U.S. DOT Federal Transit Administration
TPM-20 Office of Capital Project Management
Project Management Oversight

Oversight Procedure 32C - Project Scope Review

1.0 PURPOSE

The purpose of this Oversight Procedure is to describe the review, analysis and recommended procedures and reporting requirements that the Federal Transit Administration (FTA) expects from the Project Management Oversight Contractor (PMOC) regarding the sponsor's project scope. The purpose of the review is to verify that the scope of the project represented by the totality of all documentation, including environmental documents, basis of design and design criteria, third-party agreements, Real Estate Acquisition and Management Plan, and contract plans and specifications is internally consistent, defined to a level appropriate for the project development phase and applicable project delivery method, consistent with the estimated cost and schedule, and when applicable, consistent with the scope approved by FTA in the Sponsor's approval letters and Letters of No Prejudice (LONP), Letters of Intent (LOI), Early Systems Work Agreements (ESWA) and Full Funding or Small Starts Grant Agreements (SSGA).

2.0 BACKGROUND

Monitoring scope as the project moves through the various phases of development benefits cost control and management of risks inherent in the design and construction process. The scope of a transit project funded by Section 5309 or other federal funds is first established through the development of alternatives, and the selection of a preferred alternative. The scope at that point is often defined in general terms by the type of transit technology to be employed, the length of the project, the number of stations, and other general characteristics. The project scope is continuously refined as it moves through the successive phases of Project Development and Engineering. The scope of the project is first defined at the completion of the environmental review process required under the National Environmental Policy Act (NEPA) and ultimately the scope of the project is established in the Full Funding Grant Agreement (FFGA) or Small Starts Grant Agreement (SSGA) entered into between the Sponsor and the FTA. Any changes in the scope as defined in the FFGA or SSGA are expected to be minor in nature, and any significant changes are subject to the approval of the FTA.

The scope of the project is subject to FTA review as part of the process of approving the Sponsor's entry into Engineering, and later, prior to award of an FFGA or SSGA. Ideally, scope definition and refinement occurs during the Project Development Phase. The scope of the project should be very well defined at the completion Project Development or early in the Engineering phase; the later stages of the Engineering phase should be limited to preparing the drawings, specifications and related documents necessary for construction. In practice, however, some projects are not completely defined at the completion of the Project Development phase and additional definition is provided during the Engineering phase. Note that the effort to define (or redefine) any particular element of project scope becomes increasingly costly and disruptive as the project moves from the evaluation of alternatives through Project Development, Engineering, and into construction. The cost of a construction change order is greater and its impact on completion of the project is more significant than if the change had

occurred prior to bid. This is especially true if an alternate project delivery method such as design-build has been selected. For these reasons, the scope must be tightly defined prior to advertising the work for construction, or design and construction in the case of an alternate delivery method.

If the sponsor has selected a design-build project delivery method, the most important design document will be a performance specification. This document will determine what the construction contractor has to deliver, and once under contract, the Sponsor gives up the right (subject to contractual provisions) to make detailed design decisions. Because of the nature of a design-build contract, a change in scope that occurs after contract award is likely to be much more costly than a similar change to a project being built using a design-bid-build process. This result occurs because any scope change will affect both the design schedule and the construction schedule, which are closely tied by the design-build contract.

> In the TCRP Report G-07, *Managing Capital Costs Of Major Federally Funded Public Transportation Projects* (2006), the Transportation Research Board notes that project definition entails the "conceptualization of the alternatives and the refinement of this project definition through the course of the project-development process. The inception and evolution of a project can have a large impact on the capital costs. In particular, the level of design is an important factor affecting the uncertainty of the capital costs and the subsequent variation in the estimates.
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> Clear cost priorities, established early in project development, are important to cost and schedule performance. These priorities should be reflected in the initial evaluation of alternatives. Establishing clear budget and schedule constraints early in the project-development process helped contain scope creep and identify reasonable project-development schedules. However, some flexibility with respect to scope and schedule should be maintained in the project-development process in order to adapt to the more unique project conditions identified throughout the development process. This flexibility combined with appropriate budgetary targets and reasonable developmental schedules formed the successful factors in project definition."
>
> Further: "[t]he project definition strategies that contributed the most success to the project-definition process were a transparent development process with extensive stakeholder input, a reasonable project-development schedule that reflects sufficient time for stakeholder outreach, *a value engineering exercise at each stage that reconsiders the definition results to that point, and a design-to-budget approach that maintains budgetary considerations within each stage of project development."* (Emphasis added.)

