COMMUTER CONNECTIONS
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National Capital Region Transportation Planning Board Commuter Connections Program

Examination of A Flextime Incentive Application

July 18, 2017

TITLE: National Capital Region Transportation Planning Board (TPB) Commuter Connections Flextime Incentive Application

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AUTHORS: Steven Osborn, Operations Assistant
Patrick Zilliacus, Transportation Engineer
Daivamani Sivasailam, Manager, Systems Performance, Operations and Technology Programs
Andrew Meese, Director, Systems Performance Planning
Nicholas Ramfos, Director, Transportation Operations Programs

AGENCY: The National Capital Region Transportation Planning Board (TPB) is the federally designated Metropolitan Planning Organization (MPO) for the region and plays an important role as the regional forum for transportation planning. The TPB prepares plans and programs that the federal government must approve for federal-aid transportation funds to flow into the Washington region. The TPB became associated with the Metropolitan Washington Council of Governments (MWCOG) in 1966. MWCOG was established in 1957 by local jurisdictions to address regional concerns including growth, air quality, public health, transportation and housing. Although the TPB is an independent body, its staff is provided by MWCOG's Department of Transportation Planning. Commuter Connections is a regional network of transportation organizations coordinated by MWCOG and provides information and programs on commuting options to help with congestion and air quality improvements.

ABSTRACT: This document provides speculation on the positive impacts of implementing a flextime incentive program for the Washington D.C. metropolitan region. Research on the subject is examined and COG/TPB Staff have studied flextime impacts within major metropolitan areas of the United States and abroad. This document selects corridors in the Washington D.C. region that may benefit from an incentive program and details the beneficial impacts of implementing a flextime-incentive pilot program.

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Preface

In support of the National Capital Region Transportation Planning Board's Commuter Connections program efforts to reduce traffic congestion and transportation emissions, the Metropolitan Washington Council of Governments has explored the implementation of a flextime-incentive pilot program for the Washington D.C. metropolitan region.

COG/TPB Staff have observed literature on the subject and have determined that implementing a pilot program would have beneficial impacts in alleviating traffic congestion throughout specific corridors in the region.

Anticipated success of the program stems from past literature written on the subject, knowledge of current incentive programs, survey responses, congestion analysis, and the monetary and social welfare benefits the participant(s) will receive.

1. Executive Summary

Commuter Connections, the transportation-demand management program of the National Capital Region Transportation Planning Board (TPB) at the Metropolitan Washington Council of Governments, has undertaken a study to investigate the effects of implementing a flextime-financial-incentive pilot program in the Washington metropolitan region. The study was conducted as part of the FY2017 Commuter Connections Work Program.

A flextime-incentive program would offer a financial benefit to commuters who are able and willing to commute during off-peak hours to avoid congestion along major corridors in the region, specifically, during a major incident. This program will reward commuters and reinforce the importance of mitigating traffic during the peak period. Financial incentives offered may come in the form of direct payment, gift certificates/cards or debit cards.

Commuter Connections Staff will also be working closely with the University of Maryland's National Transportation Center during the technological development of their integrated, personalized, real-time traveler information and incentive (icenTrip) program.

1.1 Introduction and Background

In FY2017, Commuter Connections elected to investigate the effects of implementing a flextime financial incentive program in the Washington metropolitan region. Careful attention is paid to verification techniques that identify valid flextime trips associated with implementing an incentive program of this type. Finally, United States tax laws are investigated to determine any restrictions or parameters on the amount of incentives that can be distributed.

1.2 Literature Review

A literature review is performed to learn about scholarly research regarding flextime incentive programs. An analysis of past incentive programs is included to learn and understand best practices, financial implications and positive impacts of flextime on corridors and commuters. A study on successfully structuring an incentive program is also reviewed in this section. Lastly, a review of data from The Commuter Connection's 2016 State of the Commute Report are provided.

1.3 Corridors of Interest

Corridors from the region are examined to determine which would most benefit from instituting a flextime incentive program. Criteria for selecting corridors are based off the State of the Commute Report produced by Commuter Connections and by observing data on the top-10 traffic bottlenecks in the region. The top-10 bottlenecks in the region are published as part of COG/TPB's 2016 "Congestion Management Process Technical Report." A map is included to highlight specific bottlenecks along congested corridors. Data from COG/TPB's "Traffic Quality on the Metropolitan Washington Area Freeway Systems" are presented to understand average peak-period levels of service on the selected corridors.

1.4 Implementation

The structure and implementation of the program is summarized, including a brief outline of the application process and requirements for program participation. The structure and requirements will be closely related to current programs being operated by the TPB's Commuter Connections staff.

1.5 Recommendations and Conclusions

A recommendation for a pilot program is made based on the expected effectiveness of a flextime incentive program. Data are further reviewed to reinforce the selection of corridors that would best benefit from program implementation.

2. Introduction and Background

Commuter Connections is a network of organizations that provides transportation program information and services in the Washington D.C. metropolitan area designed to inform commuters of the availability and benefits of alternatives to driving alone and to assist them to find mobility alternatives and incentives that fit their commute needs. COG/TPB administers and implements regional service programs, called Transportation Emission Reduction Measures (TERMs), in a regional effort through Commuter Connections to reduce vehicle trips, vehicle miles of travel, and emissions resulting from commute travel.

In FY2017, Commuter Connections elected to investigate the effects of implementing a flextime financial incentive program in the Washington D.C. metropolitan region. Prior to this study, the Washington D.C. metropolitan region has limited experience with offering financial incentives to encourage commuters to avoid peak-period travel.

Findings from a literature review, survey data and past incentive programs are used to comprehensively analyze all aspects of implementing a financial-incentive program in the Washington D.C. metropolitan region. A 2009 national report from the Society of Human Resources Management (SHRM) showed that 58% of organizations with "core hours[1]" formally offer a flexible work arrangement, while 51% of organizations where "core hours" do not apply offer a flexible work arrangement to their employees.

COG/TPB staff has been working closely with the University of Maryland's (UMD) National Transportation Center during the development of their integrated, personalized, real-time traveler information and incentive (incenTrip) program. University of Maryland staff have received a grant from the U.S. Department of Energy and has been tasked with quantifying potential travel energy savings in the Washington D.C. and Baltimore metropolitan regions. Part of their analysis includes conducting extensive behavioral research to design effective personalized incentives for users. Part of their focus includes studying the benefits of peak-period spreading throughout the region.

Current Commuter Connections software, combined with the University of Maryland's incenTrip program, will be used to notify users and provide proof of an individual traveling outside of the peak hours to avoid an incident or higher-than -average traffic delays. COG/TPB and UMD development teams will work closely to develop test deployment plan to add and fine tune this capability to the existing Commuter Connections mobile application before a pilot program is launched.

Within the Commuter Connections app, the user must turn on their location services so Commuter Connections can verify that the trip was taken outside their regularly scheduled work hours. Individuals registered with Commuter Connections have already elected to provide

[1] Employees choose their work hours within limits established by the employer.
They must work full time and be present daily during "core hours."

their home address, work address, contact information and schedule flexibility. The user will indicate when their trip has begun and when they have reached their destination. Location services will also help confirm that the user is traveling between their place of residence and work location. The combination of user-provided information and information gathered from the commuter's smartphone location services will be used to validate incentivized trips. Alternatively, commuters who do not own a smartphone or opt out of using location services could have the option of verifying that their commute trip was delayed or not taken by submitting their trip through the Commuter Connections TDM software. Notifications for higher than usual traffic delays and/or incidents will be customized to the commuters regularly used corridor.

Commuter Connections may have to verify some of the information provided, such as schedule flexibility, with the user's employer. Commuter Connections may also have to restrict the user's ability to edit certain information after it has been confirmed, i.e., locking a user's work schedule and/or employer address to prevent individuals from changing this information before or after accepting a notification. These measures may need to be taken to ensure that commuters are using the program for its intended purpose.

The University of Maryland also has a predictive travel model, which can calculate the estimated time of arrival when traveling along corridors in the region. This data can be calculated 24 hours in advance and can recalculate every time an incident is detected. This model may help Commuter Connections determine when to push a notification to its registered users indicating to them that the flextime incentive is available. Data from UMD's Center for Advanced Transportation Technology (CATT) laboratory has been collected and analyzed by COG/TPB staff. This analysis shows an average time of 30 minutes for incidents occurring region wide to be cleared.

Performance measures will be set for congestion delays, energy use and emissions. Behavior data from collected from the flextime incentive pilot can be used to produce system-wide benefit estimates.

Finally, United States tax laws are investigated to determine any restrictions or parameters on the amount of incentives that can be distributed:

Money received by the public through this program will be classified by the IRS as "non-employee compensation" and treated as 1099 income. In the event an individual receives a financial amount totaling $600.00 or more throughout the calendar year, the recipient will be required to provide COG with a completed W-9 Form so COG may issue a Form 1099-MISC. A completed W-9 Form may be an application requirement if COG choses to allow payments or prizes/gifts totaling over $600.00.

3. Literature Review

Research specific to flextime financial programs is limited. However, relatively recent findings indicate that commuters are receptive to using flextime to avoid congested corridors when offered an incentive.

3.1 "Rewarding for Avoiding the Peak Period: A Synthesis of Three Studies in the Netherlands"

In 2006, a series of three experiments being conducted in the Netherlands began to assess the effects of monetary rewards given to travelers who avoided the peak period.

