FINAL PROJECT EVALUATION

FALLS CHURCH BUS PROJECT

September 2, 2005

Final Project Evaluation, Falls Church Bus Project

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I. Executive Summary

After two years of operations, the GEORGE service has proven successful in many ways. Ridership has grown by 150% over the past two years. Costs have been reduced by a combination of streamlined routes and increased fares, allowing the project funding to be extended to 27 months from the original 18-month plan. The GEORGE bus system is also doing a good job of enticing some commuters away from their cars, thereby reducing the number of vehicle miles traveled, and provides Falls Church with an excellent gateway for the region's major transit system.

Exhaust emissions from the buses are some of the lowest in WMATA's fleet, and are comparable to the emissions from natural gas fueled buses. As is normal with new buses, initial reliability was poor until the learning curve was mastered by the WMATA bus maintenance staff. Currently, the reliability of the GEORGE buses is on par with similar buses in WMATA's fleet. Reliability can be expected to improve further as WMATA maintenance personnel become even more familiar with the technology. The advanced AVM system installed has proven to be very effective. It is reliable, provides accurate and timely information, and has been used to restructure routes to improve on-time performance and target high ridership areas.

The GEORGE Bus path to success has proven to be a rocky one. When the city of Falls Church began reviewing proposals for contracted bus service in 1996, they could not have imagined that almost seven years would pass before the buses hit the street. As the first GEORGE buses began revenue service in January of 2003, it marked the end of a difficult and frustrating process fraught with contractual disputes, two contractual defaults, and one bankruptcy. The Falls Church Bus Project also featured a great deal of effective coordination on the part of NVTC, WMATA, Virginia Power, and Falls Church, some of which will be detailed in the body of this report.

Though the initial goal of procuring an effective, 26-passenger electric or hybrid-electric bus to provide service to Falls Church could not be accomplished, NVTC and its partners procured and are successfully operating a Thomas Built SLF bus equipped with a Cummins® ISB diesel engine. This bus was equipped with a STT Emtec DNOx™ emission reduction system, and a Clever Devices' IVN-2™ automatic vehicle monitoring (AVM) system. Together, these systems allowed NVTC to procure the cleanest diesel technology available, and the most advanced Automated Vehicle Monitoring (AVM) system used for route planning and maintenance monitoring.

Falls Church has now assumed full funding responsibility for the GEORGE bus service, with the buses operated under contract with WMATA. City officials and staff are pleased overall with the quality of the service, and are optimistic that the service will continue to grow in the future.

II. Operation

On the cold morning of January 10th, 2003, a dedication ceremony for the GEORGE bus service was held at the Falls Church Community Center (see **Figure 1**). State, local and federal elected officials attended the dedication, along with various other transportation officials from the region. The purpose of the ceremony was to celebrate the inception of the region's newest transit system, and inspect the state-of-the-art buses that would be running the GEORGE routes. Since that frigid beginning, the GEORGE service has blossomed into a full-fledged bus system, an important amenity of the Falls Church community, and a fully-integrated component of the region's transit network.

Figure 1: Local Elected Officials at the GEORGE Dedication Ceremony

Revenue bus service on the GEORGE routes began on January 11th of 2003. The two peak routes, the 26E and 26W, served the East Falls Church and West Falls Church Metrorail stations respectively. The 26E route traveled south from the East Falls Church Metrorail station on Roosevelt Street, turned west on Broad Street, and veered north on Virginia Avenue to serve the Falls Church City Hall and Community Center area. The route then covered a short distance on Washington Street before traveling through the narrow streets of the Broadmont neighborhood on the way back to the East Falls Church Metrorail station via Roosevelt Street. The 26W route left West Falls Church Metrorail station heading southwest on Haycock Road, turned east on Broad Street, and headed south on West Street to serve the Virginia Forest neighborhood. The 26W route then traveled back to Broad Street on Virginia Avenue, heading west briefly, then turning north on Oak Street and following Lincoln and Gibson Avenues back to the West Falls Church Metrorail station via Haycock Road. The off-peak 26A route was essentially a combination of the 26E and 26W routes, run by a single bus in the afternoons and late evenings. The fare for GEORGE bus service was 25 cents. Maps of the original GEORGE routes are shown in **Appendix A**.

The GEORGE buses were operated under an agreement with WMATA. The operating agreement was negotiated through months of discussion between WMATA, Falls Church and NVTC staff, and provided for the buses to be titled to WMATA for a nominal fee, and maintained at WMATA's Arlington garage. The initial operating cost was $62.77 per platform hour.

Initial ridership reports on the GEORGE buses were disappointing. Although there were no formal demand studies, the initial financial plans for the GEORGE bus estimated over 12,000 trips per month. For January 2003, there were approximately 3,000 passenger trips on the new GEORGE buses, and February ridership showed an 8% increase. By May, the monthly ridership had increased to over 6,000 passenger trips, which was a substantial improvement over January, but still far from what had been hoped for. Monthly GEORGE bus ridership in June of 2003 peaked at just under 8,000 passenger trips, and fell to 5,500 passenger trips by December of 2003.

For the calendar year 2003, the total GEORGE bus ridership was approximately 60,000 passenger trips. During FY 2004 (July 2003 – June 2004), the GEORGE bus ridership was 74,000 passenger trips. Ridership for FY 2005 is estimated to be approximately 66,000 passenger trips, but it should be noted that weekend service and late evening service were discontinued at the beginning of FY 2005, so the decrease in ridership should be expected. For comparison purposes, the GEORGE bus system has by far the smallest average weekday ridership of any local transit system in Northern Virginia, but the GEORGE system also operates the fewest vehicles of any transit system in Northern Virginia (see **Figure 2** below). In terms of annual passengers per vehicle operated in revenue service, the GEORGE system is comparable with other transit systems in Northern Virginia, especially those that are relatively new. It should also be noted that the GEORGE service does not run on evenings or weekends.

Figure 2: FY 2004 Operating Data for Northern Virginia Transit Systems

	ART	Connector	CUE	DASH	GEORGE	Loudoun
Ridership	674,806	7,990,825	985,500	3,131,284	74,000	392,901
Vehicles	17	163	8	37	2	17
Pass. / Vehicle	39,694	49,023	123,188	84,629	37,000	23,112

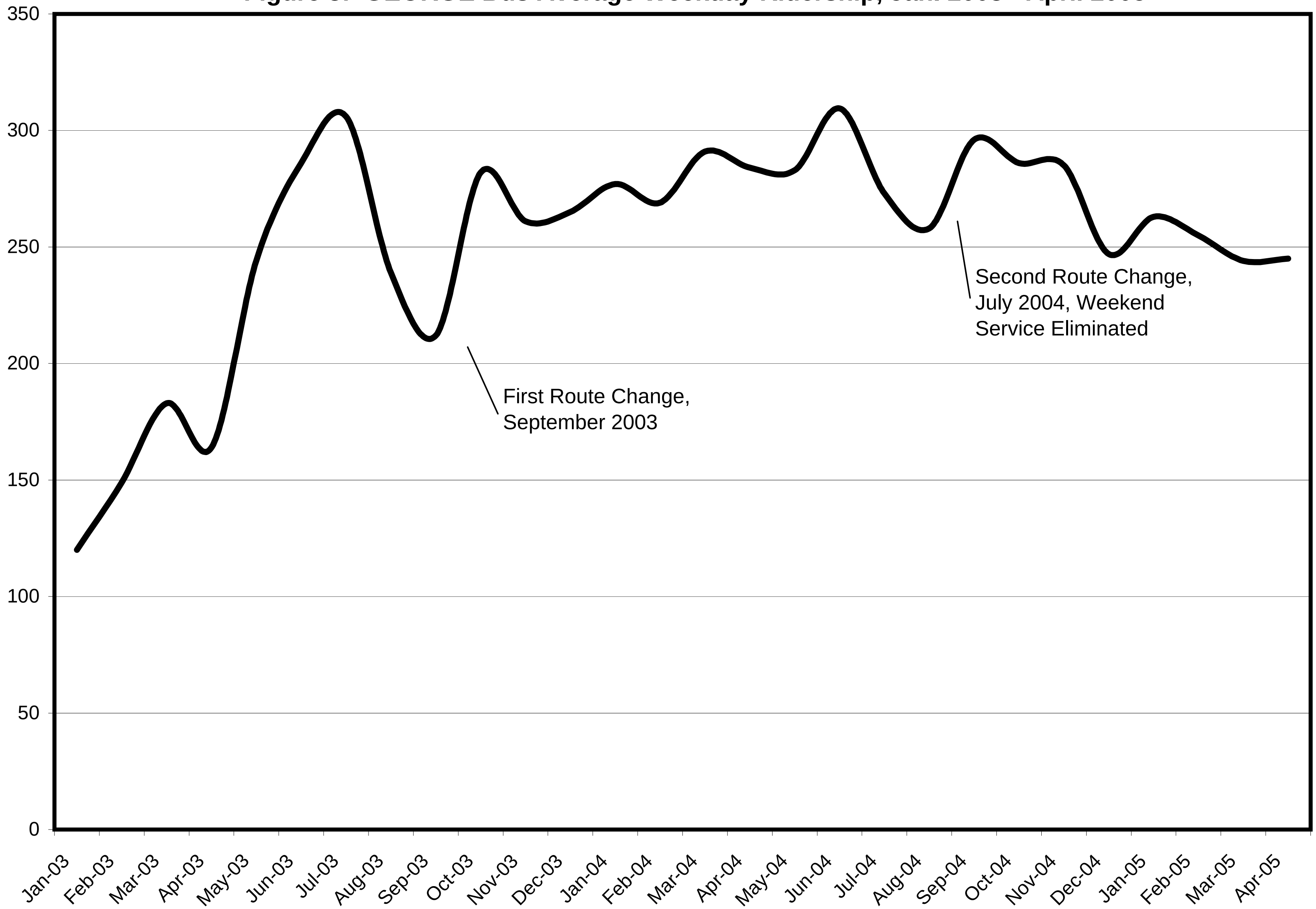
During the first months of GEORGE service in 2003, there were several customer complaints. The most frequent complaint was late-arriving vehicles, followed by complaints about speeding vehicles (especially in the Grove Avenue area), and a number of complaints about buses traveling on the narrow residential streets of the Broadmont neighborhood. WMATA, NVTC and Falls Church staff considered a number of solutions to address these complaints. WMATA personnel spent several days riding the routes and observing the running time. It was found that certain sections of the route were slowing the buses, particularly the areas with 15mph speed limits, speed bumps, and heavy traffic. As a result, the buses were running late, falling behind schedule by as much as 40 minutes during rush hour. Because the buses were running so far behind, drivers were speeding in a futile attempt to catch up to their schedule, which then generated complaints from residents. WMATA’s assessment was that the routes were too long, and that either the routes would have to be shortened, or another bus would need to be added. Since there was no funding for adding additional service, the choice was not difficult.

In June of 2003, a working group comprised of WMATA, NVTC and Falls Church staff met at Falls Church City Hall to look at shortening the GEORGE routes. The working group looked at three factors in deciding which segments to eliminate: segments with little or no ridership, segments that were prone to delay or slow traffic, and segments that had received a lot of “my house is shaking” complaints. The Clever Devices Automated Passenger Counters (APC) on the GEORGE buses greatly simplified the ridership-by- segment analysis. Normally, to get a sense of which segments are under-performing, it would be necessary to perform 100% on/off counts on both a typical weekday and a typical weekend day. That can be an expensive and time-consuming process. The APCs allowed the working group to look at the total boardings at each stop for every day of the six months that the buses had been in service.

The working group identified three segments of the routes that had zero boardings for the six-month period: The George Mason High School loop, the Virginia Avenue-Great Falls Street-Little Falls Street segment in the area of City Hall, and the Columbia Street-Van Buren Street-19th Street segment in the Broadmont neighborhood. These segments matched up with segments that had been identified as slow areas for the buses, either because of low speed limits, speed bumps, narrow streets, or congestion. In addition, two of the zero-ridership segments (Broadmont, City Hall area) were also a major source of residential complaints. The working group decided to revise the routes by removing those three segments. The changes took effect on September 7 of 2003. WMATA provided revised schedules and maps at no charge. Maps of the revised routes are provided in **Appendix B**. WMATA staff spent a day riding the revised routes, and their report was very encouraging. The GEORGE buses were maintaining their schedule while adhering to the posted speed limits.

Figure 3 shows the average weekday ridership on the GEORGE bus service from its inception through April of 2005. Note that there was a fairly sharp dip in ridership that centered on the September 2003 service changes, but also that the ridership rebounded strongly after the route changes went into effect.

Figure 3: GEORGE Bus Average Weekday Ridership, Jan. 2003 - April 2005



During the early months of 2004, NVTC worked with Falls Church staff to develop plans for funding the GEORGE bus service after the demonstration funds were exhausted. In the spring of 2004, Falls Church staff developed several options for reducing the cost of the GEORGE bus service and increasing revenue, in an effort to reduce the funding burden on the city. These options were discussed extensively with NVTC and WMATA staff, and two alternatives were developed. The first option was to discontinue all off-peak service (afternoons, evenings, and weekends) provided by the 26A route. The second option was to discontinue weekend and late evening service, but continue to provide afternoon off-peak service on a re-structured 26A route. The proposed 26A route concentrated service on the high-ridership corridors of Roosevelt Street, Broad Street, and Washington Street, and removed the "neighborhood" segments of the route. Both options included a doubling of the GEORGE bus's 25-cent fare. These options were presented in a public hearing conducted by WMATA staff at Falls Church City Hall, on May 5, 2004. After the public hearing, WMATA and Falls Church staff reviewed the comments they received, and made the decision to adopt the second alternative of eliminating weekend and evening service, doubling the fare, and revising the 26A for afternoon off-peak service. The docket from the public hearing, including the proposed/adopted revisions to the 26A route, is included in **Appendix C** of this report. The maps and schedules for the current GEORGE routes are included in **Appendix D**.

The ridership impacts of the latest service changes on the GEORGE routes, which went into effect on July 1, 2004, are noticeable. There is a clear dip in the weekday ridership numbers starting in July of 2004 (see **Figure 3**), but weekday ridership has rebounded in the months following, and seems to have returned to where it was before the service change. At the same time, there has been a significant impact in the cost of service. The platform hours and quarterly billings from WMATA dropped significantly, from an average of 753 hours and $48,000 per month in FY 04 to 491 hours and $34,000 per month in FY 05 (note also that the platform hour billing rate increased from $63.98 to $69.47 between FY 04 and FY 05). This enabled NVTC to stretch the demonstration funding from covering 18 months to covering 27 months. The reduction in costs also made it easier for Falls Church to begin pay for the service starting in April of 2005.

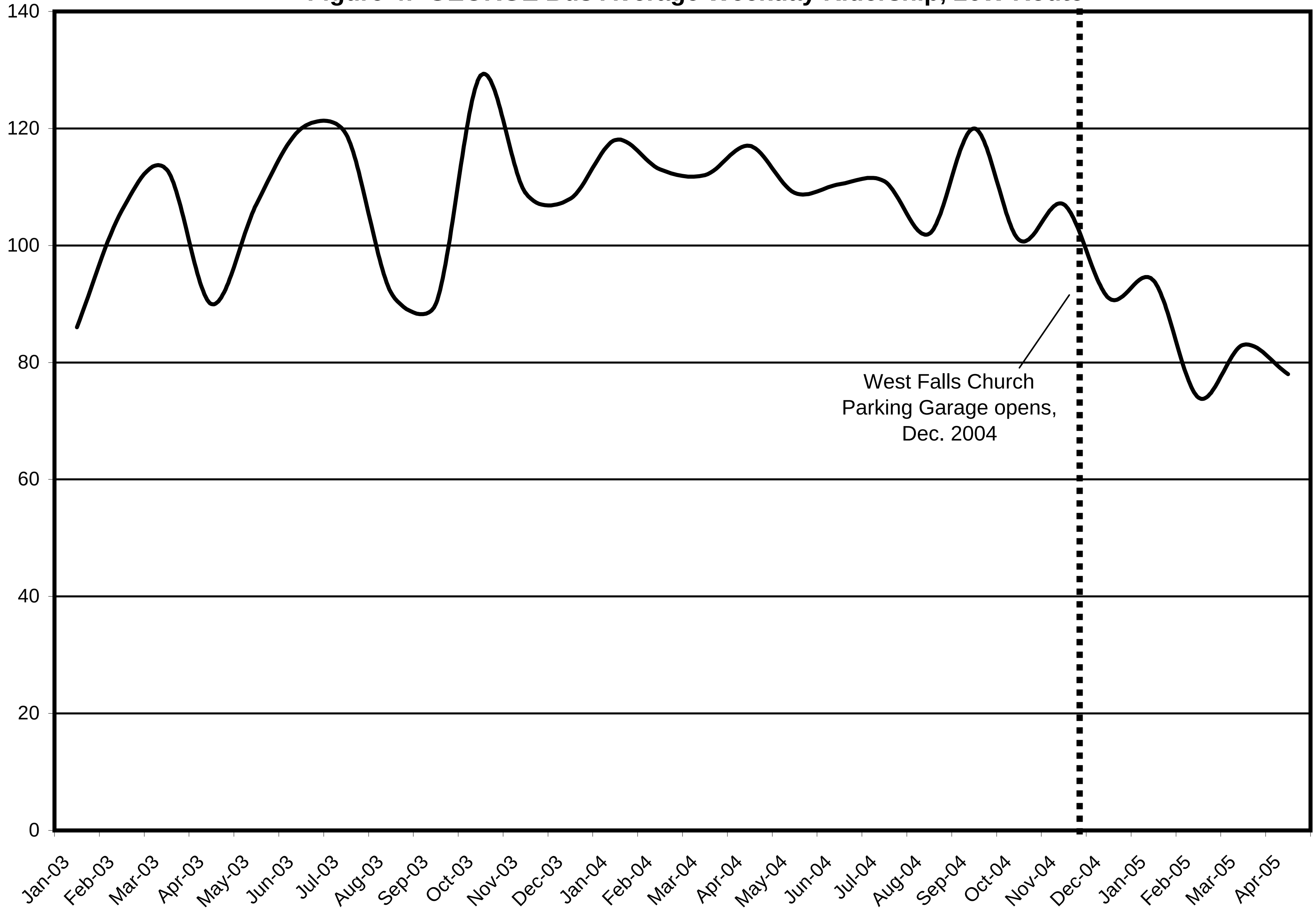
Now that the routes have been rationalized, the GEORGE service will benefit from a renewed emphasis on marketing and customer outreach. In 2004, Falls Church staff made face-to-face visits to every business in the city, extolling the qualities of the GEORGE bus service, and handing out copies of the new route maps and schedules that were designed and produced by city staff. Examples of the marketing materials distributed by Falls Church staff are shown in **Appendix E**. Falls Church staff have also made several improvements to the GEORGE bus website, with sections detailing the benefits of the clean diesel technology, and other benefits that the system provides for the city. The URL for the website is http://www.ci.falls-church.va.us/george/index.html. These outreach efforts may lead to increased ridership on the GEORGE routes.

Metrobus service changes could also have an impact on the GEORGE bus ridership. The Metrobus 3B route runs northward from the Rosslyn Metrorail station on Lee Highway to East Falls Church Metrorail Station. From there, the route essentially travels through the GEORGE bus service area, following Washington Street to a right turn on Broad Street, and proceeding to West Falls Church Metrorail station. There has been discussion among Falls Church staff and NVTC staff regarding the re-alignment of the 3B route, in an effort to remove the duplication of service along the GEORGE bus routes, perhaps using the 3B to serve Seven Corners since there is no longer bus service between East Falls Church and the shopping center. This could certainly boost ridership on the GEORGE routes, although it would degrade the level of service in the corridor. The possible service changes will be discussed with WMATA staff in the near future.

