ITEM 10 - Information
February 19, 2014

Briefing on Traffic Signal Timing/Optimization
in the Washington Region

Staff Recommendation: Receive briefing on a COG/TPB survey on traffic signal timing/optimization in the Washington region, plus a practitioner perspective on signals activities. Today's presentation will focus on slides 2, 7 through 11, 13, 14, 17, and 18, with the remaining slides provided as background.

Issues: None

Background: In response to the TPB request for a signal timing/optimization status report, staff conducted a regional survey in spring 2013. The attached memorandum summarizing results was prepared and included in the Letters Sent/Received packet for the September 18, 2013 TPB meeting, and is the basis for today's presentation. Also included as background is a District Department of Transportation blog item on DDOT's signals activities.

Item #10

Briefing on Traffic Signal Timing/ Optimization in the Washington Region

Ling Li, P.E.
VDOT
and Chair, Traffic Signals Subcommittee

Andrew J. Meese, AICP
COG/TPB Staff

Transportation Planning Board
February 19, 2014

Background

- TPB requested a regional traffic signal optimization status report at the February 20, 2013 meeting
- A memo was presented at the September 18, 2013 meeting with the presentation being deferred to today
- Originated from the 2002-2005 signal optimization Transportation Emissions Reduction Measure (TERM)
- Periodic updates document ongoing regional practices

What Does It Mean for Signals to Be Optimized?

- Traffic signals re-timed for optimal performance, considering
  - traffic loads
  - cross traffic, left and right turns
  - pedestrians
- Coordination of multiple signals (e.g., downtown areas, corridors)
- Engineering rule-of-thumb: re-time every 3 years

Optimized Does Not Always Mean Minimal Delay for an Individual Motorist

- If there are high traffic volumes / left and right turns / high cross-traffic volumes
- If traveling in the opposite direction of predominant flow
- Ensuring the safety of and sufficient crossing time for pedestrians
- Sporadic issues (e.g. emergency vehicle movements) can temporarily impact signal timing

How Do We Know that Signals are Optimized?

- Engineers do not rely solely on the "raw" computer output
- Before and after field observations help verify that the optimization process has been successful
- Ongoing field observations and monitoring from the traffic control center are important, with fine-tuning if necessary
- These monitoring and spot checks activities, as well as responding to citizen inquiries and complaints, all help ensure the system remains working properly

Traffic Signals in Real Time

- Improved technologies make it easier for engineering staff to monitor traffic flow and make real-time adjustments
- Computer algorithms and technicians monitoring traffic can detect upstream conditions and anticipate signal timing adjustments to minimize delay
- Particularly effective in addressing non-recurring congestion caused by incidents and special events

TERM Context of Signal Timing/ Optimization: Then and Now

- In 2002, the regional Signal Optimization TERM offered a way to close a gap between the projected air quality performance/ conformity of the CLRP and what was required
- In the years since, the air quality analysis context has changed:
  - Previous optimization achievements are now in the "baseline" conditions of CLRP air quality analysis and cannot be re-counted
  - There is no current gap to be filled between CLRP performance and target conformity requirements
  - Today's EPA-mandated analysis methodology does not readily accommodate TERMs of this type ("MOVES" model vs. "MOBILE" model)
  - Today's cleaner-running cars reduce air quality benefits of projects of this type
- Though the air quality conformity motivation for optimization may have been reduced, there are still congestion management and other reasons to continue optimization efforts

Survey

- TPB staff surveyed transportation agencies in April 2013
- 21 different agencies have ownership and/or maintenance responsibility for traffic signals in the Washington region
  - Not including military facilities/bases, excluded from the survey since their roads are not open to the public
- Survey focused on whether signals were optimized or checked within calendar years 2009-2012
  - Follows the 3-year engineering rule-of-thumb
- Responses reflect approximately 98% of all signals in the region that are subject to optimization
- Signals not subject to optimization were not included in the survey (e.g., firehouse emergency signals, pedestrian crosswalk flashers)

Timing/Optimization Methods

- **A signal was counted as re-timed/optimized if one or more of the following methods was utilized during the three-year 2009-2012 reporting period:**
  - **Computer optimized**: Use of software packages and detailed input data to pre-determine recommended timing plans
  - **Engineering Judgment**: Field-based observation by traffic engineers to verify timing
  - **Active Management**: Observation and adjustment of specially-equipped signals from a central control center by engineering staff, on a real-time basis, responding to quickly-changing traffic conditions
- **Not checked**: If none of the above methods were used in the three-year period for a given signal
- **No report**: For signals documented on regional lists but for which no report was received in this time frame

