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PG No. 32C: Pre Bid Design Scope Review

Grantee: Virginia Department of Rail and Public Transportation (DRPT)

Dulles Corridor Metrorail Project Extension to Wiehle Avenue

Grantee Design Scope Review – Final Issued August 20, 2007

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LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AF	Audio Frequency
AFC	Automatic Fare Collection
ATC	Automatic Train Control
BRT	Bus Rapid Transit
CCIP	Contractor Controlled Insurance Program
CCTV	Closed Circuit Television System
CMMR	Containment, Management, Mitigation, and Remediation
CMP	Congestion Management Program
CPM	Critical Path Method
CTS	Carrier Transmission System
DIAAH	Dulles International Airport Access Highway
DEIS	Draft Environmental Impact Statement
DRPT	(Virginia) Department of Rail and Public Transportation
DSC	Differing Site Conditions
DTE	Dulles Transit Engineers, JV
DTP	Dulles Transit Partners, LLC
DVP	Dominion Virginia Power
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Environmental Site Assessment
FA	Force Account
FAA	Federal Aviation Administration
FD	Final Design
FEIS	Final Environmental Impact Statement
FFGA	Full Funding Grant Agreement
FHWA	Federal Highway Administration
FIA	Fire and Intrusion Alarm System
FOS	Fiber Optic System
FTA	Federal Transit Administration
FY	Fiscal Year (Federal)
GEC	General Engineering Consultant
GER	Geotechnical Evaluation Report
IDWS	Intrusion Detection Warning System
IRP	Infrastructure Renewal Program
KV	Kilo-volt
LAN	Local Area Network
LBT	Large Bore Tunnel
LOD	Limits of Disturbance
LPA	Locally Preferred Alternative

LIST OF ACRONYMS (continued)

MIS	Major Investment Study
MRS	Mobile Radio System
MWAA	Metropolitan Washington Airports Authority
MOT	Maintenance of Traffic
NATM	New Austrian Tunneling Method
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
COTS	Commercial-Off-The-Shelf
NTP	Notice to Proceed
OCC	Operations Control Center
PA	Public Address System
PE	Preliminary Engineering
PF	Power Frequency
PG	Program Guidance
PIDS	Passenger Information Display System
PLC	Programmable Logic Controllers
PMOC	Project Management Oversight Contractor
PPTA	Public-Private Transportation Act
QA/QC	Quality Assurance/Quality Control
QMP	Quality Management Plan
RAP	Right of Way Acquisition Plan
RFMP	Rail Fleet Management Plan
ROD	Record of Decision
ROE	Right of Entry
ROW	Right of Way
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition System
SCC	Standard Cost Code
TBD	To Be Determined
TBM	Tunnel Boring Machine
TC	Track Circuit
TPH	Trains Per Hour
URA	Uniform Relocation Act
VA	Commonwealth of Virginia
VDOT	Virginia Department of Transportation
VE	Value Engineering
WAN	Wide Area Network
WFC	West Falls Church
WMATA	Washington Metropolitan Area Transit Authority

Executive Summary

The Metropolitan Washington Airports Authority (MWAA), in cooperation with the Virginia Department of Rail and Public Transportation (DRPT) and Washington Metropolitan Area Transit Authority (WMATA), proposes to implement a 23.1-mile Metrorail extension in the Dulles Corridor of Northern Virginia. The proposed corridor follows the alignment of the Dulles International Airport Access Highway (DIAAH) and the Dulles Toll Road within Fairfax County, and the Dulles Greenway, a private toll road in Loudoun County. Metrorail-like heavy rail was designated the Locally Preferred Alternative (LPA). The alignment of the rapid transit system departs the existing WMATA alignment between East Falls Church Station and West Falls Church Station and follows the highway median for most of the route, deviating to serve the Tysons Corner commercial district and the Dulles International Airport main terminal.

Due to the length of the proposed route, the Dulles Corridor Metrorail Project was divided into two phases. The first phase, known as the Extension to Wiehle Avenue, is the identified Minimum Operable Segment and extends 11.6 miles from the existing WMATA Metrorail Orange Line, just east of the West Falls Church Station, to a station to be constructed in the DIAAH at Wiehle Avenue. Included in this phase are 5 new stations, improvements to the existing WMATA shop and yard at West Falls Church, and 64 additional rail cars. Throughout this report, the Extension to Wiehle Avenue will be referred to as "the Project". The Project is scheduled to be placed into revenue service by November 2012 and is estimated to carry 62,800 average weekday riders during the first year of operation (2013).

Preliminary Engineering (PE) of the Project is complete and DRPT submitted a Request to Enter into Final Design to the Federal Transit Administration (FTA) on April 28, 2006.

Project delivery is being progressed under the Virginia Public-Private Partnership provisions that began with a Comprehensive Agreement between DRPT and Dulles Transit Partners (DTP) for the preliminary design services with agreement to negotiate a design-build contract at a later date.

On March 27, 2006, the Governor of Virginia announced that the Commonwealth had accepted the MWAA proposal to take control of the Dulles Toll Road and the construction of the Dulles Corridor Metrorail Project. Transition of the Project from DRPT to MWAA is scheduled to occur in late 2007. In anticipation of this transition, MWAA took the lead in contract negotiations with DTP and the contract was executed between MWAA and DTP on June 19, 2007.

The Project scope to be analyzed for project risks is the PE design of the Extension to Wiehle Avenue. This spot report was prepared in accordance with FTA's Program Guidance (PG) Number 32 for Project Scope Review Procedures.

The 100% PE design drawings and technical specifications have not been updated since the submission of the Project Management Oversight Contractor's (PMOC's) last scope report dated October 20, 2006; therefore, the review of the various scope elements contained within the report is still based on the evaluation of these items. DRPT has been continuing PE design development with supplemental engineering efforts to resolve any items not able to be fully developed for 100% PE. MWAA has completed the negotiated development of the contract

Terms and Conditions for the Design-Build Contract (and its Appendices) and the Division 1 General Conditions. DRPT has issued updates to the Utilities Report, Permitting Plan, and Right of Way Acquisition Plan in anticipation of entry into Final Design. The PMOC has reviewed these documents and updated the appropriate sections of this report to reflect the PMOC's review and evaluation of these items.

The PMOC has identified the following potential risks associated with the project's scope:

1. *The design of relocations of the gas, sewer, and water lines in the bed of Route 7 had not progressed until recently; therefore, a risk to the project's scope and budget still exists until the design is completed.*

2. *The contract contains a significant scope of work, called Allowance Items, that postpone subcontracted work to a later date and leaves the Grantee with both the scope and cost risk of these items.*

3. *After a $12,000,000 allowance figure is exceeded for Differing Site Conditions, the Contractor is entitled to Change Order(s), which is a potential scope and cost risk.*

4. *There is a risk that the New Austrian Tunneling Method (NATM) tunnel excavation and initial support may be difficult to construct as designed given the soft ground conditions at Tysons Corner.*

5. *The complexity of designing a shop expansion, especially on a difficult site such as West Falls Church, requires that the design be fully progressed to the 100% PE level and accepted by WMATA in order to reduce the scope and cost risk of the shop to a level comparable with the remainder of the Project.*

6. *The complexity of the train control and signal system interface to the existing system requires that certain elements of work be performed with significant oversight and support by WMATA forces. There currently is no detailed force account plan for this work.*

7. *The level of design for the high voltage (34.5 KV) distribution system is not consistent with what is expected at the completion of the 100% PE phase.*

In summary, the PMOC's review found that the current scope is consistent with a normal level of PE design for the work included under the Design-Build Contract. The PMOC also found that the scope is consistent with the FTA Record of Decision.

Project Background

Project Description

MWAA, as Grantee, in cooperation with the DRPT and WMATA, proposes to implement a 23.1-mile Metrorail extension in the Dulles Corridor of Northern Virginia. The proposed corridor follows the alignment of the DIAAH and the Dulles Toll Road within Fairfax County, and the Dulles Greenway, a private toll road in Loudoun County. The alignment of the rapid transit system departs the existing WMATA alignment between East Falls Church Station and West Falls Church Station and follows the highway median for most of the route, deviating to serve the Tysons Corner commercial district and the Dulles International Airport main terminal.

Due to the length of the proposed route, the Dulles Corridor Metrorail Project was divided into two phases. The first phase, known as the Extension to Wiehle Avenue, is the identified Minimum Operable Segment and extends 11.6 miles from the existing WMATA Metrorail Orange Line, just east of the West Falls Church Station, to a station to be constructed in the DIAAH at Wiehle Avenue (See Figure 1). Included in this phase are 5 new stations, improvements to the existing WMATA yard at West Falls Church, and 64 additional rail cars.

Throughout this report, the Extension to Wiehle Avenue will be referred to as "the Project". The Project is scheduled to be placed into revenue service by November 2012 and is estimated to carry 62,800 average weekday riders during the first year of operation (2013).

Project History

Planning for the Dulles Corridor Metrorail Project began in the late 1990's resulting in a Major Investment Study (MIS) completed in 1997. Due to funding considerations, a 1999 supplement to the MIS resulted in the selection of lower cost Bus Rapid Transit (BRT) alternatives as an interim step to rail implementation. The FTA approved initiation of PE for National Environmental Policy Act (NEPA) evaluations using the BRT alternatives in March 2000. After public comment on the Draft Environmental Impact Statement (DEIS) published in July 2002, the rail only alternative was chosen as the LPA. The WMATA Board of Directors and Virginia's Commonwealth Transportation Board formally adopted this alternative in November and December 2002, respectively and the Metropolitan Washington Council of Governments has incorporated the updated capital cost of this alternative into their fiscally constrained long-range plan.

On August 8, 2003, DRPT requested FTA approval to initiate PE for the Extension to Wiehle Avenue; this was approved on June 10, 2004. At that time, the project was estimated to cost $2.000 billion, based on project completion by 2011, with a $900 million Federal New Starts share. Through Federal Fiscal Year (FY) 2006, Congress has appropriated $216.2 million for the Dulles Corridor Rapid Transit Project in Section 5309 New Starts funds.

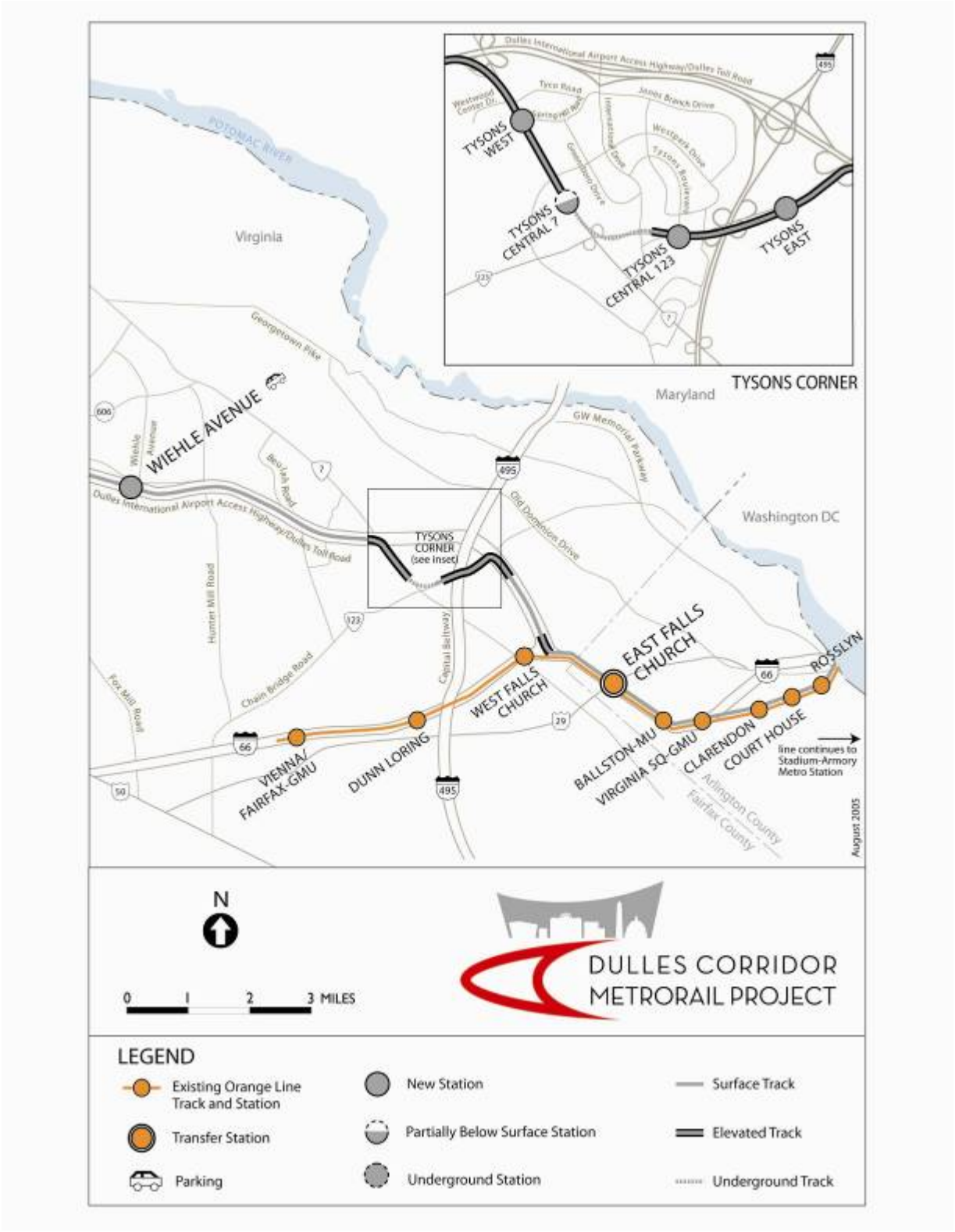

Figure 1 – Extension to Wiehle Avenue

Preliminary Engineering / NEPA

FTA approved the Final Environmental Impact Statement (FEIS) on December 13, 2004. The FTA Record of Decision (ROD) was issued on March 2, 2005. The Federal Aviation Administration, involved due to the Phase 2 portion, initially issued a ROD on April 13, 2005. However, that ROD was revised and replaced with a new ROD issued on July 12, 2005.

During March 2005, DRPT and DTP completed an alignment study requested by Fairfax County to relocate a portion of the project in the Tysons Corner area to the median of Route 7. This alignment was included in the complete 50% PE design packages.

The 50% PE cost estimate, including the effects of the alignment change, was provided by DTP on June 24, 2005. The cost estimate presented a project cost range of $1.7 billion to $2.4 billion, well in excess of the $1.5 billion cost estimate developed for the FEIS. The 50% Cost Estimate submitted on June 24, 2005 has undergone a rigorous review by DRPT and WMATA. DRPT's General Engineering Consultant (GEC) submitted a review of the DTP 50% cost estimate with the conclusion that a more realistic cost of the system, as designed, would be $2.1 billion. A review performed by WMATA based on their historical costs at the time agreed with the $2.1 billion cost estimate. DRPT considered a variety of changes in the design to further reduce the estimated cost of the project. The GEC initiated a cost estimating effort on July 12, 2005 that was completed on August 24, 2005. The document prepared by the GEC entitled "Trended 50% Preliminary Engineering Independent Capital Cost Estimate Extension to Wiehle Avenue" presents a project cost of $1,840.1 million. The revised cost estimate included the adopted cost reduction measures and was incorporated into the FTA New Starts submittal for FY 2007.

The adopted cost reduction measures and Route 7 realignment necessitated initiation of an Environmental Assessment (EA). The EA document, entitled Preliminary Engineering Design Refinements Environmental Assessment, was completed in February 2006. In parallel, DTP completed the 100% PE plans and specifications that were submitted at the end of February 2006. The submittal of the PE cost estimate and the delivery of the biddable documents (i.e. the design documents arranged in contract packages suitable for a public offering) was completed in April 2006. DRPT submitted a Request to Enter into Final Design to the FTA on April 28, 2006.

On August 18, 2006, DRPT submitted its FY 2008 New Starts Report to the FTA. During September/October 2006, the PMOC performed an evaluation of the estimate supporting the $2,065 million project cost, which was submitted to the FTA for the FY 2008 New Starts Report. The PMOC issued a Spot Report to FTA that concluded that the escalation factor used was inadequate, the contingency (both allocated and unallocated) was too low, and the project's cost and schedule could be seriously impacted due to the many uncertainties identified as a result of the lack of design and/or missing scope in the 100% PE design. The project cost estimate as of June 2007 is $2,648 million.

Project Organization

The project was originally organized with DRPT being the sponsor of the project and the grantee for Federal funding through FTA. WMATA acted as a technical advisor to DRPT. Dulles Transit Partners (DTP), a joint venture of Bechtel Infrastructure Corporation and the Washington Group, prepared the Preliminary Engineering documents.

On April 22, 2004, WMATA and DRPT entered into an interagency agreement that defined the roles and responsibilities of the two agencies during the preliminary engineering stage of the project. DRPT has assumed the responsibilities of project manager, Federal grant applicant and recipient, design-build contracting authority and owner of the project.

DRPT contemplated the use of a public/private partnership arrangement to deliver the project utilizing a design-build approach. In May 2002, under the Commonwealth of Virginia's Public-Private Transportation Act (PPTA) of 1995, DTP submitted a detailed proposal to DRPT for the project implementation including both design and construction. The Commonwealth of Virginia (the Commonwealth) convened a panel to evaluate the proposal in August 2002 that presented its recommendation to the DRPT Executive Director in December 2002. The Executive Director accepted the panel's recommendation and negotiated a contract with DTP. DRPT signed a Comprehensive Agreement with DTP for Preliminary Engineering and Development Services; NTP was issued to DTP on July 22, 2004. PE was completed in April 2006. It was intended that DTP submit a proposal for the design-build phase of the project in early summer 2006 and preliminary discussions with DTP regarding this proposal began in June 2005.

On December 20, 2005, MWAA announced a proposal to operate the Dulles Toll Road and oversee the construction of the rail line through the Dulles Corridor in Fairfax County to the Dulles International Airport and Loudoun Counties. The proposal included a provision for funding Phase 2 of the project (from Wiehle Avenue to the terminus in Loudoun County) without recourse to Federal funding, but made specific statements relating to MWAA's desire to assume the operation and revenue stream of the Dulles Toll Road. MWAA made a commitment that those funds would be utilized in the corridor for transportation improvements. On March 27, 2006, the Governor of Virginia announced that the Commonwealth had accepted the MWAA proposal to take control of the Dulles Toll Road and to build the Dulles Corridor Metrorail Project. MWAA applied and was approved by FTA as the potential FTA grantee for the project after PE, in lieu of DRPT. The transition to MWAA as grantee is expected to occur with the transfer of both the Dulles Toll Road and the Dulles Corridor Metrorail Project to MWAA. In anticipation of assuming the role of grantee, MWAA took the lead in negotiations with DTP for the Design-Build contract.

Design-Build Contract Negotiations

From the beginning of the project and the signing of the Comprehensive Agreement, it has been the expressed intent of both DRPT and DTP, to construct the project using the design-build contracting approach through a contract to be negotiated after PE.

At the end of PE, DTP provided an engineer's estimate that called for a project budget of $2.00 billion. However, this estimate did not include several scope items that had been included in the PE drawings and specifications. Restoring these items resulted in an estimate of approximately $2.37 billion at that time. DRPT obtained a comparative estimate of $2.06 billion from their GEC.

Discussions concerning Contract Terms and Conditions began in June 2005. The useable draft was completed in October 2006, which enabled DTP to submit their initial cost proposal for

construction in December 2006. DTP's most recent cost proposal was submitted on February 28, 2007. On March 30, 2007, DRPT/MWAA announced they had reached agreement with DTP for a $1.6 billion Design-Build contract consisting of a $1.1 billion firm fixed price portion and $0.5 billion in allowances for future subcontracts. An independent cost estimate was also prepared by DRPT for comparison with the DTP estimate. This cost estimate consisted of the estimated direct cost of construction, as provided by the DRPT GEC, adjusted by DRPT and MWAA for expected changes in scope, indirect costs, and profit.

Following the Memorandum of Understanding on March 30, 2007, MWAA and DPT completed negotiations of the Design-Build Contract on May 4, 2007 with the final price certifications received on May 11, 2007. Authority to execute the contract was sought from the MWAA Board and the local funding partners in June 2007. The Design-Build Contract was executed by MWAA and DTP on June 19, 2007.

In addition to the design-build contract portion of the project, MWAA/DPRT prepared a project estimate, including all project scope items, totaling $2,648 million.

Project Management Oversight Activities

The first Risk Assessment Workshop was held in the DRPT offices April 4-7, 2006. Draft Spot Reports on Scope, Cost, and Schedule were submitted to the FTA in June 2006 with a major recommendation that DRPT provide complete a bottoms-up cost estimate to comply with FTA Circulars 4220 and 5010.

Based on receipt of revised information, including the new cost estimate, the PMOC revised the draft Spot Reports and submitted them to the FTA in October 2006. Acting on one of the PMOC's recommendations, the target project profit to DTP was negotiated and reduced from 10% to 7.5%.

Subsequent to October 2006, DRPT provided additional information related to the Design-Build Contract, Terms and Conditions, Allowances, Open Items, Utility Time and Materials estimate, project costs and other related information. A workshop was held in November 2006 to discuss developments related to scope and schedule and to start the risk assessment process with the development of a risk register. Following review of these additional items, the PMOC provided revised draft Scope and Schedule Spot Reports in March 2007. In May 2007, the PMOC provided a revised draft Cost Review Spot Report. FTA shared these reports with DRPT/MWAA in June 2007. Risk Assessment Workshops were held on June 12-14, 2007 and July 10-12, 2007 at the project offices. Updated information from these workshops was used to develop this Spot Report.

Methodology

The methodology used to prepare this spot report is structured to accomplish the review described in FTA PG-32, Subtask 32C for Pre Bid Design Scope Review. The source document is FTA Project Management Oversight Program Operating Guidance PG-32 issued March 29, 2007. The PMOC's methodology used to prepare this report is described in Appendix B.

General Review of Project Design Concepts

The PMOC's assessment and evaluation as to whether the grantee's planning for the project's design has been sufficiently addressed and analyzed are discussed in the section entitled "Review of Design Scope Elements", as well as "Appendix C – Scope Review Checklist" of this report.