In the fall of 2004, NVTC contractors distributed survey forms to passengers on the GEORGE bus routes. The main purposes of the survey were to determine their attitudes and preferences toward the customer-focused ITS demonstrations on the GEORGE buses (Automatic Voice Annunciators, electronic display signs), as well as looking at the customer preferences with regard to the GEORGE buses and GEORGE service, and collecting basic demographic and origin/destination information. The one-page survey was provided in both English and Spanish, and was completed by 309 respondents (289 in English, 20 in Spanish). A copy of the survey form is located in **Appendix F**, along with a weighted tabulation of responses to each of the survey questions. Subsequent sections of this report will discuss the survey responses in more detail.

One of the more interesting pieces of information provided by the survey was the high percentage (48.9%) of respondents who indicated that they had a car available, but chose to ride the GEORGE bus. A majority of these discretionary riders also indicated that the main reason they chose to drive was the cost and scarcity of parking at East Falls Church Metrorail Station. As one would expect, the opening of the West Falls Church parking facility in December of 2004 has made a clear, negative impact on the ridership on the GEORGE system. **Figure 4** shows the average weekday ridership on the 26W route from its inception in January 2003 through April of 2005. The portion of the chart to the right of the vertical dotted line indicates the time period following the opening of the parking facility. In the year prior to the opening of the garage, weekday ridership on the 26W route averaged 111 passengers, never dipping below an average of 100 for any given month. In the months following the opening of the parking facility, the monthly average weekday ridership for the 26W route has never topped 100, with an overall average of 87 daily passengers for the five-month period. It should be noted that there are still spaces available at the West Falls Church parking facility, and that as these spaces are filled, the ridership on the 26W may rebound.

Figure 4: GEORGE Bus Average Weekday Ridership, 26W Route



III. Background

When the city of Falls Church staff began reviewing proposals for contracted bus service in 1996, they could not have imagined that almost seven years would pass before the buses hit the street. As the first GEORGE buses began revenue service in January of 2003, it marked the end of a difficult and frustrating process fraught with contractual disputes, two contractual defaults, and one bankruptcy. The Falls Church Bus Project also featured a great deal of effective coordination on the part of NVTC, WMATA, Virginia Power, and Falls Church, some of which will be detailed in the following paragraphs. A detailed chronology of the project is shown in **Appendix G**.

The city of Falls Church occupies two square miles bordering the counties of Fairfax and Arlington in Northern Virginia, approximately nine miles from Washington D.C. (see **Figure 5**) The city was named for the Falls Church, which was founded in 1734 at the intersection of two major Indian trails (which later became Leesburg Pike and Lee Highway), and still stands today as a historic landmark in the center of town. Falls Church was founded as an independent city in 1943, and has in recent years grown into a prosperous and well-educated community. According to the 2000 Census, Falls Church had the highest median family income of any city or county in the United States. Falls Church also features outstanding public schools, recently ranked as the best in the nation by Newsweek magazine.

Falls Church is served by two Metrorail stations that are located just outside the city limits, in Arlington and Fairfax: East Falls Church, and West Falls Church. For many years, Falls Church officials sought to develop local transit service that would link the Metrorail stations with residential and commercial areas in the center of town, and supplement the Metrobus service on the main corridors of Leesburg Pike and Lee Highway. City officials envisioned feeder routes that would transport commuters to the two Metrorail stations, and would also carry residents to shopping and social destinations in the center of town.

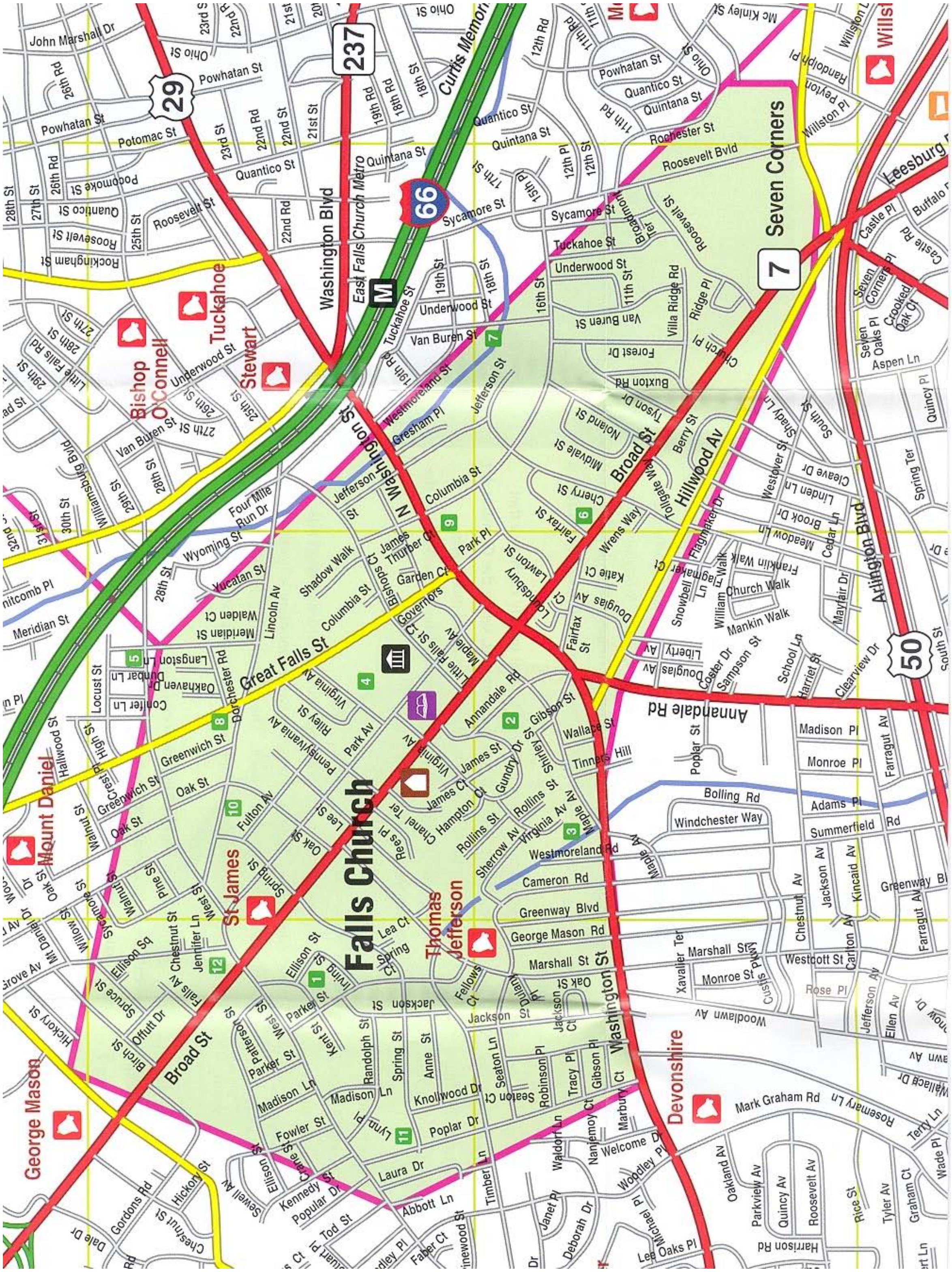


Figure 5: Map of The City of Falls Church

In 1995, the Northern Virginia Transportation Commission (NVTC), a state-chartered organization that provides funding and advocacy for transit programs in Northern Virginia, was enlisted to assist Falls Church with the process of developing local transit service. The Washington Metropolitan Area Transit Authority (WMATA), the organization that runs the Metrorail and Metrobus systems that provide service to Northern Virginia, was also brought in to provide technical expertise and assistance.

In early 1996, Falls Church solicited proposals from contract bus service providers, in an effort to develop a local feeder bus system for the city. Many proposals were received and evaluated, but in the end the city agreed to a NVTC plan to help fund the city's existing Metrobus service.

In 1997, the mayor of Falls Church returned from a trip to Chattanooga excited at the prospects of the battery-powered electric buses he had seen there. A working group was formed to explore the possibility of providing service to Falls Church using electric buses. The working group was comprised of representatives from Falls Church, WMATA, NVTC, and Virginia Power. Virginia Power (now known as Dominion Virginia Power), the provider of electricity to Northern Virginia, offered to provide Falls Church with the power and charging facilities for electric buses, free of charge. WMATA would operate the 22-foot, battery powered buses under contract, and maintain the vehicles. NVTC would apply for and coordinate funding for the project.

By the spring of 1998, NVTC had secured a Transportation Efficiency Improvement Fund (TEIF) grant from the Commonwealth of Virginia in the amount of $345,000, $83,000 in Virginia Revolving Fuel (VARF) funds, and a federal earmark of $391,000. The grant application stated that the primary purposes of the project were to demonstrate innovative technologies, provide improved public transit service for Falls Church residents, reduce automobile vehicle miles and trips, provide measurable clean air benefits, and provide better links to the regional Metrorail system. These purposes are repeated almost verbatim in the documentation for the CMAQ and other federal grants. The complete set of project funding sources is shown in **Appendix H**. With this funding in place, and a detailed bus specification developed by WMATA, NVTC issued RFP 98-3 to procure four electric buses powered by high-tech nickel metal-hydride batteries. In July of 1998, NVTC awarded the hybrid-electric bus contract to Electric Vehicles International (EVI) of Indiana, to purchase four hybrid-electric buses at a cost of $254,850 apiece. Unfortunately, the contract was terminated in October of 1998 because of EVI's inability to perform under the terms of its proposal. The firm essentially admitted that it could not design and build a bus that would meet the specifications it had agreed to in the contract. As a result, EVI forfeited its $80,000 performance bond.

During the course of the several months it took to develop the bus specifications, WMATA staff came to believe that battery-powered buses lacked the range necessary for the proposed routes in Falls Church. Accordingly, WMATA conducted further research and consulted with industry experts on the use of 22-foot hybrid-electric buses. The hybrid-electric buses were powered by a combination of batteries and a small turbine engine, which could be fueled by either diesel fuel or compressed natural gas. The fuel turbine provided electric charging power to the batteries while the bus was in service, replacing energy drained by uphill descents or hard acceleration, and extending the range of the bus to over 300 miles. The turbine also provided extra power for the air-conditioning system. While 22-foot battery-powered buses were in service, and 40-foot hybrid-electric buses had been successfully deployed, there were no examples of 22-foot hybrid-electric buses operating successfully. The project sponsors agreed that they should proceed to develop and test the promising new technology.

By the fall of 1998, NVTC had secured an FY 99 federal earmark for electric bus technology in the amount of $379,000. In November of 1998, NVTC issued RFP 99-2 using a similar funding plan and specifications from RFP 98-3. The specifications called for a 22-foot hybrid-electric bus using a Capstone Micro-Turbine engine. The contract was awarded to Advanced Vehicle Systems, Inc. (AVS) of Chattanooga, Tennessee, in January of 1999, with the notice to proceed given in April of 1999. The price per bus was $273,189.

The contract with AVS called for the four hybrid-electric buses to be delivered to WMATA in April of 2000. To that end, several steps were taken to prepare for the delivery of the vehicles. Virginia Power installed two chargers for the buses at the WMATA garage in Arlington. One of the vehicles was a prototype of a "quick charger" that was among the new technologies to be tested. Because they were already working successfully with WMATA, Clever Devices was awarded a sole source contract for the Automated Vehicle Management (AVM) system that included the on-board communication devices that would announce the stops (a requirement of the Americans with Disabilities Act), the automated passenger counters (APC) and the vehicle component monitoring and maintenance management system (IVAN).

Falls Church approved the routes and service plan, which had been developed in collaboration with WMATA and NVTC. Buses would provide neighborhood circulator service between the East and West Falls Church Metrorail stations. The exact routes had been determined based on extensive street-by-street surveys, asking residents about their desire or need for bus service. The fare was set at 25 cents. Falls Church, with input from the community, approved the name "Electrek" for their new bus system, with associated bus graphics that emphasized the electric aspect of its hybrid-electric drive train (see **Figure 6** below).

Figure 6: Electrek Bus

At the same time, WMATA staff was making periodic trips to the AVS manufacturing facility to monitor the progress of the buses being constructed. Disappointing progress reports foreshadowed impending problems with AVS vehicles. The first bus was to be completed and shipped to WMATA in October of 1999 for on-site testing. Because of parts delays, and problems with the diesel-fueled turbine, the first bus was not actually delivered to WMATA until February of 2000. As an omen of future events, that bus was improperly transported, and arrived with water damage. The second bus was not delivered until August of 2000, four months past the original delivery date in the contract. By this time, NVTC had made over $400,000 in contractual milestone payments to AVS, and the problems with the vehicles were mounting. One major issue involved changing the problematic battery-management systems on the vehicles, which required a retrofit of vehicles already delivered. AVS promised to have all vehicles delivered and/or retrofitted by December of 2000.

In December of 2000, WMATA utilized Booz-Allen to evaluate the new battery management systems. The Booz-Allen report was completed in February of 2001, and it found that significant problems still existed with the battery-management system. AVS disputed that report. Meanwhile, the remaining two buses were finally delivered in March of 2001, but they could not be tested because their turbines were not functioning. AVS agreed to repair the turbines on the non-functioning buses, and established with WMATA a 45-day testing period for the four buses. At the end of this 45-day testing period, AVS and WMATA disagreed over what constituted a “failure”. According to WMATA, the turbine problem had still not been resolved. WMATA also pointed out the fact that, during the 45-day test, the AVS buses had averaged 75 miles between failures. WMATA’s bus fleet averages 12,000 miles between failures in daily service.

Also, in March of 2001, the project team learned of a brake failure issue with AVS buses operating in Tempe, Arizona. AVS assured the working group that if there were any necessary adjustments or modifications to be made to the Falls Church buses, AVS personnel would make them. In July of 2001, AVS decided to install new brake systems on all of their buses.

WMATA and NVTC contacted several AVS clients nationwide, and assembled an informal roundtable of AVS customers. Participants included Island Transit in Galveston, Texas, and Hillsborough Area Transit of Tampa, Florida. Tempe was invited but chose not to participate. The goal was to facilitate the sharing of information and to learn from each other about various problems with AVS vehicles. The group would also attempt to exert collective pressure on AVS to be more responsive to their complaints.

The communications with Hillsborough and Galveston were very informative for the Falls Church Bus working group. In addition to the same problems that had been discovered by WMATA testing, the working group learned that there had been numerous other problems with the AVS buses in Florida and Texas, such as repeated stalling, battery failures, tire problems, “wandering” steering, leaking windows and wiring problems with the driver’s console. While AVS continued to claim that these problems had all been successfully addressed, officials from Hillsborough and Galveston vehemently disagreed.

In the spring of 2001, AVS had sent a bus to the FTA testing facility in Altoona for structural and safety testing, but the bus axles failed in the pre-test evaluations. The working group requested a copy of the engineering report for the failed testing in July of 2001, but the report was not provided until October. AVS assured the working group that the corrective axle plate was not needed on the NVTC buses.

NVTC gave AVS one final chance to provide acceptable vehicles. The four buses underwent five days of “shake-down” testing at WMATA facility in October of 2001, and all four buses failed. This time, the steering system failed, specifically the tie-rod ends. WMATA expressed serious reservations about AVS’s proposed re-engineering of the steering system. This was the final straw.

In November of 2001, 18 months after the contractual deadline for the delivery of the four hybrid-electric buses, NVTC issued Notice of Default Termination to AVS. Unfortunately, because AVS had allowed its performance bond to expire, NVTC was not able to recover all of the funds it had paid to AVS for achieving intermediate contract milestones. In April of 2002, AVS and NVTC agreed to a contractual settlement. The settlement required AVS to return $200,000 of the $426,350 in progress payments it had received from NVTC, and to provide a demonstration vehicle for six months free of charge. AVS was never able to provide a functioning hybrid-electric bus to WMATA, and by the summer of 2003 AVS had declared bankruptcy. Because AVS was now unable to deliver the promised demonstrator vehicle that was included in the April 2002 settlement agreement, NVTC felt that AVS was in breach of the settlement agreement. In August of 2003, NVTC filed a claim in the United State Bankruptcy Court in Tennessee seeking to recover the $226,350 that was not returned to NVTC as part of the settlement. The results of the NVTC claim are still pending.

Once the AVS settlement was completed, the working group was reluctant to issue another proposal for hybrid-electric vehicles, given ITS experiences with the first two contractors. Clean diesel technology was seen as an environmentally friendly choice, which would not carry the same functional risks as the emerging hybrid technology. The working group identified Thomas Built buses equipped with DNOx low-pressure exhaust gas re-circulation (EGR) filters as a preferred choice among clean diesel vehicles. The DNOx EGR filters employed new and innovative technologies, and had out-performed other clean diesel aftermarket systems in emissions testing for NOx, VOC, and Hydrocarbons. The Federal Transit Administration (FTA) agreed in March of 2002 to allow a mid-course correction to the project, letting NVTC transfer the earmarked funding for the purpose of purchasing clean diesel buses, and operating instead an 18-month demonstration project. At this point, Virginia Power withdrew from the project.

In April of 2002, NVTC approved a resolution to initiate the purchase of four Thomas Built buses, four DNOx EGR filter systems, and to apply for additional federal funds to support this purchase. NVTC staff worked with Congressman Jim Moran’s office to revise the language of a 1999 earmark for Falls Church, thereby allowing the earmark to be used for the purchase of the clean diesel buses.

The issue of what to name the bus again came into play. Since hybrid-electric buses were no longer being used, the Electrek name was no longer an appropriate choice. Falls Church staff had developed the name "E-Connector", which was intended to represent green energy (the "E" in E-Connector was to be green, the other letters blue) without explicitly referencing electric propulsion. However, the Falls Church City Council instead chose the name GEORGE for the city's bus service. The name GEORGE was chosen in honor of George Washington, who was a vestryman at the Falls Church (after which the city is named). Falls Church staff quickly developed a graphics scheme for the GEORGE buses, which was then approved by the Falls Church City Council (see **figure 7** below).

Figure 7: The GEORGE Bus

The four Thomas Built buses were purchased by NVTC in October of 2002 from a state contract, to ensure the most favorable price. The final cost for each bus was $236,151. The DNOx EGR filters were purchased directly from the manufacturer at a cost of $20,000 each. The first bus was delivered to WMATA in November of 2002, with the remaining three delivered in early December of 2002. DNOx personnel flew in from Sweden to train the WMATA staff on the installation and maintenance of the EGR filter system, the first of which was installed in early December of 2002. The GEORGE buses began non-revenue service on December 15, 2002, providing free service along the original routes designed in 1999. Revenue service began less than a month later.

IV. Technology[1]

Among the requirements set for the operation of this service was the implementation of the latest available technology. In lieu of using an electric or hybrid-electric bus, WMATA and NVTC staff consulted with various vendors to find the best technology to ensure the lowest emissions possible, and to improve the operations with the use of an advanced vehicle monitoring system. In addition, the selected technology had to be cost-effective, as the project was operating on a fixed budget. Through WMATA's involvement in other programs, STT Emtec's DNOx™ technology was selected for emissions reductions, and Clever Device's IVN-2™ system was selected as the vehicle monitoring system. The STT Emtec DNOx filters cost approximately $20,000 apiece. That cost, in addition to the $236,000 cost of the 31-foot Thomas Built low-floor buses, compared very favorably with the cost of hybrid-electric buses (approximately $500,000 each). Clever Devices provided the IVN-2 system free of charge for the 18-month demonstration. It typically would cost approximately $30,000 per vehicle.