3.0 OBJECTIVES

The objective of this review is to assess the Sponsor's definition of the project scope as represented by environmental documents and permits, basis of design and design criteria, third party agreements, Real Estate Acquisition and Management Plan, drawings, specifications, narratives, plans for project delivery, etc., for adequacy and completeness given the phase; for internal consistency; for compliance with applicable laws, regulations, policies, etc.; bid-ability and constructability. If the review is performed after issuance of approval letters, Letters of No Prejudice (LONP) or Early Systems Work Agreements (ESWA) or award of an FFGA or SSGA, the review may include verification that the

scope definition still meets the functional requirements documented in the approval letter, LONP, ESWA, FFGA or SSGA.

4.0 REFERENCES

The following are the principal, but by no means the only, references to Federal legislation, codification, regulation and guidance with which the PMOC should have a good understanding as related to the Sponsor's project work being reviewed under this OP:

4.1 STATUTES AND LEGISLATION

- Moving Ahead for Progress in the 21st Century Act (MAP-21), Pub. L. 112-141, effective October 1, 2012.
- National Environmental Policy Act of 1969, as amended, 42 U.S.C. §§ 4321 et seq.
- Americans with Disabilities Act of 1990 (ADA), as amended by the ADA Amendments Act of 2008 (Pub. L. 110-325).

4.2 EXECUTIVE ORDERS

- Executive Order 11988 - Floodplain Management, May 24, 1977, 42 Federal Register 26951, page 117, 3 CFR, 1977 Compilation, page 117, as amended.

4.3 REGULATIONS

- Project Management Oversight, 49 C.F.R. Part 633
- Chapter 53 of Title 49 as amended by MAP-21 provisions
- 49 CFR Part 602, Emergency Relief Program, Interim Final Rule, 78 Federal Register 61, March 29, 2013, pages 19136 – 19147.
- 49 CFR Parts 27, 37 & 38: U.S. Department of Transportation regulations implementing the transportation provisions of the ADA. http://www.fta.dot.gov/civilrights/ada/civil_rights_5936.html. Important to the design of transit stations are paragraphs 206.3 regarding the location of accessible routes relative to general circulation paths, and 810.5.3 regarding the coordination of platform and rail car door height. Paragraph 810.5.3 also contains language correcting a misunderstanding of 49 CFR 38.71(b) (2) concerning light rail.

4.4 GUIDANCE

- Project and Construction Management Guidelines, 2011 Update
- Project Construction Management Handbook, 2013
- FTA Standard Cost Category Workbook (SCC) http://www.fta.dot.gov/planning/newstarts/planning_environment_2580.html

5.0 PROJECT SPONSOR SUBMITTALS

The PMOC should obtain the most current versions of the following documents from the Sponsor. Depending on the project phase in which this review is completed, not all of the documents below will be available.

- Written Project Description
- Environmental Documents (FEIS/ROD; EA/FONSI; CATEX)
- Basis of Design Reports, Design Criteria Reports

- Design Documents (Plans, Performance Specifications and Specifications)
- Project Management Plan, Project Delivery Plan
- Real Estate Management Plan (RAMP) with current status
- Risk and Contingency Management Plan or Risk Register (if available)
- Permits
- Project Schedule
- Current Capital Cost Estimate
- Review documents
  - Independent Cost Estimates
  - Threat and Vulnerability Assessments
  - Hazard Analyses
  - Value Engineering Reports
  - Constructability Reviews
  - Risk Assessment Reports
- Documentation of changes to scope that have occurred since last milestone
- Approval letters, Letters of No Prejudice (LONP) or Early Systems Work Agreements (ESWA) issued by the FTA
- Full Funding Grant Agreement or Small Starts Grant Agreement and Attachments; approved and pending amendments

6.0 SCOPE OF WORK

6.1 PMOC QUALIFICATIONS

The individual or team of individuals selected to perform this evaluation should have extensive experience in the planning and delivery of large, complex, federally funded transit projects. The experience should include familiarity with the issues usually presented during the construction phase of such projects.