Review and Analysis of Project Design Scope Elements

The review of project scope was conducted in such a way as to identify areas of potential risk to the project from the design chosen for the project and its implementation as shown in the 100% PE design drawings, specifications, and supporting documents. Refer to Appendix B for a description of the methodology used to complete the review. Refer also to Appendix C for a listing of target areas for analysis.

Where concerns were raised by the technical specialists relative to risks arising from the nature of the design or the completeness of the scope shown in the drawings, scope risks are identified and characterized. Where in the opinion of the PMOC items of risk are identified, the text is italicized for emphasis.

Design Overview

Design Status

The PE design package for the Wiehle Avenue Extension includes a massive body of delivered work. The drawing package includes 2,097 drawings developed specifically for this project and 233 WMATA Standard Drawings. The written documentation includes a Basis of Design Report, the WMATA Standard Technical Specifications and amendments to those specifications, the Right-of-Way Acquisition Plan, a Permitting Plan, and 16 other design reports. DTP has also prepared a Storm Water Management Report with 13 supporting calculations and 4 Structural Reports, including Aerial Structure, Mined Tunnel, Cut and Cover Tunnel, and Stations and Facilities, with 49 supporting calculation packages.

The DRPT contract with DTP required DTP to provide a design package that was suitable to support procurement of the Project using the Design-Build method of project delivery. The expected level of design at this point is designated Preliminary Engineering, or PE. The PE milestone in design has also been variously described as "at the 30% design level" or "100% preliminary engineering". This review is based on the expectation by the PMOC that the level of design achieved by the PE package is adequate for release as Design-Build based on the PMOC's experience with other engineering design packages at the 30% design level or at the end of PE. Specifically, the question is whether the scope of the PE documents adequately describes the grantee's expectation of the completed project so that the contractor's design engineers can complete the design and the contractor can successfully build the project. But again, the benchmark is the minimum design needed to successfully define the required scope.

The Civil, Architectural, Trackwork, and System packages have been generally advanced to the level expected for the completion of PE before procurement of a Design-Build contract for construction. The guideway alignment, track layout, and architectural layout of the stations are well advanced as would be expected at PE. Other design disciplines are not as far advanced, but have outlined their requirements and concepts as appropriate for PE. WMATA Standard Specifications and Drawings are included to describe the requirements for trackwork construction, traction power, systems, and vehicles and the interface requirements among systems.

The descriptions and work definitions used in the specifications for the various subcategories are consistent and uniformly applied with the drawings and the specifications and are cross-referenced to other documents supporting the designs.

The PE design of the cut and cover tunnels, retained cut structures, ventilation structures and temporary structures for the project are reported to be fully in accordance with the WMATA Manual of Design Criteria and other applicable codes and standards. The design loads and calculations are in accordance with Section V – Structural Section of the Design Criteria and applicable codes and standards. Lateral pressures have been developed based on the latest available soil data for the design of permanent and temporary structures.

The cost estimate and the schedule provided in support of the PE package are the subject of separate PMOC Spot Reports to FTA on the Dulles Metrorail Extension.

As an identification convention, the Dulles Extension has been designated the "N" line. All drawing numbers begin with the letter N. Work to be preformed on the existing WMATA line to Vienna or in the West Falls Church Yard is prefixed with the letter K, which was the designation used for the construction of that line.

Survey

Topographic information was developed for the alignment from orthophotography by Post, Buckley, Shur and Jernigan in 2002. Supplemental field surveys were performed by Dewberry and Davis and NXL in 2005. Referencing the Civil Drawings – Volume 3 the horizontal control is based on the WMATA control system and the vertical control is tied to the North American Vertical Datum (NAVD) of 1988. System wide survey control points have been established in plan and in the field tied to the WMATA grid system. The available survey information is extensive and adequate for this stage of design. The PE civil engineering plans for utilities, Limits of Disturbance (LOD), grading and the guideway reflect the survey information.

Geotechnical

Preliminary Engineering documents, including the structural design reports, reference and make use of the geotechnical information available. The borings are profiled in Volume 2 - Geotechnical of the Preliminary Engineering plans.

A preliminary geotechnical investigation for the entire Dulles Corridor Metrorail Project alignment was performed by Law Engineering during 2001. In 2003 and 2004 additional investigations, including 226 borings (including 56 rock corings) together with laboratory

analysis along the proposed alignment, were performed and the resultant information compiled into a Geotechnical Evaluation Report (GER) issued by DTP dated February 17, 2006. The report documents the site geological, hydrological and geotechnical data and design parameters to support structural design calculations at the PE phase of design. The report includes the following information:

- A review of the project information
- General reviews of surface topographical features and site conditions
- A general review of area and site geologic conditions
- Final logs for 226 soil test borings records
- Subsurface profiles to illustrate the subsurface conditions encountered
- Rock mass rating (RMR) for the rock cores that were obtained
- Results of all field permeability tests
- Results of pressuremeter testing
- Results of the all laboratory testing on selected soil and rock samples
- Discussion of ground-water conditions and recommendations relative to permanent and/or temporary dewatering systems, where necessary
- A review of subsurface soil stratigraphy for each area of common geotechnical characteristics
- Recommendations of engineering properties of the soil and rock strata encountered for use in foundation and wall design
- Recommendations of foundation types, including shallow foundations, driven piles and drilled shafts
- Recommendations for foundation design including compression, tension, lateral capacities and estimated bearing depths.
- Recommendations relative to foundation installation, non-destructive testing, and load testing
- Evaluation of settlement potential and stability

According to the GER, the field exploration program was developed with the intention of characterizing the subsurface conditions for the Extension to Wiehle Avenue section of the project into generalized, geological zones, taking into account the types of structures proposed along the alignment. The purpose of this effort was to develop general geotechnical index and engineering properties based on the conditions encountered in specific zones that could then be used as the basis for the preliminary engineering analysis and design. The project has been divided into six areas based on similar stratigraphy and/or alignment.

- Dulles Connector Road, east of Tysons Corner
- Tysons Corner, elevated section east of I-495
- Tysons Corner, tunnel section
- Tysons Corner, western elevated section
- DIAAH, west of Tysons Corner
- West Falls Church Yard

Where shallow foundations were judged to be appropriate, estimations of bearing capacities were made using the Terzaghi Bearing Capacity Equation. The GER mentions that in the limited areas where shallow foundations are anticipated, settlement estimates will have to be performed during the detailed design phase, and will be limited based on tolerable settlements for the proposed structure.

Drilled pier ultimate axial capacities were estimated following the method provided in the American Association of State Highway and Transportation Officials (AASHTO) manual ("Standard Specification of Highway Bridges", 17th Edition, 2002) using the maximum un-factored loads derived from calculations of dead loads and live loads from the superstructure. Lateral load analyses of caissons were performed using LPILEPLUS Version 5.0, which is a special purpose program based on rational procedures for analyzing a pile or drilled shaft under lateral loading.

The guideway and ballasted bridge foundations were designed using deep foundations, drilled shafts (caissons), and driven piles dictated by loading, settlement, and underlying geology. According to the GER, the geology along the Dulles Corridor is favorable to caissons that support structures with high loads, which are sensitive to settlement or subject to space constraints. The GER recommendations indicate that five to ten foot diameter caissons with lengths of 60 feet are appropriate for use in design of the aerial guideway piers to resist the anticipated axial and lateral loading.

No unusual structural protections or concerns were identified for the aerial, at-grade, retained cuts and fills or cut and cover sections of the alignment. Temporary shoring of foundation excavations can utilize conventional support methods such as soldier pile and lagging, tie-backs or ground anchors as appropriate.

However, there are three areas of particular concern from a subsidence/structural protection standpoint for the mined tunnels section at Tyson's corner.

- The mined tunnels pass within 25-ft (plan distance) of an underground parking garage at the Marriott Hotel.
- The inbound tunnel is approximately 50-ft plan distance from the pile foundations for the overpass of Route 123 over Route 7. The top of the roadway of Route 123 is approximately 35-ft above the inbound tunnel roof level.
- The tunnels are at shallow depth where they pass underneath the exit ramp from southbound Route 123 onto westbound Route 7. The PE design shows the cover above the tunnels in this area to be on the order of 8 to 10-ft. DTP announced during the June 2007 risk management workshop that they plan to redesign this approximate 500-ft long section of mined tunnel to facilitate construction using cut and cover techniques but these plans have not yet been made available for review by the PMOC.

Calculations (Dulles Transit Engineers, Tysons Corner Tunnels Structural Calculations, Calculation Number 25071-00-CTC-01-00001, January 2006, Rev. C) were carried out to assess and verify acceptable ground behavior in response to tunneling and to obtain estimates of lining forces, tunnel deformation, ground deformations, and stress re-distribution for each of these critical locations.

Constructability

Dulles Transit Engineers (DTE) prepared a Constructability Report dated February 21, 2006 (Document 25071-000-G16-GCXE-00001) which addresses all major work aspects of construction including phasing, staging and laydown areas, construction access, utilities, grade preparation, aerial structures, tunnels, stations, trackwork, traction power, train control and

communications. The project is broken down into 10 major operational areas or segments and each of the previously referenced components are separately addressed for each operational area or segment. The construction schedule is also broken down into these same corresponding operational areas with one intention being to allow for sequencing by resource.

Mass balance diagrams have not been prepared for the project. The contract documents and interagency agreements have been developed to permit the expected excess of excavated materials to be stored on site at the Dulles International Airport.

Permits/Permitting

This assessment is based on a review of the updated Permitting Plan, Extension to Wiehle Avenue, dated May 2007, the Design-Build Contract and its Appendices dated May 4, 2007, and the Final PE Cost Estimate for the Dulles Corridor Metrorail Project.

Permits and the permitting process have been thoroughly covered by MWAA/DTP. As required by the ROD, a Compliance Matrix has been developed for the Project to systematically record and track the 182 permits necessary for the project from 15 regulatory agencies. Because of the nature of the Design-Build Contact, the permitting process is critical to the overall success of the Project from PE through turnover and acceptance. For the most part, the process will be lead by the Contractor following the PE phase. Presently, permitting is not on the Project's critical path.

Article 10 of the Design-Build Contract covers Applicable Laws and Regulatory Approvals. MWAA is responsible for Project permits of a global nature. The Contractor will be responsible for obtaining regulatory approvals (local permits).

The Permitting Plan covers the following processes:

- Permitting strategy
    - Streamline the review and approval process.
    - Integrate the permit process into the design and construction planning as early as possible.
- Applicable permits and agencies
    - The FEIS and RODs were distributed to all parties in the design and construction planning process to facilitate communication with regulatory agencies.
    - Interagency agreements were developed early in the Preliminary Engineering phase to address, among other issues, permits. These agreements also provide for periodic design reviews and staff to perform same.
    - Agreements with all oversight agencies will address timely reviews and approvals.

- Roles and responsibilities
    - In general, MWAA will seek permits and approvals that can be obtained based on the Preliminary Engineering drawings and that would impact bidding, estimating or the start of construction. These are generally global (project wide) permits.
    - The Contractor will continue the balance of the permitting process now that the Contract has been executed. The project has been divided into 10 segments to facilitate the permit process during construction.
    - The Contractor will establish in house environmental manager and building permit manager to continue the process.
- Tracking regulatory requirements and submittals
    - The Compliance Matrix will be updated quarterly and will be used to track and demonstrate permit compliance during the life of the Project.
    - A Permit Matrix has also been developed listing permits, requirements, and applicability. This will be updated during the life of the Project.
    - Required permit modifications will also be tracked.
- Implementing permitting and permit compliance
    - MWAA is committed to complying with all regulatory requirements, laws and permits.
    - Permit close-out will be systematically structured to ensure compliance with all permit requirements.
- Developing and managing permitting schedules
    - Permitting was integrated into the project schedules during Preliminary Engineering.
    - Confirm review cycles.
    - Presently, permitting is not on the Project's Critical Path.

Guideway Elements

All major work items related to the guideway on aerial structures, on grade and the tunnel, including track relationships, dimensions, design interfaces, and physical interfaces are well defined in the drawings, specifications and standards and consistent for a 30% level of design. A detailed review of each type of construction follows.

Guideway: Aerial Structure

This review is based on a full evaluation of the Preliminary Engineering drawings, Volume 4 – Civil dated February 2006 and the Structural Design Report for Guideways and Bridges (Document 25071-000-S0R-YB00-00002, dated February 10, 2006, Rev. B). The PE drawings consist of plans, applicable elevations, cross-sections and standard details.

Scope of Design

The aerial guideway sections incorporate three types of structural beam support: AASHTO precast concrete box beams, precast concrete segmental WMATA box beams and structural steel beams all supported on poured in place reinforced concrete bents, and concrete columns, which in turn, are founded on drilled shafts. In general, the AASHTO box beams are employed on

tangent sections of the guideway, WMATA segmental box beams are employed on the curved sections, with structural steel beams used to span the larger major roadway crossings.

The first sections of aerial guideway are approximately 2,200 foot sections adjacent to the West Falls Church Yard, crossing over the westbound roadway of I-66 and the lead track from the West Falls Church Yard. There are separate structures for the inbound and outbound tracks. These structures are supported on AASHTO box beams. The second section of aerial structures carries both guideways over the eastbound lanes of Route 267, an exit ramp, and Route 123, crossing to the north side of Route 123/Chain Bridge Road. These guideway sections incorporate all three structural beam types – AASHTO box beams, segmental box beams and structural steel beams over Route 123. This section of aerial guideway continues until it ties in with the Tysons East Station structure which incorporates WMATA box beam sections. Beyond the Tyson East Station, the guideway continues on two structures, utilizing AASHTO sections, to the Tysons Central Station. Beyond the Tyson East Station, the guideway is carried underground in twin tunnels emerging at the Tysons Central Station on Route 7.

Between the Tysons Central 7 Station and the Tysons West Station the guideway is carried on twin structures in the median of Route 7. This is a change reflected in the EA dated February 2006. Previously, the alignment of the aerial guideway in this area was on the south side of Route 7 straddling the service road. This is a tangent section of guideway comprised of AASHTO box beams for structural support.

Beyond Tysons West Station, the aerial guideway curves to the west across the eastbound lanes of the DIAAH returning to grade in the median area. This section is to be constructed utilizing AASHTO box beams, segmental box beams and structural steel beams over the eastbound lanes of DIAAH.

The aerial structures vary in height to maintain clearance at required crossovers, as well as in material composition depending on the span required and configuration (i.e. curved or tangent section). The aerial structures are generally founded on caissons, concrete foundations and poured piers and bents. At several locations poured bents are required to span existing utilities or roadways. In general, the abutment walls to be installed at the ends of the aerial structures are founded on H-piles, concrete foundations and poured walls. Approach slabs are included at each abutment wall transitioning to the aerial structures.

Adequacy of Design

The plans for the guideway supported on aerial structures are consistent with the FEIS and ROD, as modified by the EA, and various documents available prior to receipt of the PE design package.

Changes reflected in the EA include relocation of the alignment of the guideway along Route 7 through the Tysons Corner area, which has been shifted from the southern side of the roadway to the median area. Additionally, the tunnel sections through Tysons Corner have been shortened by approximately 3,000 feet and replaced by an aerial structure. The PE plans currently reflect the substitution of AASHTO box beams for segmental pre-cast, post-tensioned box beams on tangent sections. The AASHTO box beam cross-sections were modified slightly by tapering the sides of the boxes to match the taper on the segmental box beam cross-sections.

Drilled shaft ultimate axial capacities were estimated following the method provided in the AASHTO manual ("Standard Specification of Highway Bridges", 17th Edition, 2002) using the maximum un-factored loads derived from calculations of dead loads and live loads from the superstructure. Lateral load analyses of caissons were performed using LPILEPLUS Version 5.0, which is a special purpose program based on rational procedures for analyzing a pile or drilled shaft under lateral loading. Reference is also made to WMATA Design Criteria and Standard Specifications, AREMA Manual for Railway & Maintenance for Way Engineering, AASHTO Standard Guide Specification for Horizontal Curved Steel Girder Highway Bridges (2003), AASHTO Standard Guide Specification for the Design and Construction of Segmental Bridges (1999), and VDOT Road and Bridge Standards. The structural drawings are consistent with a 30% level of design anticipated at the conclusion of PE. Details remain to be resolved during Final Design.

All major work items related to the guideway on aerial structures, including track relationships, dimensions, design interfaces, physical interfaces are well defined in the drawings, specifications and standards for a 30% level of design.

Guideway: Underground Cut and Cover

This review is based on a full evaluation of the PE drawings, Volume 4 – Civil, dated February 2006, and the Structural Design Report - Cut and Cover Tunnel (Document 25071-000-CTR-01-00004, January 30, 2006, Rev. B)

Scope of Design

There are three sections of underground cut and cover guideway tunnels reflected in the plans for the Wiehle Avenue extension. The first section is a single track tunnel approximately 123 feet in length that carries the West Falls Church Yard lead track from that yard under the eastbound lanes of the DIAAH to the median of that road. Retaining walls extend from the north portal to transition the tunnel to grade in the median area. This tunnel is poured in place concrete to be constructed with pile/lagging excavation support.

The remaining two sections of cut and cover tunnel lie at either end of the NATM mined tunnels in the Tysons Corner area. These sections lie between the mined tunnel and the ventilation structures to be constructed as part of the Tysons Central 123 and Tysons Central 7 Stations. The section adjacent to the Tysons Central 123 Station is approximately 120 feet in length. The section adjacent to the Tysons Central 7 Station is approximately 180 feet in length in the PE design but, according to DTP in the June 2007 Risk Mitigation workshop, this section will be extended by approximately 500-ft to address concerns related to minimal cover over the NATM tunnels in this area. Both sections of these tunnels are poured in place concrete. Both are to be constructed within pile/lagging supported excavations.

Adequacy of Design

The plans for the underground cut and cover sections of the guideway are consistent with the FEIS, the ROD, as modified by the EA and various documents available prior to receipt of the PE design package.

The drawings indicate stationing start to finish, typical cross-sections and longitudinal cross-sections, walkways, utilities and temporary excavation support.

All major work items related to the guideway in the cut and cover tunnel sections appear to be well defined in the drawings, specifications and standards for a PE level of design, including track relationships, dimensions, design interfaces, and physical interfaces.

Guideway: Underground Tunnel

Scope of Design

The PE design includes one section of mined tunnel, 2,100 feet in length, in the Tysons Corner area of Fairfax County in the city of Vienna, Virginia between Tysons Route 123 and Tysons Route 7 stations. The tunnel alignment is curved for most of its length and lies generally under Route 123 and the intersection of Route 123 and Route 7. The portals of the tunnel are located at the ends of the sections of cut and cover tunnel; the total length of the tunnel is 2,400 feet. Reportedly, limited real estate and existing topography led to a decision to mine two parallel guideway tunnels beneath the intersection of Chain Bridge Road (Route 123) and Leesburg Pike (Route 7). The original alignment through this area situated the tunnels much deeper in a more competent rock formation. The current shallow alignment is the result of cost savings and alignment optimization studies following the 50% PE design stage.

The current alignment leads underground approximately 400 feet west of the Tysons Central 123 Station, just east of International Drive, and then travels underneath Route 123 to the Route 123/Route 7 intersection. From there the alignment curves northwestward and returns to the surface along the center median of Route 7 just before transitioning to the Tysons Central 7 Station. The area near the intersection of Route 123 and Route 7 is the highest within Tysons Corner, cresting around an elevation of 510 feet. A single, emergency access/egress cross-passage connects the two running tunnels and is located at the approximate midpoint of the NATM tunnel section.

The tunnels will be constructed in a variety of geologic conditions, ranging from decomposed rock to residual soil and will be located adjacent to existing structures and utilities that are sensitive to ground movements. The tunnels will be primarily driven in residual soils. Completely decomposed rock is expected to be encountered in the tunnel invert area close to the West Portal. Fill and terrace gravels may be encountered close to the East Portal near International Drive.

The New Austrian Tunneling Method (NATM) has been selected as the preferred approach for mining the tunnels, using immediate shotcrete support and a short invert closure in combination with systematic pre-support measures. A good deal of attention has been directed toward the design of relatively robust pre-support measures intended to limit or prevent the loss of ground

in the arch of the tunnel while the designed initial lining, consisting of lattice girders and shotcrete, is installed. Additional spot measures have also been considered and designed to address local conditions that may require additional short-term support.

For the NATM tunnel, preliminary finite element analyses have been performed using a 2D finite element software package by Rocscience. Triangular solid elements were used to model the ground and beam elements were used to model the lining. The numerical analyses were utilized to assess the performance of the NATM tunneling with regard to ground and tunnel lining stresses and associated ground deformations. Physical properties of the soils were compiled from the geotechnical investigation programs.

The final lining is a cast-in-place concrete liner. Reinforcement of the concrete liner will only be provided in the vicinity of the intersections with the cross-passage and at sections with very low ground cover. A waterproofing system consisting of a geotextile fabric and a waterproof membrane layer will be sandwiched between the initial and final liners.

Adequacy of Design

Tunnel construction usually poses a higher degree of risk than other types of heavy-civil work and, typically, soft-ground tunneling is the riskiest type of tunnel construction. Reportedly, the original vertical alignment of the tunnels at Tysons Corner was situated deeper in order to enhance the stability and the constructability of the openings by locating them in bedrock, rather than in the decomposed rocks and soils found in higher strata at this location. The current vertical alignment situates the tunnel mostly in the S2 layer, which is a residual soil formed by extreme weathering of original bedrock (average N=30; average fines content = 57%).

The design of the NATM tunnels is more advanced than what is normally considered minimally acceptable for PE. The sizeable amount of geotechnical data available (refer to page 9) has been integrated into the design and there has also been a substantial amount of construction-oriented input to the design of the tunnels. Soil conditions along the tunnel alignment are being addressed via specification of varying degrees of ground support. The specifications include provisions, which afford a good degree of flexibility for changing the support measures in response to in-situ conditions encountered during construction.

There appears to be ample concern for the potential difficulties that could develop as a result of the soft ground conditions that the current alignment will traverse. The twin 2100-foot mined tunnel segments include twin guideway tunnels and an emergency cross-passage. The twin bores have an approximate 21 foot outside diameter and each can accommodate one track. The tunnels are typically separated by a minimum of one tunnel diameter. These structures will be constructed in soft ground and will be located adjacent to existing structures and utilities that are sensitive to ground movements. Just west of International Drive, the tunnels pass by a deep underground parking garage, with a minimum clearance of approximately 25 feet in plan. The minimum plan clearance between the eastern bridge abutments for the Route 123/Route 7 overpass is approximately 50 feet.