The DNOx™ system is a low-pressure, exhaust gas recirculation system (LP-EGR). There is significant experience in the industry with high pressure EGR, and many engine manufacturers use this technology to meet stringent EPA emission standards. The advantage of the DNOx™ system is that it can be retrofitted to in-use engines, something that is not possible with high pressure EGR systems.

At the time of the procurement, no low-pressure EGR units had been successfully installed in transit vehicles in the US. However, the manufacturer had extensive European experience with the system, and assured the group that it could be successful in this application. The DNOx™ system was expected to reduce particulate emissions (PM) by 90% or more, Nitrous Oxides (NOx) emissions by 30%, while virtually eliminating all Hydrocarbon (HC) and Carbon Monoxide (CO) emissions. Since this was new technology for WMATA, and the project could not afford any further delays, WMATA

[1] Sections IV and V of this report provided by WMATA Bus Maintenance staff and consultants

worked closely with the manufacturer on the installation to ensure that this system would perform reliably and deliver the expected emission reductions.

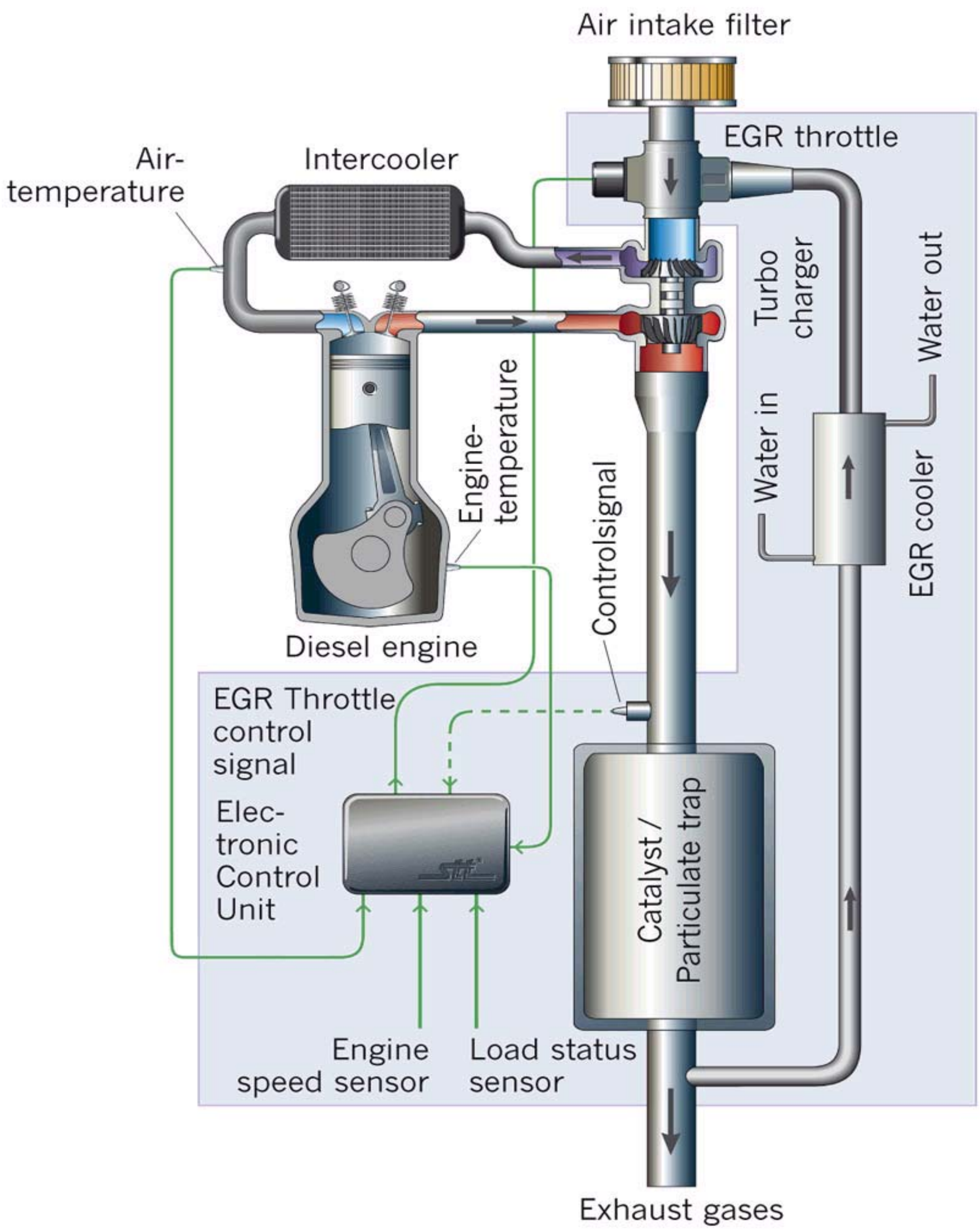


Figure 8: DNOx System General Layout

The DNOx™ system is electronically controlled, and interfaces with all bus electronics utilizing the standard J-1939 CAN data link. This system is particularly well suited to meet the demands of the Falls Church bus system by its ability to simultaneously control PM and NOx, something that is not commonly offered. The system works by first, flowing the hot exhaust gases through a particulate filter. This removes most of the PM emissions. As the gases exit, a portion of the exhaust gas is captured, cooled, and reintroduced into the turbocharger (hence the name Exhaust Gas Recirculation –EGR). This effectively controls the combustion temperature and lowers the NOx emissions. The amount of recirculated gas is metered closely and controlled by the on-board control unit. The unit can be programmed with different strategies to maximize NOx reduction. To achieve a balance between emission reductions, reliability, and reduce possible drivability concerns, WMATA worked with the vendor to target a 30% NOx reduction.

In addition to emission reduction technology, Falls Church and NVTC requested to have an advanced vehicle tracking and monitoring system installed. WMATA had been working on a separate project with Clever Devices using an older generation of their products. Clever Devices suggested that this would be a perfect opportunity to install their latest iteration of the automatic vehicle monitoring system. WMATA suggested to NVTC to install this system, which includes the following items:

- **Automatic Vehicle Monitoring (AVM)** is a Clever Devices product through which transportation, operations and maintenance staff of the Transit Authority can access data and information generated by intelligent systems located on a vehicle. In addition, AVM provides the means for transferring updated operational data, configuration data, and software updates to intelligent systems on board vehicles. The AVM system is comprised of a suite of integrated hardware and software products designed to provide transit authorities with the tools needed to automate the collection of data from vehicle sub-systems, and to provide the means through which this data is converted to information and delivered to end-users. The primary components of the system include: On-vehicle integration computer, On-vehicle software that runs on IVN2™ Wayside communications server and wireless LAN, used to get the data on to and off of the buses, Wayside database and server used to store the data collected from the buses, Wayside web-based reporting system, and Real time Exception Reporting System

- The **IVN2**™ is a rugged computer which serves as the vehicle integrator, listening to and communicating with the diverse array of microprocessor-controlled systems inside the transit vehicle. IVN2™ understands the standard and sometimes unique languages or protocols through which each system communicates.

- **BuswareNT**™ is the Clever Devices software that runs on IVN2™ and provides the functions of Automatic Voice Annunciation, AVM, navigation, and more. The IVN2™ also stores the AVM data collected from the vehicle subsystems until such time as it can communicate the data to the wayside AVM system. The on-vehicle system is configured to collect and store data gathered from the engine and transmission systems.

- **APC** (Automatic Passenger Counting) Automated collection and storage of passenger counts relative to Bustools™ bus stop inventory from Clever Devices APC

- **AVA** (Automatic Voice Annunciation) Automated voice and text based announcements at Bustools™ bus stop inventory locations.

- **PerfectNav**™ vehicle navigation system with GPS. Highly accurate vehicle positioning information shared with other BuswareNT™ software components as well as stored and forwarded to wayside intranet FTP site location.

- **BusLink**™ provides the means through which the AVM data collected on-vehicle by IVN2™ and BuswareNT™ is transmitted to wayside systems. Utilizing standard off-the-shelf wireless LAN technology (e.g. Wi-Fi) married with Clever Devices software, BusLink™ retrieves and stores AVM data from IVN2™ equipped vehicles in a managed and secure manner. BusLink™ runs on a Microsoft Windows NT server strategically located within the Arlington facility such that the attached wireless LAN access point (antenna) provides sufficient range to capture data from the vehicles on a regular basis. Once data are received by the BusLink™ system at the Arlington facility it is now in the realm of the WMATA corporate IT infrastructure and relies on the networking resources inherent in that infrastructure to deliver the data to the other components of the AVM system, namely the Fleet Data Bank™ database server and TA- Tools™ web server, and ultimately to the end-users. For this demonstration, the Fleet Data Bank database server and TA- Tools web server was located at the Clever Devices corporate headquarters in Syosset, NY.

- **The Fleet Data Bank**™ is a database running on a Microsoft Windows NT server and is designed to accommodate storage and management of data retrieved from the IVN2™ equipped vehicles at the Arlington facility. The Fleet Data Bank™ is configured to accept data from the IVN2™ equipped vehicles currently in service.

- **A TA- TooIs**™ web server is installed at the Clever Devices corporate headquarters and configured to provide reports, derived from Fleet Data Bank™ resident data, to a specified list of end-users. TA- Tools™ was to provide NVTC with access to information that had previously been unavailable, untimely or inaccessible. Through TA-Tools™, information like engine performance characteristics, duty cycles, dwell times, and more could now be delivered to the end-user's desktop. No longer did one have to probe each vehicle directly for information; views of information by vehicle type or by facility could now be realized.

- **Mobile TA Tools** is Clever Devices software product which provides the Maintenance Center with real time reporting of vehicle maintenance status. Maintainers can use Mobile TA Tools for viewing the maintenance status of the vehicle as it pulls within range of the Maintenance Center. Mobile TA Tools allow the Maintainer to determine if the Vehicle has an active or inactive exception and the component and condition that caused the exception.

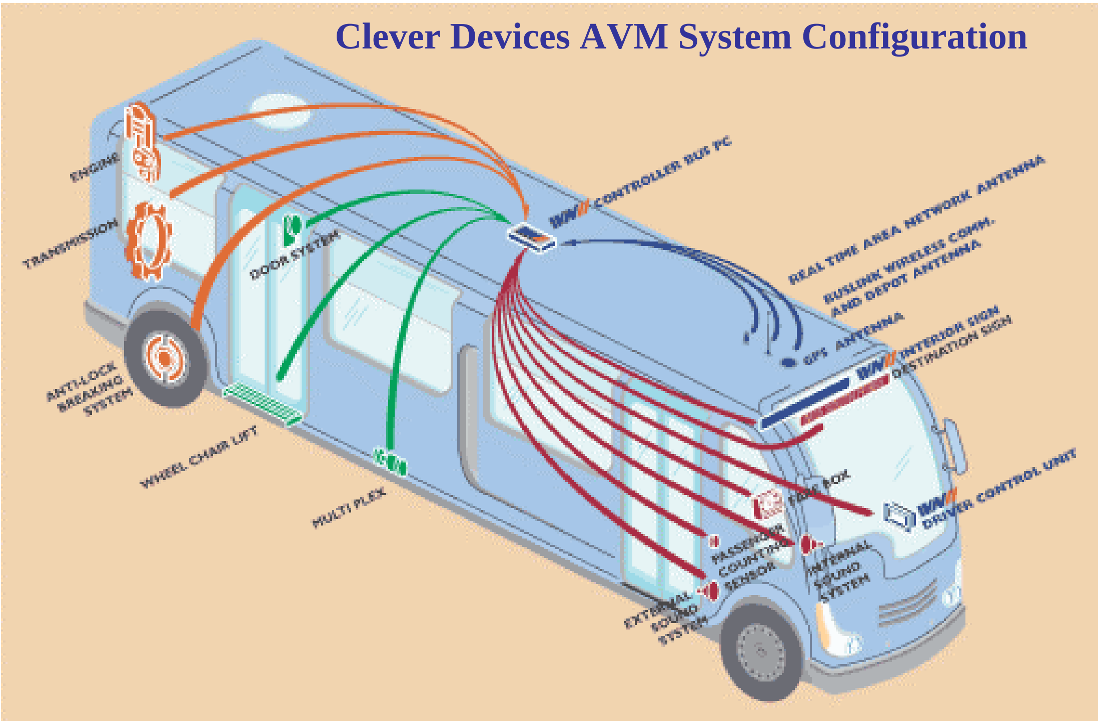


Figure 9: Clever Devices AVM System Configuration

All four GEORGE buses were equipped with the full AVM system. The IVN-2™ system wirelessly transmits all data to a central location which can then be queried by the maintenance garage. The system is currently set up to automatically notify WMATA maintenance personnel if any faults exists in the vehicle, and whether the bus should be held for repair before being sent out on revenue service.

Several examples of information gathered from the IVN2™ have been included in **Appendix I** and **Appendix J**.

V. Technical Results

The demonstration project has run for approximately two years. WMATA has kept maintenance records and operational costs for the four buses.

The GEORGE bus operates with a Cummins ISB engine developing 175 hp. The engine was certified to meet EPA's 2002 emission requirements. The addition of the DNOx™ system reduced the engine emissions to below EPA standards, approaching levels attained by the WMATA's compressed natural gas (CNG) fleet.

Direct emission measurements on the bus were not possible due to budget constraints. However, two other tests performed can be used to estimate with reasonable accuracy the emission reductions achieved by the GEORGE buses.

The first test carried out was performed on an engine dynamometer ("test bed") during calibration of the DNOx™ system. This data provides the most precise measurement of emission reduction under ideal conditions. The second test used for comparison was a direct emission test carried out on a chassis dynamometer by West Virginia University. This test used the same system installed on a different engine. The chassis dynamometer test is the most accurate way of determining 'real world' emission performance. The two measurements taken together provide an accurate assessment of the emission reductions. The results are provided in **Figure 10** below:

Figure 10: Observed Emission Reductions

Pollutant	**Emission Reductions**
CO	94%
HC	100 %
PM	94%
Nox	26%

Note: Baseline is 2000 Model Year bus

After the installation of the DNOx™ system, these buses are now some of the cleanest buses running in WMATA's fleet.

As mentioned above, due to technical difficulties the original plan to purchase electric or hybrid-electric buses could not be fulfilled. However, NVTC and WMATA were able to find the cleanest alternative possible, while still providing reliable, cost effective service to the community. **Figure 11** (below) illustrates the reductions gained, and how this bus compares to a typical 2000 model year diesel bus, and to WMATA's 2003 Cummins CNG buses.

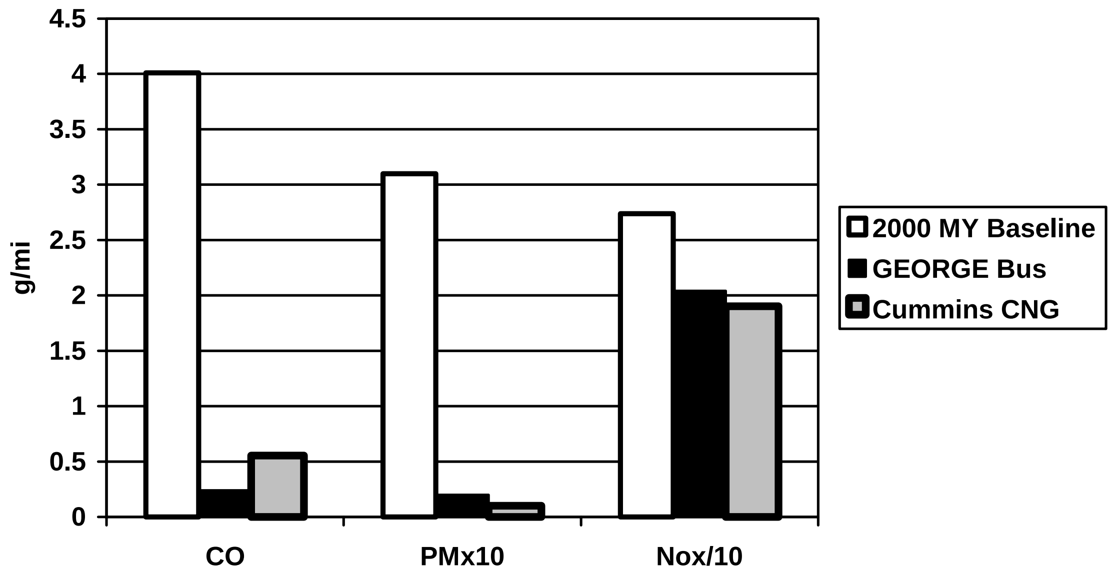


Figure 11: Comparative Emissions Performance in WMATA Fleet

NVTC staff recently evaluated the performance of the Clever Devices Automatic Passenger Counting (APC) system on the GEORGE bus. The evaluation utilized a methodology outlined in a December 2003 NVTC report entitled "Development of a Continuing Process for Monitoring Performance Data on Transit-Related ITS Investments." The APC system was compared with the traditional method of counting passengers using ride checkers. The evaluation found that the APC system offered advantages in terms of the efficiency of data collection and processing, although the extent of the benefit depended on the frequency with which ridership counts are required. In terms of the quality of service and route planning, the APCs provide a much greater quantity of data, and much easier access to the data. The APCs also provide a significant advantage in terms of responding to special requests for data, since they are always counting. In terms of data accuracy, the evaluation found that there was no evidence that the APCs are any better or any worse than traditional ride checkers, as both depend on human operators and both are prone to human failures. Overall, the evaluation found that the Automatic Passenger Counters provided measurable and significant benefits over traditional counting methods in three of the four evaluation categories. The complete evaluation is included in **Appendix K**.

During the 18-month period of the demonstration, NVTC and Falls Church staff received monthly APC reports from Clever Devices. Clever Devices was also responsible for maintaining the APCs during the demonstration period, and this required them to re-calibrate the system when the routes changed. Since the demonstration period has ended, Clever Devices are no longer responsible for generating reports. Additionally, since the final route change occurred after the demonstration period had ended, Clever Devices did not re-calibrate the system for the new routes. WMATA is now responsible for maintaining the APCs on the GEORGE buses, but WMATA is also deploying Clever Devices APCs on several hundred vehicles in their Metrobus fleet. The re-calibration of the GEORGE APCs will be a part of the larger deployment, and Falls Church staff will hopefully be receiving regular APC reports within the next year.

Over the course of this demonstration, the Clever Devices AVM system has continuously monitored and collected data from both the Cummins ISB engine and Allison transmission on-board the four GEORGE buses. This includes fault codes and performance data points broadcast by the intelligent systems on-board the vehicle. Collecting such data provided NVTC with continuous status on the health of the vehicles and automatically notified WMATA's maintenance department when problems were detected.

These data were then externalized via weekly reports produced by both TA Tools and Mobile TA Tools and forwarded to WMATA for review and action. Several examples of the type of information gathered are found in **Appendix L** and **Appendix M**. These represent just a few of the data points that were monitored during this demonstration.

This information was used in a number of ways:

- **Fueler-Shifter**: The shifter uses AVM to triage buses returning to the depot according to their need for maintenance.