Timing Results (2009-2012)

- Approximate total signals in region: **5,500**
- Total optimized, checked, or adjusted in the three-year period: **76%**
  - Computer optimized: **47%**
  - Engineering Judgment: **7%**
  - Active Management: **22%**
- Not checked: **22%**
- No report: **2%**

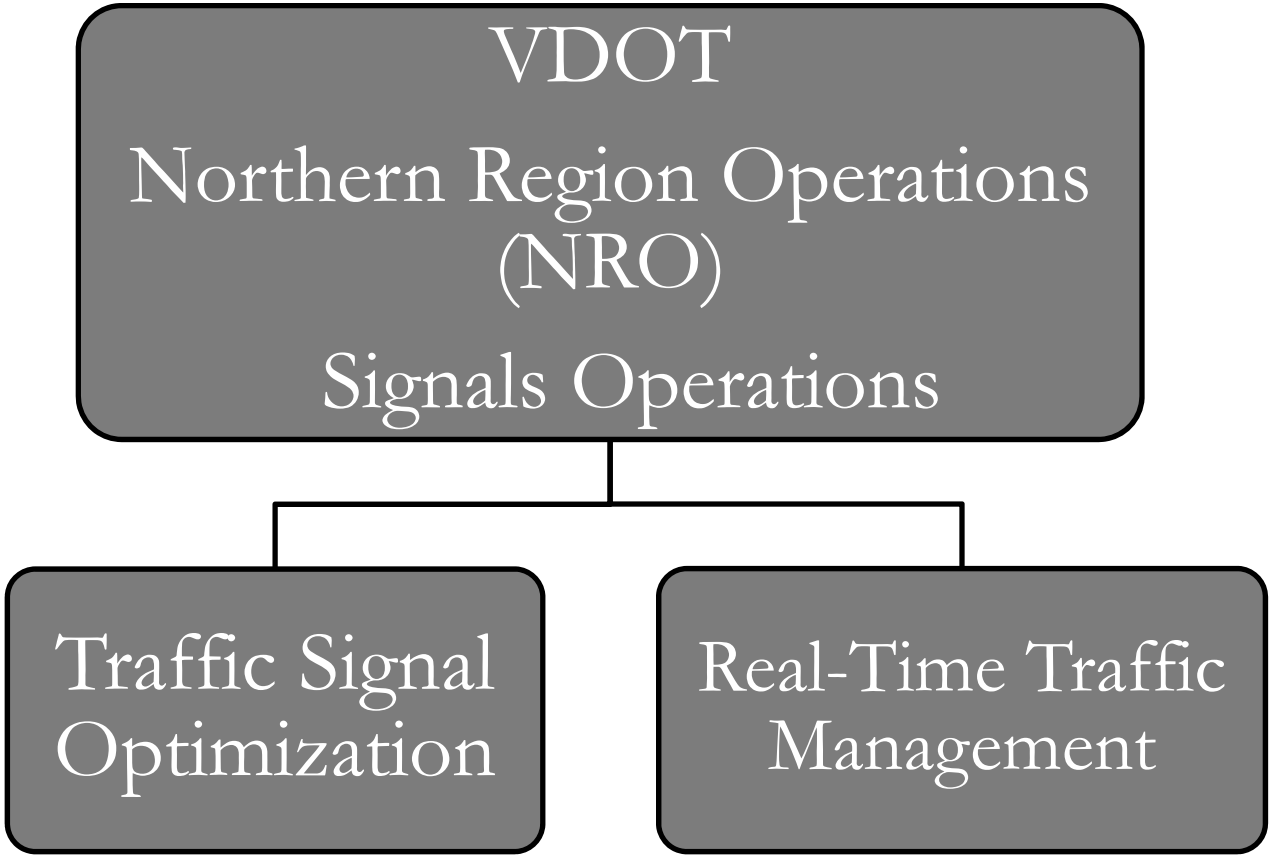
How is the Region Doing on Optimization Compared to 2009?