6.2 PRELIMINARY DOCUMENT REVIEW

Upon receipt of the assignment, the PMOC should obtain the specified materials from the Sponsor. The PMOC may already be generally familiar with the project as a result of on-going monitoring activities. If the assigned personnel are not familiar with the project, they should review the materials in preparation for their on-site visit.

6.3 PROPOSED APPROACH TO REVIEWING THE SCOPE – A SAMPLING PLAN

The PMOC shall propose to FTA an approach to reviewing the Sponsor's scope documentation that, regardless of the level of development of the project, will provide FTA with reliable analysis and recommendations. The proposal should include a description of the level of sampling of the documentation.

6.4 ON-SITE REVIEW MEETING

The PMOC should arrange for an on-site briefing by the Sponsor's project management team. The briefing should include a narrative description of the project scope supplemented by suitable graphics with particular emphasis on any changes in the scope of the project that have occurred since the last major review milestone, e.g. commencement of project development, commencement of engineering, execution of the FFGA or SSGA. The discussion of project scope should include a review of the Sponsor's plan for project delivery, any changes in the Sponsor's plans for managing the project through the construction, start-up, testing and acceptance phases, and any changes in external factors such as right-of-way, permits or third-party agreements that would affect project scope.

6.5 REVIEW AND ASSESSMENT

The PMOC should review the Sponsor's internal plan to check and review its design for scope completeness and coordination. The PMOC should review the adequacy and timing of the checks planned and implemented by the Sponsor. Checks may be in the form of peer reviews and/or independent or internal design reviews that ensure the design provided to the PMOC for FTA's review is, at a minimum, adequately complete given the project phase, internally consistent and coordinated.

The Scope Review Checklist, attached as Appendix B, provides a guide to evaluating the scope for completeness. The checklist should be used in conjunction with the project cost estimate and schedule to develop a comprehensive understanding of the scope and as a cross-check for scope omissions and conflicts.

The PMOC should address the following questions. The answers should be comprehensive, with sufficient information to allow the reader to develop a complete understanding of any significant changes in the scope of the project since the last major milestone.

1) What changes in project scope have occurred since the last major milestone e.g. commencement of project development or engineering, execution of the FFGA, or SSGA?.
2) Have the known changes been incorporated into the documents, design criteria, plans, specifications, related Management Plans, and the Grant Agreement?
3) Are there any additional known or anticipated changes to scope at the time of this assessment?
4) Do the project delivery plans and construction documents reflect the full scope of the project? If not, identify any missing elements.
5) Does the current capital cost estimate and schedule correlate with the known and anticipated scope of the project?
6) Identify any unknown or uncertain conditions (e.g., real estate to be acquired, permits to be issued, and third-party agreements to be finalized) that may affect the cost and/or schedule for construction and assess the Sponsor's plan and schedule for resolving these issues.
7) Do the contract documents address these unknown or uncertain issues in a way that appropriately allocates risk and avoids incurring unnecessary costs?

8) Based on this review of the project and its current documentation, are there likely to be changes in project scope (including related cost and schedule impacts) beyond those ordinarily expected of a project at this phase of development. If so, identify these items and discuss the Sponsor's plan for resolving them.

9) If the scope of the functional elements of the project has changed, e.g., longer/shorter alignment, fewer/more stations, fewer traction power substations, etc., can the revised project still meet the capacity requirements of the program and as approved in the FFGA or SSGA?

The PMOC shall assess and evaluate Sponsor and material third party project information and data. Then the PMOC shall produce characterizations of the project scope that integrate and summarize available information and data for the project, providing professional opinions, analysis, information, data and descriptive text in an accessible and understandable format.

1) Such project information can include but is not limited to scope, capacity, level of service, functionality, reliability, etc.

2) Characterizations for individual scope elements such as guideway, vehicles, systems, etc. shall be sufficient to provide FTA with a project-level and element-level of understanding.