Reportedly, an alternative tunneling method to NATM has also been reviewed for constructability, which uses an open-face shield with pre-support measures and precast segmental initial linings.

Using either tunneling method, excavation is planned to start at the inbound tunnel and proceed westward. A single point of access is provided to start the excavation at the east portal. An adequately sized contractor laydown area is to be established east of International Drive. Excavated muck will be hauled through the east portal for disposal and further transport away from the site. The construction of the outbound tunnel will start at its east portal after the inbound tunnel has progressed a minimum of 150 feet.

Most of the major work items related to tunnel design and construction, including track relationships, dimensions, design interfaces and physical interfaces appear to be well defined in the drawings, specifications and standards for a 30% level of design. Work that remains includes the redesign of an approximate 500-ft long section of the tunnels at the westernmost end of the mined tunnel alignment, where DTP reported in the June 2007 risk mitigation workshop that the cut and cover method will be used for construction of this portion of guideway instead of the NATM method due to extremely shallow cover in this reach. Revised plans from this redesign effort have not yet been made available for review by the PMOC.

Drawings and specifications are well developed for the PE stage of design, and include considerations for dynamic clearance of the design vehicle envelope as well as walkways and cableways. Clearance appears to be adequate for the installation of other systems including lighting and communications.

Underground Tunnel Summary

NATM has been selected and specified for construction of the tunnels as being the most appropriate for the near-surface, soft ground conditions that will be encountered. This method has been in use for several decades in Europe, but has been slow to catch on in the United States. This fact alone tends to intensify the risk of the work, simply because there are fewer workmen, front-line supervisors and experienced Project Managers available in-country from which to assemble an experienced project construction team. While a few NATM tunnels have been driven in the United States over the past 10 to 15 years, most were in ground that exhibited higher degrees of consolidation and associated stand-up time than is anticipated for the residual soils at Tysons Corner. For instance, tunnels driven using the NATM tunneling method at Dulles International Airport require mechanized rock cutting equipment called “roadheaders” to excavate the soft rock through which the tunnels are driven, whereas a specialized backhoe-type excavator should be able to excavate the relatively soft soils at Tysons Corner. The ground condition for a recent NATM job in San Diego consisted of a weakly cemented conglomerate rock, which exhibited fairly good stand-up time for completing the excavation and support installation cycles. The NATM section of WMATA’s E4b tunnels (New Hampshire Avenue Tunnels constructed between 1994 and 1997), which was representative of true soft ground NATM tunneling conditions, utilized an extensive program of chemical grouting to consolidate the soils over the top of the tunnels prior to excavation. The foregoing examples represent much of the United States based NATM experience and are representative of the relative “newness” of the methodology in this country, especially in soft ground. This aspect presents a degree of risk that is inherent whenever a project requires introduction of new methodologies into a construction culture represented by personnel who do not normally support changes to their means and methods, at least not to the extent that designers desire. This is not meant to indicate that the NATM tunnel activity is not constructible as designed, *but there is a risk that the NATM*

tunnel excavation and initial support may be difficult to construct as designed given the soft ground conditions expected at Tysons Corner. It is the PMOC's opinion that the NATM tunnel activity is a risk to the project.

While the 100% PE design drawings and specifications emphasize construction of the Tyson's Corner tunnels using the NATM approach, drawings are included in the design package which addresses the final tunnel lining configuration required if a tunnel boring machine (TBM) or a digger shield method of construction were to be undertaken. The final tunnel lining cross-sections are similar, with the NATM approach producing a tunnel that has slightly more cross-sectional area due to its ovaloid shape, while the TBM/shield construction method would produce a circular cross-section. Either method is designed to satisfy the required minimum clearance envelopes.

Guideway: Retained Cut or Fill

The at-grade sections of the Wiehle Avenue Extension are in the center median of a limited access highway. As such, the guideway must be separated from the traffic lanes by retaining wall for most of this length to compensate for height differences between the sides of the guideway and the adjacent traffic lanes. These retaining walls also function as highway safety barriers.

Scope of Design

This review is based on a full evaluation of the PE drawings, Volume 4 - Civil, dated February 2006. Corresponding design reports were also reviewed. The PE drawings consist of plans with applicable cross-sections, standard details of footings, retaining walls, under drainage, cross drainage and manholes. The retaining walls vary in height, depending on the adjacent ground and highway configuration. Sound walls have been incorporated in the top of the retaining wall where appropriate (West Falls Church area). The first 2,200 feet of guideway extending to the northwest from the existing WMATA Metrorail Orange Line are to be installed in the median of I-66 in retained fill. Both tracks then transition to aerial structures to pass over the westbound lanes of I-66 and the new West Falls Church Yard lead track.

The guideway returns to grade and the retained cut section in the median of the Dulles Connector Road north of the West Falls Church Yard and continues north, on retained fill, for approximately 1.8 miles where it then transitions to aerial structure. The aerial structure passes over the eastbound lanes of I-66, proceeding for approximately 3.3 miles through Tysons Corner on a combination of aerial structure and tunnel, returning to grade and retained fill in the median of the DIAAH north of the intersection with Route 7 (Leesburg Pike). The guideway then continues in a westerly direction for approximately 5.9 miles, on retained fill, to its terminus 2,000 feet west of the Wiehle Avenue overpass. There are three bridges in this section crossing local highways and small streams.

Adequacy of Design

The plans for the guideway supported on retained fill are consistent with the FEIS, and ROD, as modified by the EA, and various documents available prior to receipt of the PE design package.

All major work items related to the guideway in retained fill including track relationships, dimensions, design interfaces, physical interfaces appear to be well defined in the drawings, specifications and standards for a 30% level of design.

Track Elements

The Wiehle Avenue Extension runs from a junction with the WMATA Orange Line to Wiehle Avenue a distance of 11.6 miles.

The Dulles Extension alignment starts east of the West Falls Church station at survey station K488+43 on the K line, which is the westerly portion of the WMATA Orange Line route. Two #15 turnouts will be installed for diverging movement onto the Dulles Extension. Some adjustment of the vertical alignment for 0.4 miles of the K Line, mostly east of the junction, is needed to accommodate the junction turnouts. For operational flexibility, a #10 double crossover will be provided on the Orange Line east of the junction turnouts.

Survey stationing on the Dulles Extension is in the "N" series. The alignment starts as ballasted track on at-grade/retained fill sections for a short distance and changes over to the aerial structure for a distance of 0.7 miles to transition to the median of the DIAAH. The track returns to at-grade/retained fill with the track center distance is at 14 feet to the end of the Orange section line. There are two #10 single crossovers laid at a distance of 7,500 feet from junction.

For section of the line through Tysons Corner, the double track alignments are mostly in aerial structure with one double tunnel segment and short lengths of at-grade track in between and at the end at-grade/retained fill. There are four stations on this section. The distance between the tracks has been kept at 40.5 feet to provide for island type platforms. There are three sets of #10 double crossovers on this section.

The final segment of track is the DIAAH line, which is a double track alignments laid at-grade or on retained fill. The only station being built on this line is the Wiehle Avenue station at the end of this line. There is provision in this project for a future station at West Post Farms. The track centers are nominally 14 feet except at the station where the distance is 40.5 feet to provide for center island platforms. There are two sets of two #10 single crossovers laid in this section. At the end of this section at Wiehle Avenue, a pocket track is laid between the mainline tracks with two #10 turnouts and one #6 equilateral turnout at each end. Tracks centers are more 14 feet or more throughout this section, widening to 40.5 feet for the center island platforms at the stations.

Eight additional storage tracks are provided in the West Falls Church Yard with a total capacity of 54 cars. A lead track has been provided from West Falls Church Yard directly to the Dulles Extension entering the line at survey station N779+42.

Scope of Design

The PE drawings consist of the alignment of the track layout, plan and profile, tabulation of the track curve geometry both horizontal and vertical, track charts showing the rail and contact rail and the type of trackwork, either ballasted or direct fixation, dimensioned layouts of turnouts and

crossovers, track work details showing typical track sections and details for direct fixation and special track work, and construction staging plans.

Adequacy of Design

The trackwork drawings are adequate at the PE design level to be followed by a Design-Build type contract. The track alignment provided in the design meets operational needs. The vertical profile has a maximum of 4% grade and is operable. Crossovers and the turnouts are provided as needed for operational flexibility. The trackwork design requirements are well documented in the WMATA Standard Drawings and WMATA Standard Specifications.

Station Elements

Architectural

There are five stations proposed for the Wiehle Avenue Extension that are detailed in the architectural plans. Outbound (westward) they are: Tysons East, Tysons Central 123, Tysons Central 7, Tysons West and Wiehle Avenue. The track guideway, and consequently the station platforms, are elevated at Tysons East and West. There is a tunnel proposed between Tysons Central 123 and Tysons Central 7 Stations so these station platforms are partly at grade and partly elevated. Pedestrian bridges across adjacent roadways provide access to the stations. The Wiehle Avenue station platform is at-grade with pedestrian bridges to the adjacent parking garage facility and surface lot for Park & Ride and Kiss & Ride, respectively.

Scope of Design

In order to evaluate the level of architectural design progress, this review is primarily based on a sampling of the PE drawings, Volume 5 – Architectural, dated February 2006. Other documents reviewed include the FEIS, dated December 2004, the FTA ROD of March 2, 2005, the FAA ROD of July 12, 2005, the PE Design Refinements EA of February 2006, parts of the PE drawings, Volume 6 – Electrical, Mechanical and Plumbing (as related to stations and buildings), and Environmental Conditions with Limits of Disturbance – Extension to Wiehle Avenue, dated March 17, 2006, as well as design guidelines as appropriate.

The architectural PE drawings include systemwide architectural plans and details, as well as specific plans for each individual station. The systemwide drawings provide documentation of typical and standard drawings of plans, elevations, sections, reflected ceiling plans and details for entrance pavilions, toilet rooms, elevators and hoistways, stairs and escalators, pedestrian bridges, platform canopies, bus canopies and mezzanine roof vaults. Systemwide drawings also include typical miscellaneous details, room finish and door schedules and details. Typical systemwide lighting fixtures and signage types and details are also included in Volume 5.

Drawings for each individual station include site, ground level, mezzanine level and pedestrian bridge level(s) for general orientation. These are followed by roof plans; elevations; longitudinal and traverse sections, fire separation and egress plans and signage location plans showing the layout, placement of components, and basic dimensions. Finally, groups of drawings cover landscape architectural for each station including site, landscape, paving and planting plans.

Electrical drawings in Volume 6 were reviewed for general adequacy and completeness for the PE level. Station drawings included wiring, lighting layout, one line diagrams for lighting and fan power, emergency lighting, and schedules. The Tysons Central 123 Station was reviewed in more detail and other stations were reviewed for verification. Similar review was made of mechanical drawings in the Volume 6 set. In this case, the Tysons West Station was reviewed because it presented the only complete, typical design for the Tysons Central 123 and Tysons East Stations. Notes on the Tysons West Station drawings indicate that the "Design-builder" will need to complete the specific designs for Tysons Central and Tysons East Station based on the designs for Tysons West Station. Mechanical designs for the Tysons West Station included HVAC air flow and control diagram; HVAC plans; a ground, mezzanine and platform, HVAC schedule; fire protection and plumbing riser diagrams; and fire protection plans for ground, "Mezzanine and Platform levels. Similar levels of completeness were verified for other stations, garage, substation buildings, etc. As noted below, using typical plans for two stations may be a risk factor.

Subsequent to the PMOC's original review of the 100% PE drawings and the June 2007 risk workshop, DTP provided additional information on the station design, including the June 2007 60% PE Supplemental Engineering design submittal of Route 123. Based on the PMOC's review of this submittal, it appears that the Tysons Central 123 Station has been significantly redesigned. It also appears that all stations have been modified to provide public access to toilet facilities in addition to the staff-only toilet facilities provided in previous designs.

The Tysons Central 123 Station now has the fare mezzanine on the upper level, allowing direct access to the future Tysons II Development and pedestrian bridge access to the south entrance pavilion on the south side of Route 123. At-grade access is via escalators and elevators up though the platform level in order to reach the fare collection mezzanine at the top level. Upon paying the fare, riders must then proceed down to the platform level.

Additionally, the location of the Tysons Central 123 Station has been slightly moved to the east. This allows emergency egress from the east end of the mezzanine and platform levels directly to street level. As in the previous design, the west end of the station has emergency egress to grade.

Adequacy of Design

Approximately 61 drawings were reviewed in detail, tracking references, smaller and larger scale plans sections, elevations and details. Although all station drawings were reviewed to verify a consistent level of completion, the in depth reviews were focused particularly on Tysons Central 123, Tysons West and Wiehle Avenue Stations.

The June 2007 60% PE Supplemental Engineering design submittal of Route 123 appears to be somewhat beyond the 60% PE level of completion, which is adequate for estimating and pricing purposes. Overall, the layout and functional aspect in regards to passenger access and use of the station are significantly improved over the original 100% PE design. Other aspects of the design, although somewhat less detailed and less complete, seem to be equal to the quality level of the documents previously reviewed and as such are adequate. The Tysons Central 123 relocation, which allows at-grade egress at the east end of the station, is a significant improvement to the life-safety aspect.

The architectural plans for the stations, pedestrian bridges, parking facility and other architectural elements are consistent with the FEIS and ROD, as modified by the EA, and other documents available prior to receipt of the PE design package. All major elements of the design including pedestrian flow to and from platforms, life safety and egress, dimensions, significant detailing and design coordination appear to be well defined in specific drawings, notes and typical details for a 100% PE level of design.

In general, the station plans are consistent with the various documents produced prior to PE. The plans are complete in that no functional elements were noted to be missing. The scope is consistent with the ROD. All station and transportation related facilities footprints are well defined in terms of access and egress, as well as vertical circulation. General arrangement drawings, typical side elevations, typical sections, bridge layouts, lighting, and elevator and escalators are shown. All major or critical work details, structural element dimensions, design interfaces and physical interfaces appear to be well defined in terms of drawings, standards, criteria, and specifications.

In some areas of the architectural design, the level of completion appears to be in excess of a typical 30% level of design. Materials, details and dimensions are significantly advanced beyond the 100% level of PE. As such, the accuracy of the cost estimates should be quite high, at least in this area. In summary, the station plans are generally consistent with the various documents produced prior to PE. The plans are complete in that no functional elements were noted to be missing. Overall, the station design is consistent with the scope of the ROD. The drawings are consistent in terms of content, presentation, clarity, cross-referencing and detail for the appropriate design level.

The PMOC's initial review of the Fire/Life/Safety Report and the design did not reveal concerns in the area of life-safety with regard to the stations. The designs are quite detailed in this area, and the criteria, as well as other aspects of the report, are appropriate. Nothing was identified that would indicate increased risk in this area; however, the review was not intended to be comprehensive.

At Tysons East Station, there are two emergency exit stairs at the remote ends of the platform. The west exit is at-grade, but the east exit returns to the Mezzanine level where the possible means of egress include one stair to ground level, across the bridge and through fare collection, up to the platform and down the west exit. It is not apparent if the time required to exit is sufficient to meets the National Fire Protection Association (NFPA) Standard 130 – Standard for Fixed Guideway Transit and Passenger Rail Systems.

At Tysons Central 7 Station, there does not appear to be a location for an emergency evacuation cart and storage cabinet. At all other stations this location is shown and noted, but only one is provided per station, which is at one end of the platform.

At Wiehle Avenue Station, there are "Paved Safe Dispersal Areas" at the east and west ends of the platform, both of which are between the tracks. Other means of egress from these dispersal areas do not seem to be provided. There is an emergency evacuation cart and storage cabinet location shown at the east end of the platform level, but it is unclear on how the cart can be used evacuate patrons from the dispersal area.

Review of the technical specifications reveals that there are no division 15300 Fire Protection sections. Instead, Fire Protection is under Special Construction in Section 13905. This section appears to be comprehensive and adequate with criteria listed as NFPA 12A, 13, 14, 15, and 2001, as applicable.

For the most part, ADA elements are adequately addressed.

Most areas of the electrical design seem to be at, or considerably beyond, the 100% level of PE. It should be possible to estimate probable costs accurately based on the documents. Adjustments will naturally be needed as the design evolves, but most items, if not everything, appears to be covered. This is likewise true in the mechanical area – at least in the areas that are actually designed. This includes the all the stations, with two exceptions. The mechanical drawings for Tysons Central 123 and Tysons East Stations include a note that state, "Tysons West is that prototypical design for Tysons Central 123 [and East]. Design-builder is responsible for finalizing the design of Tysons Central [and East]". Although this may 'technically' cover the requirements at these two stations, *there is the risk that due to the absence of actual designs, the mechanical elements of the Tysons Central 123 and Tysons East Stations will be missed in the quantity take-offs and/or miscounted in the development of the Station Finishes and MEP Allowance Item included in the Design-Build Contract due to the considerable differences in the overall architecture of the three stations. This may result to an increased risk of a cost overrun of the Allowance Item value when the actual costs are determined through the bidding process, which will be based on complete construction documents.*

There is an additional risk in that the Allowance amounts in the design-build agreement may be based on some or all of the 100% PE documents, which have since been modified (e.g., to add public toilets), or will continue to be modified prior to construction. Since a significant portion of the station costs are as an Allowance with the Owner assuming the cost risk, the design-build contractor does not seem to have an incentive to control costs for the stations.

Structural

Scope of Design

The structural drawings for the five stations in Phase I are contained in Volume 4 of the PE design package. Again, the five stations running east to west are Tysons East, Tysons Central 123, Tysons Central 7, Tysons West and Wiehle Avenue. The structural support system and configuration for the Tysons East and West Stations are similar; that of the other stations is varied.

Tysons East and West Stations are comprised of three levels. The grade level includes a concrete slab on-grade (compacted fill), supported on concrete spread footings and foundation walls. The mezzanine level at both stations is a concrete slab on metal decking supported by steel beams bearing on concrete cross girders at the piers. The piers also support the guideway and platform levels above. Steel framed canopies cover the platform levels. Guideways through both stations are supported on precast concrete box girders. The concrete piers are founded on drilled shafts (caissons). The concrete platforms are supported on precast concrete beams with cast-in-place concrete diaphragms.

Tysons Central 123 Station originally had the mezzanine level at and below grade with the guideway and platform level above. Based on the June 2007 60% PE Supplemental Engineering design submittal of Route 123, the at-grade level entrance appears to have been considerably altered. The 100% PE documents included a concrete slab on-grade (compacted fill), supported on concrete spread footings and foundation walls. The revised 60% PE Supplemental Engineering submittal now shows concrete caissons with pile caps supporting the foundations. However, the section and detail drawings were not included in the submittal. The original design had the platform level and the guideway supported on two structural systems; the first section, running 566 feet from the east, was supported by precast concrete guideway sections. The next sections of guideway were supported on a concrete structural slab over metal decking with a concrete track slab, all bearing on steel beams on concrete cross girders and cast-in-place concrete walls. This structure then transitioned into the ventilation structures for the twin tunnels. The concrete platform slab was supported by precast concrete girders longitudinal to the platform. Steel framed canopies covered the platform levels.

Evaluation of the current Tysons Central 123 Station structure, based on the June 2007 60% PE Supplemental Engineering design submittal of Route 123, is not possible because sections and detail drawings were not included. However, based on the plan drawings provided, it appears that the structural design has been significantly altered. Plans include structural steel framing supporting the mezzanine level concrete deck slabs. This submittal was issued nearly concurrent, or possibly after the signing of the design-build agreement.

Given the significant changes to the station and structural design, as well as the late completion of the documents for Tysons Central 123 Station and the Allowance arrangement in the design-build agreement, there is a risk that costs due to structural changes are not included and will result in cost overruns to the Owner.

Tysons Central 7 Station is designed with the guideway and platform level at or just below grade depending on the exterior ground conditions. The guideway through this station is supported on a grade slab. The concrete platform is supported on poured in place concrete walls on spread footings. The mezzanine level above is a concrete slab on metal decking supported by structural steel girders and beams on concrete columns. Steel framed canopies cover the mezzanine level.

The Wiehle Avenue Station guideway and platform levels are at-grade with the mezzanine level above. The guideway through this station is also supported on a concrete grade slab. The concrete platform is supported on poured-in-place concrete walls on spread footings. The mezzanine level above is a concrete slab on metal decking supported by structural steel girders and beams on concrete columns. Steel framed canopies cover the mezzanine level.

The structural drawings are consistent with a 30% level of design anticipated at the conclusion of PE. Details remain to be resolved during Final Design. The Design Criteria spells out the applicable Codes and Standards to be followed, clearly differentiating between structures supporting or not supporting rapid transit vehicles and highway loadings. Applicable referenced standards include: WMATA Manual of Design Criteria and Standard Specifications (Nov. 7, 2003 Edition), AREMA Manual for Railway & Maintenance for Way Engineering (2000 Edition), Virginia Uniform Statewide Building Code (2000 Edition, 2002 Supplement, and MWAA Design Manual (2004 Edition, ASCE 7-98 and ACI 318-99).

Automobile Parking Multi-Story Structure

Scope of Design

This review is based on a review of the PE drawings, Volume 5 – Architectural, dated February 2006, relating to the parking structure at the Wiehle Avenue Station, specifically drawings N13-APF 101-103, 201-203, 301, 302 and 702. The parking garage is a seven level (including basement), pre-cast concrete structure to provide parking for approximately 2,100 vehicles. The structure is founded on caissons and poured footings. The structure itself is composed of pre-cast columns and beams with pre-cast concrete T-decks and a poured slab on-grade. The exterior panels are also pre-cast concrete.

Three elevators have been provided servicing all levels, together with three stair towers. A pedestrian bridge has been provided between the parking structure and the new Wiehle Avenue Station. Two escalators service the garage bridge level from grade level.

Adequacy of Design

The plans for the parking garage are consistent with the FEIS, and ROD, as modified by the EA, and various documents available prior to receipt of the PE design package.

The drawings indicate foundation plans, typical floor plans, typical building cross-sections, elevations, stair plans, parking lot equipment and wall sections.

Access and laydown areas are not shown for the Wiehle Avenue parking structure. The site is presently used as a Park & Ride lot. Current plans and cost estimate call for the construction of a temporary parking lot during construction. Additionally, this site is under consideration by Fairfax County for a Joint Development Proposal which would eliminate the garage from the project.

Access and laydown areas for the Tysons West Station are located within the Dulles Access Road interchange on the 100% PE Drawings. This may be too far from the station to be effective, and will create additional traffic issues due to the congestion on Route 7. Later planning indicates that laydown for this station could be in the Route 7 median.