- **Foreman**: Reviews the listing of vehicles with exceptions to determine work assignments for staff. Better able to identify which buses can go back into service and when.

- **Maintenance/Engineering**: Reduce the time mechanics spend diagnosing problems. Engineers can perform trend analysis via year-to-date reports on performance, exceptions, and component usage.

- **Integration**: Integrate Clever Devices' AVM software with existing maintenance management systems to facilitate information flow between departments and continue to drive data into information.

These functionalities allowed WMATA to run a more efficient operation, thereby reducing the cost to operate the buses. Since the AVM system allows one to integrate on-vehicle systems into a single, common view of information, personnel can identify problems early, reducing the number of road-calls and service interruptions. Additionally, the AVM system has reduced diagnostic time and improved resource allocation.

One important benefit of having AVM functionality on-board the buses is the constant monitoring of the bus's performance, as well as health and safety related performance. AVM is always collecting and filtering data to prevent road calls and customer dissatisfaction due to unreliable service.

Reliability is generally measured in terms of mileage traveled between service interruptions, commonly called Mean Distance Between Failure (MDBF). WMATA tracks bus reliability in terms of MDBF for each of its fleets of buses.

The graph below represents the observed reliability of the GEORGE buses compared to the system-wide average, and a similar sized, similar duty cycle bus, the Orion II.

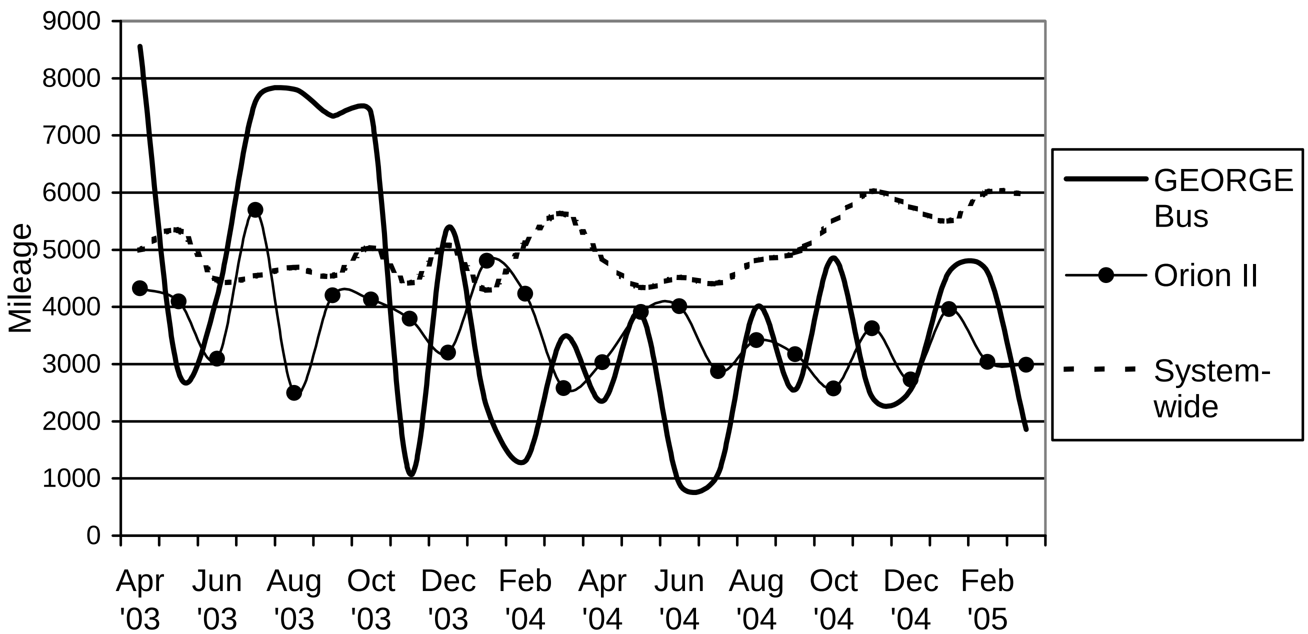


Figure 12: Mean Distance Between Failures, GEORGE, Orion II, WMATA Fleet

As seen in the chart, bus reliability is commonly variable, but several factors made the GEORGE buses more prone to wide fluctuations. The George buses operate on only three routes not shared with any other buses. This limits their monthly accumulated mileage. Hence, only one breakdown is sufficient to have a significant impact on reliability numbers. In addition, there are only four buses in this fleet. It can clearly be seen that a small number of buses provides a skewed statistical sample, and a single failure can lead to a large impact on the reliability numbers (e.g. one breakdown means that 25% of the fleet is down!). WMATA generally operates fleets of at least 30 units, with many fleets of over 100 units. WMATA currently operates a total of 1450 buses.

One additional factor that merits caution is the small size of this bus. Most of WMATA's fleet (reflected in the 'system-wide' average) is comprised of full size (40ft.) buses. These buses are heavier duty and generally outperform smaller buses in terms of reliability. Hence, a true apples-to-apples comparison may not be possible.

For the above reasons, it is important to analyze the reliability of the buses in finer detail. What is observed after two years of operations tells a story that is similar to other bus procurements that WMATA has been involved with. The GEORGE buses underwent a normal 'shakedown' period shortly after beginning service. This is observed in most new bus procurements, and issues were addressed as part of normal warranty work. As the buses have matured, and maintenance practices improved, the reliability improved. Again, this is something that is normally found after receiving new buses. The buses are now entering their third year of operation, and the expected component failures begin to appear. Corrosion may have been the cause for several electrical relay faults on one particular bus. One transmission failure was recorded, and due to parts shortages could not be immediately repaired. These failures are not unusual, but for the reasons described above, the MDBF is lower than average.

In terms of cost of operation, the GEORGE bus is also in line with similar buses. Fuel consumption for this bus is slightly better than average, at about 3.59 mpg.

VI. Customer Responses

As mentioned in Section II, NVTC surveyed GEORGE bus passengers in the fall of 2004 to determine (among other things) their attitudes and preferences with regard to the ITS features being demonstrated on the GEORGE system. Specifically, the survey questioned respondents about the effectiveness of the Clever Devices Automatic Voice Annunciator sytem and electronic display signs that provide stop information to passengers. When asked if they could hear the stop announcements that are made outside the bus, only 35% of respondents said yes, and of those respondents only 32% said they were helpful, and only 42% said they were timely. These low ratings may be a result of early noise complaints from residents along the GEORGE routes, which led to a volume reduction on the stop announcements broadcast outside the bus. When asked about the stop announcements inside the bus, the responses were far more positive, with 98% responding that they could hear the announcements. Of those who responded that they could hear the announcements, 90% found them helpful, and 87% felt that the stop announcements were made in a timely manner.

When asked if the electronic display stop listing inside the bus was helpful to them, 87% of respondents answered yes. Automatic Voice Annunciators and electronic displays like those demonstrated inside the GEORGE bus are being installed by transit systems throughout the region as a means of ensuring ADA compliance, but it is good to know that they are seen as a benefit by the vast majority of passengers.

The survey results also provide excellent information about the GEORGE bus ridership. Two-thirds of the GEORGE passengers surveyed live within the City of Falls Church, while 12% live in Fairfax County and 7% live in Arlington. Fifteen percent of the respondents live in another jurisdiction. The average age of the respondents was 42 years old, and over 57 % of respondents were female. Over 99% of the respondents transferred either from Metrorail (87%) or Metrobus (12.1%), which represents an astounding level of interaction with the regional transit system. Nearly 50% of respondents (48.9%) responded that they had a car available to them, but chose to ride the

GEORGE bus, which shows that the GEORGE system is doing a good job of attracting discretionary riders, and removing vehicle trips from the region's roads and highways. Eighty percent of respondents reported that their trip was for work, while seven percent chose "school" as a trip purpose, and eight percent chose "other". Two-thirds of respondents reported that they ride the system daily, 19% ride weekly and eight percent ride monthly. When asked to select three things they like most about the GEORGE bus service, "clean buses" was chosen by 59% of respondents, "improved access to Metrorail" was chosen by 52% of respondents, "low fares" was chosen by 50% of respondents, and "cheaper than driving" was chosen by 43% of respondents.

A copy of the survey form is located in **Appendix H**, along with a weighted tabulation of responses to each of the survey questions.

VII. Conclusions

In terms of lessons learned, one of the most important aspects of the Falls Church Bus Project is the management of the AVS contract. While some might look at the results of that three-year period as a failure, that would not be an accurate assessment. The most important thing to remember about the AVS situation is that WMATA's policies of regular inspections, progress reports, and cooperative troubleshooting at the AVS plant and during testing in Northern Virginia, ultimately proved successful. The AVS hybrid-electric vehicles never went into service because they could not pass WMATA's rigorous screening. While it was disappointing for the working group to deal with the repeated failures of the AVS buses, it would have been far worse for transit passengers to experience those failures. WMATA staff should be commended for not allowing that to happen.

Ultimately, the working group found an excellent compromise and delivered an environmentally friendly bus that today operates very well. The DNOx™ system is successfully lowering emissions matching that of the cleanest buses available. The AVM system has proven to be a valuable tool for scheduling buses, maintenance tracking, and lowering cost of operations. Overall, the GEORGE buses are delivering similar reliability to other buses in WMATA's fleet while achieving lower levels of emissions.

While the ridership on the GEORGE routes has been less than expected, it is still comparable to smaller transit systems in the area (in terms of passengers per vehicle and passengers per route). As mentioned in Section III (page 17) of this report, the GEORGE bus has been successful in attracting a large number and percentage of discretionary riders to ride the bus. Transit systems everywhere are searching for ways of enticing discretionary riders to leave their vehicles at home and take transit. As the number of zero and single car households decreases each year, this is the only way for transit systems to increase ridership. Attracting discretionary riders is also the only way to get people out of their automobiles, reduce the number of vehicle miles traveled, and improve the region's air quality. According to a 2001 region-wide survey conducted by

NVTC, approximately 37 percent of passengers on local transit systems are considered discretionary riders (see http://www.thinkoutsidethecar.org/resource/research.asp for more info). On the GEORGE bus system, 49 percent of passengers are discretionary riders. Although some of the discretionary ridership can be attributed to the lack of parking at the Metrorail stations, that is normally the case at every Metrorail station, so the GEORGE bus has made a significant achievement with attracting these riders. The survey also found that over 99 percent of GEORGE passengers are transferring either to or from Metrorail (87 percent) or Metrobus (12.1 percent), which represents an astounding level of interaction with the regional transit system. The point here is to note that, although the GEORGE bus ridership is not as high as some hoped, it is certainly doing a good job of enticing commuters away from their cars, and providing an excellent gateway for the region's major transit system.

The financing for the project provides a fascinating case study of teamwork and flexibility. As shown in **Appendix B**, over $2.6 million was assembled by the project sponsors over the life of the project. These funds came from a multitude of state, federal, regional, local and private-sector sources, including cash grants and in-kind products and services. As the nature of the project evolved , some funding sources were lost (e.g. Virginia Power), others were altered, and new sources were identified. As Falls Church assumes full funding responsibility after two years of operations and nine additional months of development funded by the project sponsors, the city is well positioned to use this new community resource to its best advantage to improve mobility, clean its air, and boost its economic vitality.

Looking back at the original purpose and objectives of the project, as outlined in the various State and Federal grant applications, the GEORGE service has clearly met the majority of goals that were set. The demonstration provided an excellent test bed for new and innovative technologies. Some of these technologies, like the EVI and AVS electric vehicles, were found to be lacking in terms of reliability and performance. Other technologies, such as the Clever Devices AVM systems, were found to work quite well. The service provides improved transit service for residents of the City of Falls Church, and, as found in the passenger survey, provides an excellent gateway to the regional Metrorail and Metrobus systems. The passenger survey also showed, with the number and percentage of discretionary riders on the GEORGE service, that the bus system is meeting the stated goal of reducing automobile usage and vehicle miles traveled. In terms of providing measurable clean air benefits, the data from the WMATA Bus Maintenance Office clearly shows that the DNOx system provides significant measurable benefits in comparison with a traditional diesel bus, and is comparable to the emissions performance of a CNG-fueled vehicle. Again, while the ridership on the GEORGE system has not met expectations, the service has met many of its original goals.

Falls Church staff are taking a long term approach to judging the success of the GEORGE bus system. According to Assistant City Manager Wyatt Shields “the City sees the GEORGE bus system as a long term need.” “It may take time to build a consumer base for the bus system, like it did in Alexandria” referring to the DASH system serving the City of Alexandria, which experienced growing pains in its early years of service. Mr. Shields also pointed to the new, high-density development in the center of town, stating that these new residents will be less likely to own automobiles, and more likely to ride transit.

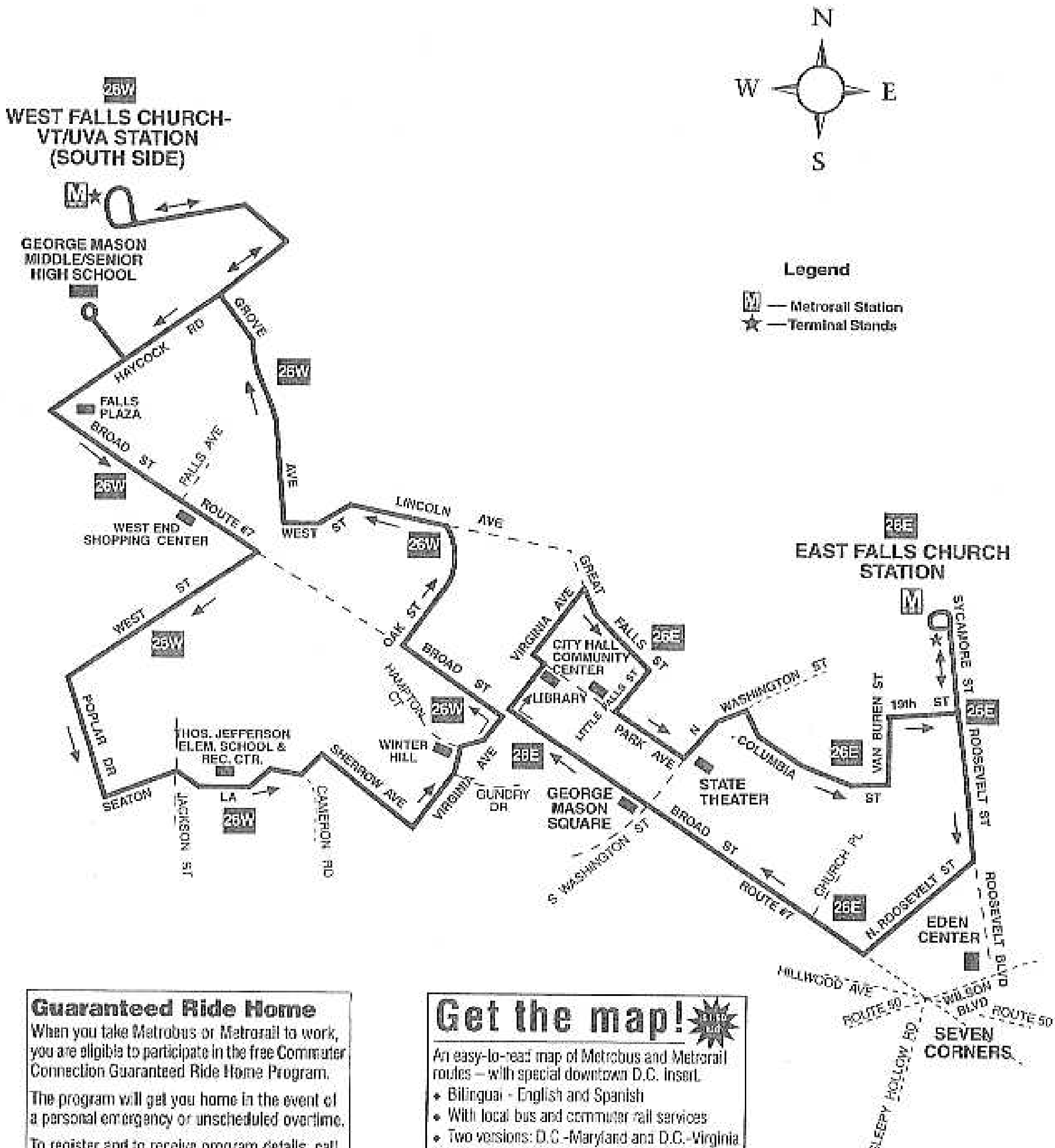
APPENDIX A:

ORIGINAL GEORGE ROUTE MAPS, AS OF 12/15/2002

FALLS CHURCH SHUTTLE SERVICE ROUTES 26E,W

East and West Falls Church Loops
Weekday Peak Hours Only

For route and schedule information
Call 202-637-7000
www.metroopensdoors.com



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When you take Metrobus or Metrorail to work, you are eligible to participate in the free Commuter Connection Guaranteed Ride Home Program.

The program will get you home in the event of a personal emergency or unscheduled overtime.

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City of Falls Church GEORGE

FALLS CHURCH SHUTTLE SERVICE
ROUTE 26A

Serving East and West Falls Church-VT/UVA Stations
Weekday Off-Peak Hours, Saturdays, Sundays and Holidays

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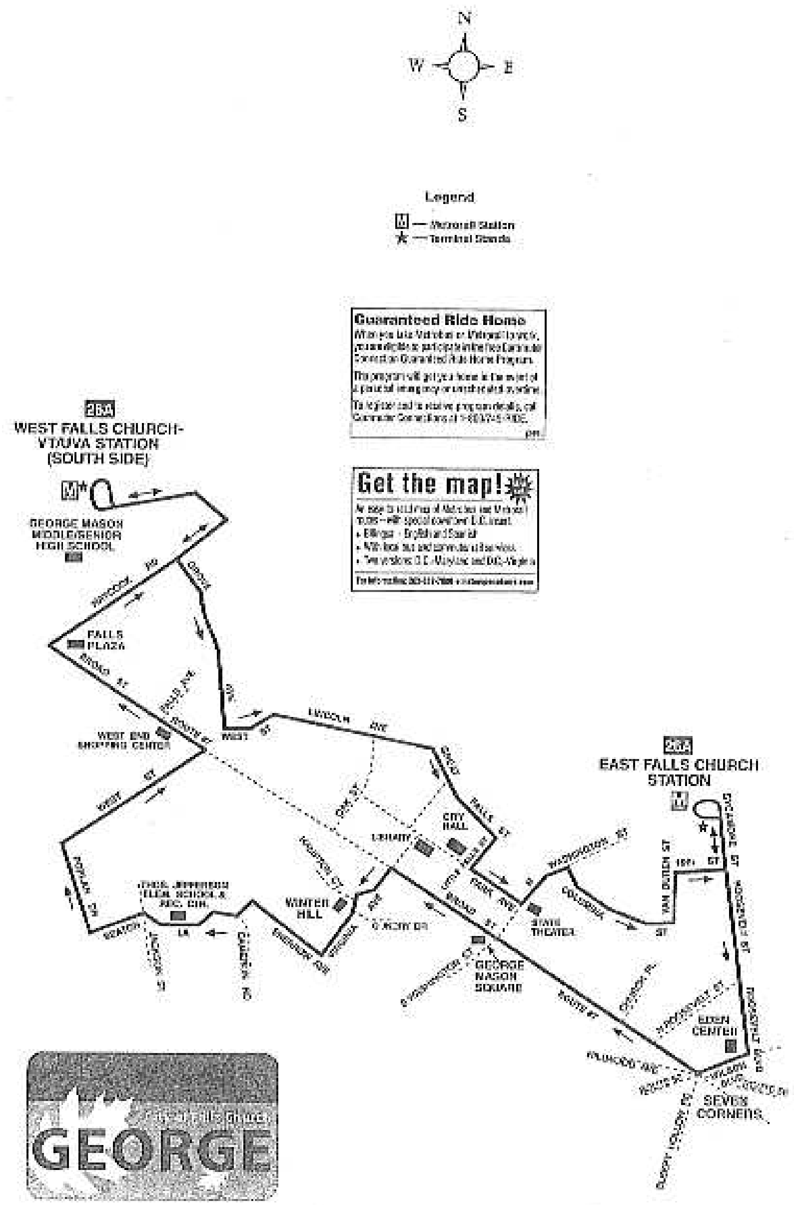


APPENDIX B:

GEORGE ROUTE MAPS, AS OF 9/7/2003

George Can Get You There!