- Regional results overall held to a similar albeit lower level than three years ago (76% vs. 80%)
  - Regional results, though lower, perhaps better than expected due to this having been an especially difficult "belt-tightening" period for state and local agencies
  - Regional total of 4,200 optimized/timed signals compares favorably to the original TERM target of 2,946
- DDOT currently has a five-year signal re-timing project that will boost the regional average as of 2014
- The proliferation of advanced signal control technology has allowed agencies to improve traffic flow beyond what is possible with computerized pre-timed optimization methods alone

Outlook

- Continuing awareness of and commitment to safe and effective signals operations
- Effective interagency coordination through the Traffic Signals Subcommittee and other forums
- The benefits of providing sufficient resources to ensure good signals operations are widely recognized

Example: VDOT



Traffic Signal Optimization

- Nearly 1,350 Signals
- 21 Networks
- 3 Counties - Fairfax, Loudoun and Prince William Counties.
- 8 Timing Plans
  - AM Peak, PM Peak, Midday Peak, Off-Peak, Weekend AM, Weekend PM, Saturday Peak and Sunday Peak.
- Special Timing Plans
  - Holiday Plans, 4th of July Plans, and other event plans

Traffic Signal Optimization Process

- Data Collection
- Data Analysis
- Network Setup
- Optimization
- Simulation
- Implementation & Fine Tuning
- Evaluation & Recommendation

Traffic Signal Optimization Benefits

- Economic Benefits
  - Stop, Delay and Fuel Consumption
  - Benefit to Cost Ratio – 49:1 (Fourth Round)
  - Overall Savings - $97,742,104 (Fourth Round)
- Environmental Benefits
  - Annual Emission Reductions of 555.24 metric tons (Fourth Round)
- Travel Time and Level of Service Improvements
- Update of Pedestrian and Vehicular Clearance times based on the latest MUTCD and VDOT guidelines
- Digital Library
- Operational and Geometric Recommendations

Real-Time Traffic Management

- Manage nearly 1,350 traffic signals.
- Implement real time signal timing changes in response to incidents, congestion, work zones, weather events, special events and emergency conditions.
- Coordinate with TOC (Transportation Operation Center) and local agencies during incidents.
- Monitor the performance of arterials using CCTV's, VICADS and MIST Central Signal System.
- Maintain the health of the arterial signal network system.

Real-Time Traffic Management

- **CCTV Cameras – 111 cameras**
- **SOC Hours**
  Monday to Friday: 5:00 am to 9:00 pm
  Saturday and Sunday: 9:30 am to 6:00 pm
- **Coverage during major events**
- **Staff on call to handle emergency situations**

Signal Operations Center (SOC)

SIGNAL OPERATIONS CENTER

REAL-TIME TRAFFIC NETWORK MANAGEMENT

- Arterial Networks Monitoring
- Real-Time Incident Management
- Congestion Management
- Work zone Management
- Weather Events and Emergency Management
- Special Event Management

SIGNAL SYSTEM HEALTH MANAGEMENT

- Monitoring & Reporting of CCTVs Status
- Monitoring Signals on Flash, Detector Status and Pedestrian Signal Status using MIST.
- Dispatching of Signal Technicians as per the need of the issue.
- Coordinating with Signal Contractors to Resolve Problems relating to Signals Under Construction.

COMMUNICATION AND INFORMATION PASS-DOWNS

- Documentation of Incidents
- Coordination with TOC Personnel, Traffic Engineers and Customer Service Center
- Discussion with the Management on critical and major operational issues
- Transferring of any on-going incidents to the oncoming shift personnel and TOC personnel.

National Capital Region Transportation Planning Board
777 North Capitol Street, N.E., Suite 300, Washington, D.C. 20002-4290 (202) 962-3310 Fax: (202) 962-3202 TDD: (202) 962-3213

TO: Transportation Planning Board

FROM: Ling Li
Virginia Department of Transportation
and Chair, Traffic Signals Subcommittee

Andrew J. Meese
COG/TPB Staff

DATE: September 12, 2013

SUBJECT: Status Report on Traffic Signal Timing/Optimization in the Washington Region

Executive Summary

At the February 20, 2013 meeting, the Transportation Planning Board requested a status report on traffic signal timing/optimization in the region, as well as a review of the TPB's discussions of the topic in conjunction with a 2002-2005 Transportation Emissions Reduction Measure (TERM). This memorandum contains the results of an April/May 2013 TPB staff survey on the topic of signal timing, as well as associated information on background and on related traffic signals management activities by the region's transportation agencies. Key points are as follows:

- Survey results showed a rate of retimed/optimized signals in the region (within defined criteria) of 76%; 22% not retimed/optimized; and no report received for 2%. This is a similar but slightly reduced level of optimization compared to the last such survey in 2009.

- In 2002, credit was taken as a TERM in the regional air quality conformity determination process for an increased level of signal optimization. Such credits are now part of the "base" conditions for conformity determinations and cannot be counted anew in future emissions reduction measures/TERMs. Note that the region today still meets (in fact exceeds) the target set in the 2002 TERM for retiming signals.