All major work items related to the parking garage sections, including dimensions, design interfaces, physical interfaces are well defined in the drawings, specifications and standards for a 30% level of design.

Electrical design for the parking structure seems to be at, or considerably beyond, the 100% level of PE design. The design of mechanical elements (plumbing, HVAC, fire protection) also seems to be at or considerably beyond the 100% level of PE design.

Shops and Yards

All of the construction in this project relating to shops and yards is at the West Falls Church (WFC) Yard. The changes in the yard include additional storage tracks, extension of the covered

service platforms for car cleaning, and the construction of a sound cover box on the loop track. The sound cover box is a requirement of the FEIS and is included in the FTA's ROD. The new access track to the Wiehle Avenue Extension is connected to the loop track in the WFC Yard.

An expansion of the WFC Service and Inspection Shop, a light maintenance facility, is included in the scope of this project. The shop will be expanded by two tracks providing eight additional spots for inspection and running repair. Construction of this expansion will also include retaining wall against highway I-66, which is needed to provide space for the maintenance facility expansion.

In the Phase 2 plans, there is a maintenance facility and storage yard proposed for construction on a designated site in Dulles International Airport. This facility is included in both the FTA and FAA RODs for the fully developed Dulles Corridor Metrorail Extension.

WMATA provided their Rail Fleet Management Plan (RFMP), which is titled "Metrorail Revenue Vehicle Fleet Management Plan" and dated November 2006. WMATA was asked by FTA and DRPT to address the need for the expansion of WFC Shop in the RFMP. As an alternate, WMATA could provide a plan for interim maintenance support to be provided for this project as an element of the overall system vehicle maintenance requirements. WMATA's RFMP included the expansion of WFC as part of this most recent plan. The expansion of the West Falls Church storage yard was included in the original PE documents included in the EIS but was deleted from the project scope at the 50% PE stage when the EA was prepared. At that time, alternatives for providing adequate space if needed, such as expansion of Alexandria Yard, were being pursued. As a result of being included in the most recent RFMP, the WFC Shop expansion has now been restored to the project scope and is now included in the project cost estimate. The PE design for the shop expansion is currently underway in order to bring the design up to the 100% PE level.

Scope of Design

The sound box cover is a steel frame structure about 860 feet long covering two tracks. Space is provided for the application of sound absorbing material on the sides and ceiling of the structure. The floor is the existing track on ballast.

The addition to the WFC storage yard includes eight tracks with three, 8-car capacity and five, 6-car capacity tracks. These tracks include an extension of the existing covered access platform for car cleaning.

Some difficulty is expected in the construction of the additional storage yard capacity at West Falls Church in general because the site is congested and is a working yard that must be kept in service.

The modifications to expand the WFC Shop were not in the scope at 100% PE. However, it is known from the concept engineering that the design for the shop expansion must include a retaining wall to be built against Interstate Highway 66, rearrangement of roadways at the site, and construction of two new tracks in the yard on congested yard leads. *The design of the expansion of the WFC Shop is progressing, but there is still a risk to scope and budget due to the complexity of designing a shop expansion at this location.*

Adequacy of Design

The design is adequate for the PE stage of development. The concept of the sound box cover is sufficiently developed to allow Final Design; critical details and structural element decisions have been made. Lighting, access, and fire suppression requirements are included. Natural ventilation will be used.

The track layout for the yard expansion is shown with a level of detail for alignment, train control, and traction power comparable to track on the remainder of the Project. Interface with the existing facilities has been addressed. The yard is an existing facility for which the site conditions are well known and are adequately addressed and properly included in the design. Fill is required for the yard expansion, the traction power substation, and the access road to this area. Access and laydown areas at WFC Yard are not specifically addressed at this time.

Though the design of the WFC Shop expansion is currently being progressed to bring it up to the 100% PE level, the PMOC has not received any new and/or updated plans. At this point in the Project, the lack of a submitted preliminary design indicates that the scope of the modification is not well known. Therefore, the cost and construction schedule cannot be known with the same accuracy as the remainder of the Project.

Sitework and Special Conditions

Site Utilities and Utility Relocations

This review is based on an evaluation of the PE drawings, Volume 3 – Civil dated February 2006 relating to grading, storm drainage, including storm water management (detention basins) and water, gas and electric distribution systems. The corresponding Utility Report, which was updated in January 2007, was also reviewed. The updated report included two new cross-sectional sketches of the Route 7 "Boulevard" concept.

Scope of Design

Grading and LODs are shown for the length of the Wiehle Avenue extension. Existing utility crossings and required relocations of utilities are shown throughout the length of the Project. *One notable exception is that the relocation of gas, sewer, and water lines in the bed of Route 7 (Leesburg Pike) were not shown in the 100% PE design package, which is a risk.* This is partially the result of the relocation, during the EA phase, of the aerial guideway in this section of Tysons Corner from over the south service road to the median area. The eventual intent of Fairfax County is to develop Leesburg Pike into a "Boulevard", eliminating the service roads and providing a utility corridor in a landscaping strip on the north side of the roadway. Final Design of Utilities is proceeding under a Letter of No Prejudice issued December 20, 2006.

Adequacy of Design

Existing utility crossings and required relocations of utilities are shown throughout the length of the project in the 100% PE design with the exception of the necessary utility relocation of gas, sewer, and water lines in the bed of Route 7. *The design of relocations of the gas, sewer, and water lines in the bed of Route 7 had not progressed until recently; therefore, a risk to the project's scope and budget still exists until the design is completed.*

The Utility Report dated January 2007 indicates there are 28 utility companies which will be impacted and involved in the project. Under a Letter of No Prejudice (LONP) issued on December 20, 2006, DRPT has authorized all of the 28 utility companies to proceed with Final Design of their respective systems. Final Design and cost estimates for the various utilities are anticipated to be complete by early summer of 2007. Utility construction is anticipated to begin in fall 2007.

The guideway work on Route 7 extends from Station 960+00 to Station 1025+00, approximately 6,500 feet, or 1.23 miles (approximately 11.6% of the 11.6 mile Phase I corridor). The utility corridor concept is in the development or sketch stage, and is not reflected in the PE drawings. The intent is to install all utilities in the corridor rather than within the roadbed. Wet utilities (storm sewer, sanitary sever, and water) would be placed first at the lower elevations, with dry utilities installed at the upper elevations (gas, electrical and communications).

Twelve (12) storm detention basins along the alignment are detailed in the civil drawings. Plans for the basins include grading, storm water piping and outfalls. Profiles and details have been provided for the storm water management systems. These basins provide storm water management for sections of the guideway on grade.

Most major work items related to the various required utility systems, including locations, dimensions, and physical interfaces are well defined in the drawings, specifications and standards for a 30% level of design, with the exception of the required utility relocations (water, storm sewer, sanitary sewer) in the roadbed of Route 7.

Environmental and Hazardous Materials

Phase I Environmental Site Assessment reports have been prepared as part of PE for the ROW acquisition parcels. If required, DTP will recommend additional studies. All costs for the Phase II studies and for CMMR services for remediation are the responsibility of DRPT according to the Contract Terms and Conditions. There are six sites with known petroleum contamination.

Scope of Design

Environmental and hazardous materials are not addressed in the PE package. Design has not been progressed for sites with known hazardous material contamination.

Adequacy of Design

Design has not been progressed at PE stage.

There are scope and cost risks for hazardous material remediation for the parcels being acquired. Some risks could be mitigated by progressing the design for known cases requiring remediation and establishing the cost prior to contract.

Automobile, Bus, and Van Accessways and Landscaping, including Roads and Parking Lots

Scope of Design

This review is based on an evaluation of the PE drawings Volume 5 – Architectural, dated February 2006. The PE plans reflect a kiss and ride parking lot, which has 34 parking spaces adjacent to the Tysons West Station. Bus bays shown in the FEIS were eliminated at the Tysons West Station location. The lot is reached from Tyco Road via a 400 foot access road. The Tysons West Station is reached via a 300 foot walkway to be constructed between the lot and the station. The access road, parking lot, and walkway are paved, lighted and landscaped.

A second park and ride lot, containing 36 parking spaces, is proposed on Colshire Drive opposite the Tysons East Station. The lot is reached from Colshire Meadow Drive via a short access road. The Tysons East Station is reached via a pedestrian walkway to be constructed over Dolly Madison Boulevard. The access road and parking lot are paved, lighted and landscaped.

Five bus bays have been provided at the Tysons West Station, together with a bus canopy. At the Tysons East Station provisions have been made for two buses and a canopy on the north side of Dolly Madison Boulevard adjacent the station and four buses and a canopy on the opposite side of Dolly Madison Boulevard at the terminus of the pedestrian bridge from Colshire Drive. At the Tysons Central 123 Station, four bus bays have been provided together with a bus canopy on Tysons Drive. Bus access lanes have been provided at the Wiehle Avenue Station, together with provision for 15 buses, adjacent to the proposed parking garage structure.

Adequacy of Design

All major work items related to the parking lots and bus facilities, including dimensions, design interfaces, physical interfaces appear to be well defined in the drawings, specifications and standards for a 30% level of design.

Temporary Facilities

Scope of Design

Schematic designs have been provided, which indicate specific areas set aside for office trailers, automobile parking and laydown.

Adequacy of Design

Designs for the temporary construction field office and laydown areas are schematic, which is adequate for this stage of design.

Systems Elements

Train Control and Signals

Scope of Design

The train control system design provides for a fixed block signaling and automatic train control (ATC) with speed command, train separation, train routing, station stops, and door operation features for the safe and efficient Metrorail operations. The train control system is designed to allow train headways of 90 seconds. It provides for control and indications to WMATA Operations Control Center (OCC) via Remote Terminal Units (RTU) in each train control room. It also includes an Intrusion Detection and Warning System (IDWS) for the at-grade portion of the ROW. The track and corresponding train control system for the Dulles Corridor Extension will tie in with the K-Line between East Falls and West Falls Church Stations with extension to WFC yard. The tie-in interlocking has been designated as "Dulles Junction."

Adequacy of Design

The following observations were made with regard to the train control and signal design as part of the review for the adequacy of design at this phase:

- The PE design developed 190 train control drawings and 154 WMATA Standard Drawings. For each of the developed drawings, corresponding WMATA Standard Drawing reference has been included. All control match lines and drawing references have been done with the WMATA drawing numbers.

- The design drawing package referenced above includes wiring diagrams, control unit layout), train control rooms layout, double line track plan for interlockings with locations of signals, track circuits, impedance bonds, track profiles and grades, control panel layouts, ATC route and locking chart, modifications to existing interlocking at WFC, typical traffic initiation and control circuits, speed command control lines, vital and non-vital repeat relay circuits, route initiation, time locking and approach circuits, switch control, operation and lock circuits, route check and lock, signal control and lighting circuits, controls and indications, yard signal layout and signal mountings, snow melter layout and control, switch rod heater layout, track circuits and bonding, switch machine layout and circuit and duct plan.

- The IDWS design includes drawings of typical location of sub-zones, tip over boxes for types of swing/sliding gates, fence, typical mounting and installation details, and alarm circuits.

- Various components of the signaling system will require extensive testing for the new "N" route of Dulles Corridor, interfaces at the adjoining new Dulles Junction and to/from the OCC. There is no indication that a preliminary test program has been developed.

- DRPT and WMATA have developed an agreement on the division of responsibility between the contractor for the train control and signals work.

- The signaling system will have to interface with WMATA's system at the junction to the K-Line, as well as interfaces with the OCC and other facilities. The complexity of the signal system and the interfaces to the existing system requires that certain elements of work be performed with significant WMATA oversight and support. There currently is no detailed Force Account (FA) Plan for this work. The lack of a FA work plan represents a scope risk to the Project.

- WMATA has requested a change to the train control and signals criteria to allow for separation of track circuit cables that carry like frequencies for train detection.

- During the initial design review by the PMOC, there were certain inconsistencies in the design details between documents, which were brought to the attention of the Grantee for correction.

- The train control design is consistent with what is expected at 100% PE. The train control work has been divided into three areas; the system equipment procurement and testing is an Allowance item; the installation of the system is part of the Firm Fixed Price and WMATA forces are responsible for the Automatic Car Identification System, the Destination Code Table Revision and oversight and support of the system procurement and installation, particularly at the interface to the existing system. (The WMATA oversight and support costs are in the Force Account budget under Project Management). There is a contract document that adequately describes the Allowance scope of work.

Train Control and Signals Risks

The complexity of the train control and signal system interface to the existing system requires that certain elements of work be performed with significant oversight and support by WMATA forces. Currently, there is no detailed force account plan for this work, which is a risk to the Project. The lack of a preliminary signal test plan, particularly at the interface between the existing system and the Extension at the new Dulles Junction, is a part of this risk.

WMATA has requested a change to the train control and signals criteria to allow for separation of track circuit cables that carry like frequencies for train detection. This is a potential scope risk to the project.

Traction Power Elements

High Voltage (34.5 KV) Distribution System

Scope of Design

The traction power substations and passenger stations will be supplied high voltage (34.5 KV) power from the Dominion Virginia Power (DVP) system. AC switchgear will be required to comply with DVP requirements with regards to switchgear type, ratings and required relay protection. The original PE design for the 34.5KV distribution system was based on the assumption that the utility company would supply power from 4 different power stations. DRPT/MWAA is proposing to revise the criteria to reduce the number of utility power stations

from 4 to 3. This would significantly reduce the cost of the 34.5KV distribution system; however, it would correspondingly reduce the system backup redundancy and potentially, system reliability.

DRPT is negotiating with DVP to include the cost of the cable, installation and metering equipment costs as part of the utility rate structure and not as a capital cost, and this work has been deleted from the project scope. If these negations are not successful, then this scope of work will have to be added back into the project.

The 34.5 KV design documents consist solely of one line schematic diagrams. There is no conduit and cable plans or plan drawings for DVP metering locations.

Adequacy of Design

The following observations were made with regard to the high voltage (34.5 KV) distribution system design as part of the review for the adequacy of design at this phase:

The installation of high voltage (34.5 KV) cables from the electric utility to the substation is only shown schematically.

There are no cable and drawing plans for the installation of high voltage cables from the utility drop off point to the traction power substations and station electrical distribution rooms.

The 34.5KV distribution system design is still at the Conceptual stage. The duct bank installation work is part of the Utilities Relocation work and will be done by the Contractor on a "Time and Materials" basis. The installation of the cable portion of the work will be done by the power utility company, DVP. The Grantee is negotiating with DVP to incorporate the cost of the cable installation into the utility rate.

In the PMOC's opinion, the level of design for the high voltage (34.5 KV) distribution system is not consistent with what is expected at the completion of the 100% PE level of design, and thus, a scope risk. There is insufficient information to determine whether the design is constructible. It is the PMOC's opinion that this represents a significant omission in the 100% PE design package, and is a risk to the Project's scope. A "below the line" estimate for providing 34.5KV utility service has been developed and included in the Project's budget. The estimate assumes that the distribution system will be acceptable to the utility company.

Substations and Tie-Breaker Stations

Scope of Design

The original PE design included the construction of 11 new traction power substations, four tie breaker stations, duct banks, and distribution of positive and negative power cables along the proposed alignment. Subsequently, DRPT deleted one substation and one tie breaker station as part of the "Open Items" incorporated into the contract. There is a risk that this equipment may have to be put back in the project scope.

The design is consistent with the existing WMATA DC traction requirements, as the existing WMATA rolling stock must be able to operate on the extension. The traction power design capacity provides for sufficient power for 8-car trains operating on two-minute headways, even though the operating plan is seven-minute headways.

The substations are identified, numbered, and located on the ROW drawings. The substations locations are properly spaced. All substations indicate their traction power Megawatt ratings. The traction power substations are designed and spaced to permit full normal train operations with any one substation off line. Tie-breaker stations are provided to sectionalize the third rail traction power distribution system, allowing sections of the track to be isolated from the DC power system.

Nominal DC voltages are identified as 750 VDC. The choice of project voltage is based on the existing WMATA DC voltage requirements, as the existing WMATA rolling stock must be able to operate on the extension. The design capacity requires sufficient power for 8-car trains operating on two minute headways. Operational simulation studies have been performed to ensure that minimum voltage requirements are met or exceeded under all operating scenarios. The simulation studies addressed optimal vehicle performance issues. The system does not utilize power regeneration. The design drawings are consistent with the FEIS.

Adequacy of Design

The following observations were made with regards to the substation and tie-breaker station design as part of the PMOC's review for the adequacy of design at this phase:

- One line diagrams were developed for each traction power substation and tie circuit breaker station.
- Plan layout drawings were made for six substation locations. The remaining five locations were identified as similar to one of the six layouts.
- Power transformer and rectifier equipment is identified and matched. The design utilizes two types of power transformers – oil-filled outdoor transformers and indoor dry-type transformers. The transformer and rectifier design requirements are relative to pulse, ratings, etc., and are in accordance with WMATA design standards and recent procurements of the Infrastructure Renewal Program (IRP) and Metro Matters Capital Program.
- AC and DC switchgear and feeder circuit breaker specifications are identified as WMATA standard specifications. Where modifications were necessary, addenda were prepared to reflect the required specification changes. The switchgear type (metal clad) and ratings are defined on the drawings and/or in the equipment specifications.
- The over-current protection design has not been prepared and will be accomplished during final design.
- The requirements of the Programmable Logic Controllers (PLCs) have not yet been defined and will be developed during final design.
- Detailed conduit and cable schedules were prepared.
- Typical substation design details have been developed.
- Structural details have been developed for substations located at passenger stations. For substations that are not located at passenger stations, site specific details are not

provided. While this item needs to be addressed during the design-build phase, it does not rise to the level that it represents a significant scope risk to the Project at this stage.

- Some details are included for power cable installation but they are not complete. The remaining required details will be designed during the design-build phase.
- Typical design details for annunciator panels are provided.
- Substation ground grid and grounding details are provided, including lightening arrestors.
- Fault current and protective relay design has not been developed and will be addressed during final design.
- System-wide plan layouts and detail drawings for the wayside emergency trip system (blue light) are provided.
- Design details for the substation ventilation system are provided.
- Low voltage AC distribution panel details are provided.

In the PMOC's opinion, the level of substation and tie-breaker station design for the traction power system is consistent with what is expected at the 100% PE design level. The design is constructible and is consistent with the project scope developed in the FEIS. There are suppliers with appropriate experience and expertise to provide the necessary technical equipment and local and national contractors with appropriate experience to perform the required construction. Labor forces with the requisite skills and experience are available.

During the PMOC's subsequent review of the project cost estimate, components of the traction power system were broken out of the traction power section and moved to other scope sections. For example, substation and tie breaker station structures were moved to the structural section and contact rail was moved to the track section. The PMOC could not obtain adequate traceability documentation regarding traction power scope changes. As a result, it could not be determined if the project cost estimate is complete or consistent with the design documents.

The Traction Power work has been divided into two areas; the system equipment procurement and testing is an Allowance item; the installation of the system is part of the Firm Fixed Price portion of work. There is a contract document that adequately describes the Allowance scope of work.

Power Distribution

Scope of Design

The traction power distribution system will be a contact (third) rail system in order to be compatible with the existing WMATA traction power distribution system. There is no overhead catenary distribution system in the project scope.

Adequacy of Design

The following observations were made with regard to the contact rail distribution system design as part of our review of the adequacy of design at this phase:

- The contact rail is a composite rail design consistent with WMATA standards.
- Detailed system-wide contact rail layout drawings for the ROW are provided.

- Contact rail heater elements are provided at all outdoor portions of the ROW.
- Detailed schematic drawings of the contract rail heater plan are provided.
- Detailed contact rail assembly drawings, including support and insulators, are provided.
- Typical details for cable connections to the contract rail are provided.
- Contract rail layout plans in special track work locations are provided
- Procurement of the contact rail is an Allowance item. The installation will be performed by the track subcontractor. There is a contract document that adequately describes the Allowance scope of work.

In the PMOC's opinion, the level of design for the contract rail system is consistent with what is expected at the 100% PE design level and is consistent with the project scope developed in the FEIS. Historically, the construction of contact rail systems on rail rapid transit systems has been split between two functional entities – the guideway and track section and the electrical power distribution section. The grantee has assumed that this will occur on this Project. The contact rail and its supports will be installed by track forces, while cables and connections to the contact rail are made by electrical forces. In the PMOC's opinion, this is the appropriate breakdown of responsibility. It is also the PMOC's opinion that the contract rail system as designed is constructible. Qualified suppliers and constructors are available, and there is a sufficiently skilled labor force in the region to perform the work.

Traction Power Risks

DRPT is negotiating with DVP to include the cost of the cable, installation and metering equipment costs for the 34.5KV power distribution system as part of the utility rate structure and not as a capital cost. This work has been deleted from the project scope. There is a risk that if these negations are not successful, then this scope of work will have to be added back into the project.

Subsequent to the completion of PE, one substation and one tie breaker station were deleted from the project scope. There is a risk that this equipment may have to be put back in the project scope.

During the PMOC review of the project cost estimate, elements of the traction power system were broken out and shifted to other sections of the project cost estimate. In the PMOC's opinion, there were insufficient traceability documents to ensure that the complete traction power project scope was accounted for in the project cost estimate.

As the design progresses beyond the PE level, there is a potential risk that additional work may be added to the project scope.

Communications Elements

Scope of Design

This communications system for the Dulles Corridor Extension Project will consist of the following sub-systems:

- Fiber Optic System (FOS) as a Backbone
- Local Area Network (LAN) / Wide Area Network (WAN)
- Carrier Transmission System (CTS)
- Passenger Information Display System (PIDS)

- Public Address System (PA)
- Telephone System including Emergency Telephone and Intercommunication System
- Closed Circuit Television System (CCTV)
- Mobile Radio System (MRS)
- Fire and Intrusion Alarm System (FIA)
- Communication provisions for Supervisory Control and Data Acquisition (SCADA) System
- Communication provisions for Automatic Fare Collection (AFC)

The above systems will be consistent and compatible with the existing systems currently in operation on WMATA.

