

**U.S. DOT Federal Railroad Administration  
Office of Passenger and Freight Programs**

**Monitoring Procedure 32C - Project Scope Review**

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**1.0 PURPOSE**

This Monitoring Procedure describes the Monitoring and Technical Assistance Contractor's (MTAC) review and analysis of the Grantee's project scope.

**2.0 KEY PRINCIPLES**

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 should be 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 consistent with the scope approved by FRA.

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 rail projects.

The MTAC may be directed to review the scope of the project during any phase.

The review results inform the risk analysis and the reviews to accept the Grantee's completion of the following phase work:

- Planning and Concept Design / NEPA Tier 1
  - The scope of a rail project 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:
    - length of the corridor and extent of improvements proposed for corridor
    - type of vehicle technology to be employed
    - general horizontal location
    - general vertical location -- relationship of the rail guideway to grade (roadbed/elevated structure/below-grade trench or tunnel)
    - number and general location of stations
  - Changes to project scope become increasingly costly and disruptive as the project moves from the evaluation of alternatives through Preliminary Engineering, Final Design, and into Construction.
- PE / NEPA
  - The scope of the project is better defined at the completion of the environmental review process required under the National Environmental Policy Act (NEPA) and is continuously refined as it moves through PE.
  - The scope of the project should be fully defined at completion of PE. This is particularly important for alternate project delivery methods such as Design-Build (D-B), which bid at completion of PE. D-B performance specifications state what D-B contractors must deliver; at the same time, they may limit the Grantee's rights to make design decisions.

Because the DB contractor controls the schedules for both design and construction, a scope change that occurs after contract award is likely to be much more costly than a similar change using Design-Bid-Build.

- FD
  - During FD, the scope is ideally only refined, not modified, as the drawings and specifications and related documents are prepared for construction.

### **3.0 REQUIRED DOCUMENTS**

The MTAC will obtain from the Grantee current versions of the following documents. Depending on the project type and the phase during which this review is completed, not all of the documents listed below will be applicable or available.

1. Copy of the grantee's grant agreement(s) with FRA and the Grantee's application for funding. Note: the project scope review is intended to ensure the project aligns with proper planning and design processes as well as with the scope proposed in the original application.
2. Written project description; approved project scope with changes since the last milestone
3. Environmental documents (FEIS/ROD; EA/FONSI)
4. Basis of design reports; design criteria reports
5. Design documents (drawings, specifications)
6. Project schedule
7. Project cost estimate (and estimate from completed project phase to track changes)
8. Project Management Plan and subplans such as Risk and Contingency Management Plan
9. Planning and Concept Design documents
  - a. Service Development Plan
  - b. Service Outcome Agreement (performance objectives)
  - c. Corridor studies (capacity, operations, etc.)
  - d. Rail alignment and station location plans
10. Review documents:
  - a. Value Engineering Reports
  - b. Constructability Reviews
  - c. Risk Assessment Reports

### **4.0 SCOPE OF WORK**

#### **4.1 On-Site Review Meeting**

Before the on-site meeting, the MTAC should review the relevant documentation listed above, and propose to FRA a sampling approach to the scope documentation review that, regardless of the project type or phase, will provide FRA with reliable findings and recommendations.

The MTAC should arrange for an on-site briefing by the Grantee's project management team. The briefing should include:

- a narrative description of the project scope
- project graphics, drawings, maps, projections

- scope changes that have occurred since the last major review milestone, e.g. completion of Planning/Concept Design; completion of PE, etc.
- plan for project delivery
- plans to change the manner of project management in subsequent phases
- changes in external factors such as right-of-way, permits, or third-party agreements that would affect project scope

## 4.2 Review and Assessment

The MTAC should review the Grantee's plan to review project scope for completeness, coordination, timing of the reviews, personnel including independent peers reviewers and the Grantee's project team.

The Scope Review Checklist, attached as Appendix A, provides a guide to evaluating the scope. 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.

On the following, the MTAC will comprehensively address and report (see MP 01 for report outline.)

1. Does the Grantee have change control procedures and appropriately timed checks to track scope, verify approvals of changes, and ensure consistency of scope, cost estimate, and schedule?
2. Characterize the project scope in a manner that integrates and summarizes available information, provides professional opinions, analyses, and recommendations.

In Planning/ Concept Design: (refer also to MP 32A)

- Does the scope appear to fulfill the established project rationale, goals and objectives?
- Have key stakeholders (host railroads, infrastructure owners, operators, FRA, community representatives, Grantee agency leadership, etc.) provided the appropriate input to the project scope?
- Have planning analyses been done to provide parameters related to existing and forecasted infrastructure and service conditions?