Experiment 1: Zoetermeer to Hague (A12 Motorway)

This initial experiment was intended to gauge receptiveness to the idea, not to necessarily solve the congestion problem.

The rewards experiment took place from October through December 2006 during 10 consecutive weeks. The participants were monitored two weeks prior to, and one week after the rewarding period. Participants were chosen based on those who frequently traveled the motorway. Invitations were given and participation was validated using a license plate detection system.

The monetary-reward scheme consisted of multiple values. Participants could earn €3 to €7. For three weeks, €3 could be earned each day commuters avoided the morning peak by car. For another four weeks, they could earn €7 each day. And for yet another three weeks, they could earn €3 per day, which increased to €7 if they were not detected at all in the morning peak.

The behavioral change with the €3 and €7 per day incentive was as follows:

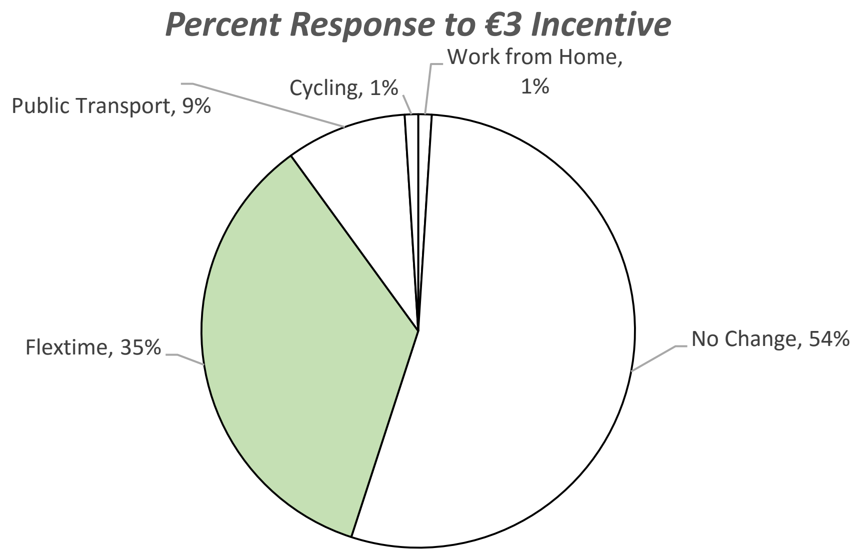

***Figure 1**: Behavioral Response (trip percentages) for the Zoetermeer A12 motorway with a €3 per day incentive for flextime use*

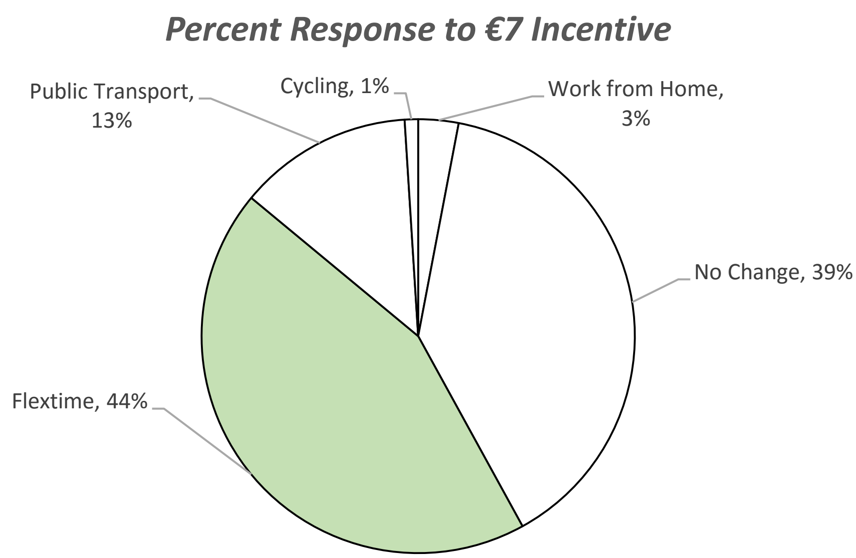

***Figure 2**: Behavioral Response (trip percentages) for the Zoetermeer A12 motorway with a €7 per day incentive for flextime use*

As shown, most commuters who changed their travel behavior decided to travel during off-peak hours.

The percentage of flextime used sees a relatively modest rise when commuters are offered a 133% increase from €3 to €7 per day. The third reward scheme where participants who earned €3, with an increase to €7, saw an almost identical percentage as the flat €7 reward scheme.

Experiment one concluded that a relatively low reward sufficed for most participants to be affected.

Experiment 2: Hollandse Bridge

The second experiment conducted had a clear goal in mind: avoid a significant increased level of congestion during a year-long construction project. To achieve this, it was estimated that the motorway needed a reduction of 1,000 to 1, 500 trips per week during the morning peak. Mobility management measures included free public transport, vanpools and a monetary reward for those traveling by car to avoided the peak hour. Those who received the monetary reward were not also eligible to receive free public transportation.

A reward of €4 per work day could be earned by participants for avoiding the morning peak (6 a.m. – 10 a.m.). An additional €2 could be earned if an individual did not travel by car that day. This lead to a maximum weekly incentive of €30: 5 x (4+2). Invitations were given and participation was validated by the same license plate detection system used in experiment one.

Given the reward scheme, it was expected that individuals who chose the monetary reward would shift their travel times to avoid the peak hour. The behavioral change was as follows:

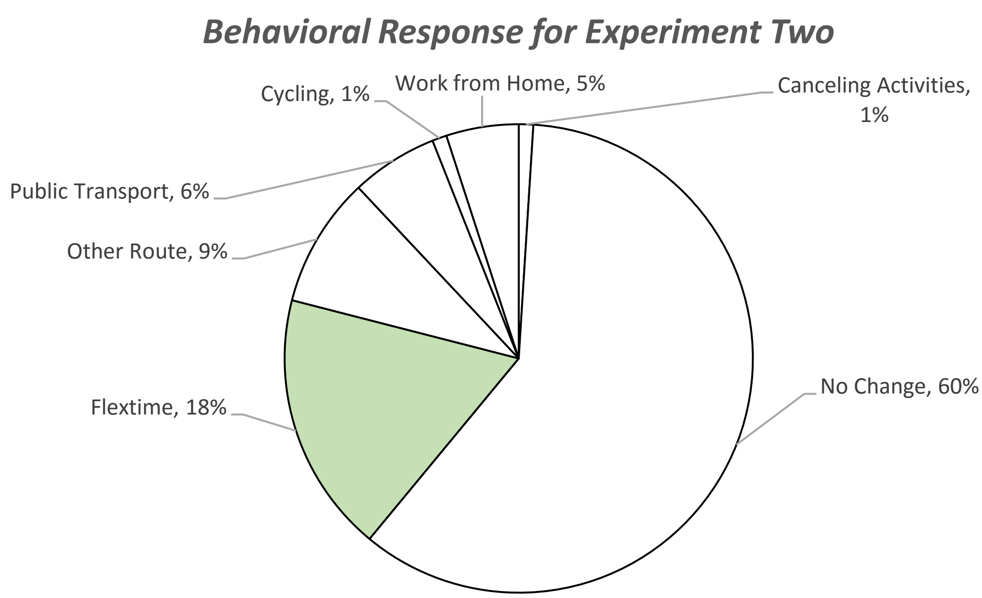

Figure 3: *Behavioral Response (trip percentages) along the Hollandse Brug during Experiment two*

Experiment two yielded a behavioral change response of 40%, with the largest change (18%) belonging to those who chose to travel outside of the peak hours.

Their analysis of license plate data for the first half of the year showed a reduction of approximately 1,250 car trips of the 1,433 participants observed per week. This reduction was an equivalent to approximately 250 cars per morning peak, or, 1.5% of the total traffic flow.

After analyzing data from the first half of the year, a second outreach effort was made to invite additional commuters traveling along the bridge to participate in the reward scheme. This resulted in a further reduction of trips taken during the morning peak from 250 cars to 425 cars, or, 2.6% of the total flow along the bridge.

Experiment 3: Moerdijk Bridge

Much like experiment two, experiment three aimed to avoid a significant increase in traffic congestion due to roadwork. However, the duration of this experiment only lasted 2.5 months, from April to July, 2008.

Like experiments one and two, automated license plate detection was used to identify and invite commuters traveling along the bridge. Automated detection was also used to validate travel times for commuters.

This experiment's reward scheme payed €4 per day to those traveling south on the bridge during evening peak hours (3 p.m. – 7p.m.), giving commuters the opportunity to earn a maximum of €20 per week.

The key difference in experiment three being that there were two feasible alternate routes, unlike experiment one (A12 Motorway) and experiment two (Hollandse Bridge).