- The world of traffic signal operations has evolved significantly since the 2002 TERM, including advancing technologies and increased real-time active management of signals, going above and beyond what is achievable in pre-set optimization. This memorandum describes a number of those activities.

- A total of 21 different agencies have ownership and/or maintenance responsibilities for the approximately 5,500 traffic signals on public roads in the National Capital Region.

- The costs of equipment installation and ongoing maintenance remain a constraint for signals agencies around the region.

- A presentation on one or more of these topics can be made at a future TPB meeting at the convenience of the Board.

What Are Signal Timing and Signal Optimization?

Signal timing (definition adapted from Wikipedia) is the traffic engineering technique to allot right-of-way at an intersection, involving the determination of how much green time the traffic lights shall provide at an intersection approach, how long the pedestrian "walk" signal should be, and numerous other factors. Signal timing strives for the dual goals of safety and efficiency. Signal timing may be achieved in advance studies and the uploading of "pre-planned" timings, and/or in "real-time" adjustments of signals (if so equipped – see below for more information on adaptive and active management of signals).

The concept of signal optimization generally falls into the "pre-planned" category. Signal optimization is a traffic engineering concept whereby traffic signals (often groups of signals in corridors and/or isolated systems) are (re-)timed to reduce delay for vehicles on the roadway system while ensuring safety. In optimization studies, engineers use a combination of traffic volume counts, in-car and in-field travel time observations, control center observations, and computer analysis to determine signal timings given the complex interactions of traffic flows. The results for any one driver on any one trip may not appear to be “optimal”, due to high traffic loads, cross-traffic, pedestrian movements, and other factors, but overall system delay should be minimized. An engineering “rule-of-thumb” recommends checking signal timing at least every three years because traffic patterns evolve.

Traffic signals allot time at intersections for safety, traffic flow, pedestrians, and other factors; an individual signal’s timing needs to be balanced for these factors. Multiple nearby signals can be analyzed as a system to coordinate timings. Under certain conditions, a corridor with a predominating flow and direction can be timed for “progression”, reducing delays for traffic in that flow. Signals generally have three or more timing plans, usually including morning peak period, midday, and evening peak period, and frequently additional plans such as weekend or overnight plans.

“Optimized”, however, does not mean “without delay”. The motorist may still experience delays even after signal or corridor optimization, if, for example:

- There are high traffic volumes / left and right turns / high cross-traffic volumes
- The motorist is traveling in the opposite direction of predominant flow
- The safety of and sufficient crossing time for pedestrians necessitate extra time
- Signals are optimized for multi-modal travel

It is overall system delay, not necessarily the delay experienced by a given individual motorist, which is minimized in optimization.

Changes since 2002 in the Air Quality Analysis Context of the Signal Optimization TERM

In 2002, the region committed to an increased level of signal optimization at a level of 2,946 signals over a three year period for air quality credits as a "TERM". At that time, this commitment helped

the region achieve a finding of conformity with air quality standards. However, a number of changes have occurred in the years since that alter the air quality context of such a program. The former TERM level of optimization achieved is now assumed in the "base case" for regional air quality, and cannot be repeated. Also, the new Environmental Protection Agency-sanctioned "MOVES" model, in contrast to the old "Mobile" model, no longer readily accommodates analysis of TERMs of this type. Today's cleaner vehicle fleets also mean less impact for any optimization effort compared to 2002. Nevertheless, though the air quality conformity motivation for optimization may have been reduced, there are still congestion management and other reasons to continue optimization efforts.

Results of the Latest Signal Timing/Optimization Survey

According to regional records, a total of 21 different agencies have ownership and/or maintenance responsibility for traffic signals in the Washington region (this number excludes military bases/facilities which may have signals on their non-public roads). Thirteen of those agencies, covering an estimated 98% of the signals in the region, completed the recent TPB staff survey. The overall results of the survey show a slight decline in the percentage of traffic signals regionally which had been retimed within the 3-year "rule of thumb" window for the period ending December 31, 2012. An estimated 76% of the region's eligible traffic signals had been retimed or checked within the three-year window, in contrast to an estimated 80% as of the last report in 2009. This result, however, should be interpreted within the context of the comments below.