3) For projects in Project Development or Engineering, the PMOC shall review and characterize the Sponsor's project scope in terms of its descriptions, designs, products, etc. using the checklist from Appendix B to determine that:

   a) The scope is substantially consistent with the scope adopted in the environmental decision document, e.g., Record of Decision, Finding of No Significant Impact or Categorical Exclusion;

   b) The scope will support the level and quality of revenue service typically offered by the Sponsor;

   c) Proprietary systems or methods specified will permit a reasonable number of construction contractors with the appropriate expertise to compete for construction packages;

   d) Major work details, structural element dimensions, design interfaces and physical interfaces are complete and well defined;

   e) Plans and drawings or performance specifications are adequate in terms of content, presentation, clarity, cross-referencing and detail;

   f) Roles and responsibilities of construction contractors versus those of the Sponsor's team of staff and consultants or other third-parties are well defined;

   g) Project is constructible.

4) Review and characterize the Sponsor's project systems and vehicle design. Determine whether the Sponsor has matched appropriate technologies with the planned transit applications for the best performance at a reasonable cost.

5) In the absence of adequate scope detail for a given level of design, the PMOC shall validate project data by comparing the current Sponsor assumptions to relevant, identifiable industry standards or experience.

6) The PMOC's findings should be presented in order of importance (most likely, largest

consequences, etc.) and accompanied by recommendations for modifications or additional work by the Sponsor along with a time frame for the performance of the work.

7.0 REPORT, PRESENTATION, RECONCILIATION

The PMOC shall provide FTA with a written report of its findings, analysis, recommendations, professional opinions, and a description of the review activities undertaken. After FTA approval, the PMOC should share the report with the Sponsor. In the event that differences of opinion exist between the PMOC and the Sponsor regarding the PMOC's findings, the FTA may direct the PMOC to reconcile its findings with the Sponsor and provide FTA with a report addendum covering the agreed modifications by the Sponsor and PMOC.

The report formatting requirements of OP 01 apply. When necessary, the PMOC shall perform data analysis and develop data models that meet FTA requirements using Microsoft Office products such as Excel and Word and use FTA-templates when provided. The PMOC may add other software as required but documentation and report data shall be made available to FTA.

APPENDIX A

Acceptable Quality Level

	DESIRED OUTCOME	PERFORMANCE REQUIREMENT	CHECK LIST	ACCEPTABLE QUALITY LEVEL (AQL)	PERFORMANCE MEASURE	MONITORING METHOD
1	PMOC shall review and analyze the scope of Sponsor's project and its completeness and consistency with Project documentation.	**R1a.** The PMOC shall develop and document a process for review and analysis of Sponsor's overall project scope.		**Q1a.** Process exists and has been followed.	**M1a.** Evidence of a documented process.	**MM1a.** Periodic review by FTA or its agent.
		R1b. The PMOC shall use its process to analyze the completeness and consistency of Sponsor's overall Project scope.		**Q1b.** PMOC must verify internal processes as documented have been followed.	**M1b.** Documented review and analysis of the overall project scope and supporting documents for completeness, definition and consistency.	**MM1b.** Periodic review by FTA or its agent.
2	The PMOC shall review the scope of Sponsor's project prior to advertising for construction; verify project scope is internally consistent with contract plans and specifications, cost and schedule.	**R2a.** The PMOC shall review all Project scope documentation and arrange an on-site briefing from the Sponsor.		**Q2a.** Professional opinion of scope review through Sponsor's submittals and on-site briefing.	**M2a.** Documented evidence of a thorough review by PMOC and attendance at an on-site briefing by Sponsor, supported by professional opinion.	**MM2a.** Periodic review by FTA or its agent.
		R2b. The PMOC shall review for adequacy and timing Sponsor's plan for checks and reviews for scope completeness and coordination.		**Q2b.** Professional opinion and review of Sponsor's plan of scope checks and reviews.	**M2b.** Documented evidence of review of Sponsor's check and review plan for scope completeness and coordination, supported by professional opinion.	**MM2b.** Periodic review by FTA or its agent.
		R2c. The PMOC shall, in conjunction with Project cost estimate and schedule, develop an analysis of significant changes in scope since the last major milestone.		**Q2c.** Professional opinion and review of Project scope and significant changes in scope.	**M2c.** Documented evidence of review of the overall project scope and supporting documents with analysis of scope changes, supported by professional opinion.	**MM2c.** Periodic review by FTA or its agent.
		R2d. The PMOC shall analyze potential changes to Project scope based on current documentation and evaluate the risks to Project associated with those potential changes.		**Q2d.** Professional opinion and evaluation of potential changes in Sponsor's scope and evaluation of associated risks.	**M2d.** Documented evidence of analysis of potential changes and evaluation of associated risks, supported by a professional opinion.	**MM2d.** Periodic review by FTA or its agent.
		R2e. The PMOC shall assess and evaluate Sponsor and 3rd party documentation and develop characterizations of Project scope that integrate and summarize all available information for the Project.		**Q2e.** Professional opinion and characterization of Project scope that integrates available data.	**M2e.** Documented evidence of review and characterization of Project scope integrating available data, supported by a professional opinion.	**MM2e.** Periodic review by FTA or its agent.
		R2f. The PMOC shall present its findings in descending order of importance, make recommendations for needed Sponsor action and present a time frame for Sponsor's actions.		**Q2f.** Professional opinion evidenced by findings, recommendations for corrective action and recommended time frame.	**M2f.** Documented evidence of findings, recommended Sponsor actions and a recommended time frame, supported by a professional opinion.	**MM2f.** Periodic review by FTA or its agent.
	DESIRED OUTCOME	**PERFORMANCE REQUIREMENT**	**CHECK LIST**	**ACCEPTABLE QUALITY LEVEL (AQL)**	**PERFORMANCE MEASURE**	**MONITORING METHOD**