George Can Get You There!

With so much to see and do in Falls Church City, why waste time driving? GEORGE, the City's local transit system, will pick you up from the East or West Falls Church Metro Rail station, and take you to most any destination within the City. Whether your interests are in history or the arts, hanging out with friends or family fun, Falls Church City has something for everyone and GEORGE can get you there.

Please note the schedule and route changes for GEORGE:

For Route 26A and 26E - the Little Falls & Great Falls Streets bus stop has been omitted. Riders can now catch GEORGE at Park Avenue and Little Falls Street. Next, the East Columbia & Van Buren Streets bus stop has been omitted. Riders can now catch GEORGE at North Washington & Jefferson Streets.

For Route 26W - the George Mason Middle/Senior High School bus stop has been omitted. Riders can now catch GEORGE at Haycock Road and Leesburg Pike.

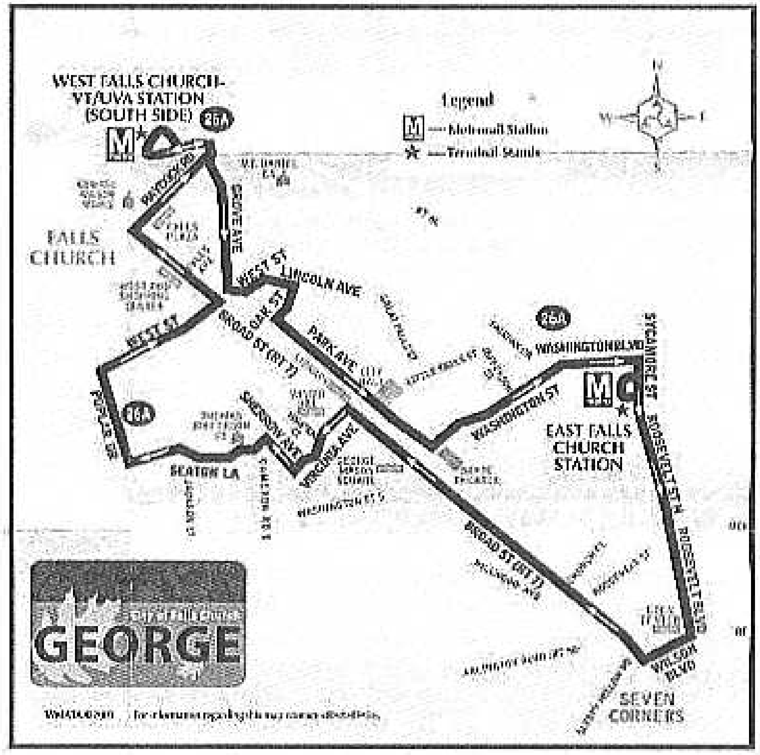
The trip times for GEORGE have changed as well.

For the 26A, GEORGE will run its mid-day and evening service every 45 minutes between buses instead of every 40 minutes as it currently runs. The 26A weekend schedule will still run every 40 minutes.

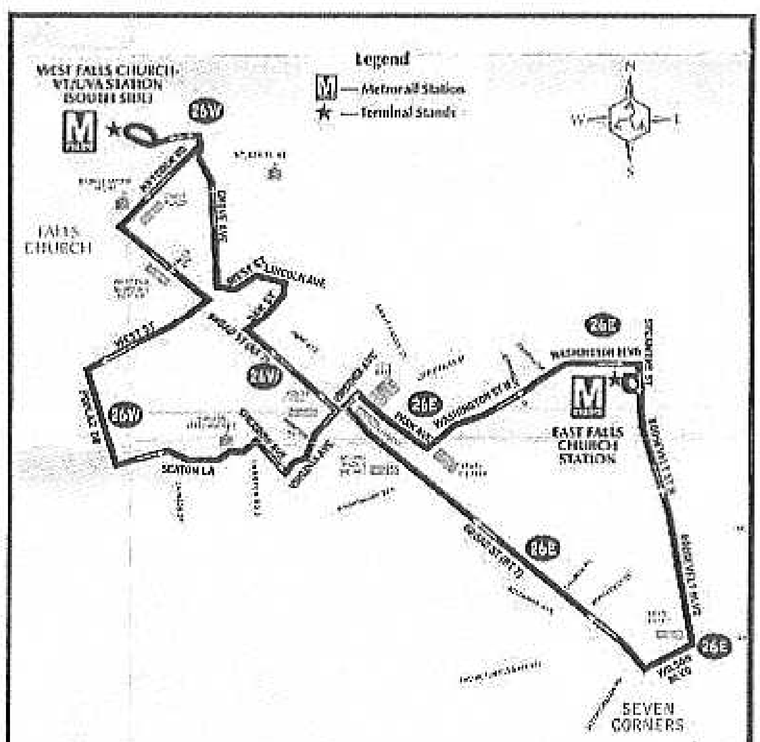
In the afternoon, the 26W will run during the evening rush hour every 30 minutes between buses instead of every 25 minutes as it currently runs.

For more information about GEORGE, or about the City of Falls Church, please contact 703-248-5003, or visit

Route 26A–East Falls Church Line

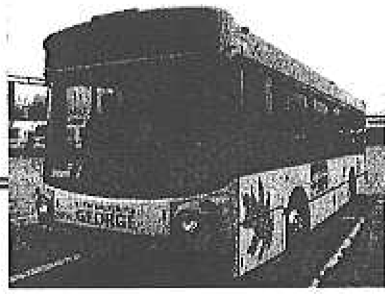


Route 26E–East Falls Church Line
Route 26W–West Falls Church Line



APPENDIX C:

DOCKET FOR PUBLIC HEARING ON PROPOSED RESTRUCTURING OF GEORGE ROUTES
5/5/2004



City of Falls Church GEORGE

Notice of Metrobus Public Hearing

No. 510

Proposed Restructuring of GEORGE Routes

26A, 26E and 26W

and Fare Increase

in Falls Church, Virginia

Docket No. B04-4

metro
Washington Metropolitan Area Transit Authority
600 Fifth Street, N.W. Washington, DC 20001

Persons wishing to testify are requested to furnish at least five days prior to the proposed date of appearance, the name, address, telephone number and organization affiliation, if any, to: Mr. Harold Bartlett, Secretary, Washington Metropolitan Area Transit Authority, 600 Fifth Street, NW, Washington, DC 20001. Further information is available by calling (202) 962-2595, or TDD (202) 638-3780.

Notice is hereby given that a public hearing will be held by the Washington Metropolitan Area Transit Authority (WMATA), the City of Falls Church and the Northern Virginia Transportation Commission on the proposed restructuring and fare increase on GEORGE Routes 26A, 26E and 26W in Falls Church, Virginia.

Metrobus Public Hearing Number	Date and Time	Location
510	Wednesday, May 5, 2004 7:00 P.M.	Harry Wells Municipal Building Training Room, Ground Floor 300 Park Avenue Falls Church, Virginia

This hearing is being conducted in a location accessible to persons with disabilities. Any individuals with a disability who require special assistance, such as a sign language interpreter, to participate in the public hearing should contact Mrs. Leenda Chambliss at (202) 962-2595 or TDD (202) 638-3780 no later than five days before the hearing date.

HOW TO REGISTER TO SPEAK AT THE PUBLIC HEARING

All organizations or individuals desiring to be heard with respect to the proposed service changes and fare increase on GEORGE Routes 26A, 26E and 26W will be afforded the opportunity to present their views, make supporting statements, and offer alternative proposals. In order to establish a witness list, individuals and representatives of organizations who wish to be heard at this public hearing are requested to furnish in writing their name, address, telephone number, and organization affiliation, if any, to Mr. Harold M. Bartlett, Secretary, Washington Metropolitan Area Transit Authority, 600 Fifth Street, N.W., Washington, D.C. 20001. Alternatively, you may fax this information to Mr. Bartlett at (202) 962-1133. Please submit only one speaker's name per letter. Lists of individual speakers will not be accepted. Others present at the hearing may be heard after those persons on the witness list have been called and heard. Public officials will be heard first and will be allowed ten minutes each to make their presentations. Others who register in advance will be allowed five minutes each and will be heard in order of registration. Those who do not register in advance will be allowed three minutes each. Relinquishing of time by one speaker to another will not be permitted.

HOW TO SUBMIT WRITTEN STATEMENTS

Written statements and exhibits may be submitted until close of business on Monday, May 10, 2004 to Mr. Harold M. Bartlett, Secretary, Washington Metropolitan Area Transit Authority, 600 Fifth Street, NW, Washington, DC 20001. Alternatively, you may submit an e-mail to public-hearing-testimony@wmata.com. Please reference the Hearing and/or Docket Number shown on the front of this document in your submission.

PROPOSED RESTRUCTURING OF GEORGE ROUTES 26A, 26E AND 26W AND FARE INCREASE IN FALLS CHURCH, VIRGINIA

DOCKET NO. B04-4

The City of Falls Church implemented GEORGE Routes 26A, 26E and 26W on December 15, 2002. GEORGE is operated under contract by WMATA as reimbursable service. Service is operated seven days a week with four 26-foot, low floor Thomas clean diesel buses out of Arlington Division with new service agreement operators. Routes 26E and 26W connect the residential neighborhoods of the City with East Falls Church and West Falls Church-VT/UVA stations, respectively, every 25 to 30 minutes during weekday peak hours. During weekday off-peak hours and on weekends service is provided every 40 to 45 minutes by Route 26A, which is a combination of Routes 26E and 26W connecting neighborhoods on the east and west sides of the City with both Metrorail stations. The fare is 25 cents, with all four buses equipped with SmarTrip fareboxes since the inauguration of service. In September 2003, service was rerouted and schedules adjusted in response to complaints from residents concerning bus operation on several neighborhood streets, as well as to reflect actual travel times.

Ridership on GEORGE service has been modest since implementation. Most riders use Routes 26E and 26W during weekday A.M. and P.M. peak hours. As of March 2004, Routes 26A, 26E and 26W averaged 179 weekday, 15 Saturday and 10 Sunday riders, for an average of 4 weekday, 2 Saturday, and fewer than one Sunday passengers per trip. In the first half of Fiscal Year 2005 beginning July 1, 2004, Federal funds for GEORGE service will be exhausted and Falls Church will be required to assume the entire cost of operation for Routes 26A, 26E and 26W. Based on ridership checks and comments received at a recent city public hearing, Falls Church city staff have requested that GEORGE service be restructured and the fare increased from 25 to 50 cents to improve productivity and reduce costs.

The proposals outlined in this docket are not final and are subject to change in response to testimony received during the public hearing process and local jurisdictional review. Following the public hearing, WMATA and Falls Church staff will review all testimony presented, both written and oral, and prepare a report with recommendations to the WMATA Board of Directors for its consideration and appropriate action. The Board may change or reject the proposals or staff recommendations with or without alternatives being provided. Implementation of the proposals for GEORGE Routes 26A, 26E and 26W outlined in the public hearing docket are dependent upon approval of the Board of Directors. If approved, the proposed GEORGE service changes and fare increase would be implemented effective Sunday, June 27, 2004, or as soon as possible thereafter.

FALLS CHURCH SHUTTLE SERVICE

Route 26A

Serving East and West Falls Church-VT/UVA Stations

Weekday Off-Peak hours, Saturdays, Sundays and holidays

For route and schedule information

Call 202-637-7000

www.metroopensdoors.com

Guaranteed Ride Home

When you take Metrobus or Metrorail to work, you are eligible to participate in the free Commuter Connection Guaranteed Ride Home Program.

The program will get you home in the event of a personal emergency or unscheduled overtime.

To register and to receive program details, call Commuter Connection at 1-800-745-RIDE.

(2/97)

OPTION 1

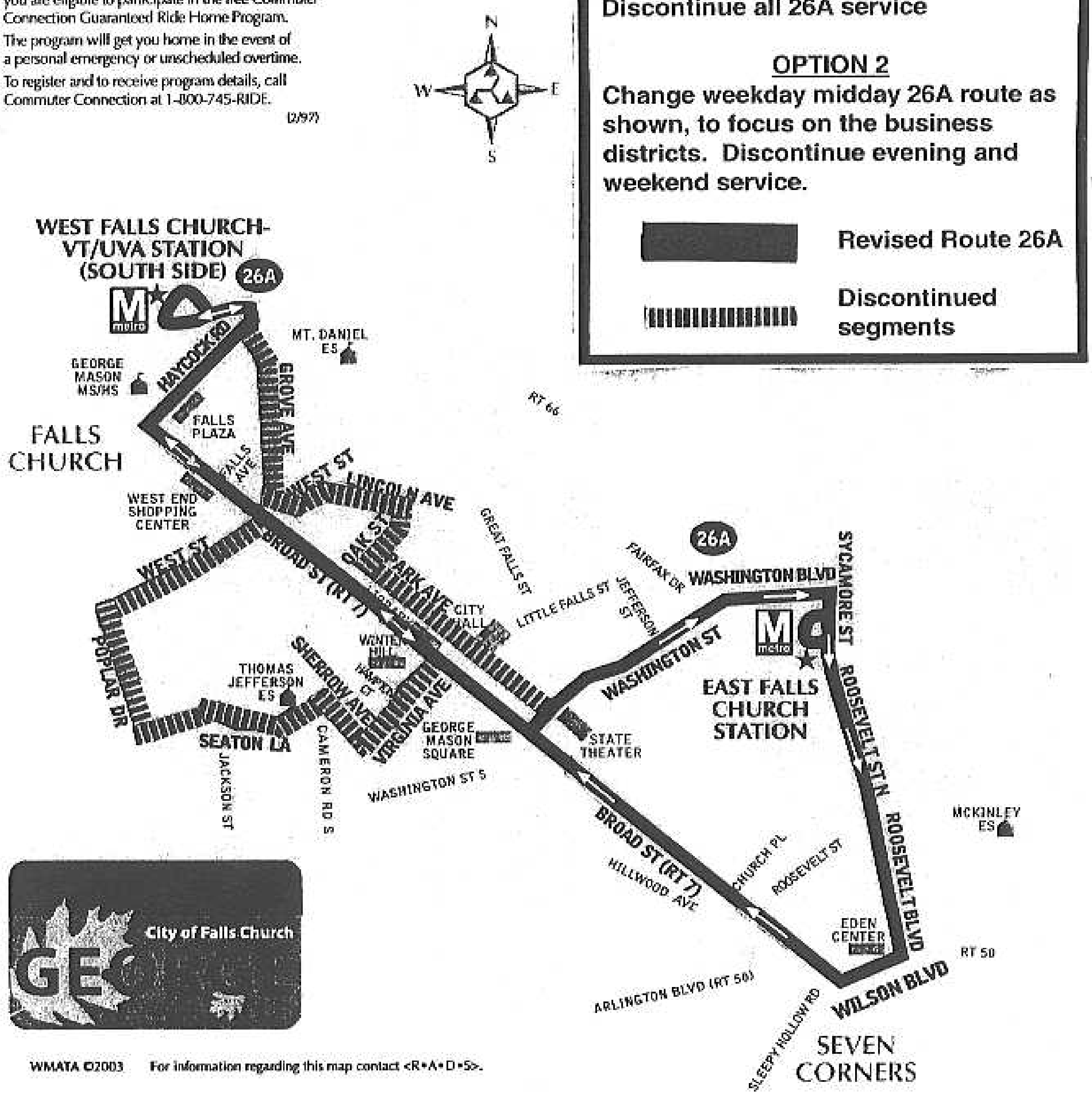
Discontinue all 26A service

OPTION 2

Change weekday midday 26A route as shown, to focus on the business districts. Discontinue evening and weekend service.

Revised Route 26A

Discontinued segments



WMATA ©2003 For information regarding this map contact <R•A•D•5>.

GEORGE EAST FALLS CHURCH SHUTTLE, ROUTES 26A, 26E
GEORGE WEST FALLS CHURCH SHUTTLE, ROUTE 26W

SERVICE AREA: City of Falls Church, East Falls Church and West Falls Church-VT/UVA stations

SERVICE PROPOSAL: Falls Church city staff have requested that the following service options be presented for public comment:

Option 1:

- Route 26A - Discontinue all service (weekday off-peak, Saturday, Sunday and holiday service)
- Routes 26E, 26W - Retain weekday peak hour service as presently operated (see map on page 4 for Routes 26E, 26W)

Option 2:

- Route 26A - Restructure route to concentrate service on the major arterials (Broad and Washington Streets). From East Falls Church station, service would operate via Sycamore and Roosevelt Streets, Roosevelt Boulevard, Wilson Boulevard, East and West Broad Streets, and Haycock Road to West Falls Church-VT/UVA station. The return route to East Falls Church would operate via Haycock Road, West Broad Street, North Washington Street, Lee Highway, Washington Boulevard and Sycamore Street to East Falls Church station. See map on page 2 for detail of proposed 26A routing. Operate weekday midday service only on Route 26A; discontinue weekday evening, Saturday, Sunday and holiday service.
- Routes 26E, 26W - Retain weekday peak hour service as presently operated (see map on page 4 for Routes 26E, 26W)

PROPOSED FARE CHANGE: Increase GEORGE fare from 25 to 50 cents

REASON FOR PROPOSALS: The proposed service and fare changes would improve productivity by tailoring service to demand, as well as reducing the cost of GEORGE service to the City.