Summary Table of Regional Signal Timing/Optimization Results of 2009 and 2013 Surveys (Original TERM commitment = 2946 signals)

Survey Year	Total Signalized Intersections	Total Retimed		Retiming Method			Not Checked		No Report	
				Computer Optimized	Engineering Judgment	Active Management				
2013	**5500**	**4200**	**76%**	**47%**	**7%**	**22%**	**1200**	**22%**	**100**	**2%**
2009	5400	4300	80%	56%	24%	*	1000	18%	100	2%

* Combined with engineering judgement in the 2009 survey

Additional information/comments provided by respondents of the survey:

- Regional results overall held to a similar albeit lower level to that of three years ago, in the context of widespread budgetary belt-tightening by involved transportation agencies; it is hoped that some upcoming anticipated investments will improve the regional picture.
- DDOT currently has a five-year signal re-timing project. This includes a phased approach, with the intent to touch all signals based on areas of concern. DDOT has also identified three corridors for possible deployment of an adaptive system.
- Signal optimization can help get an arterial closer to its design capacity but cannot increase capacity.
- Techniques are often combined; signals can be optimized using computer software followed by active field management for validation purposes.
- Active management is particularly useful to address non-recurring congestion caused by incidents and special events.
- Signal equipment must be properly maintained for signal timing to be effective.

Beyond Optimization: Other Traffic Signals Management Activities

Computer-based, pre-timed traffic signal optimization is just one of numerous activities undertaken by traffic signals agencies to ensure proper or improved operations of traffic signals. The systems described help signals (and support staff) do their jobs better, and have been the focus of a number of resource investments in the region in recent years. The following sections describe some of these activities (descriptions adapted from the Maryland State Highway administration and other sources).

Traffic Signals in Real Time

Since the adoption of the TERM in 2002, there have been technology changes (improved signals timing analysis programs, traffic detection equipment, video surveillance, traffic management centers) which make it easier for traffic engineering staff to monitor traffic flow and provide adjustments to signal timings from remote locations to address congestion caused by incidents, special events, and diverted traffic from other roads. Real-time traffic management, which is adjusting signal timing based on current demand, provides congestion relief above and beyond those obtained from the timing plans created by computer programs such as Synchro™. As can be seen from the results of the survey a number of jurisdictions have adopted such a practice either on a daily basis or during special events. Agencies such as the Virginia Department of Transportation and Montgomery County Department of Transportation actively manage their signals using the traffic operations center in real time.

Adaptive Signal Control Technology (ASCT)

There are a number of situations when a computer-generated traffic signal timing plan may not produce the desired result as discussed above. To handle such a situation, implementation of ASCT which is performed by a computer program may offer an improvement over the existing operation. ASCT employs specialized detection equipment to adjust traffic signal timing based on real-time transportation demands – within an established set of parameters. The implementation of these systems requires the installation of specialized field equipment at the selected locations – representing additional costs to the implementing agency. The traffic signals subcommittee has discussed this subject and a number of jurisdictions in the region are considering the use of ASCT for selected corridors.

Management through Engineering Judgment/Troubleshooting

The third technique used by a number of jurisdictions is managing good efficient operation of signals through engineering judgment and troubleshooting. Whenever complaints are received traffic engineers visit the signalized intersection and using their experience and judgment adjust the signal timing to reduce delay and improve operations.

The techniques continue to provide improvements over a stand-alone optimized timing plan operation which otherwise may deteriorate over time.

Sustainment of Benefits

Benefits from retiming/optimization are, of course, limited if the corridor in question was already reasonably well-timed. Once a corridor is well-timed, benefits can only be maintained, not improved upon.

Multi-Modal Considerations Including Transit Signal Priority

Urban streets and roadways are multi-modal in nature (e.g., including buses, pedestrians, bicycles, trucks, others). Best practices in traffic engineering recognize this in the operation of traffic signals, including the levels of bus, bicycle, and pedestrian activities, and ensuring that they are accommodated in traffic signal timing.

Transit Signal Priority (TSP) Systems

Transit Signal Priority is the modification of traffic signal timing to benefit transit vehicles operating along a roadway. TSP gives additional time to the green phase for buses or streetcars, by extending the green light, providing an early or advanced green light, or adding an extra green

phase just for transit. The $58.8 million Transportation Investments Generating Economic Recovery (TIGER) grant awarded to the TPB in February 2010 for Priority Bus Transit in the National Capital Region includes a project to install TSP at up to 77 intersections along seven major bus corridors across the region and at another 82 signals in downtown DC. The TIGER funded TSP system will initially be installed and tested on VA-7 (Leesburg Pike) in 2014, by WMATA in close coordination with Virginia DOT and the partner jurisdictions. The system will subsequently be tested in the District and in Maryland, for their respective, different wayside traffic signal technologies, with completion planned for 2016.

