
USACE / NAVFAC / AFCEA

UFGS-01321N (February 2002)

Preparing Activity: NAVFAC

Superseding
UFGS 01321N (September 2000)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

Revised throughout - changes not indicated by CHG tags

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SECTION 01321N

NETWORK ANALYSIS SCHEDULES (NAS)
02/02

NOTE: This guide specification covers the preparation and use of a contractor prepared Network Analysis Schedules. This section will be used on most projects in lieu of Section 01320, "Construction Progress Documentation." Section 01320 shall be used only when a hand-drawn bar chart is required for management and oversight of a project. As prescribed in FAR 36.515, the Contracting Officer may insert the clause "Schedules for Construction Contracts" (FAR 52.236-15) in solicitations and contracts when a fixed-price construction contract is contemplated, the contract amount is expected to exceed the simplified acquisition threshold, and the period of actual work performance exceeds 60 days. This clause may be inserted in such contracts when work performance is expected to last less than 60 days and an unusual situation exists that warrants impositions of the requirements. This clause should not be used in the same contract with clauses covering other management approaches for ensuring that a contractor makes adequate progress. Coordination is required with other Division 1 specifications when Network Analysis Schedules is not specified.

Comments and suggestion on this specification are welcome and should be directed to the technical proponent of the specification. A listing of the technical proponents, including their organization designation and telephone number, is on the Internet.

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

NOTE: Unless requested by the Activity, cost, manpower and equipment loading is typically not required for projects less than \$5,000,000. Bracketed options have been added throughout to aid in editing appropriately for cost, manpower and equipment loading. Verify requirements with the Activity. Where cost loading is retained, this guide specification will require project costs to be loaded into the schedule and assigned to activities. When cost loading is utilized, delete the requirement for "Schedule of Prices" in Section 01200 "Price and Payment Procedures".

PART 1 GENERAL

1.1 DESCRIPTION

NOTE: Edit options as appropriate for cost, manpower and equipment loading.

Prepare a progress chart pursuant to the clause entitled "FAR 52.236-15, Schedules for Construction Contracts" of the Contract Clauses that shall consist of a network analysis system. The network analysis system shall consist of the network analysis schedule (diagram), mathematical analysis, and associated reports. The scheduling of construction shall be the responsibility of the Contractor. Submission of progress and revision data will be used to measure work progress, [and] aid to evaluate time extensions[, and provide basis of all progress payments]. The Critical Path Method (CPM) of network calculation shall be used to generate the project schedule and will utilize the Precedence Diagram technique to satisfy [both] time [and cost] applications. [All progress payment amounts will be derived from and tied to the cost-loaded schedule activities.]

1.2 SUBMITTALS

NOTE: The "G" in submittal tags following each submittal item indicates Government acceptance and should be retained. Add "G" in submittal tags following any added submittals that are determined to require Government acceptance. Submittal items not designated with a "G" will be approved by the QC organization.

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-01 Preconstruction Submittals

[Qualifications; G]

Standard Activity Coding Dictionary

[Schedule Development Session scheduler/planner; G]

[Preliminary Network Analysis Schedule; G]

Network Analysis Schedule; G

Accepted Network Analysis Schedule; G

[Summary Network; G]

SD-07 Certificates

Monthly Network Analysis Updates; G

SD-11 Closeout Submittals

[As-Built Schedule; G]

1.3 SCHEDULE ACCEPTANCE

NOTE: Edit option as appropriate for cost loading.

Review comments made by the Government on the Contractor's construction schedule will not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for scheduling, sequencing, and prosecuting the Work to comply with the requirements of the Contract Documents. Government acceptance extends only to the activities of the contractor's schedule that the Government has been assigned responsibility for and agrees it is responsible. The Government will also review for contract imposed schedule constraints and conformance[, and cost loading of the CPM activities]. Comments offered on other parts of the schedule which the Contractor is assigned responsibility are offered as a courtesy and are not conditions of government acceptance; but are for the general conformance with established industry schedule concepts.

[1.3.1 Schedule Acceptance Prior to Start of Work

NOTE: Prior to including or editing this paragraph, contact the ROICC Field Office to determine if the contractor will be allowed to start work prior to acceptance of the project schedule.

The Accepted Network described in the paragraph entitled "Accepted Network Analysis Schedule" must be submitted to and accepted by the government

before the contractor will be allowed to start work.

1.3.2 Acceptance

- a. When the Accepted Network Analysis Schedule is submitted to and accepted by the Contracting Officer, it will be considered the "Baseline CPM Schedule". The Baseline CPM Schedule will then be used by the Contractor for planning, organizing, and directing the work; reporting progress; and requesting payment for work accomplished. The schedule will be updated monthly by the Contractor and submitted monthly with the progress pay request to reflect the current status of the work. [For payment requests made after the period covered by the Preliminary Schedule,] The submittal and acceptance of the Accepted Network Analysis Schedule and accurate updated schedules accompanying the pay requests are both conditions precedent to processing pay requests. Only bonds will be paid prior to acceptance of the Accepted Network Analysis Schedule.
- b. Submittal of the Network, and subsequent schedule updates, will be understood to be the Contractor's representation that the submitted schedule meets all of the requirements of the Contract Documents, accurately reflects the work accomplished, and that Work will be executed in the sequence indicated on the submitted schedule.

1.4 SOFTWARE

NOTE: Check with the ROICC Field Office for local personal computer (PC) equipment capacity and edit as appropriate. The Contractor's software may require more computer capacity than the ROICC Field Office has available, in which case, subject to the written approval of the Contracting Officer, the contract may include the requirement for the contractor to provide hardware and software necessary to allow the government to monitor work progress and process payments. At the end of the contract term, this equipment software may be specified to remain the property of the contractor or become government property as determined to be most cost effective by the Contracting Officer. Should this equipment be specified to become government property, all property control regulations must be followed.