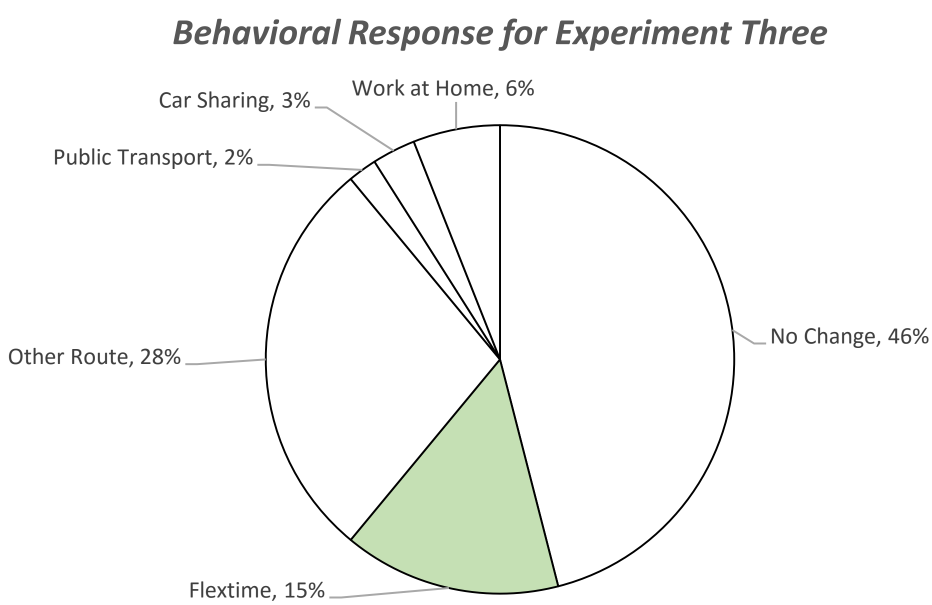

Figure 4: *Behavioral Response (trip percentages) along the Moerdijk Bridge during Experiment three*

Analyzing data from experiment three showed that the total number of bridge passengers decreased by about 920 vehicles per evening peak, or, 4.6% of the total traffic flow along the bridge.

Overview:

Location	Reward	Departure Time Shift	Route Shifts	Mode Shifts	No Trip
Zoetermeer	€3	35%	—	10%	1%
Zoetermeer	€7	44%	—	14%	3%
Hollandse Bridge	€4 – €6	18%	9%	7%	6%
Moerdijk Bridge	€4	15%	28%	5%	6%

Figure 5: *Summary of results from the three rewarding studies*

The larger departure time shifts most notable in the first experiment can be explained by how the peak period was defined differently throughout each study. The peak period was only two hours during the first experiment, as opposed to four hours along the Hollandse and Moerdijk bridges. Thus, making traveling outside the peak hour easer to achieve along the Zoetermeer A12 motorway. Another reason for the higher adjustment for experiment one is the fact that no other reward could be used by changing route. Offering no route alternative implied that commuters would only change their travel times to avoid congestion.

Although the departure shift for experiments two and three seem modest, the majority consensus was success. They were able to meet their goals in reducing traffic congestion throughout the designated corridors to allow a minimal impact by roadwork taking place. It is important to note that too large of a shift will not solve a congestion problem. It will just change the congestion period.

Clearly, the monetary incentives are effective because behavior change has significant impacts during the temporary reward periods. The experiments proved to be so effective for the region, that the Netherlands continued to implement flextime incentive programs for future construction projects along major corridors throughout the country.

3.2 "Reducing Road Congestion Through Incentives: A Case Study"

This paper studied the use of incentives to increase the willingness of commuters at Stanford University to adopt the congestion-reducing behavior of traveling outside of the peak period.

Stanford University first designed and implemented their incentive program, called CAPRI (Congestion and Parking Relief Incentives), in 2012 with participation aimed at about 10,200 permit-holding car commuters. A total of 3,082 registered to participate in the program. The study lasted for approximately two and a half years.

Those who enrolled were given passive RFID (Radio-Frequency Identification) tags to be placed on the windshield of their vehicle. The tags were sensed at 10 main entrances and exits of the campus. For each vehicle detected by the sensors during the off-peak hour, the participant was awarded 10 points. CAPRI would also assign each participant a "boost day" in which their off-peak trip would earn them 30 points instead of 10.

Participants could then redeem 100 points for $1, or, spend their points on a game to receive anywhere from $1-$50.

Participants playing the game were divided into four different tiers depending on how many off-peak trips were made throughout the week. The more off-peak trips a participant made, the higher their status would be. Failure to continue traveling during off-peak hours would result in a downgrading of their status. Participants with a higher status had a higher chance of earning a higher reward while playing the incentive game. Through the course of the study, 13.2% of participants eventually switched to playing the game to receive their reward. The rewards were paid out as paycheck supplements or through bank deposits.

To summarize their main findings: compared to the general Stanford population, CAPRI participants are 21.2% less likely to commute during the morning peak hours of 8-9 a.m., and 13.1% less likely to commute during the evening peak hours of 5-6 p.m.

The study was implemented on April 2nd, 2012 and ended on September 30th, 2014. CAPRI gave out a total of $211,989 in incentives.

3.3 "Behavioral Economics and Psychology of Incentives"

A research paper published in 2012 by the University of Chicago's Booth School of Business offers some insight on the psychology of structuring a successful incentive.

The author recognizes two broad pattern that can lead to a successful incentive structure: less money and fewer options.

He theorizes that these two patterns are a direct result of the following elements: "contextual inference," "loss aversion and dynamic inconsistency" and "choking."

The idea behind contextual inference is that people are often unsure about what the best course of action is and consequently seek clues from the environment. One of the goals of Commuter Connections' flextime incentive projects is to offer this clue and assist commuters to take a desired course of action during an incident within the peak hours. The environmental clue in this case will be an alert pushed out to the registered individual's phone or email address.

Loss aversion and dynamic inconsistency simply refers to an individual's personal preference. It is reasonable to think that commuters do not want to lose time by sitting in a congested corridor during an incident. This should naturally make them receptive to accepting an incentive to avoid an undesired situation.

The author states that "choking" may be a factor in explaining why some high-powered incentive schemes might degrade performance. Too high a reward can create a high-pressure situation, in which the volunteer may even opt out of performing. Typically, a high-stake situation is not entirely unanticipated. However, incidents along congested corridors in the metropolitan Washington region cannot be predicted. This can compound this theory by creating an unanticipated high-stakes situation, which may discourage participants.

The author continues to explain what he calls “default effects of choice fatigue,” stating that there is compelling evidence that being presented with a default option increases their ability to make a concise choice. Commuter Connections will not be incentivizing individuals to use alternative routes or shifting their mode of travel, which should make the individual more likely to accept the option of flexing their time.

Commuter Connections will be taking the theories in this literature into further consideration while developing the reward scheme.

4. 2016 State of the Commute Survey Data

The 2016 Commuter Connections State of the Commute Report is the sixth of its kind. A similar report has been produced every three years since 2001, tracking a wide range of transportation information and assistance services designed to inform Washington D.C. area commuting workers of the availability and benefits of alternatives to driving alone and to assist them to find alternatives that fit their commuting needs.

The State of the Commute Report serves several purposes, including the documentation of trends in commuting behavior, such as availability, receptiveness and use of a flexible work schedule. This survey is also used to help estimate the impacts of some transportation emissions reduction measures (TERMs).

This report defines the morning peak period for the region as being from 6:30 a.m. to 9:30 a.m. The survey sample size was 6,325.

Of the total individuals who have responded to the survey:

- 50% use the flextime they have available
- 13% have flextime available but do not use it
- 37% do not have flextime available

“Figure 6” provides the percentages of these totals, broken down by the timeslot in which individuals arrive at work.

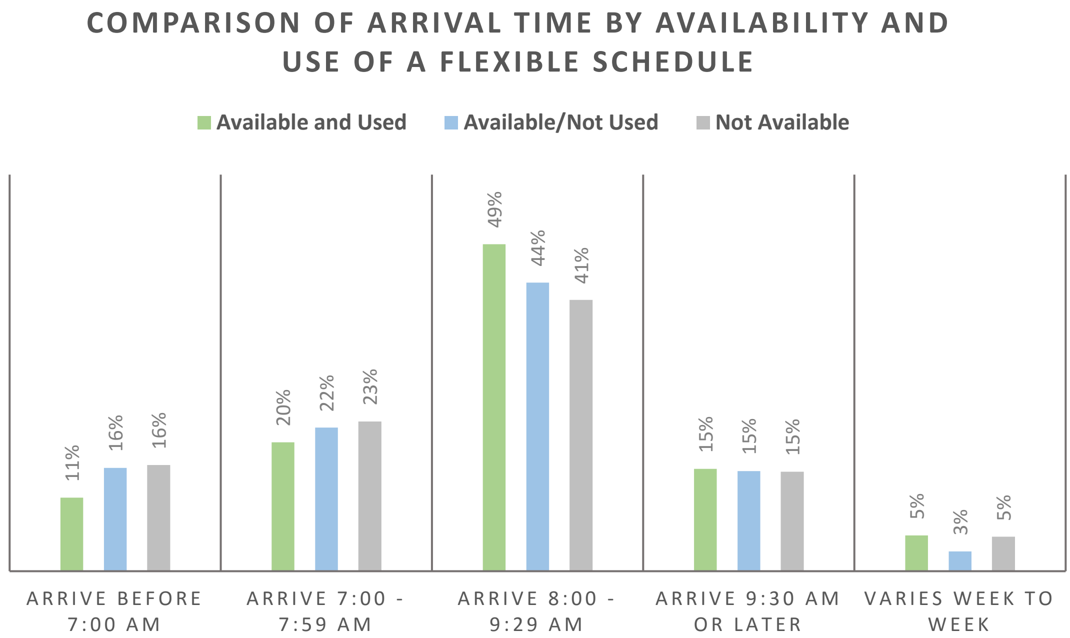

***Figure 6**: Survey results comparing arrival times with individual's availability and use of flextime.*

A large percentage of individuals within the subset of those who have and use their flextime (49%), still arrive between 8:00 a.m. and 9:30 a.m., which means they are still traveling well within the peak period.