FALLS CHURCH SHUTTLE SERVICE

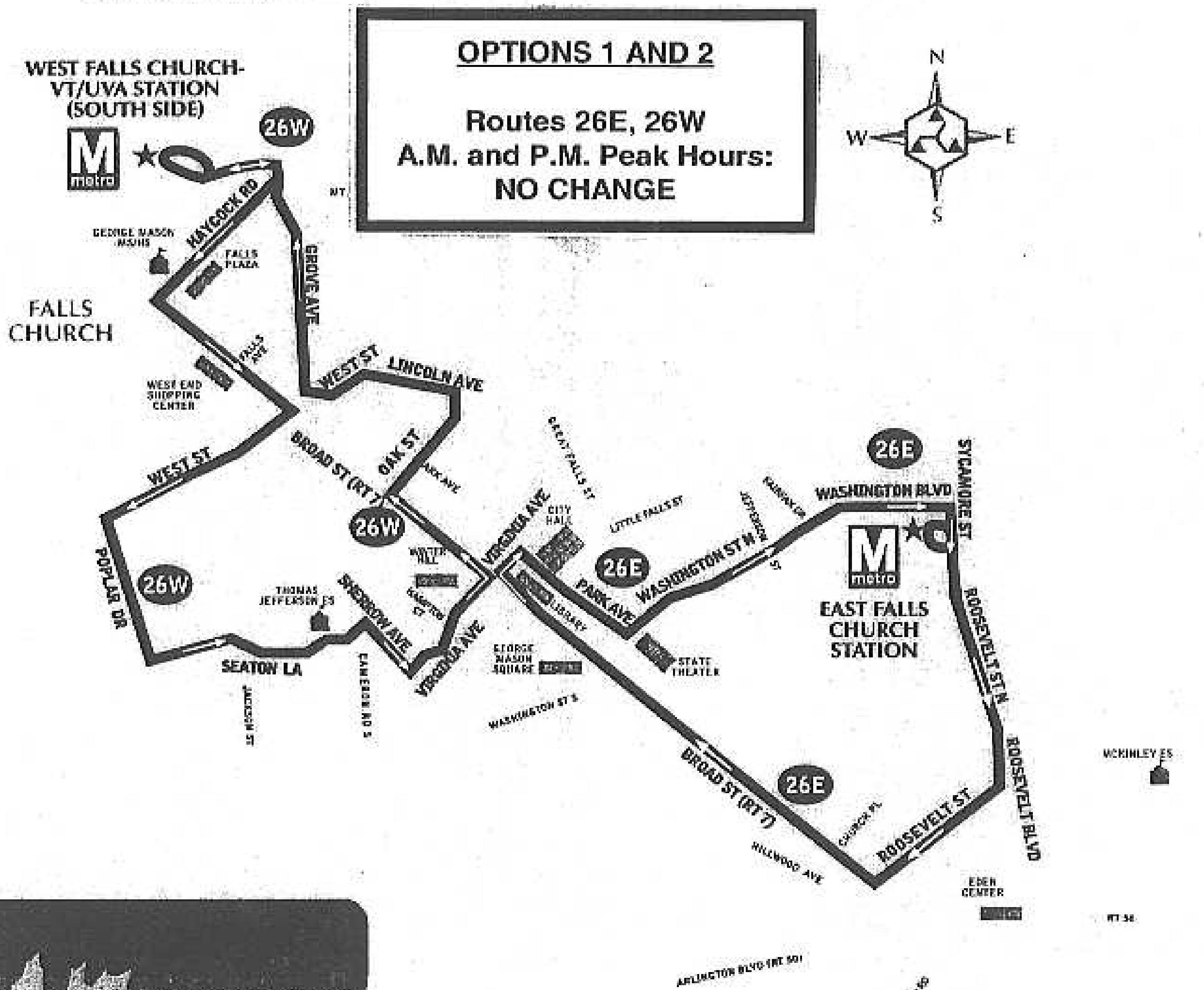
Routes 26E, W

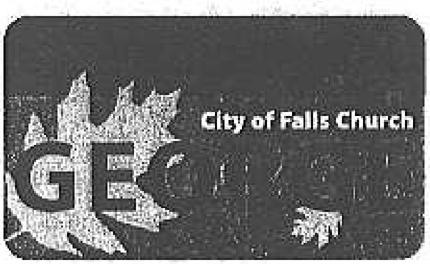
East and West Falls Church Loops
Weekday Peak Hours Only

For route and schedule information

Call 202-637-7000

www.metroopensdoors.com





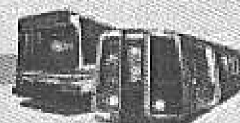
APPENDIX D:

CURRENT GEORGE ROUTE MAPS AND SCHEDULES

Using this timetable

- Use the map to find the stops closest to where you will get on and off the bus.
- Select the schedule (weekday, Saturday, Sunday) for when you will travel. Along the top of the schedule, find the stop at or nearest the point where you will get on the bus. Follow that column down to the time you want to leave.
- Use the same method to find the times the bus is scheduled to arrive at the stop where you will get off the bus.
- If the bus stop is not listed, use the time shown for the bus stop before it as the time to wait at the stop.
- The end-of-the-line or last stop is listed in ALL CAPS on the schedule.

GEORGE



Metrobus Timetable
26
A,E-East Falls Church Line
W-West Falls Church Line

Serves these locations

East Falls Church station (26A,E)
Eden Center (26A)
George Mason Square
(Broad & Washington Sts.)(26A,E)
Mary Riley Styles Library (26E)
City Hall/Community Center (26E)
State Theater (26A,E)
Winter Hill (26A,W)
Oak Park (26W)
West End Shopping Center (26A,W)
Falls Plaza Shopping Center (26A,W)
George Mason Middle/Senior High School (26A,W)
West Falls Church-VT/UVA station (26A,W)

Special 50¢ Fare

Schedule 7-5-04

metro opens doors

Washington Metropolitan Area Transit Authority

A District of Columbia, Maryland and Virginia Transit Partnership

FALLS CHURCH SHUTTLE SERVICE

Route 26A

Serving East and West Falls Church-VT/UVA Stations

Weekday Midday Hours Only

For route and schedule information

Call 202-637-7000

www.metroopensdoors.com

Guaranteed Ride Home

When you take Metrobus or Metrorail to work, you are eligible to participate in the free Commuter Connection Guaranteed Ride Home Program.

The program will get you home in the event of a personal emergency or unscheduled overtime.

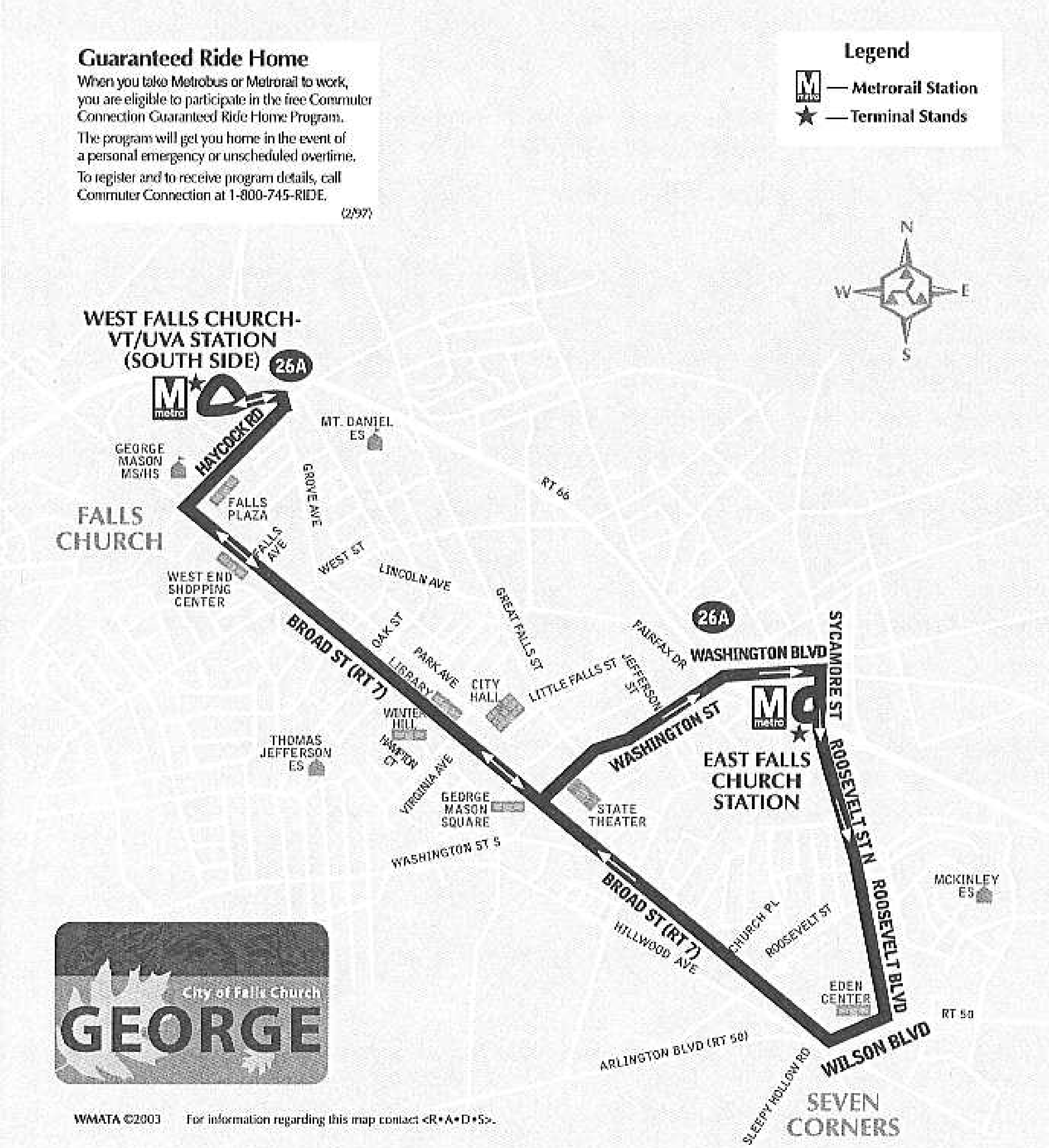
To register and to receive program details, call Commuter Connection at 1-800-745-RIDE.

(2/97)

Legend

M — Metrorail Station

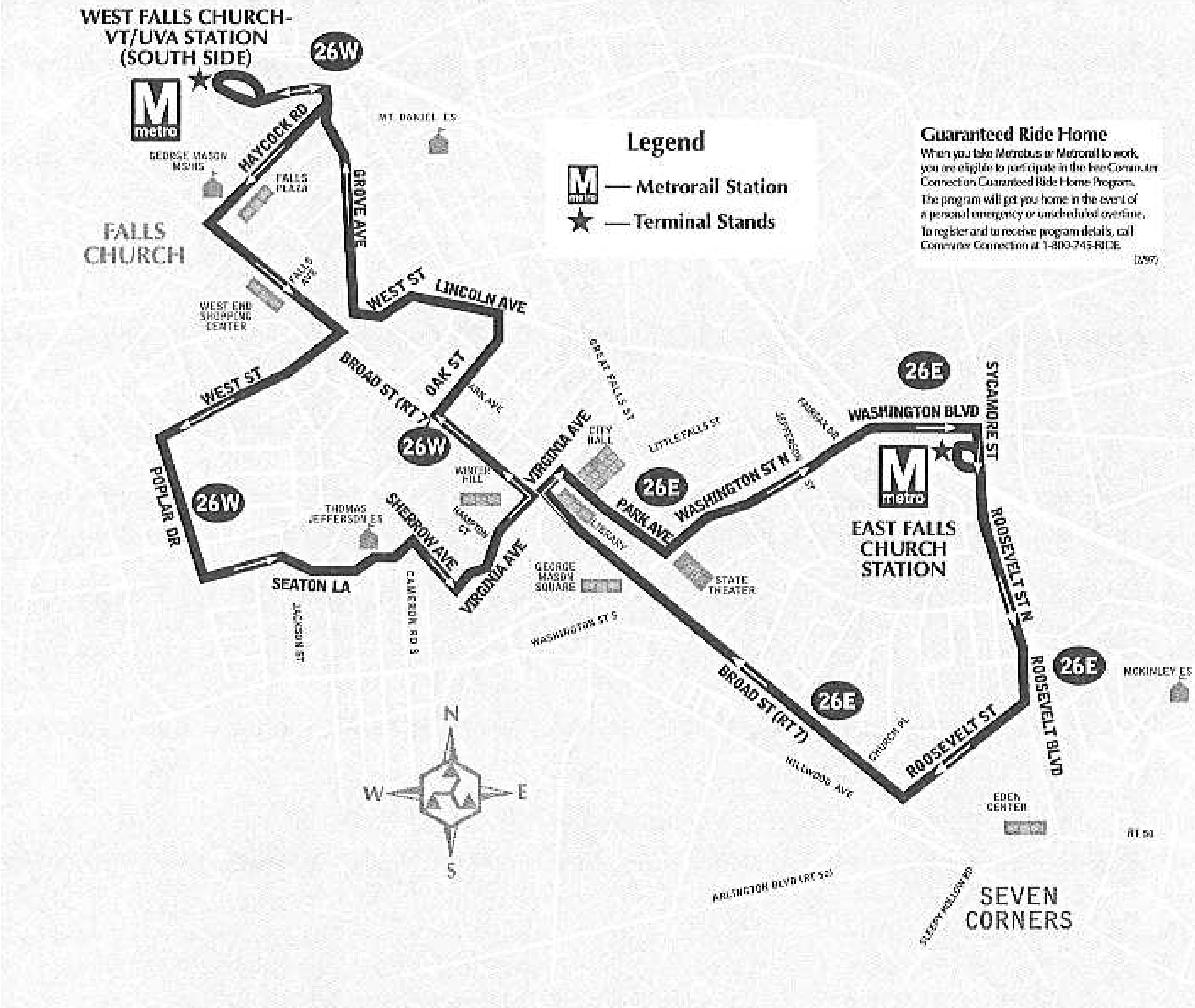
★ — Terminal Stands



WMATA ©2003 For information regarding this map contact <R•A•D•S>.

FALLS CHURCH SHUTTLE SERVICE
Routes 26E, W
East and West Falls Church Loops Weedkay Peak Hours Only

For route and schedule information
Call 202-637-7000
www.metroopensdoors.com



City of Falls Church
GEORGE

26
A,E-East Falls Church Line
W-West Falls Church Line

GEORGE, City of Falls Church Local Transit
West Falls Church Line

Monday thru Friday Loop

(except holidays)

Route Number	West Falls Church-VT/UVA Ⓜ	Haycock Rd. & Leesburg Pike (George Mason Middle/Sr High School)	West Broad St. & Falls Ave. (West End Shopping Ctr.)	Seaton La. & Jackson St.	West Broad St. & Virginia Ave.	West Broad & Oak Sts.	North West St. & Park Ave.	WEST FALLS CHURCH-VT/UVA Ⓜ
				AM Service				
♿ 26W	6:00	6:02	6:05	6:09	6:12	6:13	6:16	6:19
♿ 26W	6:25	6:27	6:30	6:34	6:37	6:38	6:41	6:44
♿ 26W	6:50	6:52	6:55	6:59	7:02	7:03	7:06	7:09
♿ 26W	7:15	7:17	7:21	7:25	7:29	7:30	7:33	7:36
♿ 26W	7:40	7:42	7:46	7:50	7:54	7:55	7:58	8:01
♿ 26W	8:05	8:07	8:11	8:15	8:19	8:20	8:23	8:26
♿ 26W	8:30	8:33	8:35	8:39	8:43	8:44	8:47	8:50
♿ 26W	8:55	8:58	9:00	9:04	9:08	9:09	9:12	9:15
♿ 26W	9:20	9:23	9:25	9:29	9:33	9:34	9:37	9:40
				PM Service				
♿ 26W	4:30	4:33	4:36	4:41	4:46	4:47	4:50	4:54
♿ 26W	5:00	5:03	5:06	5:11	5:16	5:17	5:20	5:24
♿ 26W	5:30	5:33	5:36	5:41	5:46	5:47	5:50	5:54
♿ 26W	6:00	6:03	6:06	6:11	6:16	6:17	6:20	6:24
♿ 26W	6:30	6:33	6:36	6:41	6:46	6:47	6:50	6:54
♿ 26W	7:00	7:03	7:06	7:11	7:16	7:17	7:20	7:24
♿ 26W	7:30	7:32	7:36	7:40	7:44	7:45	7:47	7:50

♿ — Trip operates with wheelchair-accessible or lift-equipped bus.

26
A,E-East Falls Church Line
W-West Falls Church Line

GEORGE, City of Falls Church Local Transit
East Falls Church Line
W/B - westbound; E/B - eastbound

Monday thru Friday Loop
(except holidays)

Route Number	East Falls Church Ⓜ	Roosevelt & Wilson Blvds (Eden Center)	East Broad St. & Church Pl.	East Broad & Washington Sts. (George Mason Square) (W/B)	West Broad St. & Virginia Ave. (W/B)	West Broad & Birch Sts. (Falls Plaza) (W/B)	West Falls Church-VT/UVA Ⓜ	West Broad & Birch Sts. (Falls Plaza) (E/B)	West Broad St & Virginia Ave. (E/B)	West Broad & Washington Sts. (George Mason Square) (E/B)	Park Ave. & Little Falls St.	N. Washington St. & Park Ave. (State Theater)	N. Washington & Jefferson Sts.	EAST FALLS CHURCH Ⓜ
							AM Service							
♿ 26E	6:00	-	6:05	6:07	6:09	-	-	-	-	-	6:11	6:13	6:14	6:16
♿ 26E	6:25	-	6:30	6:32	6:34	-	-	-	-	-	6:36	6:38	6:39	6:41
♿ 26E	6:50	-	6:55	6:57	6:59	-	-	-	-	-	7:01	7:03	7:04	7:06
♿ 26E	7:15	-	7:20	7:23	7:26	-	-	-	-	-	7:28	7:31	7:32	7:34
♿ 26E	7:40	-	7:45	7:48	7:51	-	-	-	-	-	7:53	7:56	7:57	7:59
♿ 26E	8:05	-	8:10	8:13	8:16	-	-	-	-	-	8:18	8:21	8:22	8:24
♿ 26E	8:30	-	8:35	8:38	8:41	-	-	-	-	-	8:43	8:46	8:47	8:49
♿ 26E	8:55	-	9:00	9:03	9:06	-	-	-	-	-	9:08	9:11	9:12	9:14
♿ 26E	9:20	-	9:25	9:28	9:31	-	-	-	-	-	9:33	9:36	9:37	9:39
♿ 26A	10:00	10:04	10:07	10:09	10:12	10:16	10:19	10:22	10:26	10:29	-	10:30	10:32	10:35
♿ 26A	10:45	10:49	10:52	10:54	10:57	11:01	11:04	11:07	11:11	11:14	-	11:15	11:17	11:20
♿ 26A	11:30	11:34	11:37	11:39	11:42	11:46	11:49	11:52	11:56	11:59	-	12:00	12:02	12:05
							PM Service							
♿ 26A	12:15	12:19	12:22	12:24	12:27	12:31	12:34	12:37	12:41	12:44	-	12:45	12:47	12:50
♿ 26A	1:00	1:04	1:07	1:10	1:13	1:17	1:20	1:23	1:27	1:30	-	1:31	1:33	1:36
♿ 26A	1:45	1:49	1:52	1:55	1:58	2:02	2:05	2:08	2:12	2:15	-	2:16	2:18	2:21
♿ 26A	2:30	2:34	2:37	2:40	2:43	2:47	2:50	2:53	2:57	3:00	-	3:01	3:03	3:06
♿ 26A	3:15	3:19	3:22	3:25	3:28	3:32	3:35	3:38	3:42	3:45	-	3:46	3:48	3:51
♿ 26E	4:00	-	4:05	4:07	4:10	-	-	-	-	-	4:12	4:14	4:15	4:17
♿ 26E	4:30	-	4:35	4:37	4:40	-	-	-	-	-	4:42	4:44	4:45	4:47
♿ 26E	4:55	-	5:00	5:02	5:05	-	-	-	-	-	5:07	5:09	5:10	5:12
♿ 26E	5:20	-	5:25	5:27	5:30	-	-	-	-	-	5:32	5:34	5:35	5:37
♿ 26E	5:45	-	5:50	5:52	5:55	-	-	-	-	-	5:57	5:59	6:00	6:02
♿ 26E	6:10	-	6:15	6:17	6:20	-	-	-	-	-	6:22	6:24	6:25	6:27
♿ 26E	6:35	-	6:40	6:42	6:45	-	-	-	-	-	6:47	6:49	6:50	6:52
♿ 26E	7:00	-	7:05	7:07	7:10	-	-	-	-	-	7:12	7:14	7:15	7:17
♿ 26E	7:25	-	7:30	7:32	7:35	-	-	-	-	-	7:37	7:39	7:40	7:42

♿ — Trip operates with wheelchair-accessible or lift-equipped bus.