In PE: (refer also to MP 39)

- Is the scope consistent with the approved Planning/Concept Design [and Tier 1 NEPA if applicable]?
- Is the scope compliant with applicable laws and regulations?
- Identify additional known or anticipated changes to scope. Are these changes incorporated into project documents and grant agreement?
- Identify unknown or uncertain conditions (e.g., real estate to be acquired, permits to be issued, third-party agreements to be finalized). Assess the Grantee's plan and schedule for resolving these issues.
- Considering known and uncertain conditions, do the cost estimate and schedule take these changes into account? Do the project documents and the risk/contingency management plan appropriately allocate the risk? Altogether, is

the scope internally consistent, defined to a level appropriate for PE and the applicable project delivery method, consistent with the scope approved by FRA?

In FD: (refer also to MP 39)

- Is the scope consistent with the approved PE / NEPA documents?
- Are the major work details, structural element dimensions, design interfaces, and physical interfaces consistent with the approved scope? Are the plans and drawings adequate in terms of content, presentation, clarity, cross-referencing?
- Is the scope internally consistent, defined to a level appropriate for FD and the applicable project delivery method, consistent with the estimated cost and schedule, and consistent with the scope approved by FRA?

11. The MTAC should present findings in order of importance (most likely, largest consequences, etc.) and accompanied by recommendations for modifications or additional work by the Grantee along with a time frame for the performance of the work.

## **5.0 REFERENCES – SEE MP 01**

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### Scope Review Checklist

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#### CONTENTS

- Design Document Coordination
- SCC 10 Guideway and Track Elements
- SCC 20 Stations, SCC 30 Maintenance Facilities, Yards, Shops and Admin Buildings
- SCC 40 Sitework and Special Conditions
- SCC 50 Systems
- SCC 60 ROW, Land and existing improvements
- SCC 70 Vehicles
- SCC 80 Professional Services
- Project Delivery Method, Contract Packaging

The MTAC shall review design or contract packages, or major scope element against applicable criteria.

#### Design Document Coordination

The Civil, Structural, Architectural, Electrical, Mechanical, Power, Signal and Communications, Trackwork, Track Structures, 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.

#### SCC 10 Guideway and Track Elements and Structures

Major design decisions are documented through definition of track and guideway type (elevated, at-grade, underground), rehabilitation of existing infrastructure, and structures such as bridges/tunnels.

- 1) Major or critical work details, structural element dimensions, design interfaces, and physical interfaces are complete and defined appropriately in drawings, standards, criteria, specifications and contract package scopes.
- 2) Design Relative to Site and Geotechnical Conditions
  - a) Site investigation
    - i) Pre-construction site reconnaissance visits have been made
    - ii) Site boundary and existing conditions surveys are complete
    - iii) Flood hazard analyses have 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
    - iv) Geotechnical investigations are complete
      - (1) Subsurface exploration or laboratory testing program
      - (2) Identification of buried structures and utilities
      - (3) Identification of contaminated soils and other hazardous material

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- b) Design in response to geotechnical and other below-grade conditions is appropriate
  - i) Local seismic conditions and codes have been considered
  - ii) Structural approach to ground conditions, subsidence, etc. is identified and resolved
  - iii) Design of the rock support in station caverns, crossover caverns, the TBM tunnels, drill/blast tunnels, etc. is appropriate to rock characteristics (fracture planes, hardness and cleavage)
  - iv) Relative to subsurface conditions, selection of building type, foundation, and methods of construction are reasonable
  - v) Mass balance diagrams have been completed for alignments on fill or cut
  - vi) The design appropriately responds to identified buried structures and utilities, contaminated soils and hazardous material on site, and provision for removal or remediation has been made
- 3) Structural systems and elements are established and dimensioned to show number of spans, span length, substructure design, etc.
- 4) Trackwork
  - a) Includes track layout, turnouts, crossovers, and special trackwork; (Note: On a site specific basis, taking into account operating conditions, it may be appropriate to locate platforms off the mainline.)
  - b) Track design is required to comply with 49 CFR 213
  - c) Level of detail in Concept Design: Schematic.
  - d) Level of detail in PE and FD: Scaled and dimensioned drawings, plans, profiles, with tabulations of track geometry (horizontal and vertical curve data).
- 5) For tunnels and elevated structures, the center line of track and base of rail are referenced to tunnel or elevated structure; guideway sections show the distance from centerline of track to critical clearance points such as walls, walkways and edges of platforms.
- 6) Tunnels are 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 and SCC 30 Maintenance Facilities, Yards, Shops and Admin Buildings**

Major design decisions are documented through definition of station and maintenance facility structures and buildings, and as a subset, definition of access, functionality, operations, maintenance, fire/life safety, security.