Additionally, data from this report takes a closer look at the subset of respondents who have indicated they have a flexible work schedule.

Stated flexibility of respondents who are employed full time:

- 6% up to 15 minutes
- 11% 16-30 minutes
- 18% 31-60 minutes
- 54% more than 60 minutes
- 10% flexible within reason
- 1% other

Of the subset of respondents who are employed full time with a flexible work schedule, 72% are flexible by over 30 minutes.

Stated flexibility of respondents who are employed part time:

- 25% up to 15 minutes

- 5% 16-30 minutes
- 14% 31-60 minutes
- 33% more than 60 minutes
- 16% flexible within reason
- 7% other

Of the subset of respondents who are employed part time with a flexible schedule, 47% are flexible by over 30 minutes.

The State of the Commute Report also gauged respondents on their receptiveness to accepting a small monetary reward for using the flextime they have available. The report asked, "*If you could receive $3 per day for each day that you arrive at work before 7:00 am or at 10:00 am or later, how likely would you be to make this change in your work schedule?*" This question implied a repeated or occasional incentive. Percentages may be higher or lower for respondents interested in a one-time reward (cash or prize drawing).

Worker respondents from some jurisdictions were more notable for their flexibility than others. This was due to either a high percentage of the respondents being flexible by 30 minutes or more, or, due to a high percentage of respondents who indicated they would be likely to accept a small monetary reward for using their flextime.

Notable work jurisdictions with commuting workers who are flexible by 30 minutes or more:

- Alexandria; 85% are flexible by 31 or more minutes
- Arlington County; 72% are flexible by 31 or more minutes
- D.C.; 70% are flexible by 31 or more minutes
- Fairfax County; 71% are flexible by 31 or more minutes
- Montgomery County; 69% are flexible by 31 or more minutes
- Prince William County; only 34% are flexible by 31 or more minutes
- Prince George's County; 52% are flexible by 31 or more minutes

Likelihood of notable work jurisdictions to use their flextime when commuting workers are offered a small reward:

Jurisdiction	% Flexible by 31 or more minutes	% *Very likely* to accept a small reward	% *Somewhat likely* to accept a small reward
Alexandria	85%	18%	42%
Arlington County	72%	27%	24%
D.C.	70%	22%	28%
Fairfax County	71%	30%	21%
Montgomery County	69%	30%	24%
Prince William County	34%	36%	27%
Prince George's County	52%	42%	21%

Current Primary Mode:

This report also considered the primary mode of transportation the respondent is currently using.

Bus commuters seem to be the most open to receiving a small reward for travelling outside the peak period. 42% responded very likely and 22% responded somewhat likely.

Drive alone commuters were the second most receptive at 27% very likely and 24% somewhat likely.

Carpoolers were the third most receptive at 22% very likely and 32% somewhat likely.

Major Roads Used:

The analysis also examined the extent of flexibility and interest in a monetary reward for commuters who used different major roadways. The second column of the table below shows the percentage of commuters who've used each road and had any degree of flexibility. The third column indicates the percentage of roadway users who have more than 30 minutes of flexibility and who are likely to take advantage of a monetary reward. Note that this percentage applies a 25% discount of "somewhat likely" commuters who said they would use a flextime incentive and a 50% discount of respondents stating that they would be "very likely" to use the percentages.

For example, 6% of the commuters who used the MD portion of the Beltway had more than 30 minutes of flextime and would be likely users of a $3 per day incentive to shift out of the peak period.

Interstate highways or state routes commuters use on their trip to work[2]	% with any flex	% with >30 min flex	% >30 min and likely[3]
1. Capital Beltway (I-495) (MD)	66%	42%	6%
2. Capital Beltway (I-495) (VA)	69%	58%	14%
3. I-66 OUTSIDE the Beltway (VA)	62%	41%	8%
4. I-66 INSIDE the Beltway (VA)	76%	49%	7%
5. I-95 (MD)	69%	35%	7%
6. I-95 (VA)	62%	30%	5%
7. I-270 (MD)	65%	43%	8%
8. I-295 (DC / MD)	70%	31%	6%
9. I-395 (VA)	60%	31%	6%
10. I-695 (DC - Southeast-Southwest Freeway, Southwest Expressway)	62%	32%	11%
11. I-695 (MD - Baltimore Beltway)	39%	0%	0%
12. BW Parkway (US 295, Baltimore-Washington Parkway - MD)	66%	46%	12%
13. Dulles Toll Road (Dulles Greenway, Route 267)	63%	54%	11%
14. GW Parkway (George Washington Parkway)	85%	48%	15%
15. ICC (Inter-County Connector, Route 200)	44%	10%	0%
16. US Route 1 (MD)	70%	47%	7%
17. US Route 1 (VA - Richmond Highway, Jefferson Davis Highway)	85%	38%	7%
18. US Route 29 (MD - Colesville Road, Columbia Pike)	57%	49%	10%
19. US Route 29 (VA -- Lee Highway)	40%	11%	0%
20. US Route 50 (MD -- John Hanson Highway)	71%	31%	3%
21. US Route 50 (VA -- Lee Jackson Highway, Arlington Blvd, Fairfax Blvd)	49%	29%	4%
22. US Route 301 (MD)	76%	31%	9%
23. VA Route 7 - Leesburg Pike (VA)	100%	33%	6%
24. Fairfax County Parkway - 7100 (VA)	0%	0%	0%
25. MD Route 4 - Pennsylvania Ave (MD)	58%	20%	1%
26. Prince William Parkway - Rt 234/Bypass (VA)	25%	25%	6%
27. Suitland Parkway (MD)	85%	38%	0%
29. MD Route 355 - Rockville Pike (MD)	66%	53%	11%
30. Indian Head Highway - MD 210 (MD)	54%	19%	1%
97. Other (specify)	55%	25%	4%
98. No Interstate or U.S. or State Routes	73%	49%	8%
99. DK/REF	56%	18%	3%
Total			

[2] The survey question did not ask respondents to specify which segment of interstate route or state highway they traveled

[3] Grayscale boxes indicate a lower confidence percentage level

5. Corridors of Interest

Corridors for consideration in the region were chosen based on data collected from the 2016 State of the Commute Survey and the table of top-10 peak-period bottlenecks produced as part of MWCOG's 2016 Congestion Management Process Technical Report. This data also allows for determining the corridors that would most benefit from implementing a flextime incentive program.

Data from MWCOG's Traffic Quality on the Metropolitan Washington Area Freeway Systems report are also reviewed to understand the average levels of service along selected corridors during peak periods.

5.1 Corridors for consideration

Like the work jurisdictions observed in the 2016 State of the Commute Survey in section 4, responses from individuals traveling on certain corridors were more notable than others. This is also due to a high percentage of the respondents being flexible by 30 minutes or more, or, due to a high percentage of respondents who indicated they would be likely to accept a small monetary reward for using their flextime.

Below lists Interstate Highways, U.S. and State routes in the region. Note that multiple responses were permitted. The percentages of flexibility are presented, followed by the likelihood of individuals travelling along notable corridors to use their flextime when offered a small reward:

This set of data shows flextime accessibility for State of the Commute respondents stating that had flextime availability at their work site:

The Capital Beltway:

- 12% are flexible up to 15 minutes
- 8% 16-30 minutes
- 33% 31-60 minutes
- 43% more than 60 minutes
- 4% flexible within reason

I-66:

- 15% are flexible up to 15 minutes
- 5% 16-30 minutes
- 9% 31-60 minutes
- 62% more than 60 minutes
- 9% flexible within reason

I-270:

- 3% are flexible up to 15 minutes
- 14% 16-30 minutes
- 27% 31-60 minutes
- 48% more than 60 minutes
- 8% flexible within reason

Dulles Toll Road:

- 7% are flexible up to 15 minutes
- 1% 16-30 minutes
- 20% 31-60 minutes
- 70% more than 60 minutes
- 2% flexible within reason

The George Washington Parkway:

- 9% are flexible up to 15 minutes
- 10% 16-30 minutes
- 31% 31-60 minutes
- 30% more than 60 minutes
- 21% flexible within reason

This next set of data shows the likelihood of all individuals travelling along notable corridors to use flextime when offered a small reward along with their flexibility[4]:

The Capital Beltway (MD):

- 66% have some type of flextime
- 42% are flexible by 30 minutes or more
- 6% are likely to use flextime incentive

The Capital Beltway (VA):

- 69% have some type of flextime
- 58% are flexible by 30 minutes or more
- 14% are likely to use flextime incentive

[4] This section includes percentages from different data sets within the SOC report and *will not* add up to 100%. "Some type of flextime" refers to any type or amount of flextime available to them through their employer.