APPENDIX A

Acceptable Quality Level

3	The PMOC shall document its findings, professional opinions, and recommendations in a report to the FTA.	**R3.** The PMOC shall present its findings, conclusions, and recommendations to FTA and, upon FTA approval, reconcile those recommendations with the Sponsor to the extent possible.		**Q3.** Reports and presentations are professional, clear, concise, and well written. The findings and conclusions have been reconciled with other PMOC reports and have been reconciled with Sponsor to the extent possible.	**M3.** PMOC's findings in descending order of importance, conclusions, recommendations, and presentation.	**MM3.** Periodic review by FTA or its agent.

APPENDIX B

Scope Review Checklist

Each design package, contract or budget unit, or scope element is to be reviewed against these criteria as applicable[1]. The review shall reflect as much of these criteria and concepts as is practical and consistent with the Sponsor's project design or construction plan.

Design Document Coordination

The Civil, Structural, Architectural, Electrical, Mechanical, Power, Signal and Communications, Trackwork, Sitework and other plan documents possess a comparable level of definition, clarity, presentation and cross-referencing. Design, construction, system and vehicle interfaces are well known and defined. Design Reports, Concept of Operations Report, and configuration studies are adequate and complete. Work descriptions and definitions used in designs and specifications are consistent and uniformly applied. The project phasing is adequate and the project is constructible. Adequate construction access and staging areas are defined.

Project Delivery Method, Contract Packaging

Check that the Sponsor has planned for construction, at either a project or contract package level, and has sufficiently analyzed and adequately addressed the following elements:

1) Delivery Methods
   a) Has the Sponsor demonstrated that the selected delivery method is permissible under local public contracting laws and authorized by Agency policy?
   b) Has the Sponsor performed an analysis of its contracting objectives and organizational capability and capacity in arriving at the selection of project delivery method(s)?
   c) If alternate delivery methods are permitted, has there been an analysis of the costs and benefits of Design-Bid-Build verses Design-Build?
   d) In case of Design-Build, are the risks being transferred to the contractor reasonable and can the risks be adequately addressed by the contractor?
   e) Has the level of design reached a point where major uncertainties and risks have been identified and addressed for the Design-Builder?
2) Contract packaging and structuring:
   a) Tradeoffs have been considered between large size contracts, which are often more efficient due to coordination and scheduling constraints, and small contracts that can attract industry interest and increase the number of bidders. Where small contract packages are used, they have been kept small enough to allow mid-sized contractors to bid without teaming as joint ventures (which tends to yield higher costs);
   b) Construction industry information sessions have been held after advertisement in industry publications in order to attract regional, national, and international contractors.

[1] Not every project will include every item in the list above.

c) 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;
d) Prequalification of general contractors or subcontractors has been considered to ensure quality, e.g. prequalification for experience with a type of construction, safety record, claims history, etc.
e) "Procurement only" contracts have been minimized (consistent with industry practice and agency experience), recognizing there is a higher claims risk when the installation contractor does not have full control of the materials;
f) Third parties:
    i) Contract packaging for Third-party construction contracts has been structured to maximize competition;
    ii) Third party procurement contracts have been utilized only where long lead-time items will impact project schedule if purchased by construction contractor;
    iii) Contract packaging and project schedule have been coordinated to minimize overextension of critical third parties inclusive of utilities and fire/life safety test witnessing or installation work;
    iv) Buy America provisions have been incorporated in third party contracts.
    v) Have agreements been reached with utilities on responsibility for timing and cost of relocating affected utilities.