Adequacy of Design

- The final PE design drawing package referenced above consists of 188 drawings – 54 WMATA standard drawings, 80 typical drawings for the sub systems and 54 drawings of the subsystems at the five stations.
- The physical layouts for equipment rooms and facilities in the stations have been well developed and included in the drawing package.
- Single line drawings for the above referenced systems have been developed as also the general arrangement of the system elements (PIDS, PA speakers, FIA, CCTV cameras, and monitors, help point intercoms for passengers, telephones and ETS) have been developed in the drawings for the stations.
- Interface requirements have been indicated on the drawings.
- Each of the subsystems will need extensive testing including testing of interfaces. There is no indication that a preliminary test program has been developed
- It is the PMOC's opinion that the design is constructible and is consistent with the project scope developed in the FEIS. There are suppliers with appropriate experience and expertise to provide the necessary technical equipment and local and national contractors with appropriate experience to perform the required construction. Labor forces with the requisite skills and experience are available in the region.
- The Communications scope of work has been divided into three areas; the system equipment procurement and testing is an Allowance item; the installation of the system on the extension is part of the Firm Fixed Price and WMATA forces are responsible for the system procurement and installation from West Falls Church back to the OCC. There is a contract document that adequately describes the Allowance scope of work.
- A significant portion of the communications scope of work will be performed by WMATA forces. WMATA will install fiber optic cable from West Falls Church station back to the OCC, the Passenger Information Display System, Local Area Network/Wide Area Network, Comprehensive Radio System, Telephone System Expansion, System Signage and System Maps. There are no PE design drawings for the WMATA work. No detailed WMATA Force Account Work Plan has been developed. This is a significant omission. *The WMATA portion of the Communications System is not at the level of 100% PE.*
- DRPT and WMATA have recently completed an agreement that defines the division of responsibility between the contractor and WMATA.

- During the PMOC's initial design review, there were certain inconsistencies in the design details between documents, which were brought to the attention of the grantee for correction.

Communications Risks

There is a significant risk that the communications and security scope is incomplete – there are no PE design drawings for the WMATA portion of the work.

There is a risk that as the communications design progresses through the Final Design stage that the project scope could increase, particularly in the area of security system and/or newer technology requirements. There is an "Open Item" related to a request by WMATA to upgrade the planned LAN/WAN network to state of the art capability.

Fare Collection System

Scope of Design

The revenue collection system will be an extension of the existing WMATA fare card system. The AFC system design consists of in-station revenue collection equipment, including ticket vending machines, turnstiles, parking collection equipment and system maps/schedules. WMATA will be responsible for the design and installation of the fare collection system.

Adequacy of Design

No design work has been done on the AFC System. The only drawings available are two WMATA standard drawings related to fare collection equipment. It is WMATA's plan to develop and implement the system in conjunction with Cubic, the vendor who provided the entire existing AFC system to WMATA.

No design has been developed for the AFC system, which is not what is expected at the completion of 100% PE design. The PMOC considers this a project scope risk. As indicated, the equipment procurement is planned to an expansion of its existing system. *In the document (Transmittal No T 181 dated January 12, 2007) WMATA has provided a cost estimate for supplying AFC equipment at the stations; however, there is no design.*

Fare Collection Risks

The lack of design documents for the Fare Control System represents a scope risk for the project.

Central Control

WMATA's Operations Control Center (OCC) will be modified to accommodate the Dulles Extension. The work will be designed and implemented by WMATA forces. There are no PE design drawings for this work. WMATA has assumed that the work required will be similar to previous system expansions. The lack of a PE level design is a scope risk to the project.

Adequacy of Design

No design work has been done on modifications to the Operations Control Center.

Central Control Risks

There is a significant risk that the Operations Control Center improvements scope is incomplete since there are no PE design drawings for the work and the work will be performed by WMATA forces.

Review of Procurement Scope Items

Real Estate Procurement

During the analysis required for this report, several versions of the project Right of Way Acquisition Plan (RAP) have been reviewed, as well as other related project materials. Numerous questions have been posed to MWAA, DRPT, and DTP regarding the scope, cost, and schedule regarding the ROW aspect of this project. MWAA, DRPT, and DTP have been very responsive to the queries that have been made. MWAA, DRPT, and DTP issued an update of the Right of Way Acquisition Plan in May 2007.

This scope report is based on the analysis of the updated RAP dated May 2007. It was decided to perform the ROW work under the Comprehensive Agreement, on a Time and Materials (T&M) basis, at a cost estimated to be $91.5 million. The PMOC considers the base ROW cost estimate and recent revisions thereto to be acceptable. The grantee made several other adjustments in the May 31, 2007 of the Real Estate Acquisition Plan (RAP) regarding project overhead items that require additional clarification. These added items concern DTP Acquisition Management (beginning May 7, 2007) $823,587 and Design Support $200,000. There is logic and possible justification for these items, although the PMOC has questions regarding both. The DTP Acquisition Management fee estimate is 41% of the Agent subcontractor's estimated cost for doing the actual ROW production work on the project. This amount seems excessive and further explanation of what it involves should be provided. Furthermore, the Design Support item should also be discussed in the context of its possible duplicate coverage in the design build contract. Similarly the Owner's Contingency added in this estimate should be explained. The PMOC has recommended that these items be addressed in Section 5 of the RAP.

Scope of Design

Based on completed 100% preliminary engineering and supplemental design plans, fee take and/or easement interests are to be acquired from 82 properties. This reduction from the previous number of 93 parcels is the result of supplemental engineering subsequent to the 100% preliminary engineering stage. Of these still required by the project, 52 commercial properties are owned by 41 owners. The project will also acquire interests from nine residential properties including homeowner association interests.

Additionally, 21 property interests are to be conveyed by Fairfax County including some 13-parcel acquisitions by pending proffer agreements/dedications. MWAA advises that the scope of

ROW dedications will include all compensable interests required for the project and thus no appraisals or additional negotiations will be required as the Uniform Act requirements are not applicable.

Finally, interests in land will have to be conveyed or transferred from VDOT and Dulles Airport with attendant approvals from the Federal funding agencies, namely the FHWA and the FAA. The acquisitions will also include any property interests needed for utility relocations. Final right of way plans for the critical construction segments on Route 7 were received in July 2007.

Relocation assistance and benefits will be required for seven business displacements, all of which are in the Route 7 corridor. All of these businesses are located along the Route 7 segment of the project and the balance involve a storage locker facility that is impacted, but not displaced. No residential displacements are anticipated. Personal property moves are anticipated from a self-storage locker operation near Wiehle Avenue Station. In addition to relocations associated with business displacements, 112 personal property moves were identified. Six of these involved automotive dealerships on Route 7. The balance of the relocations involve moving of individuals' personal property stored in storage units in that portion of the existing self-storage facility to be taken. The self-storage facility is a partial take. DTP has had an excellent outreach program to keep potential displacees informed of the project developments that will affect their displacement.

Another scope issue concerns the environmental issue of contamination on Merchants Tire and Tysons Square Center properties. Field investigations related to these two properties continue at this time (Reference Section 3.8 of the Real Estate Acquisition Plan). The Metro Station entrance facilities are proposed above ground in the area of the Merchants Tire site. Remediation requirements for this site will be developed with VDEQ based on the proposed use of the site and the type and levels of contamination. The PMOC is advised by MWAA that this situation will not affect adversely the ROW schedule for acquisitions necessary for the transit mainline through this area. Depending on the outcome of the environmental analysis, if redesign of the station facilities is necessary because of the contamination/remediation, it may revise the ROW scope that would require some reworking of ROW activities. However, this may have a greater impact on other functional areas. MWAA real estate advised that this issue should be resolved with VDEQ in July/August 2007.

There are no critical eminent domain issues apparent at this time. No rail crossings are involved in this project. The ROW acquisitions will also include any property interests needed for utility relocation.

DTP and its contractors will acquire the needed ROW and administer all necessary relocation assistance services and benefits to property owners and tenants affected by the Project. Project acquisition activity is now underway as real estate appraisal work has started.

The PMOC considers the ROW scope to be acceptable, with a notation that the contamination/ remediation issue may have some impact on ROW acquisition and the project in general.

Adequacy of Design

The ROW issues and limits are well defined. It is the PMOC's opinion that the properties identified are necessary and consistent with the 100% PE design requirements.

A recent issue regarding ROW scope was raised concerning the elimination of the acquisition of permanent property interests where minor fill slopes are necessary for constructing the project. The PMOC has reviewed this matter and considers this approach acceptable and consistent with approved VDOT procedures. The reference to this design requirement can be found in VDOT's Road Design Manual Volume I, Section 2E-5, Proposed Right of Way and Limited Access. This design criterion affords design flexibility to acquire a temporary property interest to construct in such areas. This usually will occur in urban areas where land values are high and a significant benefit results from keeping land in private ownership for property tax reasons and the retention of related development density rights by the property owner. In such situations, the owner is obligated to not impair the project improvement and can otherwise utilize the property so encumbered to the "toe of fill" and modify it accordingly.

DTP has prepared environmental assessments of properties that are described in the RAP, Section 3.8 – Environmental Site Assessments. This Plan incorporates all applicable regulations and standards. Where applicable, the Project will take advantage of the Virginia Department of Environmental Quality's Petroleum Program.

The Project has completed ESAs on 28 "critical" properties having a likelihood of contamination. The results of the sampling program conducted on these properties were reviewed with the Virginia Department of Environmental Quality (VDEQ), and recommendations were developed for handling the levels of contamination present. Two properties are identified below and were recommended for additional sampling which is being conducted now. Merchants Tire property will likely require groundwater treatment, but the Tysons Square Center property follow-up is to determine whether fuel tanks from a past service station were removed. The remaining properties where contamination was identified will not require remediation but will require soil management practices to isolate soils removed from these properties.

The ROW plans are acceptable based on the 100% PE plus supplemental design plans. *If the ROW acquisition requirements are based on the 100% PE design package including supplemental design revisions, DTP will need to endeavor to stay within those established limits. Reworking of ROW acquisition work products due to design changes may adversely impact the project schedule, budget and scope, and thus the PMOC considers this a risk element.*

Vehicle Procurement

As part of the Wiehle Avenue Extension, WMATA proposes to procure 64 rail transit cars. This addition to the WMATA fleet is needed to provide the additional train sets needed to maintain train frequency with the longer running time when Dulles Corridor trains operate through to Wiehle Avenue. Justification for these additional cars is contained in the Transit Operations and Maintenance Plan – Dulles Corridor Rapid Transit Project, dated November 2004, prepared to accompany the FEIS.

The essence of the justification is that the additional running time between Wiehle Avenue and East Falls Church will require that WMATA operate 6 additional train consists in this service.

Based on the 2025 operating plan, which uses 8-car trains, 56 additional cars are required for the peak hour. WMATA plans typically call for a 20% operating spare ratio that increases the vehicle requirement to 64 cars. Similarly, Phase 2 of the Dulles Corridor extension requires an additional 6 train consists (64 cars) making the total procurement 128 cars.

Scope of Design

The proposed fleet acquisition, as described in Transit Operations and Maintenance Plan – Dulles Corridor Rapid Transit Project, is intended to supplement the fleet currently assigned to WMATA Orange Line service. The new cars must be able to operate universally on the Wiehle Avenue Extension, the Orange Line and all other WMATA lines. The Wiehle Avenue Extension is designed to WMATA Standards so there are also no unique features on this line with respect to operating conditions, clearances, signals, or other systems as all other cars in the WMATA fleet must also be able to operate on the Wiehle Avenue Extension. Therefore, the fleet being procured as part of this project will generally resemble recent WMATA procurements.

There are no existing unexercised options on an open WMATA rail car procurement. The one open new car contract has progressed far enough that there would be a gap in production due to lead time for materials. Procurement regulations may require WMATA to procure these cars independently from the current rail car procurements. Therefore, WMATA has estimated, from both a cost and schedule point of view that the rail vehicle procurement for the Wiehle Avenue Extension will be a stand-alone procurement. Although this contract is assumed to be stand-alone, it is possible that WMATA may include options on the contract for additional cars for fleet replacement or fleet expansion as described in the WMATA RFMP.

WMATA issued their most recent Rail Fleet Management Plan in November 2006 with a revision in May 2007.

Adequacy of Design

The most recent WMATA procurements of new cars were the 5000 Series Rail Cars in 1998 and the 6000 Series Rail Cars in 2002. Both of these fleets were similar to the earlier WMATA fleet in that they were aluminum bodied 75-foot cars with 3-door openings per side and arranged in married pairs. They were different from the previous fleets in that they incorporate the recent technologies of AC propulsion, automated announcements, and extensive use of auxiliary inverters and computerized subsystems. Even though these rail vehicles are recent and state-of-the-art when ordered, new technologies have been introduced or advanced since WMATA's last car procurement. An example of a technology not yet in use at WMATA is the use of hermetically sealed air conditioning compressors and roof mounted air conditioning units.

WMATA has begun PE for what is now known as the 7000 Series Rail Car Procurement. The draft technical specification has been being reviewed internally and was sent out for industry review on March 19, 2007. Comments were received and the final draft of the Technical Specification is scheduled to be ready in August 2007.

WMATA is also reviewing the possibility of relaxing some specification requirements to increase competition and to allow incorporation of additional new technologies into the cars. Among these is the use of metals other than aluminum, such as stainless steel, in the carbody

shell. Also, the requirement for compatible operation with the existing WMATA fleet could be deleted allowing the use of advanced communications, propulsion, and vehicle monitoring equipment. The basic carbody size would remain and the cars would need to operate on the remainder of the WMATA system in trains of like cars. The testing program for these cars would have to prove successful operation on the WMATA system. The testing of the new cars will be done away from the Project to ensure WMATA systemwide operational capability. The systems on the Project will be tested initially using the existing fleet to determine operability of the fleet on the Project.

According to the current WMATA rail car procurement schedule, the projected completion of the last car for the Wiehle Avenue Extension is forecast for December 2012.

Other Vehicle Procurements

In addition to the procurement of rail transit vehicles, WMATA has proposed acquisition of other equipment under (SCC 70.05) and non-revenue vehicles (SCC 70.06). The substance of the non-revenue vehicles line item is included in an estimate dated June 10, 2005. The estimate includes motor vehicles, maintenance of way equipment, and special tools to be assigned to the WMATA departments responsible for maintenance of track and structures, traction power, signals and communications, plant maintenance, and operations and to the WMATA police. The following is a summary tabulation of the non-revenue vehicle and other equipment estimate:

Department		Heavy Trucks	Light Trucks	SUVs Autos	Off-road Equip.	On-Rail Equip.	Other Equip.
Track and Structures	**TRST**	4	4		1	6	
Plant Maintenance	**PLNT**	0	8		2		78
WMATA Police	**MTPD**			9			
Electrical	**ELES**		2				
Department not specified		2	7	11			
Total		2	9	11	3	6	78

Among the light trucks, the most common vehicle is a crew cab pickup truck with a lift gate. Snow fighting equipment accounts for most of the Other Tools and Equipment. The amount of equipment for five stations seems excessive since the assignment would be two tractors, four snow blowers, and four snow brooms per station.

Review of Professional Services and Agency Scope Items

A review of the revised draft of the Design-Build Contract dated April 26, 2006, the Appendices to Design-Build Contract, dated February, 2005 (Exhibit 1.1, Definitions – Revised April 26, 2006) indicates that the roles of the DRPT, the Contractor and other interested partners, sponsors and parties such as WMATA, MWAA and VDOT, are outlined in the draft of the Design-Build contract, but these roles remain to be fully defined. Several sections of the Design-Build contract note revisions are expected when MWAA assumes responsibility for the project.

There are provisions for both continuous supervision by DRPT of the on-going design development effort as well as design submittals to be made at a 60% and a 95% design completion. Definition of the content of each of these reviews is included in the Design-Build contract. These relationships are more fully reviewed in the next section.

Review of Construction Package Elements

Organizational Framework

The organizational framework for the design and construction activities is governed by the Design-Build Contract and a series of intergovernmental agreements. In Figure 2, the Grantee, DRPT transitioning to MWAA, is shown as the Dulles Corridor Project. This is the operational center of the Project. The Design-Build Contract for the Project has been executed by MWAA, in the role of the Dulles Corridor Project, and DTP for the construction of the line extension. Intergovernmental agreements have been signed between MWAA and VDOT and between MWAA and Fairfax County to outline the requirements of each of the local jurisdictions for coordination of design and construction. When DRPT had been the lead agency for the Dulles Corridor Project, an IGA was drafted for cooperation between DRPT and MWAA as owner of the DIAAH. With MWAA as the lead agency, an agreement is no longer necessary since both the Project and the DIAAH are under the same engineering management. Incorporation of the cooperative aspects which would have been in the IGA will remain but are now internal to MWAA.

The IGA with WMATA has been approved in principal by both the WMATA and MWAA Boards, but final language is still being negotiated. There will be no direct contractual relationship between WMATA and DTP. However, the work being designed and constructed by DTP must be able to be accepted and operated by WMATA as an integral part of the Metrorail system. The MWAA-WMATA IGA includes the requirements for WMATA for review and input to the design and for acceptance of the completed Project. The Design-Build Contract includes governs the design and construction of the Project so that it is acceptable to WMATA. WMATA has the right under the IGA to approve the design prepared by DTP. The Dulles Corridor Project has the responsibility to direct needed changes to DTP. Therefore, the Grantee retains all responsibility for completing the project to the satisfaction of WMATA regardless of any dispute over engineering, construction, or equipment supply with DTP.

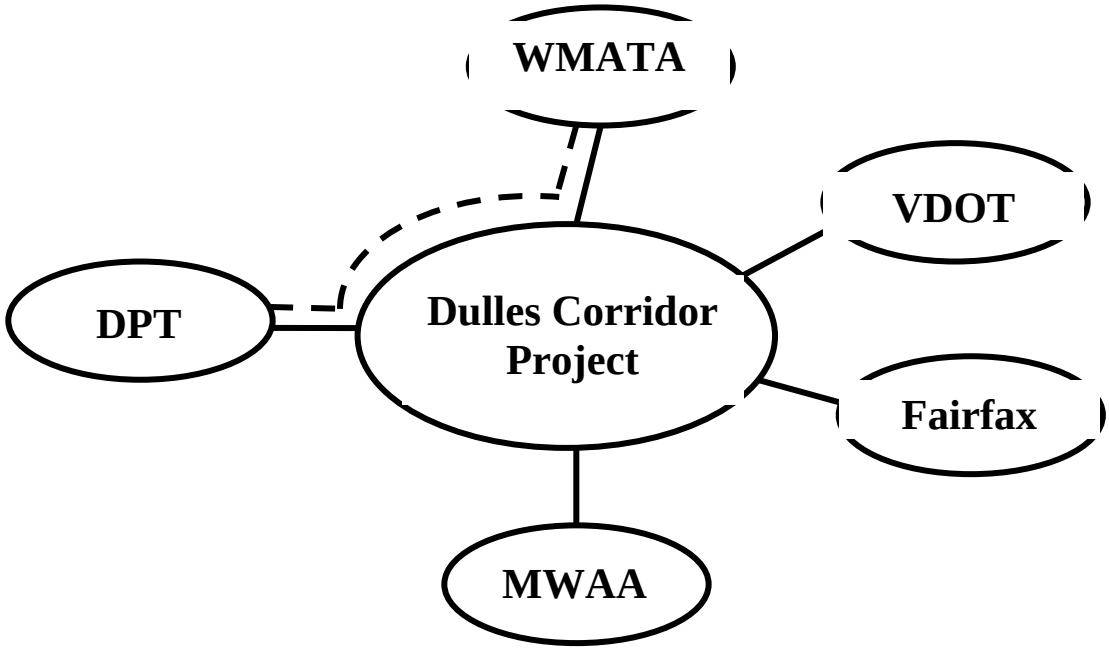

Figure 2 – Dulles Corridor Organizational Framework

A detailed review of the Design-Build Contract and the intergovernmental agreements follows.

Review of Design-Build Contract

Review of Contract Terms and Conditions

This assessment is based on the May 31, 2007 Execution Version of the Design-Build Contract for the Dulles Corridor Metrorail Project, which was executed between MWAA and DTP on June 19, 2007.

The contract is a variation on the typical design-build contract. In a typical design-build contract, an owner engages an engineering firm to prepare a PE package. This preliminary engineering package is then the basis for competitive proposals from other engineering and constructor organizations. The owner then chooses one of the proposer firms to complete the

design, procure equipment and materials, construct the project, test and commission the work, and then turn over the completed project to the owner. This contract is actually the outcome of an existing contract between the parties known as the Comprehensive Agreement ("Comprehensive Agreement" concerning the development, design, and construction of the Dulles Metrorail Project dated on or about June 11, 2004). Under the Comprehensive Agreement, DTP prepared the PE package that will form the basis of this design-build contract. This approach alters the traditional rules of interpretation of contracts and this is clearly announced in draft Section 29.9.1 of the Contract:

> "29.9.1 The language in all parts of this Contract or any other Contract Documents shall in all cases be construed simply, as a whole and in accordance with its fair meaning and not strictly for or against any party. The parties hereto acknowledge and agree that this Contract and the other Contract Documents have been prepared jointly by the parties and has been the subject of arm's length and careful negotiation over a considerable period of time, that each party has been given the opportunity to independently review this Contract and the other Contract Documents with legal counsel, and that each party has the requisite experience and sophistication to understand, interpret and agree to the particular language of the provisions hereof. Accordingly, in the event of an ambiguity in or dispute regarding the interpretation of this Contract or any other Contract Documents, this Contract or any other Contract Documents shall not be interpreted or construed against the party preparing it, and instead other rules of interpretation and construction shall be utilized."

Problematic concepts, provisions, and language have been identified and discussed. Recommendations were made for areas which in the opinion of the PMOC, should be further managed as the project proceeds. To address these concerns involves answering the following types of questions and issues:

- What risks does the party want to assume or keep?
- What risks do they want to shift to the other party?

A party, such as a Grantee/Owner, will pay a cost in the contract price by shifting risk. Claims will not disappear especially if the contractor loses money when the risk becomes reality. The PMOC observes that the parties in this contractual arrangement may have a mutual advantage if they can agree on the proper blend of risk and how the risks are managed now that the contract is in effect.

Article 2 provides for an agreed rate by which the contract price will be adjusted if design notice to proceed is delayed beyond the specified August 1, 2007 date. A similar adjustment provision is also provided for utility relocation notice to proceed and full notice to proceed.

Differing Site Conditions are addressed in Articles 5 of the Contract. The Contract establishes a Contractor's reserve of $6 million of an initial $12 million to cover the cost increases associated with Differing Site Conditions. *Once the $12 million figure is exceeded for Differing Site Conditions, the Contractor is entitled to Change Order(s), which is a potential scope and cost risk.*

Warranties are covered in Article 11 of the Design-Build contract, although the Standards of Performance are delineated in Article 2.2. The warranty period is for two years after Substantial Completion Date.