I-66 Outside the Beltway:

- 62% have some type of flextime
- 41% are flexible by 30 minutes or more
- 8% are likely to use flextime incentive

I-66 Inside the Beltway:

- 76% have some type of flextime
- 49% are flexible by 30 minutes or more
- 7% are likely to use flextime incentive

I-270:

- 65% have some type of flextime
- 43% are flexible by 30 minutes or more
- 8% are likely to use a flextime incentive

The Dulles Toll Road:

- 63% have some type of flextime
- 54% are flexible by 30 minutes or more
- 11% are likely to use a flextime incentive (Note: Low confidence level)

The George Washington Parkway:

- 85% have some type of flextime
- 48% are flexible by 30 minutes or more
- 15% are likely to use flextime incentive

I-295:

- 70% have some type of flextime
- 31% are flexible by 30 minutes or more
- 6% are likely to use flextime incentive

5.2 Top-10 Peak-Period Bottlenecks in the Region

The top-10 peak-period bottlenecks in the region are also examined for corridor consideration. “Figure 7” provides a list of top bottlenecks in the Washington region for peak periods only, i.e., non-holiday weekday 6:00-9:00 a.m. and 4:00-7:00 p.m. The bottlenecks are ranked by either the combination of Travel Time Index (TTI) and length or the multiplication of TTI, length and Annual Average Daily Traffic volume (AADT). The Travel Time Index is the ratio of the peak-period travel time as compared to the free-flow travel time. Smaller numbers indicate freer flowing traffic patterns. For purposes of this paper, the AADT will be discounted by one-third to account for a.m. and p.m. peak period of travel.

2015 Top Bottlenecks - Peak Periods								
Location	State	Ave. TTI	Length (miles)	TTI Miles	Rank by TTI Miles	AADT	AADT × TTI Miles	Rank by AADT × TTI Miles
I-495 IL between VA-267 and I270 Spur	VA, MD	2.69	8.36	22.47	1	110,376	2,480,129	1
I-495 OL between I-95 and MD-193	MD	2.57	4.35	11.17	2	104,670	1,168,848	2
I-66 EB at VA-267	VA, MD	2.47	2.83	6.99	3	65,500	548,043	6
I-270 SPUR SB	MD	3.21	2.04	6.56	4	65,406	429,242	8
DC-295 SB at Benning Rd.	DC	2.59	2.28	5.89	5	59,376	349,827	10
I-95 SB at VA-123	VA, MD	2.34	2.46	5.75	6	104,000	597,810	4
VA-28 SB between VA-7 and N. King St.	VA, MD	2.32	2.3	5.33	7	50,000	266,469	12
US-15 NB between VA-7 and N. King St.	VA, MD	2.56	2.02	5.19	8	8,800	45,656	26
I-495 OL between I-270 and MD-190	MD	2.26	2.22	5.01	9	122,010	611,335	3
I-495 IL between MD-355 and MD-185	MD	2.23	1.96	4.38	10	110,876	485,635	5
I-495 IL between I-95 and US-1	MD	2.32	1.68	3.91	12	111,740	437,336	7
I-495 OL at MD-202 / Landover Rd.	MD	2.09	1.54	3.22	14	113,390	364,755	9

***Figure 7**: Top-10 Bottlenecks during the peak period as of 2015, using data gathered from MWCOG's 2016 Congestion Management Process Technical Report.*

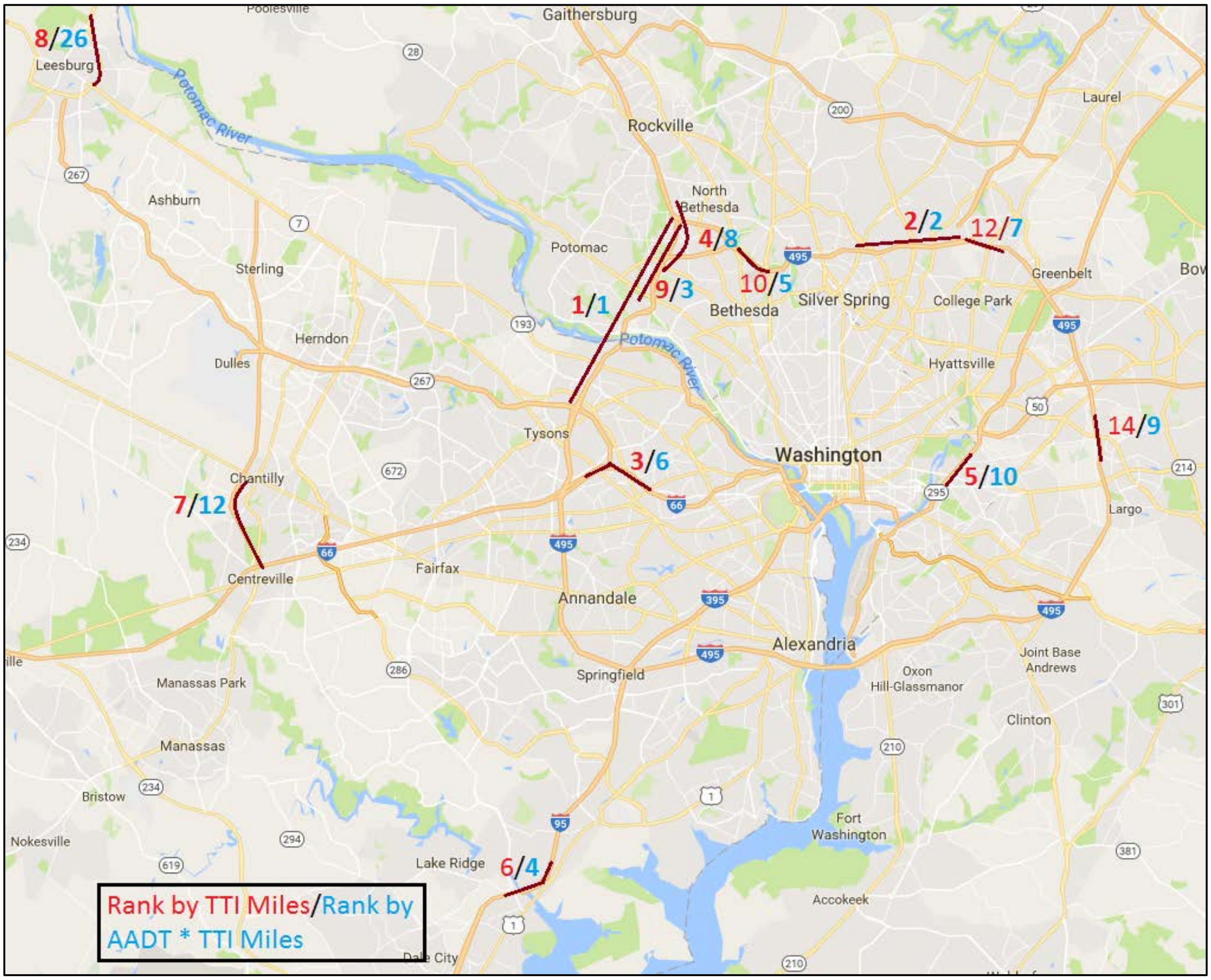

Figure 8: A regional map showing the locations of the top-ten bottlenecks by rank.

Based on responses from the State of the Commute survey, analysis of the region's top-10 traffic bottlenecks, and to allow for a variety of roadway segments on a regional scale, it is reasonable to focus the pilot program on commuters traveling on the Beltway near the I-270 spur and American Legion Bridge. This specific section is the highest ranked traffic bottlenecked area with the most volume and is extremely congested during peak hours. 42% of respondents traveling along the Capital Beltway in Maryland and 58% in Virginia are flexible by 30 minutes or more, while 43% of those traveling I-270 are flexible by 30 minutes or more. The combination of the above data leads to a recommendation that this roadway segment would be ideal for pilot program implementation.

The second roadway segment recommendation for pilot program implementation is also along the Beltway between I-95 and MD-193 and stands as the second highest traffic bottlenecked section in the region. This section ranks second in highest Travel Time Index (TTI) ratio, the second longest in length of congestion, the second highest TTI miles and fourth in traffic volume. Also, as previously mentioned, it is known that commuters traveling along the Capital

Beltway have a high percentage of flexibility and between 5 and 15% of them are likely to use their flextime if offered a reward.

The third roadway segment recommendation for pilot program implementation is along I-66 heading eastbound at VA-267. This sections is where the Dulles Toll Road merges into I-66 and ranks third in the region's top-10 bottlenecks with a high traffic volume and TTI ratio. Survey data also tells us that 49% of respondents traveling on I-66 Inside the Beltway are flexible by 30 minutes or more and 7% of respondents are likely to use their flextime if offered a reward. For the Dulles Toll Road, 54% of respondents indicated they are flexible by 30 minutes or more and 11% indicated that they are likely to use their flextime if offered a reward, although the confidence level is somewhat lower.

Our fourth recommendation for program implementation is along DC-295 heading southbound at Benning Road. This congested corridor ranks fifth in region's top-10 bottlenecks with a high traffic volume and TTI ratio. This corridor has the potential to carry commuters traveling into Washington D.C. from other congested parts of I-495 and may benefit from program implementation.

5.3 Levels of Service

COG/TPB staff produced an ongoing mobility-monitoring report in 2014 titled "Traffic Quality on the Metropolitan Washington Area Freeway Systems[5]."