3) Site investigation and geotechnical studies will be available to construction contractors;
4) The General Conditions, Supplementary Conditions, and Division 1 of the Specifications adequately describe, for bidding construction contractors, project site access; schedule; unit prices; provisions for increased and decreased compensation through incentives and liquidated damages; risk allocation as related to unforeseen conditions including geotechnical conditions; the construction contractor's design/engineering scope of work; mobilization costs; cash flow in general including pay schedule; requirements for bonds, insurance, taxes; maintenance and warranty provisions; contractor field management and supervision; socio-economic requirements related to bidding; among other things.
5) Market conditions are considered.
    a) Market conditions for the state/regional/local construction economy for the general contractors/subcontractors on public works and private;
    b) Market conditions for the national construction economy for transit general contractors/subcontractors.
    c) Availability of labor for various trades such as electricians, etc.
    d) 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.)
    e) Availability of construction equipment/sequencing/timeframe requirements for specially designed, or project specific equipment such as cranes, launching girders, pre-mix plants, barges, etc.
6) Accessing and occupancy of project construction sites
    a) Transportation of project materials to the various jobsites/access points/laydown areas;
    b) Local community restrictions and accommodations;
    c) Temporary Construction/Facility requirements and mobilizations;
    d) Weather impacts or concerns and protection of the work;

e) Special projects requirements such as permits; environmental requirements and restrictions, e.g., in-water work windows; site availability in terms of hours per day, days per week, months or seasons during a year, considering ongoing operations for transit, railroads, pedestrians, bicycles, and roadway traffic; impacts such as transportation, social and economic conditions; constraints due to public spaces, historic and archaeological resources, air quality, noise and vibration, contaminated materials and natural resources, among others.
f) Force account:
    i) Contract packaging and project schedule have been coordinated to minimize overextension of agency force account personnel;
    ii) Force account procurement contracts have been utilized only in cases where agency has substantial market leverage or "purchasing power";
g) Providing for construction contractors:
    i) Advanced utility / utility relocation contracts have been provided with significant schedule contingency since these are delay-prone activities;
    ii) Waste sites / borrow sites have been identified for use at contractor's option;
    iii) Advance agreements with utilities and agencies have been negotiated (for TBM power supply, for example), for use at contractor's option.

Design Relative to Site and Geotechnical Conditions

1) Site investigation
    a) Pre-construction site reconnaissance visits have been made;
    b) Site boundary and existing conditions surveys are complete;
    c) Flood hazard analyses has been conducted as required by Executive Order 11988 (including the potential for re-definition of flood plains and floodways as a result of climate change) and the results have been incorporated into the design.
    d) Geotechnical investigations are complete;
        i) Subsurface exploration or laboratory testing program;
        ii) Identification of buried structures and utilities;
        iii) Identification of contaminated soils and other hazardous material;
2) Design in response to geotechnical and other below-grade conditions are appropriate.
    a) Local seismic conditions and codes have been considered;
    b) Structural approach to ground conditions, subsidence, etc. is identified and resolved;
    c) Design of the rock support in the station caverns, the crossover caverns, the TBM tunnels, drill/blast tunnels, etc. is appropriate to rock characteristics (fracture planes, hardness and cleavage);
    d) Relative to subsurface conditions, selection of building type, foundation, and methods of construction is reasonable;
    e) Mass balance diagrams have been completed for vertical alignments on fill or cut;
    f) The design appropriately responds to identified buried structures and utilities, contaminated soils and other hazardous material on site, and provision for removal or remediation has been made.