- 1) Major or critical work details, structural element dimensions, design interfaces, and physical interfaces are complete and defined appropriately in drawings, standards, criteria, specifications and contract package scopes.
- 2) Site context

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- a) Site environment and development conditions are considered -- sun orientation, wind, topography, drainage patterns, flora, fauna; historical development context.
  - b) Site layout takes into account safety through principles of Crime Prevention Through Environmental Design (CPTED); and security based on a threat and vulnerability assessment.
  - c) Within the site plan are shown:
    - i) Building footprint, trackwork/guideway; relationship of the building to grade; site utilities.
    - ii) ADA-compliant walkways from the public way to the buildings, within public areas of the buildings, and to the train platform.
    - iii) Prominently located transit bus and light rail transfer points with connecting walkways to the station and the public way.
    - iv) Bikeways extending from the public way and prominently located bicycle parking lots.
    - v) Conveniently located taxi and kiss-n-ride passenger drop-off with more distant auto parking.
- 3) Station and maintenance facility architecture is established.
- a) The drawing package of site plans, floor plans, longitudinal and cross sections, elevations and details illustrate typical and special conditions; finish schedules. Design interfaces among disciplines are defined in drawings, standards, design criteria, specifications.
  - b) Building floor plans show ADA compliant access to public spaces; vertical circulation systems including stairs, elevators, escalators, dimensioned platforms, work bays in maintenance facilities, support spaces for mechanical and maintenance access; agent area, passenger waiting and facilities; fare gate area, and ADA compliant level boarding transition between the platform and train car. Building sections and elevations illustrate form, mass, relationship to grade and surrounding development; interior spaces.
  - c) The building structural system is designed and dimensioned, with supporting calculations; it may reflect security criteria stemming from a threat and vulnerability assessment.
  - d) Electrical power, lighting, fire/life safety including NFPA, security systems, passenger info, security systems; communications systems; mechanical including support facility and track area drainage, piped utilities, heating ventilation and air conditioning, and smoke evacuation; equipment; all shown on floor plans and described in schedules on drawings or specifications; all compliant with FRA safety regulations.

#### SCC 40 Sitework and Special Conditions

Major drainage facilities, flood control, hazardous materials, retaining walls, site structures, roadways, grade 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. Definition is through plans, plan profiles, standards and criteria, specifications.

- 1) Adequate construction access and staging areas are provided. Complex railroad reconfigurations (typically in and around major passenger stations or freight yards) should include a proposed construction staging sequence to avoid shutting down operating railroads during construction. Environmental documents and cost estimates should reflect the temporary tracks and other measures that may be taken to avoid impacts of construction sequencing.
- 2) Refer to Design Relative to Site and Geotechnical Conditions above.
- 3) Structural elements for retaining walls and other site structures are advanced in design.

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#### 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.
  - a) Major equipment (for the control center, substations, crossings, tunnel ventilation (both normal and emergency) and traction power) is well defined and identified in drawings and specifications, general arrangements and standard details, and single line drawings.
- 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 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) Positive Train Control (PTC) technology, where applicable, capable of preventing train-to-train collisions, overspeed derailments, and casualties or injuries to roadway workers (e.g., maintenance-of-way workers, bridge workers, and signal maintainers). PTC may be implemented as Overlay (existing method of operations remains) or Standalone (replaces existing methods of operation). PTC combines:
    - i) Precise real-time locating (usually with GPS) of all trains and other vehicles occupying track;
    - ii) Cataloging of infrastructure, including turnouts, crossing junctions, grades, and associated permissible speeds;
    - iii) Algorithms that calculate the effective safe braking characteristics for each train en route in PTC territory; and
    - iv) Wireless communications between all operating units, including engineers, dispatchers, and work crews.
  - g) Software and interface requirements (to facilities, existing system, and other system elements) are identified and defined
  - h) 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.

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- 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
- d) AC Switchgear type, ratings, relay protections provided
- e) Traction Power Transformer type is defined.
- f) Low Voltage Direct Current electric traction system - 12.5/25 kV alternating current system with redundant utility supply points.
- 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.