In the Traffic Quality on the Metropolitan Washington Area Freeway Systems report, peak-period freeway congestion is monitored on a tri-annual cycle during the a.m. and p.m. peak periods. Survey data was collected using aerial photography flights conducted on weekdays, excluding Monday mornings, Friday evenings and mornings after holidays.

Morning surveying times:

- 6:00 a.m. – 9:00 a.m. outside the Capital Beltway
- 6:30 a.m. – 9:30 a.m. inside the Capital Beltway

Evening surveying times:

- 4:00 – 7:00 p.m. inside the Capital Beltway
- 4:30 – 7:30 p.m. outside the capital Beltway

During the survey flights, overlapping photographic coverage was obtained of each designated highway, repeated once an hour over three morning and three evening commuter periods, totaling nine morning and evening observations.

Data were then extracted from the aerial photographs to measure average traffic flow density and determine levels of service. There are generally six levels of service, A through F. Level of

[5] This report was initially published in 1993 and discontinued after its 2014 edition.

service “A” is the best, describing primarily free-flowing conditions, while level of service “F” is the worst, describing flow as unstable and significant traffic delay.

At densities greater than 40 passenger cars per lane per mile, speeds typically decrease and traveler delays are experienced. The threshold for level of service “F” is approximately 46 passenger cars per lane per mile. Densities above 100 indicate severe congestion with considerable stop-and-go flow likely. Densities above 120 almost always indicate the presence of an unusual event, i.e., accidents, roadwork etc.

Traffic Quality Ratings:

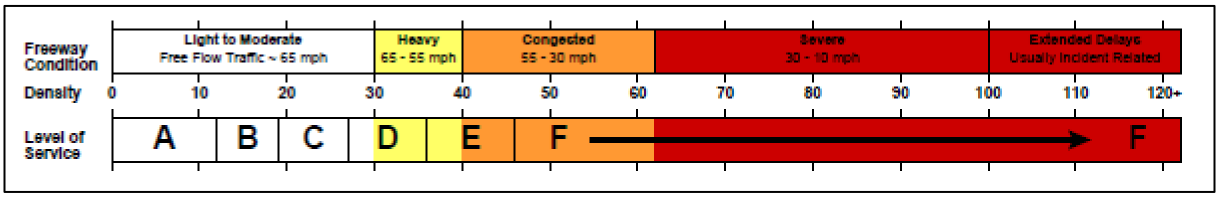

__Figure 9:__ Traffic Quality Rating Table as presented in the Traffic Quality on the Metropolitan Washington Area Freeway System survey. Density is measured in units of passenger cars per lane per mile.

Quality ratings may contain a superscript of 1, 2, 3 and\or 4. They represent the following:

- [1] Type 1 nested congestion (some days, not others)
- [2] Type 2 nested congestion (more severe in left or right-hand lanes)
- [3] Type 3 nested congestion (present only in the first or second half-hour period)
- [4] Type 4 nested congestion (partial length of segment)

The level of service on the I-270[6] Western Spur was examined as part of the Traffic Quality on the Metropolitan Washington Area Freeway Systems survey. Morning level of service is typically ranked E-F with densities varying from 55-75 passenger cars per lane per mile. Factors contributing to the congestion included: 1) the lane drop - 3 lanes to 2 at Democracy Blvd; 2) traffic entering the mainline at Democracy Blvd; 3) the merge with I-495 traffic at the terminus of the Western Spur.

Inner loop congestion found later in the morning survey period was exacerbated by sun glare; after crossing from Virginia into Maryland on the American Legion Bridge, the roadway bends sharply to the right into the direction of the sun (eastbound).

[6] The I-270 Spur produces three of the top-10 bottlenecks presented in section 5. 2.

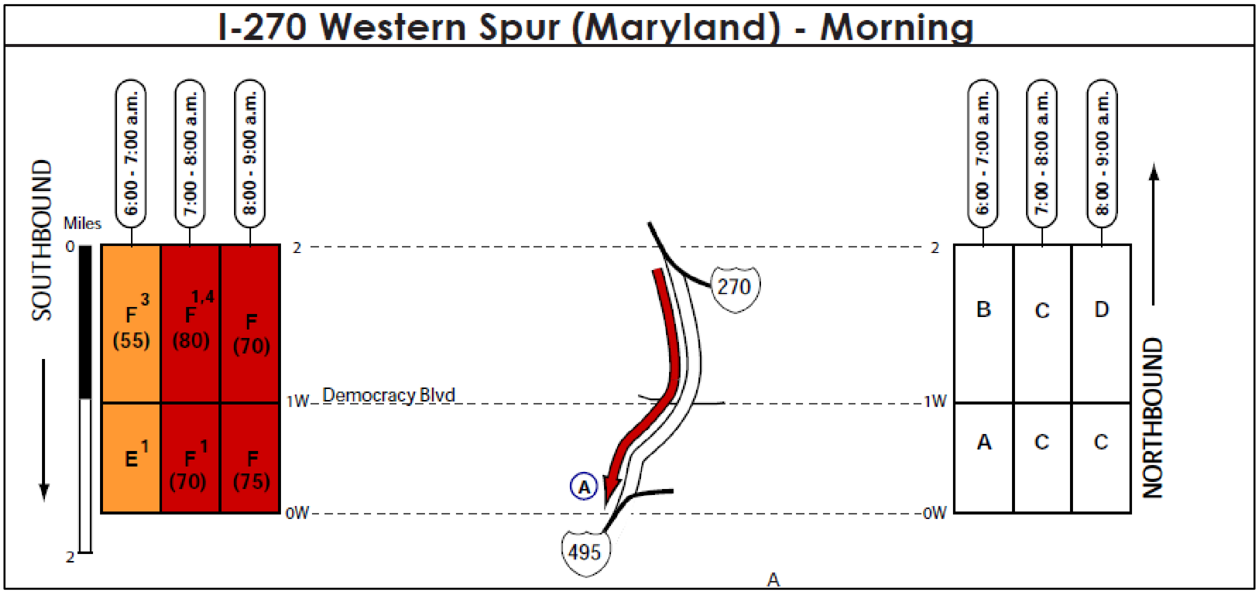

Figure 10: *The I-270 Western Spur as presented in the Traffic Quality on the Metropolitan Washington Area Freeway System survey.*

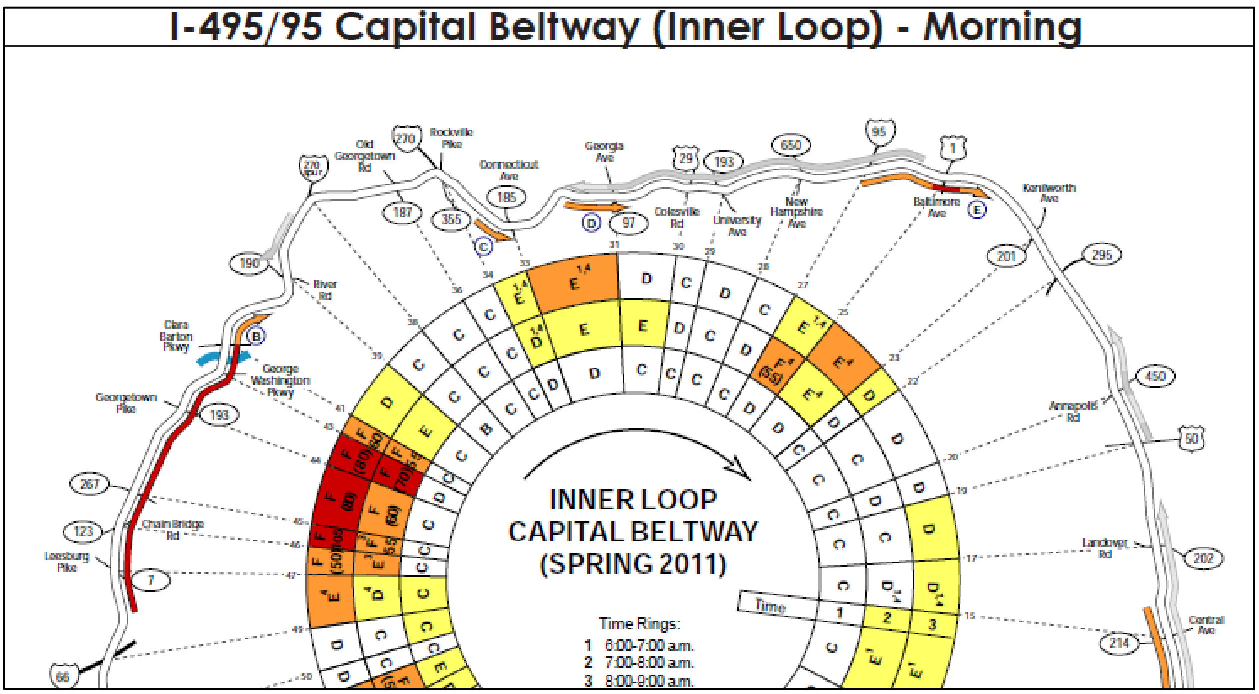

Figure 11*: The American Legion Bridge can be found to the left of this image between the George Washington Memorial Parkway and the Clara Barton Parkway.*

DC-295 southbound at Benning Road is another top-10 bottleneck that is observed in the Traffic Quality on the Metropolitan Washington Area Freeway Systems survey. Levels of service are consistently ranked “F” throughout the morning hours of 6:00-9:00 with densities ranging from 75-95 passenger cars per lane per mile. Factors contributing to the congestion were: 1) traffic entering and exiting at the series of interchanges along this section of MD/DC 295; and 2) congestion on the eastbound US 50 ramp backing into the mainline on MD 295. Southbound vehicles consistently resumed free flow speeds south of the MD 4 Interchange.