NOTE: Include the bracketed sentences requiring Primavera software for LANTDIV, PACDIV and SOUTH DIV projects. Consult with the EFD/EFA 05 and/or Field Office to determine which software will be used. As a general guide; for projects less than \$5 Mil use

SureTrak and for projects \$5 Mil and greater use P3.

[The scheduling software that will be utilized by the government on this project is [SureTrak by Primavera Systems, Inc.] [Primavera Project Planner (P3) by Primavera Systems, Inc. If the contractor chooses to use an equally capable program, the contractor shall convert all data into Primavera Machine Readable Format (Lotus, D-Base, Excel, etc.) prior to submission of all schedule inputs, included but not limited to the initial schedule, monthly updates, and changes to the schedule. It is the responsibility of the Contractor to ensure all data elements and logic required by this specification are kept intact during the conversion to Primavera. If scheduling software other than Primavera is being used, provide]] [Provide] a licensed copy of the Contractor's scheduling software and data. The software will be the most current version available and will be compatible with all MS-Windows operating systems (e.g., Win NT, Win 95, etc.). The scheduling software package shall contain all user manuals normally provided by the software distributor. If the Contractor upgrades their software during the course of the contract, the upgrade shall also be provided to the Contracting Officer. The software will remain the property of the government.

[1.4.1 Computer Hardware

[The network analysis software shall be capable of running on a [Government owned] [Contractor provided] personal computer.] [Provide and maintain a [_____] personal computer (PC) capable of running the network analysis software specified herein.] [All necessary software and hardware will be provided to make the system a complete and useable package.] [Provide a [_____] [printer] [plotter] with necessary cables. The contractor PC will remain the property of the [Contractor] [Government].]

][1.4.2 Software Training

NOTE: Select and edit this paragraph when training is needed. Coordinate with the ROICC Field Office.

[If software other than Primavera is used by the Contractor, provide][Provide] schedule software training for [two] [_____] Government personnel. A firm accredited by the scheduling software manufacturer, as their authorized trainer shall conduct the training. The training shall last a minimum of 24 hours per individual. Provide course material the training firm normally distributes at their software classes. Provide all necessary materials and equipment to conduct the training. The Contractor shall provide training within 10 working days after notification to the Contractor, by the Contracting Officer. Unless agreed to by the Contracting Officer, the training site shall be at the Contracting Office.

][1.5 QUALIFICATIONS

NOTE: Before editing the following paragraph,

coordinate with the ROICC Field Office.

The Contractor shall designate a [full time] [part time] Scheduler that will be responsible for the development, preparation, and maintenance of an accurate, computerized Network Analysis Schedule. [Part time is defined as the scheduler performing on-site coordination, attending project meetings, and updates for [_____] hours per work week.] The Scheduler shall have previously developed, created and maintained at least [2] [_____] previous computerized schedules of similar size and complexity of this contract. A resume outlining the qualifications of the scheduler shall be submitted for acceptance to the Contracting Officer. If at a later date, the Contracting Officer considers the Contractor's Scheduler to be incompetent or objectionable, the Contractor will propose a new Scheduler, meeting the qualification requirements. Payments will not be processed until an acceptable Scheduler is provided.

]1.6 NETWORK SYSTEM FORMAT

The system shall consist of time scaled logic diagrams accompanying mathematical analyses and specified reports.

1.6.1 Diagrams

Show the order and interdependence of activities and the sequence in which the work is to be accomplished as planned. The basic concept of a network analysis diagram will be followed to show how the start of a given activity is dependent on the completion of preceding activities and how its completion restricts or restrains the start of following activities. Diagrams shall be [organized by [Work Phase] [Area Code] and] sorted by Early Start Date and will show a continuous flow from left to right with no logic (relationship lines) from right to left. With the exception of the Project Start and Project Completion milestone activities, no activities will be open-ended; each activity will have predecessor and successor ties.

The diagram shall clearly show the activities of the critical path. No onsite construction activity shall have duration in excess of 20 working days. Once an activity exists on the schedule it may not be deleted and must remain in the logic. No more than [20] [_____] percent of the activities may be critical or near critical. Critical will be defined as having zero days of Total Float. "Near critical" will be defined as having Total Float in the range of [1 to 14] [[_____] to [_____]] days. Show the following information on the diagrams for each activity:

- a. Activity/Event Number
- b. Activity Description
- c. Original Duration in work days
- d. Actual Duration in Work Days
- e. Early Start Date
- f. Early Finish Date

g. Total Float (or Slack)

h. Responsibility Code

Provide network diagrams on ANSI E sheets. Updated diagrams shall show the date of the latest revision.

1.6.2 Quantity and Numbering of Activities

NOTE: A good knowledge of construction is required when determining the numbers of activities for a network analysis. Factors such as the nature of the work, geographical location, completion time, complexity ("the complexity of a project is related to the number of specification sections, the number of buildings, special phasing requirements and special quality control requirements"), cost of maintaining each activity throughout the life of the contract and level of use by field management personnel must be considered. As a general rule, use the following guidance:

| <u>PROJECT CONSTRUCTION COST</u> | <u>NUMBER OF CONSTRUCTION ACTIVITIES RECOMMENDED</u> |
|--|--|
| Up to \$1,000,000 | 150 + activities |
| \$1,000,000 to \$2,000,000 | 150 to 200 activities |
| \$2,000,000 to \$5,000,000 | 200 to 1000 activities |
| \$5,000,000 to \$10,000,000 | 1000 to 2000 activities |
| Over \$10,000,000 | 2500 + activities |

***Important**

-When selecting the number of activities, please keep in mind the cost added to the contract. An activity needs to be maintained throughout the life of the contract and the use of too many activities will unnecessarily increase the total contract cost.