SCC 10 Guideway and Track elements

Major or critical design decisions are defined including trackway type (elevated, at-grade, or underground), rehabilitation or reuse of existing infrastructure, structures, facilities or systems including but not limited to the following:

1) 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;
2) Structural systems are established and dimensioned to show number of spans, span length, substructure design, etc.; structural elements are advanced beyond simple span design.
3) Work descriptions and definitions used in designs or specifications are consistent and uniformly applied;
4) 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;
5) Special trackwork is adequately defined;
6) Tunnels are well defined in terms of access and egress, construction access and laydown, temporary and permanent drainage, openings for stations, cross-passages or refuge chambers, ventilation or emergency access shafts or 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.

SCC 20 Stations, Stops, Terminals, Intermodals and SCC 30 Support Facilities: Yards, Shops and Admin Buildings

Major or critical design decisions are defined including rehabilitation or reuse of existing structures, facilities or systems. Major or critical operational, maintenance (heavy and light, wayside, facilities and vehicle), accessibility, fire/life safety, security and logistics (spares, rebuild, training, documentation) requirements whether in the existing system or the project have been defined.

1) Station and support facility architecture is established. The drawing package consists of site plans, floor plans, longitudinal and cross sections, elevations and details illustrating typical and special conditions; finish schedules;
2) Within the site context, the building footprints are shown. The relationship of the building to grade and to adjacent facilities is clearly defined, as is provision for pedestrians and bicycles to access the public way from the building. Site layout takes into account Safety and Security considerations, e.g. Crime Prevention Through Environmental Design (CPTED). Site environmental conditions such as wind load, drainage and foundations have been considered. Provisions for motorized vehicles are also shown. Platform access, building access, and building interiors comply with ADA.

3) Station building floor plans show vertical circulation systems including stairs, elevators, escalators, dimensioned platforms, work bays in maintenance facilities, support spaces for mechanical and maintenance access; agent area, fare gate area, etc.; the building structural system is established and dimensioned. Structural elements are advanced beyond simple span design.
4) Building sections and elevations illustrate the relationship of the station to grade (below, on-grade, elevated structure);
5) Level boarding between the transit vehicle and the boarding platform complies with ADA.
6) Mechanical, electrical and communications systems are described including station, support facility and track area drainage, piped utilities, heating ventilation and air conditioning, smoke evacuation, power and lighting for the station, fire/life safety including NFPA, security systems, passenger information systems (PIS), fare vending machines, etc.
7) Equipment is shown on floor plans and described in schedules on drawings or specifications;
8) Design interfaces among disciplines are defined on drawings, in standards, design criteria, specifications and contract package scopes.

SCC 40 Sitework and Special Conditions

Major drainage facilities, flood control, hazardous materials, 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 project scope reflects the safety and security requirements resulting from the Sponsor's Hazard Analyses and Threat and Vulnerability Assessments.

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

1) Refer to Design Relative to Site and Geotechnical Conditions above;
2) Structural elements for retaining walls and other site structures are advanced in design.
3) 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.
4) Mass balance diagrams complete for vertical alignments on fill or cut are supported by complete site specific surveys and soil investigations;
5) The presence of buried structures, utilities, and contaminated soils which may have to be backfilled or which would otherwise be unavailable for backfilling, has been taken into account;
6) Adequate construction access;
7) Access and staging areas are defined.

SCC 50 Systems

1) System (Wayside and Facilities), Trackwork (Running and Special) and Vehicle (revenue and non-revenue) descriptions, functionalities, reliabilities, technologies (level identified and cost effectiveness known) and performances are defined. Major equipment (for the control room, substations, crossings, tunnel ventilation (both normal and emergency) 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).

2) Signaling and Train Control
   a) 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.
   b) 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.
   c) Site specific requirements are defined (for signal structural work) and location drawings for signal enclosures (as input to ROW requirements)
   d) 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.
   e) Signal cable routing methodology as well as power supply and distribution are identified and defined
   f) Software and interface requirements (to facilities, existing system, and other system elements) are identified and defined
   g) Maintenance, testing and training requirements are identified and defined (factory acceptance, site acceptance, field integration, start up, etc.)
3) System Description
   a) Built-in-place substations are identified, numbered and located with approximate spacings along the system route, ratings (MW) as well as the details (e.g. three phase nominal 12.47–13.2 kV distribution circuit [name utility] and any exceptions.
   b) 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.
   c) Third-rail or 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.
   d) AC Switchgear type (i.e. indoor, metal clad vacuum circuit type breaker, etc.), ratings (i.e., 15 kV, 500 MVA, etc.), relay protections provided (Phase overcurrent protection, Ground overcurrent protection, Negative sequence voltage relay, Rectifier overload relay, AC lock-out relay, etc.)
   e) Traction Power Transformer type (i.e. vacuum pressure impregnated dry type, etc.), ratings (i.e., 1110 kVA 65°C rise at 100% load, three phase, 60 Hz., ANSI and NEMA standards for extra heavy-duty service).
   f) 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.
   g) DC Switchgear basis of design and choice of switches, busses and feeder breakers is identified and equipment list is complete.