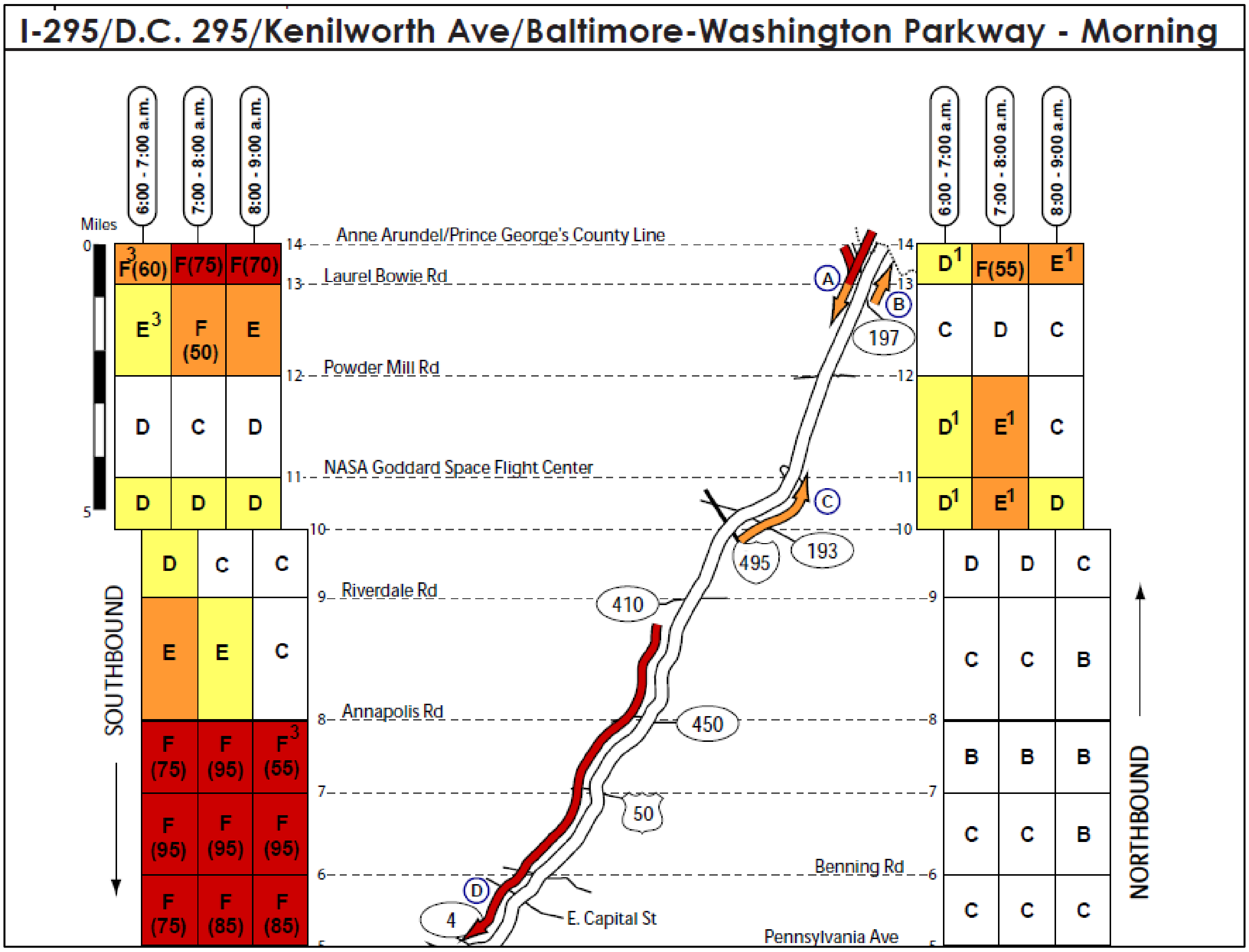

__Figure 12:__ D.C. 295 southbound at Benning Road as presented in the Traffic Quality on the Metropolitan Washington Area Freeway System survey.

Another bottleneck observed in the Traffic Quality on the Metropolitan Washington Area Freeway Systems survey is the I-495 Capital Beltway Outer loop between I-95 and MD-193. This segment consistently has a level of service rank “F” during the morning hours of 6:00 – 9:00 and densities varying from 75-105 passenger vehicles per mile per lane. Congestion appeared to be caused by exit queue throughout the segment.

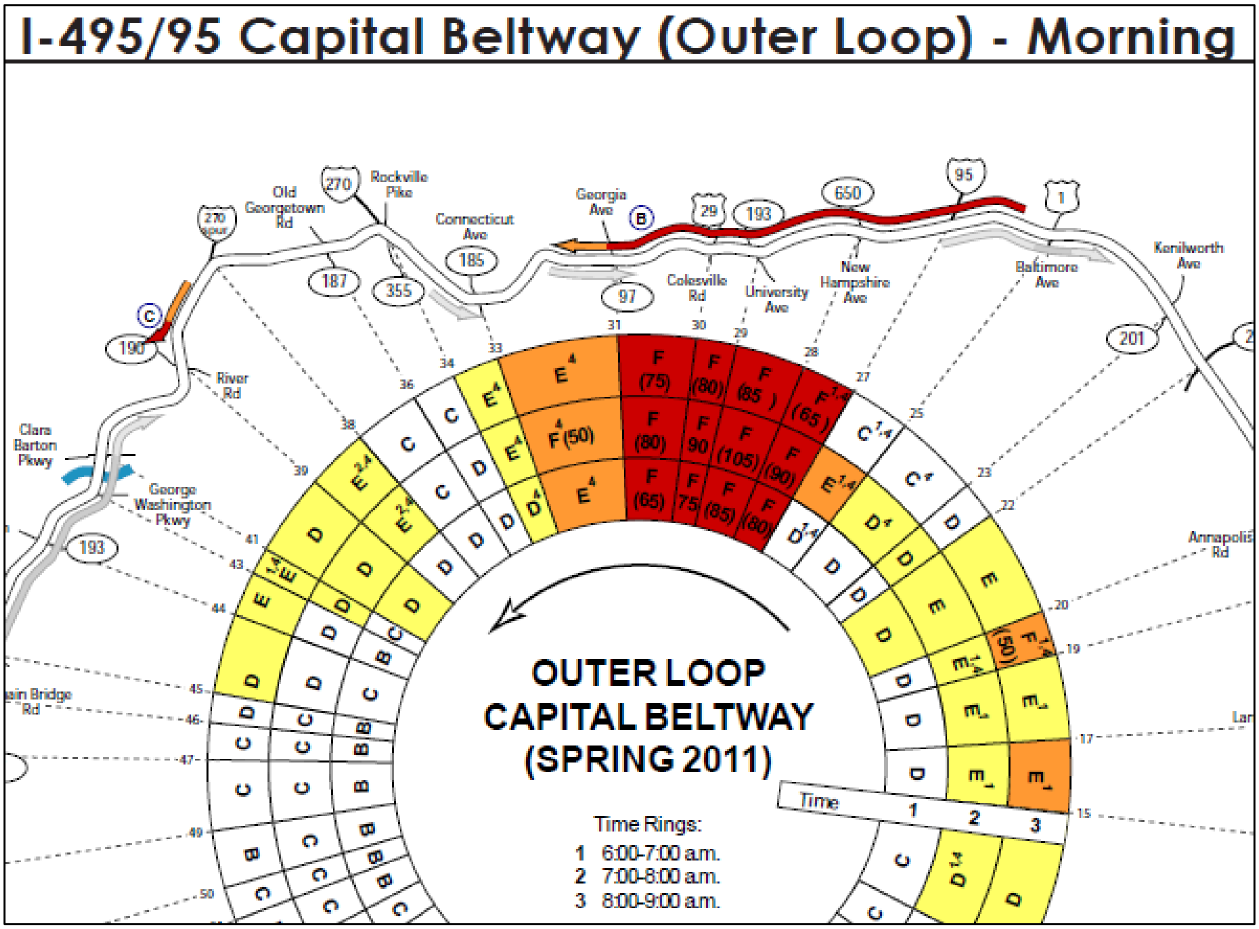

Figure 13: *The bottlenecked segment of I-95 – MD-193 as presented in the Traffic Quality on the Metropolitan Washington Area Freeway System survey. Densities have been observed as severe as 105 passenger vehicles per mile per lane.*

The bottleneck on I-66 eastbound at VA-267 was also observed in the Metropolitan Washington Area Freeway Systems survey. This segment is ranked “E” – “F” with densities varying, reaching severe congestion at 105 passenger vehicles per lane per mile. After 7:30 a.m., moderate to severe eastbound congestion was consistently found on I-66 between VA-267 and George Mason Dr.; factors that contributed to the congestion included; 1) the lane drop (3 lanes to 2) at US-29; 2) traffic entering the mainline from Sycamore St; 3) sun glare.