-The guidance provided above is meant as GUIDANCE. Use your best judgement for selecting number of activities. Some contracts may require less number of activities than recommended amounts. (Ex: A contract to stripe a 500-mile stretch of highway may have a project cost of \$6,000,000 but it should not require between 1000 to 2000 activities).

Numbering shall be assigned so that, in general, predecessor activity numbers are smaller numerically than the successor activity numbers. Skip numbering shall be used on the network to allow insertion of additional

activities for contract modifications and logic changes. The minimum number of construction activities in the final network diagram shall be [____]. Types of activities included in the schedule are specified below.

[1.6.2.1 HVAC TAB Activities

NOTE: This paragraph will be used only when HVAC Testing, Adjusting and Balancing work is specified in the contract specifications.

Requirements for the activities related to HVAC TAB work, Section entitled, "HVAC Testing/Adjusting/Balancing," are specified in Section entitled, "Price and Payment Procedures."

]1.6.2.2 Procurement Activities

NOTE: Edit option as appropriate for cost, manpower and equipment loading.

Tasks related to the procurement of material or equipment shall be included as separate activities in the project schedule. Examples of procurement activities include, but are not limited to: Material/equipment submittal preparation, submittal and approval of material/equipment; delivery of O&M manuals; material/equipment fabrication and delivery, delivery of extra parts, extra stock, special tools, notification of Government Furnished Material/Equipment delivery requirement, etc. As a minimum, separate procurement activities will be provided for every specification section. If the Contractor intends on using Just-In-Time (JIT) delivery methods, the schedule will show each JIT delivery with relationship tie to the Construction Activity specifically for the JIT delivery. [Material and equipment for which payment will be requested in advance of installation shall be cost-loaded with the procurement costs.] All activities within a procurement process/cycle will have a unique identifier in the activity code to show their relationships and will extend to the related construction activities (i.e., Work Category).

If the Government's action on any submittal is "Disapproved" or "Revise and Resubmit", a new series of Procurement Activities will be inserted into the schedule. Predecessor for the new submittal preparation activity will be the original approval activity and the successor of the new approval activity will be the fabrication/deliver activity for the equipment or material.

1.6.2.3 Government Activities

Government and other agency activities that could impact progress shall be clearly identified. Government activities include, but are not limited to; Government approved submittal reviews, Government conducted inspections/tests, utility outages, Notice(s) to Proceed and delivery of Government Furnished Material/Equipment. Show activities indicating

Government furnished materials and equipment utilizing delivery dates indicated in "FAR 52.245-2, Government Property (Fixed-Price Contracts)." Government activities will be driven by calendars that reflect Saturdays, Sundays and all Federal Holidays as non-work days.

1.6.2.4 Construction Activities

Construction activities shall include, but are not limited to: Tasks related to mobilization/demobilization; the installation of temporary or permanent work by tradesman; testing and inspections of installed work by technicians, inspectors or engineers; start-up and testing of equipment; commissioning of building and related systems; scheduling of specified manufacture's representatives; final clean-up; training to be provided; and administrative tasks necessary to start, proceed with, accomplish or finalize the contract. Contractor activities will be driven by calendars that reflect Saturdays, Sundays and all Federal Holidays as non-work days.

1.6.2.5 Anticipated Weather Delays

Schedule activity duration(s) shall be formulated with allowance for normal adverse weather conditions. Any activity duration which could be impacted by normally anticipated adverse weather (precipitation, high or low temperature, wind, etc.), due to the time period which the Contractor has scheduled the work, shall include an adjustment to include the anticipated weather delay. The Contractor shall anticipate delay by comparing the contractually imposed environmental restrictions in the Contract Documents to the National Oceanic and Atmospheric Association's (NOAA) historical monthly averages for the NOAA location [at (Enter NOAA Station here)] [closest to the project site]. The number of anticipated adverse weather delays allocated to an activity will be reflected in the activity's calendar. A lost workday, due to weather conditions, is defined as a day in which the contractor's workforce cannot work 50 percent or more of the day. The Contractor shall immediately notify the Contracting Officer when a lost day has occurred due to weather and will record on the Daily Reports, the occurrence of adverse weather and resultant impact to the normally scheduled work. If the number of actual adverse weather delay days exceeds the number of days anticipated, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days and issue a modification in accordance with the contract clauses.

1.6.2.6 Activity Properties

Schedule activities will have the following properties:

- a. **Standard Activity Coding Dictionary:** The Contractor shall submit a coding scheme for Schedule Activity Numbers that shall be used throughout the project. The coding scheme submitted shall list the values for each activity code category and translate those values into project specific designations. Code length shall not exceed [10] [_____] characters. Once accepted, the coding scheme will be used for the duration of the project.
- b. **Activity Description:** Each activity shall have a narrative

description consisting of a Verb or work function (e.g.; form, pour, excavate), an Object (e.g.; slab, footing, underfloor plumbing), and Area (e.g.; 3rd floor, northeast quadrant, basement).

NOTE: Include the following paragraph when the project includes the requirement for Phased Construction.

- [c. Work Phase: If phasing is specified in the contract, all activities shall be identified in the project schedule by the phase of work in which the activity occurs. Activities shall not be contained in more than one Work Phase.]
- d. Work Category: All Activities shall be identified in the project schedule according to the work category which best describes the activity. Examples of work categories are procurement, government, and construction activities that are all related to a single Definable Feature of Work. Activities shall not be contained in more than one Work Category.
- e. Area Code: All activities shall be identified in the project schedule by the Area Code in which the activity occurs. Activities shall not be contained in more than one Area Code. Area is defined as a distinct separation in construction, such as a story of construction, separate structure, usage or function difference, utility distribution systems, etc.
- f. Responsibility Code: All activities in the project schedule shall be identified with the party responsible to perform the task. Responsibility includes, but is not limited to; the prime contractor, subcontracting firm, or Government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by a responsibility code. For example, a responsibility code value, "ELEC", may be identified as "Electrical Subcontractor."
- g. CSI Code: All activities in the project schedule shall be identified with its respective 5-digit Specification Section number. Activities shall not belong to more than one Section number. If an activity does not have an applicable CSI Code, (such as "Mobilize"), the code will be "00000".
- h. Drawing Code: All activities in the project schedule shall be identified with its respective project drawing code. The drawing code is the Sheet Number on the primary project drawing which indicates the work to be performed. Activities shall not belong to more than one Drawing Code. Examples of Drawing Codes are "C-10", "C.10" or "C10". The code system will allow organizing all activities by drawing code in alpha and numeric order. If an activity does not have an applicable Drawing Code, (such as

"Mobilize"), the code will be "00000".