Weekday service after 7:25 PM, and all Saturday and Sunday service DISCONTINUED.

Appendix E:

GEORGE Bus Marketing Materials

FOCUS
ON THE CITY OF FALLS CHURCH
QUARTERLY

Winter 2003–Issue #353

In This Issue

GEORGE Can Get You There

Promoting the City of Falls Church, Virginia's Local Transit System

CITY OF FALLS CHURCH

Why Waste Your Summer Driving When GEORGE Can Get You There!

CITY OF FALLS CHURCH

Tactics

- *The Weekly FOCUS*

THE WEEKLY FOCUS

GEORGE Can Get You There

Classes and Events

Robert Palermo to be New TJ Elementary Assistant Principal

Students Have Fun on Japan Day

New TJ Student Award

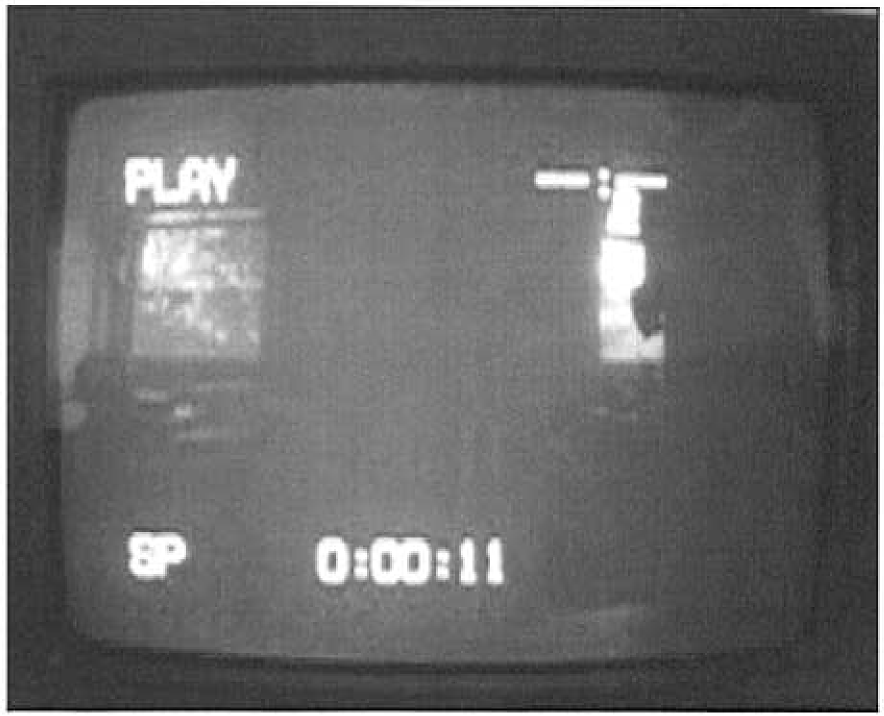
Mount Daniel Thanks Its Volunteers

Older Americans Month Celebrated

CITY OF FALLS CHURCH

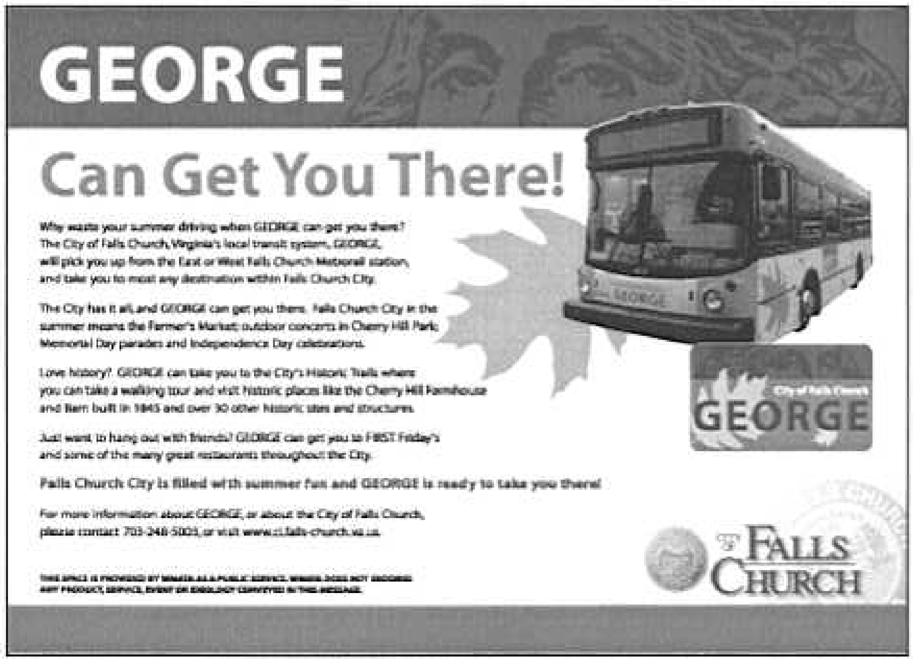
Tactics

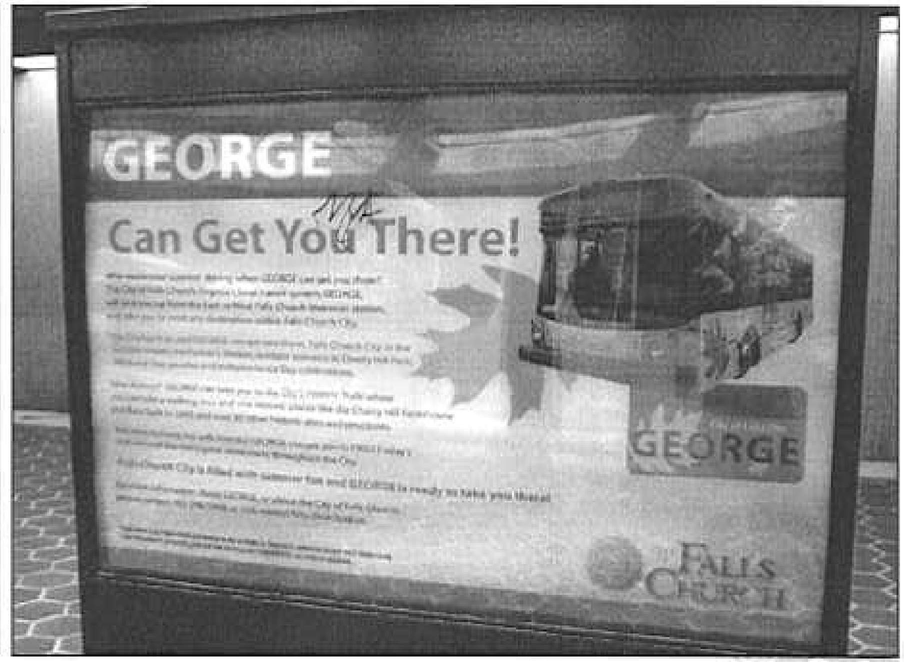
- Television PSA in English & Spanish



CITY OF FALLS CHURCH

Tactics





CITY OF FALLS CHURCH

Tactics

http://www.ci.falls-church.va.us/george/index.html

CITY OF FALLS CHURCH

Appendix F:

GEORGE Bus Passenger Survey Form, Weighted Tabulation Sheet

City of Falls Church GEORGE Bus, Weighted Frequencies of On-Board Survey Results

---

Where do you live? **City of Falls Church – 66%** **Fairfax County – 12%** **Arlington County – 7%** **Other – 15%**

Can you hear the stop announcements **outside** the bus?	Yes – 35.4%
If **yes**, are they helpful to you?	Yes – 31.8%
Are the stop announcements made on time?	Yes – 48.7%
Can you hear the stop announcements **inside** the bus?	Yes – 98.0%
If **yes**, are they helpful to you?	Yes – 89.7%
Are the stop announcements made on time?	Yes – 86.9%
Is the electronic display stop listing **inside** the bus helpful to you?	Yes – 87.2%
Did you use a SmarTrip card to pay your fare?	Yes – 55.8%

Are you transferring to/from Metrorail?	Yes – 87.1%
Are you transferring to/from Metrobus?	Yes – 12.0%
Did you have a car available to use for this trip today?	Yes – 48.9%

What is the purpose of this trip? *(Circle all that apply)*

Work – 79.8% **Shop – 1.8%** **School – 7.2%** **Medical – 3.3%** **Other – 7.9%**

How often do you ride the GEORGE bus? *(Circle one)*

Daily – 66.0% **weekly – 18.7%** **monthly – 7.9%** **annually – 4.0%**

How old are you? – Average age = 41.7

Are you Male? – 42.6% or Female? – 57.4%

Please check the three things you like MOST about GEORGE bus service:

58.5% Clean buses	23.1% Access to jobs	52.0% Improved access to Metrorail
18.9% Fuel savings	43.3% Cheaper than driving	22.7% Improved access to places in F.C.
29.2% Reduced pollution	49.6% Low fares	2.7% Attracts new businesses to the city
18.4% Improved traffic cond.	19.6% Imp. mobility for non-drivers	30.2% I can use my SmarTrip card

---

Versión en español al reverso Serial Number

Falls Church is interested in your opinions about the new GEORGE bus service. Please take a few minutes and complete this survey. When you are finished, please place it in the return box. Thank you for your help!

Have you completed this survey on a GEORGE bus this month? Yes____ No____

Where do you live? *(Circle one)* **City of Falls Church** **Fairfax County** **Arlington County** **Other**

Can you hear the stop announcements **outside** the bus? Yes___ No___
If **yes**, are they helpful to you? Yes___ No___
Are the stop announcements made on time? Yes___ No___

Can you hear the stop announcements **inside** the bus? Yes___ No___
If **yes**, are they helpful to you? Yes___ No___
Are the stop announcements made on time? Yes___ No___

Is the electronic display stop listing **inside** the bus helpful to you? Yes___ No___

Did you use a SmarTrip card to pay your fare? Yes___ No___

Where did you get on this GEORGE bus? (Address, nearest intersection, landmark)

____

Where will you get off this bus? (Address, nearest intersection, landmark)

____

Are you transferring to/from Metrorail? Yes___ No___
Are you transferring to/from Metrobus? Yes___ No___
If you are transferring to/from Metrobus, which route number?______________

Did you have a car available to use for this trip today? Yes___ No___
If **yes**, why did you choose to ride the GEORGE bus?______________________________

What is the purpose of this trip? *(Circle all that apply)* **Work** **Shop** **School** **Medical** **Other**

How often do you ride the GEORGE bus? *(Circle one)* **daily** **weekly** **monthly** **annually**

How old are you?____ Are you Male?___ or Female?___

How did you learn about the GEORGE bus? ______________________________

Please check the three things you like MOST about GEORGE bus service:

___Clean buses
___Fuel savings
___Reduced pollution
___Improved traffic conditions
___Access to jobs
___Cheaper than driving
___Low fares
___Improved mobility for non-drivers
___Improved access to Metrorail
___Improved access to places in Falls Church
___Attracts new businesses to the city
___I can use my SmarTrip card

THANK YOU FOR RIDING GEORGE

APPENDIX G:
DETAILED CHRONOLOGY OF THE FALLS CHURCH BUS PROJECT

Activity	**Dates**
Falls Church considers proposals for a contracted local bus system but instead agrees to an NVTC plan to help fund the city's existing Metrobus service.	Winter, 1996
Working group formed with members from NVTC, WMATA, Falls Church and Virginia Power to explore electric bus service.	February 21, 1997
NVTC applies for FY 1998 state TEIF grant and seeks authority to reprogram an existing Virginia oil overcharge grant (VARF) that had been awarded to WMATA.	March, 1997
FY 98 TEIF grant awarded ($345,000).	July, 1997
CTB approves reprogramming of FY 95 VARF funds for Electric Bus project and allocates $83,404 in FY98 VARF funds.	July, 1997
Electric Bus project awarded federal earmark ($390,879) for FY99.	Spring, 1998
With a multi-year funding plan in place, and detailed specifications developed by WMATA, NVTC issues RFP 98-3 to procure 4 hybrid-electric buses.	April, 1998
NVTC is awarded FY 99 TEIF grant for $310,000.	July, 1998
NVTC approves award of contract to Electric Vehicles International (EVI).	July, 1998
$564,000 is allocated for the project from FY 99 CMAQ funds.	October, 1998
Contract 98-3 is canceled due to EVI's inability to perform under the terms of its proposal. This leads to an $80,000 bond forfeiture by EVI per the terms of the contract.	October 23, 1998
NVTC issues RFP 99-2 to procure 4 hybrid-electric buses.	October 26, 1998
NVTC receives a FY 99 Federal Earmark for electric bus technology in the amount of $397,000.	Fall, 1998
NVTC approves award of 99-2 contract to Advanced Vehicle Systems (AVS).	January, 1999

Contract signed with AVS.	February 28, 1999
Notice to proceed (letter dated March 24, 1999)	April 1, 1999
WMATA staff travel to AVS to inspect Bus 1 frame.	May 19, 1999
Virginia Power installs 2 chargers for the buses at WMATA's Arlington garage, as called for in the contract.	September, 1999
Sole–source contract with Clever Devices for on-board communication software.	September 1999
Falls Church city council approves routes and service plan.	November, 1999
Pilot Bus delivered by AVS. Water damage to bus caused by improper transport.	February, 2000
Testing by WMATA begins. Estimated arrival for other three buses is May.	March 2000
Contractual date for delivery of all four buses.	April 1, 2000
Operating agreement between WMATA, Falls Church, and NVTC executed.	April 19, 2000
Installation of bus stop signs completed by WMATA.	June 2000
Agreement with Clever Devices for free demonstration of maintenance and passenger monitoring software with modest costs for on-board hardware.	June, 2000
Schedules printed with September 2000 start date.	July 2000
AVS notified that liquidated damages are accruing.	July 15, 2000
Bus 2 received. Bus 3 expected by the end of August and Bus 4 by the end of September.	August 17, 2000
AVS switches from Neocom to PEI, and must retrofit all buses with PEI battery-management systems.	September 2000
WMATA contracts with Booz-Allen to evaluate the new battery management systems. The consultants go to AVS and work with AVS personnel to evaluate the system.	December 2000/ January 2001
Booz-Allen report completed and presented to working group. Report shows that PEI system is an improvement, but that there still are problems. Recommends extensive testing once buses are delivered.	February 23, 2001

Received buses 3 and 4. Buses 1 and 2 taken back to AVS for retrofits.	February 25, 2001
Received buses 1 and 2. All four buses onsite.	April 23, 2001
45-day test begins	May 14, 2001
45-day test ends. AVS and WMATA disagree over what constitutes a failure.	June 28, 2001
NVTC acts to obtain legal services.	November 2001
Notice of default termination issued to AVS.	November 16, 2001
NVTC, WMATA, and Falls Church staffs identify clean diesel buses with Exhaust Gas Recirculation filters available for purchase from Thomas-Built buses, Inc. FTA provides a letter agreeing to pursue a transfer of earmarked federal funding for a mid-course correction. A revised financial plan is created including funds for a federal earmark for Falls Church.	November 2001-March 2002
E-Bus, Inc. provides a hybrid-electric bus to WMATA for inspection and seeks the opportunity to lease at least one for the project.	February 2002
Settlement agreement reached with AVS.	March 2002
Resolution provided to NVTC to initiate procurement of four Thomas-built buses with EGR filters, apply for additional grant funds, and negotiate a contract with E-bus to lease a demonstrator hybrid-electric bus.	April 4, 2002
NVTC secures $250,000 in re-programmed 5309 earmark funding for bus purchase.	October 2002
Four Thomas-built buses and Engelhard EGR filters purchased by NVTC from Sonny-Merryman Incorporated.	October 2002
Buses delivered to WMATA Bladensburg facility	December 2002
GEORGE bus graphics applied by WMATA, first of the Engelhard EGR filters installed on GEORGE bus	December 2002
Non-revenue service begins on original routes from 1999	December 15, 2002
Dedication ceremony for GEORGE service at Falls Church Community Center	January 10, 2003
Revenue service begins on the GEORGE routes	January 11, 2003
Remaining three Engelhard EGR filters installed on GEORGE buses and put into revenue service	March 2003
Working group analyzes GEORGE routes and identifies necessary changes to improve service	June 2003

Operating Agreement signed by WMATA, NVTC, and the City of Falls Church	July 2003
Advanced Vehicle Systems (AVS) declares bankruptcy, NVTC files claim to recover $226,350 in unpaid settlement	August 2003
Revised routes put into service	September 2003
Falls Church staff performs ridership counts and makes recommendations for route and service changes	April 2004
WMATA conducts Public Hearing at Falls Church City Hall to discuss proposed changes to GEORGE 26A route.	May 5, 2004
Revised 26A route put into service, weekend and off-peak evening service discontinued	July 1, 2004
GEORGE Bus passenger survey	October 2005
NVTC demonstration grant funds fully expended, Falls Church assumes entire operating cost of service	April 2005
Falls Church to exercise first option year of Operating Agreement with WMATA	July 2005

APPENDIX H:
FALLS CHURCH BUS PROJECT FUNDING SOURCES

Fiscal Year	Agency	Source	Purpose	Amount (Unmatched)
1995	VDOT	Virginia Alternative Fuels Revolving Fund (VARF)	Capital	$90,000
1998	VDOT	Virginia Alternative Fuels Revolving Fund (VARF)	Capital	$83,404
1998	FTA	Section 5309 via congressional earmark	Capital	$390,879
1998	EVI	Bond Forfeiture	Capital/ Operating	$80,000
1998	VDRPT	Transportation Efficiency Improvement Fund (TEIF)	Capital/ Operating	$345,000
1999	FTA	Section 5309 via congressional earmark	Capital	$397,000
1999	VDRPT	Transportation Efficiency Improvement Fund (TEIF)	Capital/ Operating	$310,900
1999	FTA/FHWA	Congestion Mitigation and Air Quality (CMAQ)	Capital/ Operating	$564,000
2001	FTA	AVS Recovery	Capital	$200,000*
1998-2005		Interest earned on Falls Church funds and Bond Forfeiture	Operating	$22,111
2002		Interest earned on AVS Recovery	Capital	$2,810
2002	FTA	Section 5309 via congressional earmark	Capital	$250,000
2000-2002	Falls Church	$40,000/yr. for 3 yrs.	Operating	$120,000
Total				**$2,656,104**

NVTC in-kind expenses not included in project funding

* To avoid double counting, $200,000 in funds recovered from AVS not included in overall total.