Article 12 provides for a monthly report in a form suitable to the Owner.

Article 13 addresses the schedule and adjustments to the schedule. Compensation will be granted for delays deemed Force Majeure events. There is a reserve of 45 days established in this Article. The reserve must be exceeded before compensation is allowed. The schedule will also be adjusted for impact of Allowance contracts (that are defined in detail in Article 14.1.6).

Article 14 of the Design–Build Contract states the compensation and among other items provides the Contractor with the ability to recover for escalation costs such as steel, asphalt, and fuel used on the Project (Section 14.1.3). The Contract also contains significant allowances that will adjust the contract price as these allowance contracts are finalized (Section 14.1.6). Should the allowance exceed a cost figure threshold specified in this section, the Contractor loses its right to its fee on the excess amount.

Article 26 identifies the Liquidated Damages for delay in completion of the project. It also defines a limitation on Liquidated Damages and an overall liability cap.

Article 28 provides for dispute resolution through a series of steps including negotiations, elevated negotiations, mutual agreement to use an independent expert, and submittal of a certified claim and mediation, all prior to any legal proceeding.

The following are some general observations regarding the Terms and Conditions:

1. The project has one completion date. There are no intermediate milestones.
2. Related to the above, there are no provisions governing partial acceptance.
3. WMATA's role is defined in Appendix 9 and also in Division 1. These provisions were completed before the WMATA-MWAA interagency agreement was finalized. There are no specific provisions in the terms and conditions further describing the roles.
4. The reporting of costs and trends is addressed generally. The Owner should seek to have meaningful trend data provided.
5. Issues may arise from the anticipation of multiple Notices to Proceed. There are liquidated damages for late notices.
6. There is an initial $12 million in differing site conditions (DSC) claims threshold to be shared 50%-50%. A reasonable conclusion is that some contingency will be part of the proposal price.
7. The Extension of Time Provisions and Force Majeure clause have atypical provisions. Force Majeure delays are compensable to Contractor if they exceed a stated force majeure reserve, e.g. 45 days. The Contractor explicitly assumes this risk under the Contract. A reasonable conclusion is that some contingency will be part of the proposal price.
8. Access delays from other agencies as WMATA, VDOT, MWAA, may be Force Majeure delays.
9. The allowances for some of the later contracts shift most of the cost risk to the Owner. Contractor loses some fee if a ceiling is passed

Review of General Requirements

The PMOC reviewed Appendix 1- Division 1 Specifications, Revision 6, dated April 24, 2007. These are the General Requirements of the Technical Specifications for the Contract for the Dulles Corridor Metrorail Extension to Wiehle Avenue.

Division 1 in many respects supplements and details some of the requirements of the Terms and Conditions in the Contract. These were reviewed for consistency and clarity with appropriate sections of the Contract. The following Sections are aligned with key Terms and Conditions:

- Verification Requirements (section 01112A) interfaces with the drawing review process and whether there is non-acceptance of design.
- WMATA, VDOT, MWAA Work Restrictions (sections 01140-2) may have impact on delays and force majeure provisions in Terms and Conditions.
- Contract Data Requirements List Information and Procedures (section 01330) interfaces with the drawing review process and whether there is non-acceptance of design.
- Contract Schedule and Progress Reporting (section 01322) interfaces with Project Deadlines and Adjustments to Completion Date.

With the Design-Build Contract finalized, the risks are allocated. The management of the risks assumed by both Contractor and Owner will determine a successful project outcome.

Review of Article 14.1.6 Allowances and Allowance Items

The reason for choosing to use a negotiated contract is to gain certain project execution efficiencies. These were laid out in the Comprehensive Agreement and reiterated in Recital B of the Design-Build Contract. Later in the Recitals, Recital H describes the origin of the Allowances as:

> "During the course of such negotiations, the parties agreed that certain Subcontracts are subject to future uncertain price variation due to the level of design as of the Final Fixed Price Proposal Pricing Date, schedule for implementation, and market conditions for such Subcontracts. Consequently, the Contract Price and the Project Schedules include allowances that have been determined by Owner for the price and schedule of such Subcontracts, with such allowances to be reconciled pursuant to this Contract."

In Article 14 paragraph 14.1.6 is as follows:

> **14.1.6 Allowances and Allowance Items**. The Contract Price includes allowances for the pricing of certain Subcontracts ("Allowance Items") that the Parties have determined to be subject to uncertain future price variation due to the current level of design, schedule for implementation, and market conditions. The Initial Baseline Schedule includes allowances for the schedule durations for performance of the Allowance Items. The price and schedule allowance for each Allowance Item has been established by Owner. The price allowance includes certain other items calculated on the basis described in Exhibit 14.1.6(a) (each referred to as a "Contract Allowance Price"). Adjustments, as appropriate, will be made to the Contract Allowance Prices in

accordance with this Section 14.1.6. Adjustments, as appropriate will be made to the Project Schedule for the Allowance Items in accordance with Section 13.3.3.

The PMOC is of the opinion that the use of the phrase "price and schedule allowance for each Allowance Item has been established by Owner" could be interpreted as placing all risk for the Allowances on the Grantee. The scope of each Allowance Item is recorded in detail in Exhibit 14.1.6.(c) of the Contract. However, in spite of the rather detailed discussion of interface items, in the absence of final design documents there is the opportunity for additional work to be allocated to the Allowance Item away from the scope of work in the Firm Fixed Price.

If there had been a single design-build contract, then the coordination of various subcontract items would have been at the discretion of the Contractor and for his benefit. Now that the Allowance Item is removed from the Firm Fixed Price, there is an option, in the absence of a clear delineation of scope, to assign work to the Allowance Item scope. There is no language in the Contract which requires the Contractor to consider this balance as an engineering professional nor is there an obligation to design to budget. It is to the benefit of the Contractor to assign the work to the Allowance Item in the case of doubt.

Upon receiving proposals from bidders for the Allowance Items, if the proposals are in excess of the Allowance, there is no mechanism to require the Contractor to revise the design to reduce subcontract costs. If the proposal documents were prepared properly, revision of the design would appear to be extra work under the Contract. By comparison, if the original design for work solely within the scope of the Firm Fixed Price was in excess of the Contractor's estimate, then the Contractor would surely consider redesign at his own cost.

Table 1 – Contract Allowance Items

No.	Allowance Item	Contract Allowance Price
1.	Trackwork	$ 59,525,680
2.	Wiehle Parking Garage	$ 25,951,149
3.	Station Finishes and MEP	$ 87,493,630
4.	WFCY Sound and Box Platforms	$ 4,916,879
5.	Pedestrian Bridges	$ 11,297,310
6.	Site development	$ 50,909,257
7.	Installation of Public Art	$ 530,774
8.	Communications and Security	$ 18,881,973
9.	Fire Suppression	$ 2,151,166
10.	Elevators and Escalators	$ 32,005,660
11.	Spare Parts	$ 5,000,000
12.	WFCY S&I Building	$ 33,792,562
13.	Traction Power Supply	$ 47,493,484
14.	ATC Supply	$ 27,547,647
15.	Cathodic Protection and Corrosion Control System	$ 1,424,170
16.	Contact Rail and Hardware Supply	$ 8,290,686
17.	Wiehle Avenue Replacement Parking	$ 1,370,187

Review of Intergovernmental Agreements

Intergovernmental Agreement between MWAA and WMATA

The agreement reviewed for this report is the June 8, 2007 draft version of the Agreement between WMATA and MWAA. This contract is not a final draft and this risk analysis is subject to change pending review the final version of the agreement between the parties. MWAA was authorized to sign the agreement on June 8, 2007 and WMATA was authorized to sign on June 28, 2007.

- As a third party beneficiary (Recital G, page 6) to the Design Build (DB) Contract, WMATA may be able to affect that agreement in some way not anticipated. This is unlikely given the detailed relationship of this draft agreement, particularly regarding dispute resolution.
- WMATA is responsible for ARS Acceptance Tasks (Recital L, page 7) and MWAA will be reimbursing these reasonable and allocable costs. MWAA is assuming risk that these costs may overrun due to acceptance of project from the DB Contractor which may occur separate and distinct from WMATA Acceptance.
- WMATA Acceptance is defined in Article 1, Section 1,T. The DB Contract discusses an anticipated three-month period for WMATA to conduct Operational Testing and requires DB Contractor support (Div. 1, Section 01810, page 3). The DB Contract does not specifically make DB Contractor Final Acceptance contingent on WMATA Acceptance, however. See DB Contract 17.5.2 where subsection g calls for , *"(g) all of Contractor's other obligations under the Contract Documents (other than obligations which by their nature are required to be performed after Final Acceptance) shall have been satisfied in full or waived."* This may be a risk assumed by MWAA if there if DB Contract Final Acceptance but WMATA Acceptance is outstanding. Although a risk it is unlikely based on (g).
- WMATA is the final arbiter of scope (in the final design) according to Article 2, Section 1,B on page 13. This will be an ongoing responsibility. In general, the detailed role of WMATA to the DB Contract is defined in detail in this agreement (Article 2) and only generally in the DB Agreement. Appendix 9 and the Division1 address aspects of what is stated here in the Agreement. They are not conflicting.
- WMATA strictly controls access to its existing system and has no responsibility for failing to provide access (Article 2, Section 1, b, 2 on pages 14, 15).
- WMATA has the responsibility for many elements of the overall project such as Rail Cars, Non-revenue Equipment, Automatic Fare Collection, Communications Backbone, Operations Control Center modifications, Service and Inspection Building, Signage, and Arts-in-Transit. WMATA is to provide a CPM and updates to status its ongoing work to be integrated into the overall schedule. This updating must be properly managed by MWAA to avoid delay and conflict.
- WMATA has an extensive role as Technical Advisor to MWAA during design; it has a contractual 21 calendar days to conduct its reviews (Article 2, Section 2, B for example). Late performance may affect the DB Contractor a risk held my MWAA. In this agreement, MWAA also assumes the risk of having to remove disputed work (arising from such WMATA Approvals or lack of approvals is WMATA determines the submittal as non-compliant to the design criteria.

- WMATA has an obligation to timely notify MWAA of issues in design and construction that may affect acceptance. See Article 2, Section 2, B, 3 d.
- MWAA assumes any additional costs for overruns in the Technical Advisory Budget for WMATA's role in Dynamic Testing and Performance Demonstration Testing.
- The Agreement specifies twelve tasks (Article 2, Section 2,C.) to be performed by WMATA prior to WMATA acceptance. There is a risk (even anticipated) that this WMATA acceptance may not correspond to DB Final Acceptance. This is a risk assumed by WMATA should there be issues other than warranty or other post completion tasks.
- In Article 6 on page 48, MWAA assumes the risk for certain key approval WMATA is to be responsible for –
- Dynamic Readiness Certificate
- Undertaking Operational Readiness Testing
- Approve deviations to design criteria
- Provide railcars and personnel (if WMATA determines work does not conform to Design Criteria
- Article 6 creates a process for mitigation of delays associated with conformance with design criteria and readiness testing. This dispute process is outside the process described in Article 12.
- In Article 7 on pages 50-2, Agreement establishes an Escrow Fund for Latent Defects to counter the 5-year liability limit in the DB contract to stay in place for 20 years after WMATA Acceptance. MWAA fund the account up to $15 million.
- In Article 7 on pages 52-3, punch list work is to be completed to WMATA's "satisfaction" for all limits of the revenue system as a condition precedent to WMATA Acceptance. MWAA has 90 days after acceptance to complete all punch lists. WMATA takes risk of not having project reach final completion (ALL punch lists complete) while it may be obligated to "accept" project. All punch lists should be complete at WMATA acceptance without exception.
- In Article 7 on page53, the Spare Parts Allowance may be understated. MWAA is bearing the risk of what WMATA needs.
- In Article 7 on page 53, the Training may be understated. MWAA is bearing the risk of what WMATA needs.
- In Article 7 on page 54, this assignment of warranties appears to conflict with the language on page 36. MWAA was to administer the warranties for 24 months, but here WMATA is to receive assignment prior to acceptance of the system. These two dates are not the same.
- The dispute resolution process (Article 12) includes an escalation of claims to 1) organizational level executives (resolution within 3 days), then 2) to the general manager/CEO level (resolution within 5 business days). If unsuccessful, a dispute review board can be instituted. This DRB is not a standing DRB and would have to be created. This 3rd level is not required if the parties do not agree. Finally there can be litigation. This process is invoked for numerous contract issues such as disagreements on approval of submittals, acceptance tests, system integration, and issues of default.

MWAA and Virginia Department of Transportation (VDOT)

This undated agreement has been revised to substitute MWAA in place of DRPT. The agreement is similar to the earlier agreement between DRPT and VDOT with several notable additions. The agreement now indicates:

- Within the project alignment, MWAA shall be responsible for the containment, management, mitigation, and remediation ("CMMR") of any and all hazardous substances found on VDOT property.
- MWAA is responsible for acquiring all rights-of-way and property rights necessary for the construction and operation of the Project.
- MWAA will use a property acquisition agent.
- VDOT will not enter into any agreements with MWAA's contractors.
- All costs to MWAA and VDOT will be borne by the project.
- VDOT will provide staff to coordinate the project. MWAA will provide space and carry the costs for staff and office space.
- Project will comply with Federal Highway Administration (FHWA) and VDOT standards.
- VDOT will review the plans for suitability and has the right to approve or deny any request affecting their facilities.
- MWAA is responsible to secure all rights-of-way required. VDOT will assist in this endeavor.
- VDOT will assist MWAA in coordination with the various utility companies to determine the proportional costs of relocations, utilize master agreements, and assist in negotiations of costs with the utilities for MWAA.
- The Project is solely responsible for the costs associated with utility relocations for the benefit of the project.
- MWAA and MWAA's contractors are responsible for QA/QC activities to be performed in accordance with VDOT standards on VDOT facilities.
- MWAA will develop traffic control plans in conjunction with VDOT and local jurisdictions.
    - Maintenance and Protection of Traffic
    - No disruption of peak hour traffic.
    - Compliance with VDOT and FHWA standards on signs, marking, lighting, devices, and barricades.
    - MWAA to develop and administer a Congestion Management Program (CMP) and participate in the sharing of costs for the CMP.
- Plans for temporary and permanent traffic signals to be closely coordinated with VDOT.
- MWAA will work with VDOT to develop a financial plan which meets the requirements of the Commonwealth and FTA.
- MWAA has committed to construct the roadway improvements as outlined in the ROD.
- Payments to VDOT by the project will be via interagency transfer.
- Disputes to be resolved by MWAA and VDOT staff, then Directors, and finally the Secretary of Transportation.
- Agreement to be in effect until all VDOT facilities are accepted, all transfers complete.
- MWAA will provide as-built drawings to VDOT at the conclusion of the Project.
- MWAA facilities to be warranted for a five-year period.
- VDOT will provide appropriations and funding from the Dulles Toll Road allocated to the Project by the Commonwealth Transportation Board.

The Agreement between MWAA and VDOT is consistent with the typical interagency agreement. There are no elements or language which would allow for additional compensation, provided the final plans, specifications, and contracts are developed to match the agreement conditions. All Project costs under the Agreement are the responsibility of MWAA.

MWAA and Fairfax County, Virginia

There are two interagency agreements between MWAA and Fairfax County in Virginia. One agreement has to do with the local share of project funding which is being provided from taxes raised by Fairfax County. The second agreement concerns coordination of engineering and inspection services for the project and the ground rules for the approval and permitting processes required for construction in Fairfax County.

MWAA and Fairfax County, Virginia (Funding)

This draft agreement is dated May 31, 2007. The substantially revised agreement identifies MWAA as the federal project grantee in lieu of DRPT and indicates:

- The estimated Phase I total cost to construct Phase I is $2.647 billion and the total cost to construct Phase II is $2.5 billion.
- Fairfax County's commitment with respect to Phase I is $400 million and for Phase II is $214 million.
- The funding partners are Fairfax County, Loudoun County, and MWAA.
- MWAA is ultimately responsible for implementation of the Project.
- Project funding assumes a fixed FTA contribution of $900 million and a fixed contribution from funds available through the Virginia Transportation Act of $75 million.
- The total percentage of contribution from MWAA from funds derived from the Dulles Toll Road (DTR)will be 100% of the amount remaining after all other contributions from the funding partners, including funds derived from other than from operation of the DTR The total percentage from non DTR funds is 4.10%. The total percentage contribution of Fairfax for the Project is 16.1%. The total percentage contribution of Loudoun for the project is 4.8% to be paid in Phase II.
- MWAA will receive $12.8 million as fair market value for the use of Dulles Airport properly counted against the MWAA contribution. Other land contributions such as median areas of the DIAAH and the DCR are to be in addition to and not an offset to MWAA's capital contribution to the Project.
- The FTA commitment will be established in the FFGA for Phase I and could be less than $900 million. In that event MWAA will be responsible for 100% of any federal shortfall.

The Funding Agreement between MWAA and Fairfax County, Virginia is consistent with the typical interagency agreement. There are no elements or language which would allow for additional compensation, provided the final plans, specifications, and contracts are developed to match the Funding Agreement conditions. All Project costs under the Agreement are the responsibility of MWAA.

DRPT and Fairfax County, Virginia (Cooperative)

This undated agreement with the County of Fairfax, Virginia has been revised to substitute MWAA as the project federal grantee in place of DRPT. The agreement which has been substantially revised now indicates:

- The County will assign a full time coordinator to the Project. WMAA will provide office space for the coordinator. The County, VDOT, MWAA, and WMATA will participate in formal design reviews at the 30%, 60%, and final design completion milestones.
- Periodic "over the shoulder reviews will also be held.
- At all stages of construction MWAA and its contractors will provide regular notice of activities to the County coordinator.
- MWAA will maintain during construction and furnish "as-built "drawings to the County at the completion of construction.
- The WMATA Manual of Design Criteria and Airports Authority Design Manual shall apply to the design of the Project. Relevant standards of the Virginia Uniform Statewide Building Code, and Fairfax regulations and ordinances shall apply to the portions of the Project located in Fairfax not on Airports Authority Property.
- MWAA is responsible to obtain all necessary regulatory approvals for the Project and to ensure that the Project complies with all federal, state, and local laws, ordinances regulations, and other applicable requirements. In order to expedite WMATA's acceptance of the completed Project facilities, MWAA will request and the County will provide relief from the County's nighttime noise ordinances.
- MWAA will secure DGS approval for all site plans and building permits and DCR approval for all stormwater management and erosion and sediment control plans associated with the Project.
- MWAA will require the Contractor to permit site access for inspection purposes.
- MWAA is responsible to secure all rights-of-way required, in the name of the Commonwealth,
- Fairfax shall transfer to WMATA, in fee simple for no monetary consideration, all Fairfax property that is necessary for the operations and maintenance of the Project. The County will retain title to the existing Reston Park & Ride and Fire Station #29.
- MWAA will prepare Maintenance of Traffic plans in coordination with VDOT and Fairfax County complying with VDOT and FHWA design criteria.
- MWAA will also assist in developing a Transportation Management Plan ("TMP")/ to assist in reducing reliance on single occupancy vehicle travel in and around the Project construction area.
- To the extent permitted by law MWAA will indemnify Fairfax against claims of injury, death, property damage, etc., which may otherwise accrue against Fairfax as a consequence of this Project.

The Cooperative Agreement between MWAA and Fairfax County, Virginia is consistent with the typical interagency agreement. There are no elements nor contract language which would allow for additional compensation provided the final plans, specifications, and contracts are developed to match the agreement conditions.

DRPT and Metropolitan Washington Airports Authority (MWAA)

This assessment is based on the PMOC's review of the 10 page unsigned agreement between DRPT and MWAA last revised March 30, 2006. The scope of this agreement is intended to

coordinate construction within the DIAAH ROW. Although this IGA is now longer needed, as noted earlier in this report, the draft document indicates the interdepartmental operational coordination which will still need to occur for construction of the Project. The draft IGA indicated that:

- MWAA will provide a full time project coordinator to support DRPT.
- MWAA will provide staff to coordinate the project. DRPT will provide space and carry the costs for MWAA staff and office space.
- MWAA will actively participate in design reviews and attend workshops.
- MWAA will advise DRPT of construction or modification of MWAA facilities which may impact the Project.
- MWAA will grant building permits and provide easements necessary for construction on MWAA property.
- MWAA agrees to the use of the Y15 yard site on airport property for soil disposal and/or storage during the Project.
- DRPT will receive all required permits from MWAA or the Commonwealth at no cost to the project.
- MWAA to review, approve and inspect storm water measures.
- Construction on MWAA property to conform to MWAA Building Codes Manual. MWAA is to have discrete inspection rights.
- DRPT to provide Maintenance and Protection of Traffic (MOT) plans.
- DRPT to develop and administer a Congestion Management Program (CMP) with all Partners.
- MWAA agrees to the relocation of its facilities as required by the Project at the Project's cost.
- DRPT will coordinate with MWAA to develop a financial plan acceptable to FTA.
- MWAA will make available to DRPT funding necessary to meet the Project's cash flow.

The Agreement between DRPT and MWAA is consistent with the typical interagency agreement. There are no elements or language which would allow for additional compensation, provided the final plans, specifications, and contracts are developed to match the Agreement conditions. All Project costs under the Agreement are the responsibility of DRPT.

Conclusion

The PMOC reviewed the project scope and found that it is at the level expected at a normal level of PE design. This opinion is based on the PMOC's review of the approximately 2,500 drawings and various reports.

Upon review of the project's scope, the PMOC has identified the following potential risks:

1. The design of relocations of the gas, sewer, and water lines in the bed of Route 7 had not progressed until recently; therefore, a risk to the project's scope and budget still exists until the design is completed.

2. After a $12,000,000 allowance figure is exceeded for Differing Site Conditions and Hazardous Materials, the Contractor is entitled to Change Order(s), which is a potential scope and cost risk.

3. There is a risk that the NATM tunnel excavation and initial support may be difficult to construct as designed given the soft ground conditions expected at Tysons Corner.

4. There may be potential scope risks associated with NFPA 130 requirements and ADA elements at several stations such as sufficient station exit times, availability of emergency evacuation carts needed in the event of power or mechanical failure, and evacuation of the disabled from "Safe Dispersal Areas".

5. There is the risk that absent actual designs, the mechanical elements of the Tysons Central 123 and Tysons East Stations, which are to be based on the Tysons West Station, will be missed in the quantity take-offs and/or miscounted due to the considerable differences in the overall architecture among the three stations.