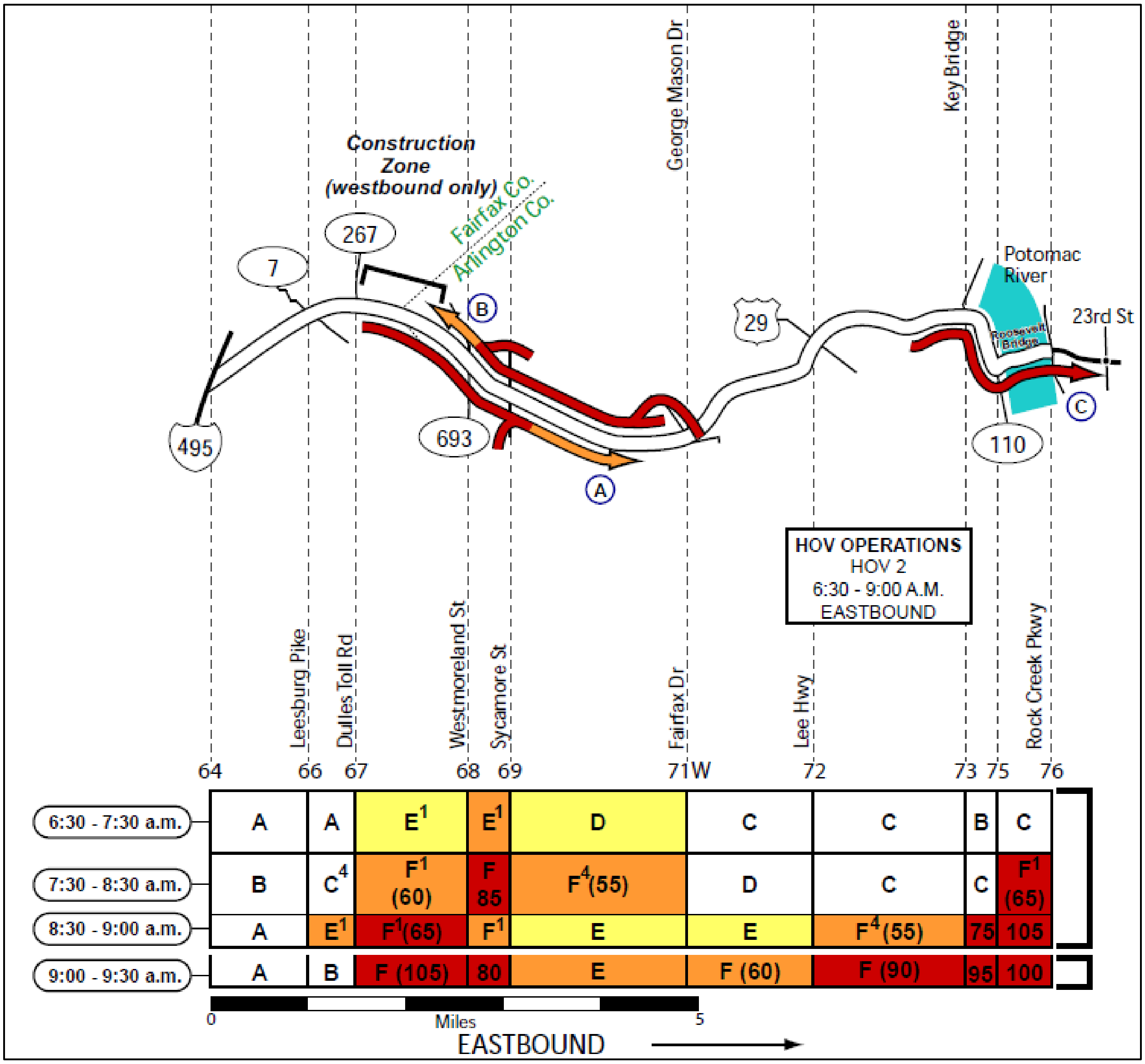

Figure 14: The bottlenecked segment of I-66 eastbound at VA-267 as presented in the Traffic Quality on the Metropolitan Washington Area Freeway System survey.

6. Implementation

While this report concentrates on a handful of specific corridors in the Washington region, these selected corridors of interest are not the only possible in which to implement a flextime incentive program. The corridors selected for observation were purposely chosen in the event that a pilot program is initially launched. Corridors not included as a corridor of interest may still benefit from an incentive program and can still be a candidate for future implementation.

A major concern of this incentive program is verifying the accuracy of commute time to minimize/eliminate cheating or defrauding the incentive program. Currently, incentive program administrators use a variety of techniques to prevent/remove duplicate participants and to verify the actual commute characteristics. Commuter Connections plans on using a variety of new verification techniques to confirm the legitimacy of a user's trip. This includes the mandatory use of location services to verify departure and arrival times, as well as verify the route the individual has traveled. This verification will help Commuter Connections Staff confirm the participants are traveling to their registered work place, particularly for those receiving a cash incentive. It will also help Commuter Connections Staff verify that the participant is truly flexing their time and rerouting the trip. Other verification techniques can include self-reporting by the commuter for inclusion in monthly or quarterly prize/gift drawings.

Another concern regarding the implementation of this program is determining the severity of an incident along a corridor that would require a notification to be sent to registered users. Levels of service during the peak period are already consistently rated "E" – "F" without the presence of an incident.

The University of Maryland's predictive travel model may be able to assist Commuter Connections in determining which incidents warrant a notification. This model calculates the estimated time of arrival while traveling along corridors in the region and recalculates every time an incident is detected. This will give Commuter Connections insight into the severity of an incident that has recently occurred and allow notifications to be pushed appropriately.

This incentive program will have a registration process modeled after Commuter Connection's current benefit and incentive programs electronic applications. The applications received from individuals traveling along select corridors will be reviewed and either approved or denied by COG/TPB staff. Careful attention is given during this process to determine eligibility associated with implementing an incentive program of this type. Depending on eligibility requirements, existing Commuter Connections account holders may be able to simply opt in to the program.

Incentives provided could include direct cash similar to the current 'Pool Rewards carpool incentive and/or monthly/quarterly prize/gift drawings. Direct cash would be provided to participants notified about an incident or higher than normal traffic volumes on their route to or from their work site who use geolocation services that would allow for immediate verification of whether a trip was delayed. An additional option would be to allow for prize/gift drawings on a monthly/quarterly basis for those notified who would later self-report that they delayed their trip to or from work after they receipt of a notification.

Costs for the incentive could vary depending on the options that are chosen. Below are some examples based on the four chosen corridors for a pilot program:

Route	AADT	AADT*[7]	Flex Likelihood*[8]	$3/Day	$5/Day	$10/Day
I-495 IL Between 267 and I-270 Spur	110,376	36,424	10% (avg of VA and MD Beltway) = 1,821	$5,463	$9,105	$18,210
I-495 OL between I-95 and MD-193	104,670	34,541	6% = 1,036	$3,108	$5,180	$10,360
I-66 EB at 267	65,406	21,615	7% = 757	$2,271	$3,785	$7,570
DC -295 SB at Benning Road	59,376	19,594	6% = 588	$1,764	$2,940	$5,880
TOTAL DAILY COSTS				$12,606	$21,010	$42,020

Based on historical travel time index data for non-holiday weekdays in 2015 and 2016 in the morning and evening peak hours (7 a.m. – 8 a.m., and 5 p.m. to 6 p.m.) there are typically 70 higher than usual traffic delays days which include significant traffic incidents and high demand.

Summary of Unusually Congested Commute Days, 2016 & 2015			
	2016	2015	Average
7 AM Hour (regional TTI over 1.2)	39	49	44
5 PM Hour (regional TTI over 1.3)	33	48	41
Overlaps - days with congestion in AM and PM (TTI over 1.2 in 7 AM hour and 1.3 in 5 PM hour)	9	19	14
Total (7 AM + 5 PM) - Overlaps)	**63**	**78**	**71**

Given that the pilot project will focus on four top bottleneck corridors in the region, it is reasonably expected that 35 flextime notifications would be sent during a typical year involving the selected corridors resulting in the following *annual* incentive costs:

$3/day = $441,210 ($12,606 x 35)

$5/day = $735,350 ($21,010 x 35)

[7] AADT* is inclusive of peak period travelers only and represents 33% of the overall AADT

[8] *Flex Likelihood* results reflect a 50% from the AADT* column. EX: 50% of 36,424 = 18,212. 10% of 18,212 = 1,821. This reduction was made to reflect a more realistic percentage of registration and participation.*

$10/day = $1,470,700 ($42,020 x 35)

Annual costs shown for the incentive could be further reduced by instituting a program participation cap.

7. Recommendations and Conclusions

The intent of this report is to study best practices and to establish a pilot flextime-incentive program along the corridors that would see the greatest beneficial impact from program implementation.

The corridors recommended are:

- I-495 IL between VA-267 and I270 Spur
- I-495 OL between I-95 and MD-193
- I-66 EB at VA-267
- DC-295 SB at Benning Rd.

After analyzing various sources of literature and data pertaining to incentive programs and peak-period travel, it is our recommendation that a pilot program will be most effective along these sections of congested corridors. If successful, Commuter Connections plans to permanently install this program to operate among our already existing benefit and incentive programs for the Washington metropolitan region.

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