor.

Asymmetrical section along Berkeley Boulevard

Recommendation — The following access management strategies are recommended along the corridor:

- Consolidate driveways to aid the progression of traffic on the mainline,
- Relocate driveways to side streets to reduce the number of driveways on the mainline, and
- Control site access at driveways by eliminating left turns entering and exiting the site – Build right-in-right-out driveways.

Berkeley Boulevard from Royall Avenue to New Hope Road currently has an asymmetrical section that is four lanes - two northbound lanes and one southbound lane with a TWLTL (see photo). The irregular roadway section is confusing to drivers, which adds to the congestion and is a potential hazard. The congestion is also worsened by the right and left turns onto adjacent streets.

Recommendation — It is recommended that the following improvements be made:

- Add a southbound lane to create a symmetrical, more familiar roadway section, and
- Build right and left turn storage bays to eliminate congestion due to turning movements.

Berkeley Boulevard from New Hope Road to Tommy's Road is also congested due to the high demand of turning vehicles. The turning movements slow traffic and increase delay for through movements.

Recommendation — It is recommended that right and left turn storage bays be built to limit congestion.

Conclusions

There is great potential for economic and infrastructure development in the Goldsboro area. With limited available funding from Federal and State agencies, we need to focus on improving our current transportation system. While there may not be an urgent need for implementing every recommendation in

the short-term, this area will greatly benefit from a clear long-term vision which should include provisions for congestion management, access management, ITS, and signal system improvements.