#### 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 fully complete RAMP is expected at the completion of PE. Land acquisition and relocation activities are being implemented in accordance with the RAMP and project schedule. 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; 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) Land owned or proposed for acquisition that is outside 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

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assessments prior to initiation of the acquisition process. The Grantee must share this information with the property appraiser.

- 6) Refer to MP 23 Real Estate Acquisition and Management Plan for more information.

#### **SCC 70 Vehicles**

Refer to MP 38 Vehicle Acquisition and Management for more information.

(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 within passenger cars and locomotives:

- 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 considering the requirement for compliance with Buy America/n.
- 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.
- 4) All compliant with ADA and FRA Safety regulations.

#### **SCC 80 Professional services**

Refer to MP 21 Management and Technical Capacity and Capability for more information.

The roles and responsibilities of the Grantee's professional consultants (design, engineering, and construction management) or others such as attorneys or insurance professionals may be distinguished from the Grantee's own professional staff and manual labor. When the Grantee'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.

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#### Project Delivery Method, Contract Packaging

Check that the Grantee 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) Grantee has demonstrated that the selected delivery method is allowed under state law.
  - b) When selecting a project delivery method, the Grantee has considered its contracting objectives, risk tolerance, level of uncertainties remaining during PE, and its own organizational capability and capacity; it has analyzed the costs and benefits of the various methods, and considered such aspects as loss of design control, input from construction contractors during Final Design, and reallocation of risk.
- 2) Contract packaging and structuring
  - a) The Grantee has considered tradeoffs between large size contracts which are often more efficient to manage and small contracts that can attract 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.
  - c) Timing of major bid activity, within schedule constraints, will be managed to maximize contractor competition, with consideration to bid schedule for project(s) in the region such as highway or major 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) Third party procurement contracts have been utilized only where long lead-time items will impact project schedule if purchased by construction contractor.
    - ii) Contract packaging for Third-party construction contracts has been structured to maximize competition; and has been coordinated with the project schedule to minimize schedule impact by critical third parties, e.g. utilities, fire/life safety test witnessing or installation
    - iii) Agreements have been reached with third party contractors on Buy America/n, schedule, and cost.
- 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 the following:
  - a) project site access, schedule, unit prices
  - b) provisions for change in compensation through incentives and liquidated damages
  - c) risk allocation as related to unforeseen conditions including geotechnical conditions
  - d) the construction contractor's design/engineering scope of work
  - e) mobilization costs

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- f) cash flow in general including pay schedule
  - g) requirements for bonds, insurance, taxes
  - h) maintenance and warranty provisions
  - i) contractor field management and supervision
  - j) socio-economic requirements related to bidding
- 5) Market conditions are considered.
- a) Market conditions for the state/regional/local construction economy for the general contractors (GC) and subcontractors on public and private work.
  - b) Market conditions for the national construction economy for rail GCs and 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, e.g. cranes, launching girders, pre-mix plants, barges.
- 6) Access and staging on project construction sites are considered.
- a) Transportation of materials to the various jobsites, access points and laydown areas, need for temporary construction for mobilization; potential weather impacts and related need to protect the work; identification of waste sites / borrow sites.
  - b) Construction impacts on ongoing transport and neighborhoods
    - i) Very complex railroad reconfigurations (typically in and around major passenger stations or freight yards) and corridor improvement projects with multiple work elements (e.g. track improvements, signal upgrades, and station work) must include a construction phasing plan that identifies the sequence in which work will be completed. The plan needs to:
      - (1) package work into phases that maximize track outages;
      - (2) ensure construction crews do not conflict with each other;
      - (3) identify temporary structures that are needed, ensure impacts to railroad operations are minimized to the extent possible.
      - (4) identify access points and access periods for construction work, given the competing need for ongoing train operations; consider adjusting train schedules, reducing service, and busing of passengers.
    - ii) Ongoing operations for other transport such as transit, auto traffic, ped walks and bikeways.
    - iii) Impacts due to socioeconomic conditions; constraints due to public spaces, historic, natural, and archaeological resources, air quality, noise, vibration, contaminated materials.
  - c) Access restrictions
    - i) Permits, environmental requirements, e.g., in-water work windows
    - ii) Site availability in terms of hours per day, days per week, months or seasons during a year
- 7) Force account
- a) Contract packaging and project schedule have been coordinated to minimize overextension of agency force account personnel
  - b) Force account procurement contracts have been utilized only in cases where agency has substantial market leverage or “purchasing power”