- i. **Modification Code:** The Modification Code shall identify activities that are modified or added by contract modification. Activities shall not belong to more than one Modification Code. The Government will assign the modification number, which will be shown on the SF 30. Use a shortened version of the modification number for the code (e.g.; A00010 = 010).
- j. **Request for Equitable Adjustment (REA) or Claim Code:** Activities that are modified or added, as a result of a Contractor's REA or Claim shall be identified by a code generated by the Contractor. Activities shall not belong to more than one REA or Claim Code.
- k. **The Three Phases of Control (Preparatory, Initial, and Follow-up):**
For each Definable Feature of Work identified in the Contractor's Quality Control Plan, include an activity for the Preparatory Phase. The Initial Phase and Follow-up Phase will be represented by the Construction Activities in the schedule.
- l. **Project Milestone Dates:** Dates shall be shown on the diagram for the start of the project, any contract required interim start and completion dates, contract completion date and other significant milestones.
- m. **Scheduled Project Duration:** The schedule duration shall extend from notice-to-proceed to the contract completion date.
- n. **Project Start Date Milestones:** The schedule shall start no earlier than the contract award date and the project duration (Day 1) will start on the Notice-to-Proceed (NTP) date. The Contractor shall include as the first activity in the schedule, an activity named "Contract Award" and another activity on the NTP date named "Start Project". Both activities will be zero duration, with constrained start dates equal to the contract award and NTP dates.
- o. **Constraint of Last Activity Milestone:** The Contractor shall include as the last activity in the project schedule, an activity named "End Project". The "End Project" activity shall be zero duration with a mandatory finish constraint equal to the contract completion date for the project. Calculation of project updates shall be such that if the finish of the last activity falls after the contract completion date, then the float calculation shall reflect negative float on the critical path.
- p. **Early Project Completion:** In the event the Contractor's project schedule shows completion of the project prior to the contract completion date, the Contractor shall include an activity named "Contractor Early Completion". The activity shall be a zero duration milestone with an unconstrained date representing the Contractor's Early Completion date.
- q. **Substantial Completion:** If the contractor elects to include an activity for Substantial Completion, then it is agreed that

Substantial Completion will be the point in time that the Government considers the project is complete and ready for its intended use. The activity will be named "Substantial Completion". The activity shall be a zero duration milestone with an unconstrained date representing the Contractor's Substantial Completion date.

NOTE: Include the following three paragraphs when the project includes the requirement for Phased Construction.

[r. Phase Start Milestone: The Contractor shall include as the first activity for a project phase, an activity named "Start Phase X", where "X" identifies the phase of work. The "Start Phase X" activity shall be zero duration with an unconstrained start date equal to the date of the Phase NTP. This unconstrained start date is not a release from contractually required start dates, but is left unconstrained to allow the schedule logic to calculate without hindrance.

s. End Phase Milestone: The Contractor shall include as the last activity in a project phase, an activity named "End Phase X" where "X" identifies the phase of work. The "End Phase X" activity shall be zero duration with an unconstrained late finish date equal to the contract phase completion date. This unconstrained completion date is not a release from contractually required finish dates, but is left unconstrained to allow the schedule logic to calculate without hindrance.

t. Early Phase Completion: If the contractor expects to finish prior to the contract phase completion date, the milestone will show an early finish date equal to the Contractor's early finish date. The name of the activity will be "Early Phase Completion" and will be zero duration with an unconstrained date representing the contractor's early phase completion date.]

NOTE: Include Summary Activities if Summary Networks will be requested or if repetitive groups of activities will be used in a project (e.g. similar housing units being built several times over). Also include if Summaries will assist in keeping Customer or Higher Management apprised of progress.

[u. Summary (a.k.a., Banding or Hammock) Activities: The Contractor shall include special activities that are a summary of a chain of activities. The start of the activity will be the start date of the first activity in the chain and the finish date will be the finish date of the last activity in the chain. Generalized work sequences, Categories of Work and all Phase of Work activity

chains will be summarized.]

- v. Activity/Event Constraints: Date/time constraint(s), other than those required by the contract, will not be allowed unless accepted by the Contracting Officer.
- w. Leads and Lags: Leads or lags will not be used when the creation of an activity will perform the same function (e.g., concrete cure time). Lag durations contained in the project schedule shall not have a negative value. The use of any lead or lag will be explained in the Narrative Report.
- x. Default Progress Data Disallowed: Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in the CPM scheduling software system. Actual Start and Actual Finish dates on the CPM schedule shall match the dates provided from Contractor Quality Control and Production Reports. These reports will be the sole basis for updating the schedule. Work activities will be updated by actual work progression rather than being cash flow driven. The updating of the percent complete and the remaining duration of any activity shall be independent functions; program features that calculate one of these parameters from the other shall be disabled. Out-of-Sequence progress (if applicable) shall be handled through Retained Logic, not the Default Option of Progress Override. Actual labor and equipment hours used on activities will be derived from the daily reports.