Pedestrians

Traffic signal timing is an essential factor in accommodating pedestrians at intersections, and safety is paramount. Agencies must consider pedestrian crossing time and wait time within their overall timing/optimization processes. Pedestrian countdown signals have come into widespread use in the region, also aiding safety.

Equipment Upgrades

Detection Systems

Until recently, the most commonly used vehicle detectors were inductive loops, typically installed in saw cuts in the pavement, with detected vehicles passing over them. Inductive loops are now being supplanted by other technologies that provide engineering advantages. Wireless detectors that are smaller, nicknamed "hockey pucks", are easier to install than the old, large inductive loops, and provide maintenance advantages as well. Video detectors are another predominant form of vehicle detection for traffic signals. A video-based detector consists of a video image acquisition system (e.g., visual spectrum or infrared camera), digitizer, appropriate cabling, and a video image processing unit, with appropriate vision processing software. Signal detection cameras generally are separate from traffic management or law enforcement cameras because of the need for signals cameras to remain fixed on their assigned detection points, and cannot be panned or zoomed.

Signals Operations Centers

Some agencies have installed sophisticated communications networks that link traffic signals, traffic cameras, and detectors into a central traffic operations center. These centers have two-way communications with field equipment that allows traffic technicians to monitor traffic signal data and video, and make changes to signals right from the office. The ability to monitor traffic signals from a central location also may enable instant notification of equipment malfunction (loss of power, detector malfunction, etc.), allowing staff to respond quickly to malfunctions and mitigate problems in real time.

LED Signal Heads

Light-Emitting Diodes (LEDs) are now the predominant form of illumination for signal heads, having largely superseded incandescent signal lamps. The higher efficiency of LEDs means that their electrical power consumption is vastly reduced, so running costs for power supply are correspondingly low. LED signal heads with their low energy consumption thus represent a valuable contribution to environmental protection: saving up to 90% of the energy consumed by signal lamps and lasting up to 15 years. Typical power consumption for a LED head is 30 watts compared to 160 watts for a regular signal head. It is also more feasible to provide battery-based power back-up systems for LED signals.

Power Back-Up Systems for Signals

Traffic signal power back-up systems provide emergency power to traffic signals when the input power source, typically public utility electric power, fails. Power back-up systems have become more practical and common in recent years as traffic signal lights have been converted from incandescent to efficient LED lights. Regional events such as the disruptive January 26, 2011 snow and ice storm and the June 29, 2012 derecho illustrate the need for such systems. There are two types of power back-up system widely used in the National Capital Region: battery-based and generator-based.

Battery-based power back-up systems provide instantaneous or near-instantaneous protection from input power interruptions by means of one or more attached batteries and associated electronic circuitry. As with any battery-powered systems, batteries will run down with use, or even at rest, and have to be maintained and replaced. The main advantage of battery-based systems is that they can start working immediately and seamlessly if main power fails, without the need for a technician to be deployed to the site. The main disadvantage is that the operational time enabled under battery power is limited, usually between two and eight hours depending on the size of the signal and its operational mode (full color versus flashing yellow/red). For battery back-ups, the signal must be composed of LED lights, and the traffic signal cabinet(s) at the intersection must be properly equipped to accommodate the battery arrays.

Generator-based power back-up systems require diesel generators to be deployed to traffic signals when power outages occur. Signal cabinets must be outfitted to handle the deployment of the generator, and, of course, generators must be obtained by the agency or jurisdiction, and be available for deployment. The main advantage of a generator system is that once equipment is deployed, the system can operate for essentially an unlimited amount of time if the generator is refueled periodically. The main disadvantage is that if back-up is needed, personnel must travel to the site of the intersection and deploy the equipment, which has inherent delay and may be difficult or impossible in given emergencies or situations.

TPB staff has surveyed the region's traffic signals agencies regarding the numbers and types of traffic signal power back-up systems in the region, most recently as of December 31, 2012; a survey as of June 30, 2013 will be completed soon. As of the end of 2012, about 50% of the region's signals benefited from either a battery-based or generator-based back-up system, up from about 26% in 2011.

Ongoing Maintenance

Given the reliance of modern signal timing technology on functioning detection devices, ongoing maintenance of loops, cameras, and other signal equipment is essential. The implementation of real-time traffic management requires adequate detection of traffic patterns, and the performance of these systems will deteriorate if equipment begins to fail. This task can be challenging given that funding is required not only to install equipment for advanced signal systems, but to also ensure that it is properly maintained.