Appendix I:

Sample Engine Data Points

PID	J1587 Message Name
000	Request Parameter
044	Attention/Warning Indicator Lamps Status
045	Inlet Air Heater Status
071	Idle Shutdown Timer Status
074	Maximum Road Speed
083	Road Speed Limit Status
084	Road Speed
085	Cruise Control Status
086	Cruise Control Set Speed
087	Cruise Control High Set Limit Speed
088	Cruise Control Low Set Limit Speed
089	Power Takeoff Status
091	Percent Accelerator Pedal Position
092	Percent Engine Load
097	Water In Fuel Indicator
100	Engine Oil Pressure
102	Boost Pressure
105	Intake Manifold Temperature
110	Engine Coolant Temperature
121	Engine Retarder Status
128	Component Specific Parameter Request
166	Rated Engine Power
168	Volts (Battery)
182	Trip Fuel
183	Fuel Rate
184	Instantaneous MPG
185	Average MPG
187	Power Takeoff Set Speed
188	Idle Engine Speed
189	Maximum Engine Speed
190	Engine Speed
192	Multisection Parameter
194	Transmitter System Diagnostic Code and Occurrence Count Table
195	Diagnostic Data Request/Clear Count
196	Diagnostic Data Request/Clear Count Response
197	Connection Management
198	Connection Mode Data Transfer
221	Anti Theft Request
222	Anti-Theft Status Report
234	Software Identification
235	Total Idle Hours
236	Total Idle Fuel Used
237	Vehicle Identification Number
243	Component Identification
244	Trip Distance
245	Total Vehicle Distance
247	Total Engine Hours
248	Total PTO Hours
250	Total Fuel Used

Appendix J:

Sample Transmission Monitoring Parameters

J1587 Broadcast Parameters
Invalid Parameter
Attention/Warning Indicator Lamps Status
Retarder Status
Hydraulic Retarder Oil Temperature
Transmission Oil Level High / Low
Transmission Range Selected
Transmission Range Attained
Transmission Oil Temperature
Transmission Output Shaft Speed
Transmitter System Diagnostic Code & Occurrence Count Table
Diagnostic Data/Count Clear Response
Software Identification
Component Identification Parameter
J1587 PIDs Received
Request
Road Speed Limit Status
Cruise Control Status
Percent Engine Load
Engine Coolant Temperature
Component Specific Parameter Request
Diagnostic Data Request / Clear Count

Appendix K:

Intelligent Transportation Systems Evaluation
Automated Passenger Counters -- GEORGE Bus System

Intelligent Transportation Systems Evaluation

Automated Passenger Counters – GEORGE Bus System

Northern Virginia Transportation Commission

August 27, 2004

Adam T. McGavock
Northern Virginia Transportation Commission
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INTELLIGENT TRANSPORTATION SYSTEMS EVALUATION

Evaluation Methodology

The methodology for this evaluation is based on the evaluation procedures and criteria outlined in the December 2003 NVTC report entitled "Development of a Continuing Process for Monitoring Performance Data on Transit-Related ITS Investments". NVTC staff is testing the approach outlined by the consultants (TranSystems) in the report to demonstrate whether their approach has value for evaluating transit-related ITS applications. If the approach yields useful results without undue burdens on agency staff, NVTC may be asked to extend the use of this approach and build a repository of transit ITS performance data for the Northern Virginia region. Section 3.2 of the report outlines the process for developing and applying specific performance measures for a given ITS application.

Evaluation of Automated Passenger Counter Installation on GEORGE Buses

The Clever Devices Automated Passenger Counter (APC) system was installed on the GEORGE bus system in 2002 as a part of the 18-month demonstration program. The APC system uses electronic sensors that are mounted in the doorway of the bus to detect a person boarding the bus. These passenger boardings are counted, and each boarding is assigned to a bus stop using a GPS system. A back end computer system then compiles the data into tables showing the boardings for each bus stop on each bus route. This data can be stratified by date range, route, bus, time of day, and day of week. The GEORGE bus system consists of three routes, with a maximum of two vehicles in peak service at a given time.

There are four performance measures listed in the NVTC evaluation methodology for Automated Passenger Counter installations. This evaluation will address each measure individually, with a discussion of applicable impacts and comparisons. Each discussion of a particular performance measure is preceded by a table showing all possible impacts and comparisons for performance measures. The shaded boxes in the tables indicate applicable types of impact, types of comparisons, and levels of impact for a particular measure. An "X" indicates that the applicable impact/comparison was used for this evaluation.

Measure - Efficiency of Data Collection and Processing Staff

Measure	Type of Impact			Type of Comparison			Level of Impact	
	Measurable Dollar Impact (Cost/ Revenue)	**Measurable Non-monetary Impact**	**Perception**	**Before/After**	**Test/ Control**	**Descriptive**	**Primary**	Secondary
Efficiency of data collection and processing staff	X			X			X	

Do the APCs provide improvements in the efficiency of data collection and processing, in comparison with traditional counting methods? This can be measured in terms of *measurable dollar impacts*, *measurable non-monetary impacts*, and *perception.* Since we are able to calculate quantifiable dollar impacts for this measure, this evaluation will focus on the *measurable dollar impacts* instead of the *measurable non-monetary impacts* and the *perceived* impacts. Even though the GEORGE system never hired anyone to perform passenger counts for their system, one can still compute a *Before/After* comparison of the *measurable dollar impacts* provided by the Automated Passenger Counters on the assumption that they would have needed to employ traditional counting methods such as on/off counts in the absence of the APCs. This is a *primary* impact, meaning that relates to a direct benefit of reduced costs.

In the absence of Automated Passenger Counters, bus ridership information is normally collected via 100 percent on/off counts. The transit agency contracts with a consultant, who hires and trains temporary workers to perform the actual ridership counts. The counts need to be performed on typical days of service, meaning that there cannot be inclement weather, special events, or other factors that would artificially inflate or deflate ridership counts. If it starts pouring rain in the middle of the morning, the day's counts are thrown out and started again. In order to get five days worth of ridership counts, it may take two weeks or more. When the required daily counts are completed, the ride counts are tabulated by the consultant. The consultant then makes recommendations for modifying the routes based on ridership patterns. Based on informal conversations with consultants who regularly perform such tasks, we have calculated an estimated cost of $10,000 for five days of on/off counts.

The cost of an Automated Passenger Counter system is approximately $8,000 per vehicle, which amounts to $32,000 for the four-vehicle GEORGE fleet. That cost does not include the initial geo-coding of the bus stops, or the back end computer system. Also, the cost of re-coding the stops when routes are changed is not included in that figure. The cost of the initial coding and re-coding is directly determined by the size of the system. If the GEORGE system requires an analysis of routes each year, the cost of the APC system will be almost fully recovered within three years, and will begin to show a measurable and positive cost impact by the fourth year. If an analysis of routes is required only bi-annually, or less frequently, then it will take longer for the APC system to provide a positive cost impact. However, it is clear that the APC system will have a positive cost impact, it is just a matter of when.

<u>Measure – Quality of Service and Route Planning</u>

Measure	Type of Impact			Type of Comparison			Level of Impact	
	Measurable Dollar Impact (Cost/ Revenue)	**Measurable Non-monetary Impact**	**Perception**	**Before/After**	**Test/ Control**	**Descriptive**	**Primary**	**Secondary**
Quality of service and route planning			X			X	X	

Do the Automated Passenger Counters provide for a higher quality of service and route planning, in comparison with traditional data-gathering methods (ridership surveys, on/off counts)? This can be characterized in terms of *measurable non-monetary impacts*, and *perception*. Because the GEORGE system has only been in service for just over 18 months, and the only service and route planning has been accomplished with the aid of the APCs, there is really no way to compute a *measurable non-monetary impact* of the APC system. A *test/control* comparison would be overly burdensome for this evaluation, as that would involve the development of two sets of route and service plans: one using data from APCs and one using data gathered by traditional methods. In terms of *perception* and *descriptive* analyses, there are clear advantages to the APCs, when compared with traditional methods of route and service planning. These are *primary* benefits, in that they directly impact the quality of data available for planning purposes.

The APC system provides data for every trip taken during every day of service for any period of time that the GEORGE buses have been in service. In June of 2003, when Falls Church wanted to look at modifying the GEORGE routes, they were able to look at the cumulative boarding activity at every stop on every route, since the inception of service. This comprehensive picture allowed them to easily identify which sections of the routes were seeing little or no ridership, and modify the routes accordingly. Traditional data gathering provides data only for the specific dates that the data is collected, which provides a much narrower view of the overall performance of the bus routes. Overall, when one considers the vast and comprehensive data provided by the APC system, in comparison with the snapshot of data provided by surveys and ridership counts, the APCs provide clearly superior data in comparison with surveys and counts.

Measure – Timeliness of Data and Availability of Information

Measure	Type of Impact			Type of Comparison			Level of Impact	
	Measurable Dollar Impact (Cost/ Revenue)	**Measurable Non-monetary Impact**	**Perception**	**Before/ After**	**Test/ Control**	**Descriptive**	**Primary**	Secondary
Turn around time for special ridership count requests (Timeliness data and availability of information)		X		X			X	

Do the Automated Passenger Counters provide an improvement over traditional data gathering methods in terms of the *timeliness of data availability*? Can the APCs provide a better response to special data requests? This measure can be characterized in terms of *measurable non-monetary impact*, as seen in a *before/after* comparison. This is a *primary* impact that directly affects the quality and timeliness of available data for special requests.

In the case of special data requests that are made in advance, the APCs can offer substantial benefits over traditional methods of gathering data. Since the APCs are always counting passengers, there is no preparation required, and no lead-time necessary to write an RFP, hire a consultant, and train ride checkers. The data can be made available within a few hours of the buses returning to the garage. This will allow the GEORGE bus system to respond more easily to requests from elected officials or local organizations, and to be more flexible with regard to the last-minute requests.

In the case of special data requests that are made after the fact, there is no comparison to be made. Since the APCs are always counting passengers, retroactive data requests are not a problem. It is simply a matter of choosing the timeframe, and compiling the data. If the City Council wants to know how many passengers rode the 26E route on Columbus Day in 2003, it is a fairly simple matter to put together a report. For traditional counting methods, retroactive data requests are simply not possible. One cannot go back in time and place ride checkers on vehicles. This is a substantial point in favor of APCs.

Measure – Accuracy of Ridership Data

Measure	Type of Impact			Type of Comparison			Level of Impact	
	Measurable Dollar Impact (Cost/ Revenue)	**Measurable Non-monetary Impact**	**Perception**	**Before/After**	**Test/ Control**	**Descriptive**	**Primary**	Secondary
Accuracy of ridership data		X				X	X	

Do the Automated Passenger Counters improve upon the *accuracy of ridership data* collected by traditional methods? This can be characterized in terms of a *measurable non-monetary impact* on the accuracy of ridership numbers. A *before/after* comparison of the two data sources would likely yield different ridership numbers, but how would anyone know which numbers were accurate? A *test/control* comparison would be more useful, but that would require assembling a test group of passengers, having them board a bus that is out of service, and comparing the resulting APC counts to counts performed by a human being sitting on the bus. The level of effort required for such a test scenario is beyond the scope of this evaluation, and probably not worth the effort. In that type of controlled situation, differences in manual and APC counts would probably be small if any. A *descriptive* analysis is appropriate in this case.

The APC system uses electronic sensors that count passengers as they pass through the doorway of the bus. Those sensors can miscount if passengers are crowding together as they board the vehicle. Ride checkers can also make mistakes on a crowded bus, when they are unable to clearly see the entry or the exit, but the ride checkers will know that they may have miscounted, and can try to rectify the situation. APCs are also susceptible to mechanical failure, which would not be noticed until someone checks the data being generated. That may take several weeks. Human passenger counters can alert a supervisor when they are unable to perform their job. On the other hand, human ride checkers have been known to doze off during passenger counts, filling in fictitious data when they awaken. In some cases, ride checkers have abandoned their bus in the middle of a count, thereby invalidating all of the passenger data for the entire day. The bottom line is that Automated Passenger Counters and human ride checkers are only as good as the human beings that train them and monitor their results. When it comes to counting people, there is no reason to think that APCs are any more accurate or any less accurate than a human ride checker.

Summary

The chart below summarizes the results of the comparisons based on the measures used in this evaluation. The shaded squares represent applicable types of impacts and comparisons, and the "X" indicates that the impacts and comparisons were used for this evaluation. The final column indicates whether the APC comparison demonstrates a measurable and significant benefit when compared with traditional methods of counting passengers. The results are explained in greater detail below the chart.

Technology	**Measure**	**Type of Impact**			**Type of Comparison**			**Does the APC system demonstrate significant benefits over traditional methods?**
Automated passenger counters		**Measurable Dollar Impact (Cost/ Revenue)**	**Measurable Non-monetary Impact**	**Perception**	**Before/After**	**Test/ Control**	**Descriptive**	
	Efficiency of data collection and processing staff	X			X			**YES**
	Quality of service and route planning			X			X	**YES**
	Turn around time for special ridership count requests		X			X		**YES**
	Accuracy of ridership data		X				X	**NO**

In terms of the *Efficiency of data collection and processing staff*, the Automated Passenger Counters (APCs) do provide benefits in comparison with traditional passenger counting methods, although the extent of this benefit depends on how frequently ridership counts are required, and how frequently the routes are modified. For a typical system that requires annual ridership counts, and makes minor route modifications every three years, the APCs should provide a financial benefit by their fourth year of usage. Looking at the *quality of service and route planning*, APCs provide a much greater quantity of data, and much easier access to that data, when compared with traditional counting methods. When one looks at the comprehensive data provided by APCs, in comparison with the "snapshot" of data provided by traditional counting methods, the data provided by the APC is clearly superior. The APCs also offer greater flexibility and better *turn-around time when responding to special ridership count requests*. Traditional ridership counts require substantial lead-time, as the agency needs to put out an RFP, hire a consultant, train the ride checkers, and make other preparations. The APCs require no lead-time, as they are always counting. In addition, the APCs allow for retroactive data requests, something that is impossible with traditional data collection methods. Clearly, in terms of responsiveness and flexibility, the APCs provide substantial benefits when compared with traditional counting methods. In terms of data accuracy, there is no evidence that APCs are any better or any worse than traditional data collection methods, as both depend on human operators and are prone to human failures. Overall, the APCs provide measurable and significant benefits over traditional counting methods in three of the four evaluation categories.

Appendix L:

Sample Engine Performance Report

TA Tools

NVTC

CleverDevices

PERIOD INTERVAL REPORT NAME SCALE

7 DY 24 HR

Engine/Propulsion Performance

For Period Beginning: 04/10/05

By Bus ID 3951

AVERAGE FUEL ECONOMY (MILES PER GALLON)

10-APR-2005			11-APR-2005			12-APR-2005			13-APR-2005			14-APR-2005			15-APR-2005			16-APR-2005		
Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
N/A	N/A	N/A	5.31	5.31	5.31	5.31	5.31	5.31	5.31	5.31	5.31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

BATTERY POTENTIAL VOLTAGE (VOLTS)

10-APR-2005			11-APR-2005			12-APR-2005			13-APR-2005			14-APR-2005			15-APR-2005			16-APR-2005		
Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
N/A	N/A	N/A	12.1	13.27	13.85	12.75	13.33	13.6	12.75	13.33	13.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

ENGINE COOLANT TEMPERATURE (DEG F)

10-APR-2005			11-APR-2005			12-APR-2005			13-APR-2005			14-APR-2005			15-APR-2005			16-APR-2005		
Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
N/A	N/A	N/A	124	183.88	200	63	178.22	188	159	186.51	216	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Report Generated: Thursday 28-Apr-2005 at 16:19:00

AVM

Appendix M:

Sample Automated Passenger Counter (APC) Report

NVTC Report Oct04.xls

Route	StopSequence	Stop Description	Weekday Total Boarding	Weekday Total Alightings	Weekend Total Boardings	Weekend Total Alightings
26A03	1	E FALLS CHURCH STA + BUS BAY A	724	1428	0	0
26A03	2	N SYCAMORE ST + 19TH ST	233	476	0	0
26A03	3	N SYCAMORE ST + 17TH ST X	0	0	0	0
26A03	4	ROOSEVELT BLVD + 12TH ST	484	468	0	0
26A03	5	ROOSEVELT BLVD + OAKWOOD APTS	108	76	0	0
26A03	6	ROOSEVELT BLVD + WILSON BLVD	324	55	0	0
26A03	7	WILSON BLVD + ROOSEVELT BLVD(EB)	20	23	0	0
26A03	8	RT 7 E BROAD ST + RT 50	26	25	0	0
26A03	9	RT 7 E BROAD ST + ROOSEVELT ST	267	253	0	0
26A03	10	RT 7 E BROAD ST + CHURCH PL	11	2	0	0
26A03	11	RT 7 E BROAD ST + BUXTON RD	18	8	0	0
26A03	12	RT 7 E BROAD ST + NOLAND ST	0	7	0	0
26A03	13	RT 7 E BROAD ST + N CHERRY ST	1	10	0	0
26A03	14	RT 7 E BROAD ST + FAIRFAX ST	0	12	0	0
26A03	15	RT 7 E BROAD ST + WASHINGTON ST	56	65	0	0
26A03	16	RT 7 W BROAD ST + N MAPLE AVE	309	547	0	0
26A03	17	RT 7 W BROAD ST + LITTLE FALLS ST	16	28	0	0
26A03	18	RT 7 W BROAD ST + N VIRGINIA AVE	58	57	0	0
26A03	19	RT 7 W BROAD ST + #412	22	15	0	0
26A03	20	RT 7 W BROAD ST + PENNSYLVANIA AVE	9	1	0	0
26A03	21	RT 7 W BROAD ST + N OAK ST	27	19	0	0
26A03	22	RT 7 W BROAD ST + N SPRING ST	7	4	0	0
26A03	23	RT 7 W BROAD ST + 926A	21	19	0	0
26A03	24	RT 7 W BROAD ST + WEST ST(WB)	0	6	0	0
26A03	25	RT 7 W BROAD ST + BIRCH ST	14	25	0	0
26A03	26	RT 7 LEESBURG PK + HAYCOCK RD	20	22	0	0
26A03	27	HAYCOCK RD + GATES AT WESTFALLS	0	0	0	0
26A03	28	HAYCOCK RD + GROVE AVE	6	33	0	0
26A03	29	WEST FALLS CHURCH STA + BUS BAY G	44	12	0	0
26A03	30	HAYCOCK RD + FALLS REACH DR	0	0	0	0
26A03	31	HAYCOCK RD + LEESBURG PK	3	1	0	0
26A03	32	RT 7 W BROAD ST + BIRCH ST X	32	3	0	0
26A03	33	RT 7 W BROAD ST + FALLS AVE	4	1	0	0
26A03	34	RT 7 W BROAD ST + WEST ST(WB)	6	9	0	0
26A03	35	RT 7 W BROAD ST + ROWELL CT	9	3	0	0
26A03	36	RT 7 W BROAD ST + S SPRING ST	5	2	0	0
26A03	37	RT 7 W BROAD ST +S OAK ST	6	16	0	0
26A03	38	RT 7 W BROAD ST + REES PL	13	8	0	0
26A03	39	RT 7 W BROAD ST + S VIRGINIA AVE	29	21	0	0
26A03	40	RT 7 W BROAD ST + LITTLE FALLS ST X	8	24	0	0
26A03	41	N WASHINGTON ST (RT 29) + PARK WASHINGTON CT	58	9	0	0
26A03	42	N WASHINGTON ST + GREAT FALLS ST	21	2	0	0
26A03	43	N WASHINGTON ST + COLUMBIA ST	17	0	0	0
26A03	44	N WASHINGTON ST + JEFFERSON ST	6	3	0	0
26A03	45	N WASHINGTON ST + FAIRFAX DR	5	3	0	0
26A03	46	WASHINGTON BLVD + SYCAMORE ST	0	9	0	0
26A03	47	E FALLS CHURCH STA + BUS BAY A	11	56	0	0
26A03	-1	Unknown stops	320	725	0	0
26E01	1	E FALLS CHURCH STA + BUS BAY A	2018	1218	0	0