1.6.3 Mathematical Analysis

**NOTE: Edit options as appropriate for cost,
 manpower and equipment loading.**

The network diagram mathematical analysis shall include a tabulation of each activity shown on the detailed network diagrams. Provide the following information as a minimum for each activity:

- a. Activity/Event number
- b. Activity/Event description
- c. Estimated duration of activities (by work days)
- d. Earliest start date (by calendar date)
- e. Earliest finish date (by calendar date)
- f. Actual start date (by calendar date)
- g. Actual finish date (by calendar date)
- h. Latest start date (by calendar date)

- i. Latest finish date (by calendar date)
- j. Total float or slack
- [k. Material/Equipment costs will be assigned to their respective Procurement Activities (i.e., the delivery activity). Costs for installation of the material/equipment (labor, construction equipment, and temporary materials) will be assigned to their respective Construction Activities. The value of inspection/testing activities will not be less than [10] [_____] percent of the total costs for Procurement and Construction Activities. Evenly disperse overhead and profit to each activity over the duration of the project.]
- l. Responsibility code (including prime contractor, subcontractors, suppliers, Government, or other party responsible for accomplishment of an activity.)
- [m. Area Code]
- [n. Manpower required (crew size)]
- o. Percentage of activity duration completed
- [p. Contractor's earnings based on accepted work-in-place.]

The program or means used in making the mathematical computation shall be capable of [compiling the total value of completed and partially completed activities. The program shall also be capable of] accepting revised completion dates as modified by approved time extensions and recompilation of tabulation dates[/costs] and float accordingly. [The total of all cost loaded activities; including costs for material and equipment delivered for installation on the project, and manpower and construction equipment loaded construction activities, shall total to 100 percent of the value of the contract.]

[1.6.4 Additional Requirements

NOTE: The information required by the following paragraphs are optional and typically not needed for routine work. Include on projects with critical completion dates. Manpower and equipment loading schedules are of primary importance to the Contractor in deciding the most efficient use of personnel resources and optimizing equipment usage and is the basis of activity duration estimates. Since these decisions are the responsibility of the Contractor's management process, the information value to the Contracting Officer is in assuring that the planned manpower and equipment are being supplied throughout the course of the project.

In addition to the tabulation of activities, in the Paragraph entitled "Mathematical Analysis", include the following data:

- a. On-site manpower loading schedule: Each construction activity shall have an estimate of the number of workers per day by trade, man-hours per day by trade and total expected hours used by trade during the execution of the activity. If no workers are required for an activity, then the activity shall be identified as using zero workers per day.
- b. Equipment loading schedule: Each construction activity shall have an estimate of the equipment used per day, number of units per day and total expected hours for each piece of equipment used during the duration of the activity. Include a description of the major items of construction equipment planned for each construction activity on the project. The description shall include the year, make, model, and capacity. If no equipment is required for an activity, then the activity shall be identified as using zero equipment per day.

11.6.5 Required Reports

NOTE: Edit options as appropriate for cost, manpower and equipment loading. Consult with the ROICC Field Office to identify which of the following reports are preferred. Always include Earned Value Report (when cost loading is utilized) and Log Report.

The following reports will be made available in the schedule submittals and in each updated schedule submission provided on disk by the Contractor:

- a. By the preceding event number from lowest to highest and then in the order of the following activity number (Activity Identification Report) showing the current status of all activities.
- b. By the amount of total float, from lowest to highest and then in order of [activity number] [early start date] (Total Float or Slack Report) showing all incomplete activities.
- c. By latest allowable start dates and then in order of activity numbers (Late Start Report).
- [d. Earned Value Report listing all activities having a budget amount and cost. A compilation of total earnings on the project from the notice to proceed to the most recent monthly progress payment request and the difference between the previous request amount and the current payment request amount. Sort report first by resource and then by activity.]
- e. By earliest allowable start dates and then in order of activity

number (Early Start Report).

- f. By tasks scheduled to start and finish by the end of the next pay period (30-Day Look Ahead).
- g. With each updated schedule submission, provide a computer generated Log Report using a recognized schedule comparison software listing all changes made between the previous schedule and current updated schedule. Identify the name of the previous schedule and name of the current schedule being compared. This report will as a minimum show changes for: Added & Deleted Activities, Original Durations, Remaining Durations, Activity Percent Complete, Total Float (or Slack), Free Float, Calendars, Descriptions, Constraints (added, deleted or changed), Actual Starts/Finishes, [Added/Deleted Resources,] [Resource Quantities,] [Costs,] [Resource Percents,] Added/Deleted Relations, Changed Relation Lags, Changed Driving Relations, and Changed Critical Status.
- h. By the activity number from lowest to highest, showing preceding and succeeding activity numbers for each activity (Predecessor/Successor Report), and showing the current status of each activity.

NOTE: Include the following two paragraphs if the requirements of the paragraph entitled "Additional Requirements" are specified.

- [i. Manpower staffing report and histogram: With each update schedule, a planned early and planned late versus actual labor resource histogram will be provided. This histogram shall be based upon and shall be in agreement with, the number of shifts and crew sizes by craft, in the Accepted Network Analysis Schedule (planned) and the Monthly Network Update (actual). Included in the report will be a tabular report that will list each trade to the activities that were worked on during the construction period.]
- [j. Equipment usage report and histogram: With each update schedule, a planned early and planned late versus actual equipment resource histogram will be provided. This histogram shall be based upon and shall be in agreement with the equipment allocation accepted on the Accepted Network Analysis Schedule (planned) and the Monthly Network Update (actual). Included in the report will be a tabular report that will list equipment (by make and model) to the activities that were worked on during the construction period.]

1.7 SUBMISSION AND ACCEPTANCE

1.7.1 Preliminary Meeting

At the Pre-Construction Conference, the Contracting Officer, Contractor and major subcontractors shall participate in a preliminary meeting to discuss

the proposed schedule and requirements of this section prior to submission of the network. The definition of a "major subcontractor" is one that exceeds [5] [_____] percent of the contract value.