Emergency Preparedness

Major traffic signals agencies have developed and coordinated plans for signals operations in the event of a major emergency, in coordination with state and D.C. emergency management agencies. Also, the locations of power back-up systems for traffic signals have been coordinated with emergency transportation plans. The real-time management capabilities of signals systems in the region also aid preparedness.

Outlook

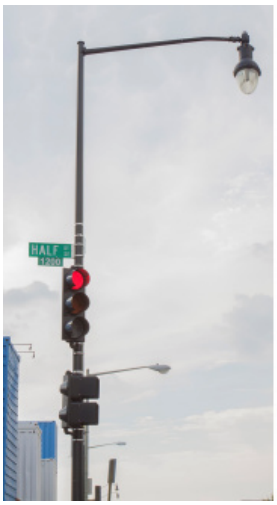
There is ongoing awareness and commitment to safe and effective signals operations among the transportation agencies of the region. There is continuing interagency coordination through the Traffic Signals Subcommittee and other forums. There are benefits of providing sufficient resources to ensure good signals operations, and it is hoped that these resources can continue to be devoted. As of now, the majority (76%) of the region's traffic signals are being re-timed/optimized or checked on a frequent basis.

A presentation on one or more of these topics can be made at a future TPB meeting at the convenience of the Board.

d.ish
The official blog of the District Department of Transportation

Signal Optimization and Improving Traffic Flow in the District

Posted on October 8, 2013 by DDOT Blogger




The District of Columbia as a humanistic, people-friendly city is first and foremost an accessible city, where mobility is possible for all. Many cities today are plagued by traffic congestion, and in densely populated city areas the fastest ways of getting around are often on mass transit, by walking and bicycling.

Under Mayor Vincent C. Gray's Sustainable D.C. initiative, our goal is to continue to switch commuters from driving alone, to bicycling, walking, and carpooling by making mass transit more appealing. Our goal is to have 75% of our morning commutes to start and end using these transportation modes.

Creating this balance starts with improving our transportation network and one key factor is traffic optimization for all modes of transportation. Toward these aims, The District Department of Transportation (DDOT) is overhauling the District's traffic signal management program through using advanced computer software.

Traffic signal management can be defined as using new technologies and equipment to make existing traffic signal control systems operate more efficiently. Improved traffic signal has many benefits including improving air quality and reducing fuel consumption; reducing congestion and creating efficiencies for commercial and emergency vehicles, and buses. This can also reduce the number of serious accidents; reduce aggressive driving behavior, including red-light running and postponing and eliminate the need to construct additional road capacity.

The DDOT system is comprised of traffic lights, stop signs, and various other control devices designed to control competing flows of traffic. It is designed to efficiently manage vehicles, pedestrians, cyclists and public transit. The 1,600 traffic signals in D.C. collectively form DDOT's comprehensive signal program. Traffic signal re-timing and management is a cost-effective way to provide safe and efficient traffic flow throughout the city.

Signal Timing

Signal timing is a special technique that traffic engineers use to manage traffic flow and determine who has the right-of-way at

signalized intersections. DDOT traffic signal engineers manage traffic signal systems operations in connection with capital improvement projects, sight clearance inspections and responses to residents' inquiries.

The central objective of signal timing is to coordinate the competing demands of motor vehicles, public transit, bicycles and pedestrians in an efficient manner. Signal timing strategies are designed to minimize stops and delays, minimize fuel consumption and air pollution emissions and optimize traffic flow and progression along major arteries. Signal lights are designed to coordinate a process in which lights respond to the traffic demand based on the time of day. The current signal timing is determined by the preset movements of traffic.

DDOT's comprehensive plan to improve the flow of traffic is a coordinated 5-year project. It is well underway and several important changes have already been implemented at nearly 600 intersections. This part of the program (Phase I) is the first step in building a solid foundation to enhance and improve traffic flow. DDOT is replacing the old and outdated traffic controller software in the field during Phase I. More extensive changes will come in Phase II which is scheduled over next three years and will include all 1600 traffic signals in the District.

The scope and scale of this project is far more comprehensive than any previous DDOT effort. DDOT is on the forefront and cutting edge of managing traffic flow to respond to our population growth and improve safety and efficiencies.

DDOT's ultimate program goals are to make DC traffic signals safer and friendlier for pedestrians, vehicles, public transit, and cyclists, and to reduce traffic congestion, improve bus travel, and reduce harmful emissions.

DDOT's traffic engineers collect data on traffic patterns, volume, speed, lane-use, and timing of signals at intersections with the goal of utilizing the data to optimize traffic flow and better manage traffic movement in the District of Columbia. Using advanced computer technology has enhanced DDOT's abilities to manage traffic flow efficiently.