6. Access and laydown areas are not shown for the Wiehle Avenue parking structure. The site is presently used as a Park & Ride lot. Assuming the lot is kept in operation during construction; the garage site is tight and will present challenges and restrictions during construction.

7. Access and laydown areas for the Tysons West Station are located within the Dulles Access Road interchange. This may be too far from the station to be effective and will create additional traffic issues due to the congestion on Route 7.

8. The design of the expansion of the WFC Shop is progressing, but there is still a risk to scope and budget due to the complexity of designing a shop expansion at this location.

9. The design of necessary utility relocations of gas, sewer, and water lines in the bed of Route 7 had not progressed until recently; therefore, a risk to the project's scope and budget still exists since the design has not yet been completed.

10. The complexity of the train control and signal system interface to the existing system requires that certain elements of work be performed with significant oversight and support by WMATA forces. There currently is no detailed force account plan for this work.

11. WMATA has requested a change to the train control and signals criteria to allow for separation of track circuit cables that carry like frequencies for train detection. This is a potential scope risk to the project.

12. The level of design for the high voltage (34.5 KV) distribution system is not consistent with what is expected at the completion of the 100% PE phase.

13. DRPT is negotiating with DVP to include the cost of the cable, installation and metering equipment costs for the 34.5KV power distribution system as part of the utility rate structure and not as a capital cost. This work has been deleted from the project scope.

There is a risk that if these negations are not successful, then this scope of work will have to be added back into the project.

14. Subsequent to the completion of PE, one substation and one tie breaker station were deleted from the project scope. There is a risk that this equipment may have to be put back in the project scope.

15. During the PMOC review of the project cost estimate, elements of the traction power system were broken out and shifted to other sections of the project cost estimate. In the PMOC's opinion, there were insufficient traceability documents to ensure that the complete traction power project scope was accounted for in the project cost estimate.

16. As the traction power design progresses beyond the PE level, there is a potential risk that additional work may be added to the project scope.

17. There is a significant risk that the communications and security scope is incomplete – there are no PE design drawings for the WMATA portion of the work.

18. There is a risk that as the communications design progresses through the Final Design stage that the project scope could increase, particularly in the area of security system and/or newer technology requirements. There is an "Open Item" related to a request by WMATA to upgrade the planned LAN/WAN network to state of the art capability.

19. No design has been developed for the Automatic Fare Collection system and is not consistent with what is expected at the completion of 100% PE design.

20. There is a significant risk that the Operations Control Center improvements scope is incomplete, since there are no PE design drawings for the work. The work will be performed by WMATA forces.

21. If right-of-way (ROW) acquisition requirements are based on the current 100% PE design plans including supplemental revisions, designers will need to stay within those established limits in developing the Final Design. If Final Design requires additional ROW, the reworking of ROW work products because of design modifications may adversely impact the project schedule, budget and scope.

In summary, the PMOC has concerns that the project will experience scope growth.

Appendices

Appendix A – Grantee Project Data

Document	Date	Author	Nature – Detail – Quality*
Cost Estimates			
MWAA Project Cost Estimate	June 22, 2007 June 20, 2007	MWAA	Based on MWAA's Adjusted Estimate and on the negotiated price. Supplements the previous report, *Design-Build Contract Cost Estimate*, which documented the estimated cost of the Design-Build contract portion of the project.
Project Cost Estimate Breakdown for Risk Assessment	June 21, 2007	MWAA	Included as Appendix E in this report
Guidance to Allowance Values	June 19, 2007 June 14, 2007	MWAA	Provides a summary of and substantiation for development of the values for the Allowances that are contained in the D/B Contract for the Project.
Updated SCC Worksheets	June 1, 2007	MWAA	
Independent Capital Cost Estimate	April 27, 2006	DRPT	Cost estimate review prepared by the DRPT GEC, STV Inc. Refer to draft PMOC Spot Report, PG-33A Grantee Project Cost Review, dated July 14, 2006 for discussion of detail and quality.
Final Preliminary Engineering Capital Cost Estimate – Extension to Wiehle Avenue	March 21, 2006	DTP and DTE	Design-Build engineer's project cost estimate at PE. Cost estimate summary excludes certain identified elements. Estimates for excluded items provided.
Project Capital Cost Estimate	April 2007 March 6, 2007	DRPT and MWAA	Cost estimate prepared by the DRPT GEC, STV Inc., and adjusted by DRPT/MWAA for Open Items and other issues.
Partial Cost Report for Allowances	March 5, 2007	MWAA	
Evaluation of Scope Modifications	March 2007	STV	

Document	Date	Author	Nature – Detail – Quality*
Cost Report	January 29, 2007	STV	Includes quantity take-offs for labor, materials, equipment, etc.
Plans, Technical Specifications, Studies, Etc.			
2007 NFPA 130 Exiting Analysis for a Center Platform Station Design	June 11, 2007	DTP	For Tysons East, Tysons Central 123, Tysons Central 7, Tysons West, and Wiehle Avenue Stations
Right of Way Acquisition Plan	May 31, 2007 February 2007 November 2006 June 2006 April 14, 2006	DTP	ROW schedule continues to be the most significant risk. The ROW scope is acceptable, with a notation that the contamination/remediation issue may have some impact on ROW acquisition and the project in general. Recent Acquisition Plan comments on the cost estimate have recommended explanation of added costs for DTP support and owner's contingency.
Permitting Plan	May 31,2007 January 2007 April 2006	DTP	Preliminary Engineering support document.
Utilities Report	May 31,2007 January 2007 December 2005	DTP	Thorough and of good quality.
Supplemental Engineering drawings and technical specifications	April 3, 2007	DTE	Route 7 60% design submittal
Basis of Design Report	February 2, 2007	DTE	For Preliminary Engineering design

Document	Date	Author	Nature – Detail – Quality*
100% Preliminary Engineering drawings, design reports, and specifications	February 2006	DTP	Preliminary Engineering submittal to grantee. Generally complete and of good quality for PE. However additional detail is needed to coordinate system interfaces, especially between WMATA and the contractor.
Design-Build Contract			
Design-Build Contract, Dulles Corridor Metrorail Project - Execution Version & Appendices to Design-Build Contract	May 31, 2007 May 11, 2007 May 4, 2007	DTP & DRPT/ MWAA	Draft of the Design-Build Contract including Terms and Conditions with Exhibits.
Technical Specifications – Division 1 – General Conditions	April 27, 2007 January 23, 2007 Dec. 4, 2006	DTP & DRPT/ MWAA	Companion to Design-Build Contract. Result of negotiations.
Environmental Documentation			
Federal Transit Administration Record of Decision	Nov. 17, 2006 March 2, 2005	FTA	Record of Decision by FTA relative their findings the Final Environmental Impact Assessment.
Environmental Conditions with Limits of Disturbance	March 17, 2006	DTP	
Preliminary Engineering Design Refinements Environmental Assessment	February 2006	DRPT	Revision of FEIS to reflect impact of refinements made after the 50% Preliminary Engineering submittal and after the FTA Record of Decision dated March 2005.
Federal Aviation Administration Record of Decision	July 12, 2005	FAA	Record of Decision by FAA relative their findings the Final Environmental Impact Assessment.
Dulles Corridor Rapid Transit Project Final Environmental Impact Statement and Section 4(f) Evaluation	December 2004	DRPT	FEIS Document accepted by FTA ROD.
Agreements			

Document	Date	Author	Nature – Detail – Quality*
Draft Cooperative Agreement between MWAA & VDOT	June 13, 2007	MWAA & VDOT	13 page agreement (unsigned)
Draft Cooperative Agreement between MWAA & the County of Fairfax, Virginia	June 11, 2007	MWAA & Fairfax	18 page draft agreement (unsigned)
Draft Intergovernmental Agreement between WMATA & MWAA	June 8, 2007	WMATA & MWAA	67 page agreement (unsigned)
Draft WMATA Right of Entry Permit between WMATA & MWAA	June 8, 2007	WMATA & MWAA	22 page draft permit (unsigned)
Draft Agreement to Fund the Capital Cost of construction of the Metrorail in the Dulles Corridor	May 31, 2007	MWAA & Fairfax	17 page draft agreement (unsigned)
Draft Master Trust Indenture	May 31, 2007	MWAA	Exhibits B and C - 60 page draft agreement (unsigned)
Draft Assignment Agreement between MWAA & DRPT	May 29, 2007	MWAA & VDOT	10 page agreement (unsigned)
Agreement between DRPT and the County of Fairfax, Virginia.	April 3, 2006	DRPT & Fairfax	10 page agreement (unsigned copy) relating to project funding
Agreement between DRPT and MWAA	March 30, 2006	DRPT & MWAA	10 page agreement (unsigned copy)
Revised Cooperative Agreement between DRPT and the County of Fairfax, Virginia	March 28, 2006	DRPT & Fairfax	8 page cooperative agreement and attachments (unsigned copy)
Agreement between DRPT & VDOT	January 10, 2006	DRPT & VDOT	13 page executed agreement for interagency coordination.
Schedules			
Design-Build Schedule (Initial Baseline Schedule)	April 2007	DTP	Revision 5

Document	Date	Author	Nature – Detail – Quality*
Baseline Schedule	December 1, 2006	DTP	Primavera Schedule developed to support construction concept at entry into Final Design. Refer to the PMOC Spot Report, PG-34A Grantee Project Schedule Review, for discussion of detail and quality.
Design-Build Schedule	June 25, 2007	DTP	Revision 7
Other Documentation			
Technical Memorandum – Assessment of Project Contingency	May 25, 2007	Golder Assoc.	
Design-Build Open Scope Items	February 2007	DTP	Book 1 of 4
Transit Operations and Maintenance Plan – Dulles Corridor Rapid Transit Project	November 2004	WMATA	Report prepared in support of FEIS. Detail is provided to support assumptions and quality is good.
New Railcar Procurement Assumptions	May 18, 2004	WMATA	Internal worksheets for schedule and cost estimate.
Support Documentation			
Bureau of Labor Statistics Producer Price Indices	Monthly	BLS	Statistics on economic performance – Official publication of the United States Federal government.
Engineering News Record	Weekly	McGraw-Hill	Construction industry trade magazine with wide distribution.

Appendix B – Methodology

Dulles Transit Partners submitted a package of drawings, design documents, and draft technical specifications to DRPT at completion of their PE effort for the Extension to Wiehle Avenue. The scope evaluation uses these documents as the primary documentation for review. Supplemental reports and working papers, especially WMATA's input to DTP was also reviewed to enable a more accurate characterization.

This spot report is structured to accomplish the review described in FTA PG-32 Subtask 32C for Project Scope Review at the completion of PE. The source document for the methodology is FTA Project Management Oversight Program Operating Guidance PG-32 dated March 29, 2006 supplemented with a revised Appendix "A" dated September 13, 2006.

Responding specifically to the requirements of PG-32, the scope review addressed the following items as quoted from PG-32:

> "The Contractor shall assess and evaluate grantee and material third party project information and data and produce characterizations (ref. PG-08) of project scope that integrate and summarize available information and data for the Federal project, providing all professional opinion, analysis, information, data and descriptive text in an accessible and understandable format.
>
> i. Such project data can include but are not limited to scope, capacity, level of service, functionality, reliability, etc.
> ii. Characterizations for individual scope elements such as guideway, vehicles, systems, etc. shall conform to PG-08 requirements and be totally sufficient to provide FTA with a project or sub-project level understanding.
>
> For those projects in the PE or FD phases, Contractor shall review and characterize the grantee's project scope in terms of its descriptions, designs, products, etc. using the checklist from PG-32's Appendix A: Basis for Design for PE and Early FD projects to determine that it is:
>
> - Substantially consistent with that adopted in the Record of Decision;
> - Sufficiently complete to support the level and quality of revenue service typically offered by the grantee;
> - Proprietary systems or methods specified will permit a reasonable number of contractors with the expertise to compete for construction packages.
> - Major work details, structural element dimensions, design interfaces and physical interfaces are complete and well defined.
> - Plans and drawings are adequate in terms of content, presentation, clarity, cross-referencing, and detail.
> - Roles and responsibilities of contractors versus those of the authority (staff and any consultant support) are also well defined.
> - Project is constructible.
> - Review and characterize the grantee's project system and vehicle description to determine that the Grantee has matched the appropriate technology with the

planned transit applications for the best performance at the lowest cost and consistently applied it in systems descriptions and designs.

- In the absence of adequate scope detail for a given level of design, the contractor may validate project data by comparing the current grantee assumptions to relevant, identifiable industry experience in conformance with PG-08 requirements.

In preparing the report, where concern was raised by the technical specialists relative to either the risk related to the estimated duration or the risk associated with the difficulty of the work, the scope risks are identified and characterized. Where in the opinion of the PMOC items of scope risk are identified, the text is italicized for emphasis.

Appendix C of this report is a listing of target areas for analysis contained in PG-32 Appendix A, dated September 13, 2006, with a summary response for each item.

Assessment Methodology

Various constraints usually do not allow the PMOC to completely review or perform 100% inspections of all grantee documents. Given the large volume of material and limited timeframe for assessment, a qualitative methodology for selective review was utilized. The purpose of a sampling plan is to develop a framework for rigorous evaluation of the project's cost estimate, schedule, and drawings. However, the material to be reviewed was expected to be unique, non-repetitive and interrelated so a formula based random selection technique was not deemed to be appropriate. Instead, following the overview and site tour, selected drawings were reviewed by technical specialists in varying levels of detail. Based on the experience of the reviewer, certain drawings and drawing such as system-wide plans and details and individual stations were identified for review. Other areas were identified for overview with the intent that any obvious deficiency in a drawing being overviewed would then cause the drawing to be more fully reviewed. Not all drawings were overviewed or reviewed, but as a practical matter most drawings were at least 'scanned'.

Two other techniques were utilized to help determine level of completeness and coordination. Certain details or plan areas were randomly or selectively chosen, based on the experience of the reviewer, and reviewed in depth. In some disciplines, a detail-tracking trail was prepared and followed to other referenced or implied drawings and details. This was particularly useful in determining whether the design was comprehensively conceived, adequately articulated and coordinated with regard to reference marks, sections cuts, etc. The importance of this is that such marks are a 'bell weather' of design quality. Because references are easily fixed, accuracy in this detail is usually indicative that the drawings have been properly reviewed.

Appendix C -- Scope Review Checklist

This appendix contains a summation of the Wiehle Avenue Extension project scope at the Preliminary Engineering following the checklist contained in Appendix "A" of FTA PG-32 dated March 29, 2007.

General Design

- **Civil, Architectural, Trackwork, Vehicle and System packages possess a comparable level of definition, clarity, presentation and cross-referencing. The design, construction, system and vehicle interfaces are well known and defined.**

Refer to Design Overview - Page 8.

- **Design and Concept of Operations reports, Configuration studies are adequate and complete.**

The primary document describing operations was prepared by WMATA and titled "Transit Operations and Maintenance Plan – Dulles Corridor Rapid Transit Project" dated November 2004.

- **Work descriptions and definitions used in designs or specifications are consistent and uniformly applied.**

Refer to Design Overview - Page 8.

General Construction

Grantee's construction planning whether at a project or contract package level has sufficiently analyzed and adequately addressed the following elements:

- **Constructability of the Design.**

Refer to Constructability - Page 11.

- **Availability and use of Site Investigation and Geotechnical information and data by the General Contractor.**

Refer to Geotechnical - Page 9.

- **General Condition's architecture inclusive of requirements for schedule, unit pricing adjustments, additional compensation. Geotechnical risk, Contractor engineering scope, adequacy of mobilization payment and cash flow in general, bonds, insurance, taxes, maintenance and warranty provisions, Contractor field management and supervision and Socio-economic requirements.**

Refer to Design-Build Contract - Page 45.

- **Market conditions for the state/regional/local construction economy for the general contractors/subcontractors on public works and private.**

Refer to the PMOC Spot Report, PG-33A Grantee Project Cost Review, for further discussion of this issue.

- **Market conditions for the national construction economy for transit general contractors/subcontractors.**

Refer to the PMOC Spot Report, PG-33A Grantee Project Cost Review, for further discussion of this issue.

- **Availability of labor for various trades such as electricians, etc.**

Refer to the PMOC Spot Report, PG-33A Grantee Project Cost Review, for further discussion of this issue.

- **Availability of major materials at the bulk commodity level (fuel, cement, steel, copper, plywood/lumber, etc.) and the finished component level (traction power supply and distribution, train control elements, vehicles, microprocessor equipment, etc.)**

Refer to the PMOC Spot Report, PG-33A Grantee Project Cost Review, for further discussion of this issue.

- **Availability of construction equipment/sequencing/timeframe requirements for specially designed, or project specific equipment such as cranes, launching girders, pre mix plants, barges, etc.**

Refer to the PMOC Spot Report, PG-33A Grantee Project Cost Review, for further discussion of this issue.

- **Transportation of project materials to the various jobsites/access points/laydown areas.**

Refer to Constructability - Page 11.

- **Special projects requirements such as permits, environmental inclusive of wetlands, site availability or work day or track window requirements.**

Refer to Permitting - Page 12, local requirements - Page 53 , and Constructability on Page 11.

- **Local community restrictions and accommodations.**

Local community restrictions are covered in the respective interagency agreements. Refer to Page 53.

- **Temporary Construction/Facility requirements and mobilizations.**

Refer to Constructability - Page 11.

- **Weather impacts or concerns and protection of the work.**

Refer to the PMOC Spot Report, PG-34A Grantee Project Schedule Review, for further discussion of this issue.

- **Special projects requirements such as permits, environmental inclusive of wetlands, site availability or work day or track window requirements; impacts such as transportation, social and economic conditions, public open space, historic and archaeological resources, air quality, noise and vibration, contaminated materials and natural resources.**

Refer to Permitting – Page 12, Environmental – Page 29, and Constructability – Page 11.

Contract Packaging

- **Contract packaging for Third-party construction contracts has been structured to maximize competition;**
  - **Contract packages have been kept small enough to allow mid-sized contractors to bid without teaming as joint ventures (which tends to yield higher costs);**

The concept of this project is Design-Build under a Public-Private Partnership. Subcontracting is under the control of the Contractor.

  - **"Procurement only" contracts have been minimized, recognizing there is a higher claims risk when the installation contractor does not have full control of the materials; and**

There are no procurement only contracts.

  - **Third party procurement contracts have been utilized only where long lead-time items will impact project schedule if purchased by construction contractor; and**

Third party contracts have not been used.

  - **Force Account procurement contracts have been utilized only in cases where agency has substantial market leverage or "purchasing power";**

Force account procurement has been used only for selected systems where the agency has an advantageous position for system procurement such as Automatic Fare Collection.

- **Incorporated advance utility / utility relocation contracts, utilizing significant float for these delay-prone activities; cost effectiveness of identifying waste sites / borrow sites to be used at contractor's option as well as advance agreements with utilities and agencies have been negotiated (for TBM power supply, for example), to again be utilized at contractor's option.**

Utility agreements and final utility design have been authorized under an LONP issued December 20, 2006.

- **Contract packaging and project schedule have been coordinated to minimize overextension of agency force account personnel, critical third party (inclusive of Utilities and Fire/Life safety test witnessing or installation work;**

Project is at PE stage and project schedule coordination has not been done.

- **Timing of major bid activity, within schedule constraints, will be managed to maximize contractor competition, with consideration to other major project(s) status in the region such as highway or redevelopment projects;**

This item is the responsibility of the Design-Build Contractor.

- **Developed strategies for Minimizing costs for workers compensation insurance (the largest insurance cost in construction) such as pre-qualifying contractors with their safety "mod" limited to 1.0 or lower and other prequalification criteria, such as unresolved claims history, has been considered;**

This item is the responsibility of the Design-Build Contractor.

- **Analyzed tradeoffs between large size contracts which are often more efficient due to coordination and scheduling constraints and strategies mentioned below have been used to attract industry interest and maximize the number of bidders;**

Project uses a single Design-Build Contractor and has been developed as a Public-Private Partnership. Refer to Review of Design-Build Contract – Page 45.

- **Construction Industry information sessions have been held after advertisement in industry publications in order to attract regional, national, and international contractors**

Project has been developed as a Public-Private Partnership.

SCC 10 Guideway and Track Elements

- **Major or critical engineering decisions and design solutions are defined including rehabilitation or reuse of existing infrastructure, structures, facilities or systems including but not limited to the following:**
  - **Pre-construction, site reconnaissance and geotechnical surveys are complete;**

Refer to Surveys - Page 9.

  - **Ground subsidence and structural protections issues have been resolved;**

Refer to Pages 11.

- **Major or critical work details, structural element dimensions, design interfaces and physical interfaces are complete and well defined in terms of drawings, standards, criteria, specifications and contract package scopes.**

Refer to Pages 8.

  - **Structural elements are advanced beyond simple span design, or simply supported; number of spans, span length, substructure design, construction methods are complete and well defined.**

Refer to Page 16.

  - **Work descriptions and definitions used in designs or specifications are consistent and uniformly applied.**

The descriptions and work definitions included in the specifications and drawings are consistent and uniformly applied. The drawings and the specifications are relatively well developed for the 30-percent, PE stage of design. While many details remain to be resolved, it is apparent that a good deal of input from construction professionals has been utilized thus far in the development of the design and work descriptions. Refer also to Page 8.

  - **Trackwork is advanced to a level where single line schematics of the track layout, plan and profile drawings, dimensioned layouts of turnouts and crossovers, and tabulations of track geometry (horizontal and vertical curve data) have been defined; alignment of tunnel structure referenced to the center line of track and base of rail; guideway sections inclusive of tunnel and station cross sections consistently show the distance from centerline of track to critical clearance points such as walls, walkways and edges of platforms.**

Track design is well advanced and tabulation of track geometry is provided. However, the stations and other guideway details are not yet coordinated with the alignment.

- **Special trackwork is adequately defined.**

Special trackwork has been adequately defined for Preliminary Engineering.

- **Mass balance diagrams complete for vertical alignments on fill or cut are supported by complete, site specific surveys and soil investigations, identification of buried structures and utilities;**

Refer to Constructability - Page 11.

- **Tunnels are well defined in terms of access and egress, construction access and laydown, openings for stations, passage chambers, ventilation or emergency adits, sections and profiles depicting cross sections of major tunnel features; cross checked to adjacent building foundations and coordinated with the vehicle's dynamic envelope, walkways, lighting, systems elements such as ventilation, communications and traction power and egress.**

Refer to Pages 8, 11, and 16. The east cut and cover tunnel has been packaged with the NATM tunnel.