h) Programmable Logic Controller (PLC) system, if provided, integrates and control intercubicle functions and provides control, monitoring, and data logging at each substation.
i) 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.
j) Minimum voltage at the pantograph is identified and the basis is established for locations during the sustained 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.
k) 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 panel boards, 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.

4) Major or critical design decisions are defined including rehabilitation or reuse of existing structures, facilities or systems including but not limited to the following:
   a) Pre-construction, site reconnaissance, geotechnical and soil resistivity surveys are complete;
   b) Ground subsidence and structural protections issues have been resolved;
   c) Structural elements are advanced beyond simple span design, or simply supported.
5) 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.

SCC 60 ROW, Land and existing improvements

1) The Real Estate Acquisition and Management Plan (RAMP) is complete consistent with the phase of the project. A complete RAMP is expected prior to entry into engineering or shortly thereafter. Land acquisition and relocation activities have been implemented per RAMP consistent with master schedule. Refer to the Real Estate OP 23 for more information. Real estate documents and drawings identify the full takes, partial takes, residential, commercial or industrial relocations, easements and other rights to be acquired, possible eminent domain actions.

2) Site surveys include property lines and identification of structures for buildings, site features, utilities, and surface improvements such as streets and railroad rights-of-way.
3) The real estate information and survey information is fully coordinated with drawings of structures for guideways and buildings; site features; utilities; streets, railroads, transitways; construction easements; site access and staging areas and environmental mitigation requirements, e.g., wetland mitigation requirements.
4) Any lands owned or proposed for acquisition in excess of the proposed project footprint must be identified as such.
5) The existence of contaminated or potentially contaminated property can influence the scope of the project footprint as well as the project schedule. The real estate to be acquired should be thoroughly analyzed during the NEPA review and through appropriate environmental site assessments prior to initiation of the acquisition process. The Sponsor must share this information with the property appraiser.

SCC 70 Vehicles

Refer to Bus and Rail Vehicle Technical Review OP for more information. Vehicle (Revenue and non-revenue) descriptions, fleet size, functionalities, reliabilities, technology and performances are defined and drawn to the upper level of assembly, major equipment, general arrangements of cabin and cab:

1) System Functional Description has been developed and advanced to include the following:
   a) Definition of the subsystems that constitute the overall system
   b) Description, graphic depiction of each interface between subsystems
   c) Description of how each subsystem will meet the requirements of the specification.
   d) Vehicle dynamic envelop has been defined to meets the facility and alignment limitations.
   e) Vehicle-systems integration has been addressed to assure compatibility of electrification, signal and communications systems.
2) Materials specifications have been developed and advanced to include lists of qualified materials, such as brake shoe composition, electric components, refrigerants, lubricants, cleaners, paints/coatings, wiring, etc.
3) Testing requirements have been developed and advanced to include the following:
   a) High-level Test Program Plan for both production and on-site acceptance should be underway (including requirements for factory inspection and testing, First Article and Pre-shipment inspections, static and dynamic testing and conditional acceptance).
   b) Maintenance and Training Requirements should be defined and identified including development of maintenance and training requirements for new system elements.

SCC 80 Professional services

Refer to the Sponsor Management Capacity and Capability OP for more information. The roles and responsibilities of the Sponsor's professional consultants (design, engineering, and construction management) or others such as attorneys or insurance professionals may be distinguished from the Sponsor's own professional staff and manual labor. When the Sponsor's manual labor, equipment and facilities are used to facilitate construction or to assist in construction of the project, a Force Account Plan and associated cost estimate should be provided.

Costs associated with construction – building contractors' management, labor, indirect costs, overhead, profit, construction insurance should not be included in SCC 80 but in SCC 10 through 50 as appropriate. Cost estimates should conform to this allocation of cost.