[1.7.2 Schedule Development Session:

NOTE: Contact the ROICC Field Office before including this paragraph in the specifications. If included, editing of the paragraph will be coordinated with the Representative. This paragraph will typically be used only on large, complex or schedule sensitive projects.

[Upon completion of the 90 day (Preliminary) Network Analysis Schedule, and] Prior to the submission of the Network Analysis Schedule, the Contractor shall conduct a Schedule Development Session. The Schedule Development Session shall include procurement of on site services of an expert scheduler/planner for not less than a [5] [_____] day period. The Contractor's choice of Schedule Development Session scheduler/planner is subject to the acceptance of the Contracting Officer. The scheduler/planner shall facilitate the session on site [and shall be fluent in the English language]. The scheduler/planner shall have at least [10] [_____] years experience developing construction project schedules with scheduling software programs that the contractor intends to use. Unless agreed to by the Contracting Officer, the session shall be conducted at the Office of the Contracting Officer. The Contractor is responsible for providing the necessary equipment for the session which, as a minimum, includes a personal computer (PC), a computer display projector to facilitate group viewing, and a printing device. During the session the facilitator [shall provide all necessary training to participants and] shall lead the development of the project's schedule. As a minimum, the scheduler/planner shall facilitate development of activity coding and work breakdown structures; establishment of procurement, government, and construction activities; activity relationship; resourcing; budgeted costs; and reports to be used during the project. Members of the Contracting Officer's staff will attend the session as well as [members of the designer of record,] [customer who will occupy the facility,] [major subcontractors (those which exceed [5] [_____] percent of the contract value), and] the Contractor's home and field project management staff. [Past experience has revealed that these services do not exist in [Indicate project location] which has resulted in the Contractor forming agreements with Scheduling Firms [in the United States] to meet the terms of the specification requirement.] All costs associated with the Schedule Development Session are to be borne by the Construction Contractor.

]1.7.3 Preliminary Network Analysis Schedule

NOTE: This paragraph should only be used on complex contracts. Do not use this paragraph on contracts that require an Accepted Network Analysis Schedule to be submitted and accepted by the Government prior

to beginning work.

Submit a preliminary network defining the planned operations during the first [90] [_____] calendar days after contract award within [20] [_____] days after contract award. The general approach for the balance of the project shall be indicated. Cost of activities expected to be completed or partially completed before submission and acceptance of the Accepted Network Analysis Schedule should be included. Submit three copies of both the preliminary network diagrams and required reports listed in paragraph entitled "Required Reports." In accordance with paragraph entitled "Monthly Reports," the preliminary network may be used for requesting progress payments for a period not to exceed 90 calendar days after receipt of "Contract Award." Submittal and acceptance of the Preliminary Network is condition precedent to the processing of the Contractor's pay requests on this schedule. Payment requests after the first [90] [_____] calendar day period shall be based upon the Accepted Network Analysis Schedule. The activities and relationships of the preliminary schedule shall coincide and mesh with the activities of the Network Analysis Schedule. As part of this submittal, provide the Project Name format (and Project Group Name if used) that will be used by the Contractor to identify initial schedule submittals, updates, fragnets, changes, etc. Include [1] [_____] copy of the Preliminary Network Analysis Schedule on 3.5" disk(s).

1.7.4 Network Analysis Schedule

NOTE: In the first sentence, remove the language in the brackets if the schedule is to be submitted prior to allowing the contractor to commence work. If a Preliminary Schedule is required remove the language for Project Name format.

Submit the complete network system, consisting of the network mathematical analysis and network diagrams[, within [40] [_____] calendar days after contract award]. Submit [three] [_____] copies of the diagrams described in the paragraph entitled "Diagrams", the required reports listed in the paragraph entitled "Required Reports ", [and] the analysis described in the paragraph entitled "Mathematical Analysis" [and information required by the paragraph entitled "Additional Requirements"]. [As part of this submittal, provide the Project Name format (and Project Group Name if used) that will be used by the Contractor to identify initial schedule submittals, updates, fragnets, changes, etc.] Include [1 copy] [_____] copies] of the Network Analysis Schedule on 3.5" disk(s) formatted to hold 1.44 MB of data.

1.7.5 Review and Evaluation

After the Government's review, the Contractor shall meet with the Contracting Officer to discuss the review and evaluation of the NAS submittal. Revisions necessary as a result of this review shall be resubmitted for acceptance within 10 calendar days after the meeting.

1.7.6 Accepted Network Analysis Schedule

**NOTE: Edit options as appropriate for cost,
manpower and equipment loading.**

Once review comments are resolved and the network has been accepted by the Contracting Officer, the Contractor shall within 5 calendar days furnish:

- a. [Two] [____] copies of the network diagrams
- b. [Two] [____] copies of the required reports listed in paragraph entitled "Required Reports"
- c. [Two] [____] copies of the "Mathematical Analysis".
- [d. [Two] [____] copies of the Cash Flow Report indicating the cash flow based upon both the early and late start schedules.]
- e. [Two] [____] copies of each major subcontractor's statement certifying their concurrence with the Contractor's Accepted Network Analysis Schedule. Each certifying statement will be made on the subcontractor's letterhead.
- f. [Two] [____] sets of data disks containing the project schedule shall be provided for the initial submission and every periodic project update. Data shall be submitted on 3.5: disk(s), formatted to hold 1.44 MB of data. A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Preliminary, NAS Submittal, Accepted, Update, Recovery, or Change), full contract number, Project Name used to identify project in scheduling software, contract name & location, data status date, diskette number with total number of diskettes in set, software name and version used to run the schedule, and the name and telephone number of person responsible for the schedule.

For major revisions, updates or changes to the network diagrams, once accepted by the Contracting Officer, the Contractor shall submit these same diagrams and reports.