SCC 20 Stations, Stops, Terminals, Intermodal Facilities

- **Major or critical operational, fire/life safety, security requirements whether in the existing system or extension that result from the project have been defined inclusive of NFPA 130 requirements.**

Refer to Page 21.

- **Major or critical engineering decisions and design solutions are defined including rehabilitation or reuse of existing structures, facilities or systems including but not limited to the following:**
  - **Pre-construction, site reconnaissance, geotechnical and soil resistivity surveys are complete;**
  - **Ground subsidence and structural protections issues have been resolved;**
    - **Rock characteristics (fracture planes, hardness and cleavage) have been established in the form of at least two parameters for the design of the rock support in the station caverns, the crossover caverns, the TBM tunnels, drill/blast tunnels, etc.,**
    - **Subsurface exploration or laboratory testing program, review of building types and foundations and methods of construction are completed.**
  - **Structural elements are advanced beyond simple span design, or simply supported.**

Refer to Survey – Page 9, Geotechnical – Page 9, and Page 21

- **Stations, parking lots and transportation related facilities footprints are well defined in terms of access and egress, vertical circulation, life safety and security with bills of materials, architectural rendering by type of stations (such as tunnel, elevated, surface, etc.) general arrangements, typical side elevation, typical center section, lighting and Passenger Information system (PIS); agents booth, cable trays, utility tunnels, elevator/escalators, passenger facilities, security features.**
  - **ADA scope elements have redundancy and lack of power, mechanical failure, or "stranding" of handicap patrons on platforms, etc. issues are addressed**

Refer to Page 21.

- **Major or critical work details, structural element dimensions, design interfaces and physical interfaces are complete and well defined in terms of drawings, standards, criteria, specifications and contract package scopes.**

Refer to Page 21.

- **Drawings consist of typical and standard drawings of various station components and details, finish schedules and schematics for each station and for each specific station, the plans begin with a site plan and composite plan, longitudinal section of the platform and mezzanine levels for general orientation; as well as sections showing the layout, placement of components, and basic dimensions of the platform and mezzanine levels, entrance structures, and ancillary buildings.**

Refer to Page 21.

- **Mass balance diagrams complete for vertical alignments on fill or cut supported by complete site specific surveys and soil investigations, identification of buried structures and utilities; Taking into account the presence of contaminated soils which would have to then be backfilled or would otherwise be unavailable for backfilling somewhere else on the project, or lack adequate construction access.**

Mass balance diagrams are generally not required for the stations or the garage project; all structures are at-grade or aerial structures. Existing utilities are identified in the plans. The Wiehle Avenue site is presently used as a Park and Ride lot. Refer also to Page 21.

- **Access and laydown areas are defined and budgeted.**

Refer to Page 21.

SCC 30 Support Facilities: Yards, Shops and Administration Buildings

- **Major or critical operational, maintenance (heavy and light, wayside, facilities and vehicle), fire/life safety, security and logistics (spares, rebuild, training, documentation)**

requirements, whether in the existing system or extension that result from the project, have been defined.

Refer to Page 26.

- **Major or critical engineering decisions and design solutions are defined including rehabilitation or reuse of existing structures, facilities or systems including but not limited to the following:**
  - **Pre-construction, site reconnaissance, geotechnical and soil resistivity surveys are complete;**
  - **Ground subsidence and structural protections issues have been resolved;**
  - **Structural elements are advanced beyond simple span design, or simply supported.**

The yard is an existing facility for which the site conditions are well known and are properly included in the design. Refer also to Page 26.

- **Major or critical work details, structural element dimensions, design interfaces and physical interfaces are complete and well defined in terms of drawings, standards, criteria, specifications and contract package scopes.**

For the yard expansion, the critical details and structural element decisions have been made and interface with the existing facilities has been addressed. Design of the shop expansion is being progressed as Supplemental Engineering. Refer also to Page 26.

- **Mass balance diagrams complete for vertical alignments on fill or cut supported by complete site specific surveys and soil investigations, identification of buried structures and utilities, taking into account the presence of contaminated soils which would have to then be backfilled or would otherwise be unavailable for backfilling somewhere else on the project, or lack adequate construction access.**

Fill is required for the yard expansion, the traction power substation, and an access road to this area. Site conditions are adequately addressed. The balance of any excavation from the shop expansion has not been addressed. Refer also to Page 26.

- **Access and laydown areas are defined and budgeted.**

Access and laydown areas at West Falls Church Yard are not specifically addressed at this time.

SCC 40 Sitework and Special Conditions

- **Major drainage facilities, flood control, housing types, street crossings, traffic control, utilities, are defined and physical limits and interfaces identified, based upon site specific surveying with digitized data integrated into alignment base mapping, plan profiles.**

Refer to Site Utilities and Utility Relocation on Page 28.

- **Major or critical engineering decisions and design solutions are defined including rehabilitation or reuse of existing structures, facilities or systems including but not limited to the following:**
  - **Pre-construction, site reconnaissance, geotechnical and soil resistivity surveys are complete;**

Refer to Surveys – Page 9.

  - **Ground subsidence and structural protections issues have been resolved;**

Refer to Geotechnical – Page 11.

  - **Structural elements are advanced beyond simple span design, or simply supported.**

Retaining wall structures, where not part of the guideway, are similarly well developed at the 30% design level.

- **Major or critical work details, structural element dimensions, design interfaces and physical interfaces are complete and well defined in terms of drawings, standards, criteria, specifications and contract package scopes.**

Refer to Site Utilities and Utility Relocation – Page 28 and Accessways and Landscaping – Page 30.

- **Mass balance diagrams complete for vertical alignments on fill or cut supported by complete site specific surveys and soil investigations, identification of buried structures and utilities; Taking into account the presence of contaminated soils which would have to then be backfilled or would otherwise be unavailable for backfilling somewhere else on the project, or lack adequate construction access.**

Existing structures and utilities are identified in the plans. Sites with possible contamination are being identified and the RAMP includes procedures for identification and effecting the remediation of contaminated sites (Section 3.8 Environmental Site Assessments). Refer also to Constructability - Page 11 and Real Estate Procurement – Page 39.

- **Identification of access and laydown areas is defined and budgeted.**

Refer to Constructability - Page 11.

SCC 50 Systems

- **Systems (wayside and facility), Trackwork (running and special), and Vehicle (revenue and non-revenue) descriptions, functionalities, reliabilities, technology (level identified**

and cost effectiveness known) and performance are defined to the level of major equipment (including the control room, substations, crossings, tunnel ventilation, and traction power) is well defined and identified in terms of specifications, bills of materials, standard drawings and specifications, general arrangements and standard details, and single line drawings (similar to industry process and instrumentation diagrams, high level logic design).

Train Controls & Communications: The train control and communication sub-system elements are consistent in terms of content, presentation, clarity, cross referencing and details for the appropriate design level. Major or critical requirements, operational functionalities, technology level and performances have been defined to the level of major equipment – control equipment, control panel and indicating track circuits, bonds, switch machines, power supply for Train Control. Typical design for Passenger Information and Display System (PIDS), PAS, Fire and Intrusion Alarm (FIA), CCTV cameras and monitors, help-point intercoms for passengers, telephones and ETS have been developed for the communication in the drawings. Communications Equipment room, rack and equipment layouts have been detailed and sized. Agency work is not clearly defined.

Traction Power: The scope of design as shown on the 100% PE drawings includes, construction of 10 new traction power substations, three tie circuit breaker stations, duct banks, distribution of positive and negative power cables throughout the proposed right-of way. The substations are identified, numbered, and located on the ROW drawings. Appropriate descriptions, functionalities and reliability are included. Appropriate, proven, industry-accepted technologies are utilized. Major equipment specifications are identified as WMATA standard specifications. Where modifications were necessary, addenda were prepared to reflect the required specification changes. One line diagrams were developed for each traction power substation and tie circuit breaker station. Substation equipment arrangements and some details are included. The level of design of diagrams and logic design for traction power substations is appropriate for the PE phase. For the High Voltage (34KV) Distribution System, the design documents consist solely of one line schematic diagrams. Major equipment, cabling, functionalities, reliability and technology are not appropriately defined. Appropriate level drawings, specifications, bill of materials and details have not been prepared. Installation of the Distribution System is in negotiations with DVP.

See also Track – Page 20 and Vehicles – Page 41.

- **Signaling and Train Control**
  - **Operations analysis has determined the most efficient location of interlockings based on track layout, headways, train lengths, braking tables as well as requirements of each interlocking and its control limits.**

Operational simulations have been performed to determine the most efficient location for interlockings, and the recommendations reviewed with WMATA operations managers.

- **Track plans have been sufficiently developed to define and identify vertical grades, horizontal and vertical curves, elevation, station platforms, switch point stationing, rail bonding and connection requirements as well as typical track circuit drawings.**

Track plans have been sufficiently developed for the 100% PE level of design, as well as track circuit plans and switch locations.

- **Site specific requirements are defined (for signal structural work) and location drawings for signal enclosures**

Site locations for signal structures have been identified and factors such as topography and proximity to other structures have been considered. Additional specific requirements will be identified during Final Design.

- **Central instrument rooms (CIR), central instrument huts (CIH), central instrument locations (CIL), relay rooms; locations and sizes as well as Room layouts (relay, termination, central instrument, power) are identified and defined.**

Typical drawings have been developed for signal huts, relay and instrument rooms. Modifications will be made as the final signal design is progressed.

- **Signal cable routing methodology as well as power supply and distribution are identified and defined**

Cable routing methodology, which includes ductbanks, has been developed. Power supply and distribution requirements have also been identified and defined. There is an "Open Item" related to track circuit cable separation. WMATA has requested a change to the train control and signals criteria to provide for separation of track circuit cables that carry like frequencies for train detection.

- **Software and interface requirements (to facilities, existing system, and other system elements) are identified and defined**

WMATA standards for system interface are defined. Specific interface details will be developed during Final Design.

- **Maintenance, Testing, and Training requirements are identified and defined (factory acceptance, site acceptance, field integration, start-up, etc.)**

WMATA standards for testing, training and maintenance procedures will apply. Specific testing, training and maintenance procedures will be determined as the system equipment vendors are selected during the procurement phase.

- **System Description:**
  - **Built-in-place substations are identified, numbered and located with approximate spacing along the system route and ratings (MW) as well as the details (e.g. three phase nominal 12.47–13.2 kV distribution circuit [name utility]) and any exceptions.**

Power is provided by Dominion Virginia Power, the local electric utility, at 34.5 kilovolts from three distribution substations. All traction power substations are feed from two of the utility substations. The substations are identified, numbered, and located on the ROW drawings. The substations locations are properly spaced. All substations indicate their traction power Megawatt ratings.

  - **Nominal (full-load Vdc) project voltage is identified and basis of design and choice of project nominal voltage relative to system voltage is identified, voltage drop minimization, maximization of vehicle propulsion system performance, and train regeneration issues have been addressed.**

Nominal DC voltages are identified as 750VDC. The choice of project voltage is based on the existing WMATA DC voltage requirements, as the existing WMATA rolling stock must be able to operate on the extension. Substation and Tie Breaker substations were located to maintain proper voltage levels with one substation out of service. The system does not utilize power regeneration.

  - **Overhead contact system (OCS) is defined including conductor sizes relative to existing parts of system, as well as any supplementary parallel feeders to meet design requirements for substation out of service scenario.**

Traction power is distributed by over-running third rail. A power distribution simulation was done to verify the choice of substation location and to verify that voltage is adequate under conditions of a traction power substation outage.

  - **AC Switchgear type (i.e. indoor, metal clad vacuum circuit type breaker, etc.), rating (i.e., 15 kV, 500 MVA, etc.) and relay protection provided (phase overcurrent protection, ground overcurrent protection, negative sequence voltage relay, rectifier overload relay, AC lock-out relay, etc.).**

AC switchgear and feeder circuit breaker specifications are identified as WMATA standard specifications. Where modifications were necessary, addenda were prepared to reflect the required specification changes. The switchgear type (metal clad) and ratings are defined on the drawings and/or in the equipment specifications. Fault current and protective relay design has not been developed and will be addressed during the design-build period. DRPT is investigating the use of outdoor AC switchgear as a cost savings measure. AC switchgear will comply with all utility company requirements.

  - **Traction Power Transformer type (i.e. vacuum pressure impregnated dry type, etc.) and ratings (i.e., 1110 kVA 65°C rise at 100% load, three phase, 60 Hz., ANSI and NEMA standards for extra heavy-duty service).**

The design utilizes two types of power transformers; oil-filled outdoor transformers and indoor dry-type transformers. The transformer design requirements are in accordance with WMATA design standards and recent procurements of the IRP and Metro Matters Capital Programs.

- **Power rectifiers are matched and assemblies capable of providing a stated output such as .." twelve pulse, 825 VDC output at rated 100% load with the overload capabilities as specified in NEMA RI-9 for extra heavy-duty traction service." Harmonics in the utility power lines and the interference voltages due to residual ripple issues have been addressed in the design.**

Power Transformer and rectifier equipment is identified and matched. The rectifier design requirements, relative to pulse, ratings, etc are in accordance with WMATA design standards and recent procurements of the IRP and Metro Matters Capital Programs.

- **DC Switchgear basis of design and choice of switches, busses and feeder breakers is identified and the equipment list is complete.**

DC switchgear and feeder circuit breaker specifications are identified as WMATA standard specifications. Where modifications were necessary, addenda were prepared to reflect the required specification changes. The switchgear type (metal clad) and ratings are defined on the drawings and/or in the equipment specifications. DRPT is investigating the use of outdoor switchgear as a cost savings measure.

- **Programmable Logic Controller (PLC) system if provided integrates and control intercubicle functions and provides control, monitoring, and data logging at each substation.**

The requirements of the PLCs have not yet been defined and will be developed during the design-build period.

- **Substation grounding system basis of design and choice of separate AC and DC ground mats as well as stray current monitoring or testing, lightning arresters and protective relays and fault current contribution from the AC equipment to the DC equipment issues and utility system faults have been addressed.**

Substation ground grid and grounding details are provided, including lightening arrestors. The over-current protection design has not been prepared and will be accomplished during the design-build period.

- **Minimum voltage at the pantograph is identified and basis established for locations during the sustained FFGA project headways with substations operating, or with ".." substations out of service. If substations are required, under voltage conditions are identified with one substation out of service and the operation plan identifies mitigation measures.**

The Traction Power distribution system will be a contact (third) rail system in order to be compatible with the existing WMATA traction power distribution system. There is no overhead catenary distribution system in the project scope. The traction power substations are designed and spaced to permit full normal train operations with any one substation off line. DRPT is considering requesting an exception to the minimum voltage requirement with one substation off line as a cost savings measure.

- **Overhead Contact Systems (OCS) are identified in terms of Single Contact Wire Auto Tensioned, Simple Catenary Auto Tensioned and Balanced Weight Anchor Assemblies and issues associated with temperature variations are addressed as structures identified. Tensions for the contact wire and messenger wire are defined; maximum distances between tensioning points is identified depending on the amount of curves and the individual track configuration, reduced to ensure the auto tensioning effect of the wheel assembly; mid-point anchor installation details and locations identified to reduce the along-track movement of the OCS equipment and minimize the work in case of a conductor breakage; OCS is sectionalized to provide isolation of the OCS section at each substation and basis for design is established and design issues associated with insulated overlaps, section insulators, electrical continuity, overlaps and at crossover locations are addressed. Substation buildings, including low voltage substation AC auxiliary electrical system and facility electrical equipment such as AC panelboards, heating and ventilation systems, transformer partitions, embedded conduit work, utility instrument enclosure, door intrusion switches, lighting, and substation ground mats are built into or coordinated with the Civil contracts in advance of the associated system contract.**

Traction power is distributed by over-running third rail. There is no overhead catenary distribution system in the project scope. Third rail sectionalization is consistent with WMATA standards. Substations and section break stations are adequate for PE in that all support systems are enumerated and ample space is provided. Auxiliary panel schedules have been developed. DRPT has requested an exception to WMATA criteria to provide heater elements for the entire third rail.

- **Major or critical engineering decisions and design solutions are defined including rehabilitation or reuse of existing structures, facilities or systems including but not limited to the following:**

For the train control system, Interlocking Control Panel Revisions for West Falls Church and East Falls Church have been documented and interfaced with the existing facilities.

- **Pre-construction, site reconnaissance, geotechnical and soil resistively surveys are complete;**
- **Ground subsidence and structural protections issues have been resolved;**
- **Structural elements are advanced beyond simple span design, or simply supported.**

The level of design of site reconnaissance, geotechnical and soil resistively surveys, ground subsidence, and structural protection is consistent with PE for systems. Structural details have

been developed for substations located at passenger stations. For substations that are not located at passenger stations, site specific details are not provided. This item needs to be addressed during the design-build phase; however, it does not represent a significant scope risk to the project.

- **Major or critical work details; structural element dimensions, design interfaces and physical interfaces are complete and well defined in terms of drawings, standards, criteria, specifications and contract package scopes.**

Train Control and Communications Systems:

- The control panel layouts for the new interlockings, Track plan for interlockings with locations of signals, track circuits, impedance bonds, IDW alarm circuits, ATC-Route and locking chart, vital and non-vital control circuits, operation commands and circuits have been developed and packaged.
- Block Design responsibility for the Design-Build Contractor has been defined.
- The ATC/TP is at 95% Design level which is to be brought up to 100% PE Design level.
- Interfaces both in physical and control elements have been documented. The complexity of the signal system and the interfaces to the existing system requires that certain elements of work be performed by WMATA forces. There currently is no detailed force account plan for this work, nor is there documentation developed which defines the demarcation of responsibility between WMATA and Design-Build Contractor, particularly for interfaces, installation, and testing of the system. The lack of a force account work plan represents a scope risk to the project.
- The Train Control Design headway of 90 seconds is not likely to be implemented for a long-time due to both physical and headway constraints existing on the main line. One potential cost saving measure would be to revise the design headway to 180 seconds or greater.
- In the design of Communications and Central Control systems, the scope of work for WMATA Force Account staff is not defined to the 30% design level.

The level of design of design interfaces and physical interfaces are consistent with PE**.** Structural details have been developed for substations located at passenger stations. For substations that are not located at passenger stations, site specific details are not provided.

SCC 60 ROW, Land and Existing Improvements

- **Major drainage facilities, flood control, housing types, street crossings, traffic control, utilities, are defined and physical limits and interfaces identified, based upon site specific surveying with digitized data integrated into alignment base mapping, plan profiles.**

The ROW issues and limits are well defined. The remaining ROW scope risk concerns whether design plans will be sufficiently complete with respect to ROW limits when ROW production work starts. It is key to the scope issue if ROW parcels can be acquired without renegotiations that will be required if further design changes are made. If the design is preliminary such that

ROW cannot be acquired without future changes, the project schedule and cost may be affected adversely.

- **Right-of-way drawings and lists that identify the full takes, 90% of partial takes, fully coordinated with mass balance diagrams, structures and facilities, utilities and base maps; identification of major or critical eminent domain issues; identification of street or rail crossings that can be closed and construction easements, access and laydown areas are defined and budgeted.**

The ROW plans are acceptable as they now exist based on the 100% PE design plans with supplemental revisions. As indicated in the ROW scope characterization in this report, if there are future design changes that result in revised ROW requirements and the reworking of ROW work products, then delay of schedule and increased ROW costs can be anticipated. There are no critical eminent domain issues apparent at this time. No rail crossings are involved in this project.

- **ROW requirements are separately identified for Guideway, Facilities and Utilities in terms of both acquisition and easements. Two step acquisitions, namely acquisition of easements first and then acquisition of the property, are identified with rationales for its use.**

The Right of Way Acquisition Plan dated May 2007 appropriately discusses the earlier acquisition of property interests in order to facilitate utility relocations. The two step process referred to above is no longer being considered.

SCC 70 Vehicles

Vehicle (revenue and non-revenue) descriptions, functionalities, reliabilities, technology (level identified and cost effectiveness known) and performances are defined to the upper level of assembly, major equipment, general arrangements of cabin and cab as well as drawings List and drawings submittal schedule as well as:

- **System Functional Description has been developed and advanced to include the following:**
  - **Definition of the subsystems that constitute the overall system**
  - **Description and graphic depiction of each interface between subsystems**
  - **Description of how each subsystem will meet the requirements of the Specification.**
  - **Definition of interfaces between components**
- **Materials Specifications has been developed and advanced to include lists of qualified materials, such as Brake shoe composition, electric components, refrigerants, lubricants, cleaners, paints/coatings, wiring, etc.**
- **Testing Requirements has been developed and advanced to include the following:**
  - **High level Test Program Plan for both production and on-sight acceptance should be underway (including requirements for factory inspection and testing, First**

Article and Pre-shipment inspections, static and dynamic testing and conditional acceptance).

- **Maintenance and Training Requirements should be defined and identified including development of maintenance and training requirements for new system elements.**

WMATA standards for rail vehicle clearance and operational parameters are incorporated in the PE documentation for construction of the Wiehle Avenue Extension.

Preliminary Engineering for the rail vehicles is being developed from the 6000 Series Technical Specification. All checklist items are addressed in detail in the WMATA 6000 Series Technical Specification; technical and procedural improvements are being included in the 7000 Series Technical Specification (Dulles Corridor Cars). Refer also to Page 41.

There are no specifications put forth for any of the non-revenue equipment or other vehicles.

SCC 80 Professional Services and Agency Costs

- **The roles and responsibilities of professional contractors (engineering/CM) versus those of the grantee (staff and any consultant support) are also well defined in terms of contract package scopes, cost estimates and schedules.**

A review of the revised draft of the Design-Build Contract dated April 26, 2006, the Appendices to Design-Build Contract, dated February, 2005 (Exhibit 1.1, Definitions – Revised April 26, 2006) indicates that the roles of the DRPT, the Contractor and other interested partners, sponsors and parties such as WMATA, MWAA and VADOT, are outlined in the draft of the Design-Build contract, but these roles remain to be fully defined. Several sections of the Design-Build contract note revisions are expected when MWAA assumes responsibility for the project.

- **Scope is defined in terms of deliverables versus level of effort.**

There are provisions for both continuous supervision by DRPT of the on-going design development effort as well as design submittals to be made at a 60% and a 95% design completion. Definition of the content of each of these reviews is included in the Design-Build contract.