DDOT uses off-line software model that can emulate real-life traffic conditions. It evaluates and optimizes traffic signal timing plans based on traffic volume and geometric conditions. And it captures data based on capacity performance and level of service at signalized intersections.

Data is based on the time of day and organized around AM drive-time peak hours on weekdays from 7-9:30, mid-day peak from 11-1, and PM drive-time peak hours from 3 to 7. On weekends, the traffic flow is different and the data collected creates a separate pattern, from 11am to 4pm. The analysis takes the existing traffic conditions, then optimizes or creates an optimized plan to improve the flow of arterials by all users. The small changes in Phase I have largely gone unnoticed to the general captures data based on capacity performance and level of service at signalized intersections. Data is based on the time of day and organized around AM drive-time peak hours on weekdays from 7-9:30, mid-day peak from 11-1, and PM drive-time peak hours from 3 to 7. On weekends, the traffic flow is different and the data collected creates a separate pattern, from 11am to 4pm. The analysis takes the existing traffic conditions, then optimizes or creates an optimized plan to improve the flow of arterials by all users.

The small changes in Phase I have largely gone unnoticed to the general public but are fairly extensive. The updated traffic controller computer software includes several features. One of the most important features allows traffic engineers to modify signal timing to improve bus progression. DDOT, working in partnership with WMATA, is also planning improvements to assist in the operations and efficiencies of WMATA's bus fleet. The WMATA/DDOT effort will improve bus routes through the implementation of a Transit Signal Priority in the various heavy bus corridors.

Another feature of DDOT's program in the traffic controller computer software upgrade is Adaptive Traffic Signal Control Technology which will utilize real-time traffic information to adjust the timing of lights to accommodate changing traffic patterns and ease traffic

congestion. In cooperation with the Federal Highway Administration, DDOT will begin testing this new technology on New York Avenue, Pennsylvania Avenue SE and Rhode Island Avenue corridors in 2014. This feature will work to improve overall traffic flow.

The new traffic controller software will simplify the tedious process of designing new traffic signal timings and utilize the most modern computer technologies to create efficiencies. Increased traffic flow and a growing population mean DDOT must continually find new and innovative ways to manage traffic flow. The new software goes a long way towards assisting and driving this effort.

DDOT has built a complex traffic signal timing computer model that is being specifically adapted to DC's local driver population, roadway network, and traffic flows. The traffic signal timing computer model was vital in helping DDOT evaluate various signal timing options and make quick signal timing changes in the Wisconsin Avenue corridor in August this year.

A concrete example of the program's early success is during the afternoon rush hour. Traffic engineers report that drivers making the trip along the full length of Wisconsin Avenue, a major traffic artery, are saving time. Drivers commuting between Georgetown and Friendship Heights on Wisconsin Avenue are saving up to 5 minutes in their daily commute. More quick-relief, traffic signal re-timing experimental projects are planned for Georgia Avenue, another major traffic artery in the coming months. And more extensive changes are scheduled for these two corridors as part of the Phase 2 implementation in 2015.

Phase 2

Phase 2 will result in more noticeable changes to the coordinated traffic signal timings. Engineers will complete the redesign of coordinated signal timings for the first 200 signals to be implemented east of the Anacostia River and along M Street in the Southeast/Southwest corridor before the end of 2013.

The next phase of the project is re-timing over 600 signals in the downtown area—which is undergoing a massive influx in development (for example, CityCenterDC and the Marriot Marquis)—by late 2014 or early 2015. Re-timing downtown signals has some unique challenges with high volume traffic all competing for the same space and the same green lights.

Traffic signal re-timing will improve downtown traffic flow by timing the signals so that groups of vehicles (referred to as platoons) can travel through the series of signals with minimal stoppage. Importantly, traffic signal optimization also improves safety because traffic flow is smoother and vehicles stop less often. This reduces the probability for rear-end crashes, reduces vehicle emissions and lowers our carbon footprint. It also reduces travel costs by reducing the amount of time stopped at red lights, saving us money at the gas station.

A bicyclist crosses at one of several HAWK signals that DDOT recently installed in the District.

DDOT is at the forefront of modernizing traffic flow and utilizing the most advanced computer software to improve traffic flow and safety. This important effort will improve the quality of life for citizens and commuters in the District of Columbia and be an important component of Mayor Gray's Sustainable D.C. program.

Related

Continuing the District's Leadership i…

A Land Where Bikes Rule the Road

Back to School – Safely!

This entry was posted in Uncategorized. Bookmark the permalink.