1.7.7 Monthly Network Analysis Updates

**NOTE: Edit options as appropriate for cost,
manpower and equipment loading.**

At monthly intervals the Contractor, Government representatives and major subcontractors will meet to jointly update the project schedule [and agree on percentage of payment for each activity progressed during the update period]. The purpose of the meeting is to [determine progress payment amounts for each activity,] allow all parties to evaluate project status at the data date, provide a complete and accurate update of procurement and

construction progress, create an historical record of the project and establish prediction of completion date(s) based upon current status. The Contractor is responsible to gather all supporting documentation, propose the update data for the schedule, and record the meeting minutes. [All progress payment amounts will be derived from and tied to the cost-loaded schedule activities.] Submit at monthly intervals a report of the actual construction progress by updating the required reports, the time scaled logic diagram, and mathematical analysis. Meeting to update the schedule and the submission of an error free, acceptable updated schedule to the Government is a condition precedent to the processing of the Contractor's pay request. As a minimum, the following actions will be accomplished during the meeting:

- a. Identify activities started and completed during the previous period and enter the Actual Start and Actual Finish dates.
- b. Show estimated duration (in workdays) to complete each activity started but not completed (remaining duration).
- [c. Indicate percentage of cost payable for each activity.]
- d. Reflect changes in the network diagram. All changes (i.e., duration changes, logic changes, new logic, conformed change orders, new activities, changes due to Conformed Modifications, changes in work sequence, etc.) shall be recorded and a note added to the activity log field. The log shall include as a minimum, the date and reason for the change, and description of the change.
- e. Submit [two] [____] copies of a Narrative Report describing: 1) Progress made in each area of the project; 2) Changes in the following; activities, original durations, logic interdependencies, milestones, planned sequence of operations, [and] critical path[, and resource and loading]; 3) Pending items and status thereof, including permits, change orders, and time extensions; 4) Status of Contract Completion Date and interim milestones; 5) Current and anticipated delays (describe cause of the delay and corrective action(s)); and 6) Description of current and future schedule problem areas. Each entry in the narrative report will cite the respective Activity ID and Activity Description.
- f. Submit [two] [____] copies of the required reports listed in paragraph entitled "Required Reports".
- g. Submit [two] [____] copies of the Update Meeting minutes.

[1.7.8 Summary Network

NOTE: Before specifying Summary Networks, verify with the ROICC Field Office that the Summary will be useful on the project being designed. Choose type of summary to be provided. Edit options as appropriate for cost, manpower and equipment loading.

A summary network shall have the same network form as the Accepted Network Analysis Schedule. The summary network will contain a minimal number of activities that represent the general approach of work sequence. The Summary will be a time-scaled logical sequence of [Work Phases] [Work Category] [Area Code]. The Contractor shall submit a summary network diagram immediately after acceptance of the Accepted Network Analysis Schedule. A summary network update shall be submitted every [6] [_____] months during the contract duration and immediately following acceptance of each major schedule change. Submit the following:

- a. [Two] [_____] copies of the summary network diagram.
- b. [Two] [_____] copies of the Activity Identification Report.
- c. [Two] [_____] copies of the Total Float (or Slack) Report.
- d. [Two] [_____] copies of the Earned Value Report indicating the actual cash flow for the current updated (not summary) network based upon both the early and late start schedules.]

]1.7.9 As-Built Schedule

NOTE: Before specifying As-Built Schedules, verify with the ROICC Field Office that the schedule will be required.

As a condition precedent to the release of retention, the last update of the schedule submitted shall be identified by the Contractor as the "As-Built Schedule". The As Built shall reflect the exact manner in which the project was actually constructed (including actual start and finish dates, activities, sequences, and logic) and shall be certified by the Contractor's Project Manager and Construction Scheduler as being a true reflection of the way the project was actually constructed. If more than one person filled the position(s) during the course of the project, each person will provide certification for the period of time they were responsible.

]1.8 CONTRACT MODIFICATION

NOTE: Edit option as appropriate for cost, manpower and equipment loading.

When a contract modification to the work is required, submit proposed revisions to the network with a fragnet and a cost proposal for each proposed change. All modifications shall be incorporated into the network analysis system as separately identifiable activities broken down and inserted appropriately on the first update following issuance of a directive to proceed with the change. Submit [one copy] [_____] of

the Total Float Report, Log Report and a copy of the proposed Time Impact Analysis on disk, with the cost proposal. Unless the Contracting Officer requests otherwise, only conformed contract modification fragnets will be added into the subsequent monthly updates. All revisions to the current baseline schedule activities that are necessary to further refine the schedule so that the changed work activities can be logically tied to the schedule shall be made. [Financial data shall not be incorporated into the schedule until the contract modification is signed by the Contracting Officer.]

1.8.1 Time Impact Analysis:

**NOTE: Edit options as appropriate for cost,
 manpower and equipment loading.**

Time Impact Analysis shall be used by the Contracting Officer in determining if a time extension or reduction to the contract milestone date(s) is justified. The Contractor shall provide a Time Impact Analysis to the Contracting Officer for any proposed contract change or as support for a Value Engineering Proposal, Claim or Request for Equitable Adjustment by the Contractor.

- a. The Contractor shall submit a Time Impact Analysis (TIA) illustrating the influence of each change or delay on the Contract Completion Date or milestones. Unless the Contracting Officer requests an interim update to the schedule, the current monthly updated schedule accepted by the government shall be used to display the impacts of the change. Unless requested by the Contracting Officer, no other non-conformed changes will be incorporated into the schedule being used to justify the change impact.
- b. Each TIA shall include a Fragmentary Network (fragnet) demonstrating how the Contractor proposes to incorporate the impact into the Project Schedule. A fragnet is defined as the sequence of new activities and/or activity revisions, [and] logic relationships [and resource changes] that are proposed to be added to the existing schedule to demonstrate the influence of impacts to the schedule. The fragnet shall identify the predecessors to the new activities and demonstrate the impacts to successor activities. Include a narrative report describing the effects of new activities and relationships to interim and contract completion dates, with each TIA.
- c. Following the Contractor's receipt of a contract modification on a Standard Form 30 signed by the Government; all changes in the fragnet used to determine impacts, shall be incorporated into the schedule. Changes will occur during the next monthly schedule update meeting.

1.8.2 No Reservation-Of-Rights

All direct costs, indirect costs, and time extensions will be negotiated and made full, equitable and final at the time of modification issuance.

1.9 CHANGES TO THE NETWORK ANALYSIS SCHEDULE

If changes in the method of operating and scheduling are desired, the Contracting Officer shall be notified in writing stating the reasons for the change. If the Contracting Officer considers these changes to be of a major nature, the Contractor may be required to revise and submit for acceptance, without additional cost to the Government, the network diagrams and required sorts. A change may be considered of a major nature if the estimated time required or actually used for an activity or the network logic is varied from the original plan to a degree that there is a reasonable doubt as to the effect on the contract completion date(s) [or phase completion dates]. Changes that affect activities with adequate float time shall be considered a major change when their cumulative effect could extend the contract completion date.

1.10 FLOAT

Use of float suppression techniques, such as; preferential sequencing (arranging critical path through activities more susceptible to government caused delay), special lead/lag logic restraints, zero total or free float constraints, extended activity times, or imposing constraint dates other than as required by the contract, shall be cause for rejection of the project schedule or its updates. The use of Resource Leveling (or similar software features) used for the purpose of artificially adjusting activity durations to consume float and influence the critical path is expressly prohibited.

1.10.1 Definitions of Float or Slack

Free Float is the length of time the start of an activity can be delayed without delaying the start of a successor activity. Total Float is the length of time along a given network path that the actual start and finish of activity(s) can be delayed without delaying the project completion date.

Project Float is the length of time between the Contractor's Early Completion (or Substantial Completion) and the Contract Completion Date.

1.10.2 Ownership of Float

Float available in the schedule, at any time shall not be considered for the exclusive use of either the Government or the Contractor. During the course of contract execution, any float generated due to the efficiencies of either party is not for the sole use of the party generating the float; rather it is a shared commodity to be reasonably used by either party. Efficiencies gained as a result of favorable weather within a calendar month, where the number of days of normally anticipated weather is less than expected, will also contribute to the reserve of float. A schedule showing work completing in less time than the Contract time, and accepted by the Government, will be considered to have Project Float. Project Float will be a resource available to both the Government and the Contractor. No time extensions will be granted nor delay damages paid unless a delay occurs which impacts the Project's critical path, consumes all available

float or contingency time, and extends the work beyond the Contract Completion Date.

1.10.3 Negative Float

Negative float will not be a basis for requesting time extensions. Any extension of time will be addressed in accordance with the Paragraph "Time Extensions". Scheduled completion date(s) that extend beyond the contract [or phase] completion date(s) (evidenced by negative float) may be used in computations for assessment of payment withholdings. The use of this computation is not to be construed as a means of acceleration.

1.11 TIME EXTENSIONS

Extension of time for performance required under the clauses entitled "Changes," "Differing Site Conditions," "Default (Fixed-Price Construction)" or "Suspension of Work" will be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the total float or slack along the network paths involved at the time Notice to Proceed was issued for the change. The Contractor acknowledges and agrees that delays in activities which, according to the network analysis schedule, does not in fact actually affect any milestone completion dates or the contract completion date shown on the CPM network at the time of delay, will not be a basis for a contract extension. Submit time extension requests with a Time Impact Analysis and three copies of the Total Float (or Slack) Report, Narrative Report and Log Report.

[1.12 MONTHLY COORDINATION MEETING

NOTE: Consult with the local ROICC Field Office on whether to use this paragraph. Include this paragraph for larger or more complex projects.

In conjunction with receipt of the Monthly Network Update submission, a coordination meeting will be held each month [on site] [in the Contracting Officer's conference room] to discuss the report. The Contractor shall make a presentation of the previously submitted and current Monthly Network Update to the Contracting Officer so as to provide an overview of the project's schedule and provide an opportunity to discuss items of coordination.

]1.13 BIWEEKLY WORK SCHEDULE

NOTE: Consult with the local ROICC Field Office on whether to use this paragraph. Include this paragraph for larger or more complex projects. Edit options as appropriate for cost, manpower and equipment loading.

To provide a more detailed day-to-day planning of upcoming work, the

Contractor shall prepare and issue detailed work plans that coordinate with and supplement the above defined network analysis. The work plans shall be keyed to the CPM activity numbers and shall be submitted each week and shall show the projects activities that will occur during the following two-week interval. Additionally, the critical path activities are to be identified on the Biweekly Work Plan. The detail work plans are to be bar chart type schedules prepared by the Contractor in sufficient detail to define the work to be accomplished[, the crews, construction tools and equipment to be used] during the current and next two-week interval. The bar charts shall be formatted to allow reproduction on 8 1/2 by 11 sheets. [Three copies of the bar chart schedules shall be delivered to the Contracting Officer not less than 3 work hours prior to the start of the weekly coordination meeting.]

]1.14 WEEKLY COORDINATION MEETING

NOTE: Consult with the local ROICC Field Office on whether to use this paragraph. Include this paragraph for larger or more complex projects.

In conjunction with the receipt of the Bi-Weekly Work Schedule, a coordination meeting will be held each week [on site] [in the Contracting Officer's conference room] to discuss the work schedule. The Contractor shall make a presentation of the previously submitted and current Bi-Weekly Work Schedule to the Contracting Officer so as to provide an overview of the project's schedule and provide an opportunity to discuss items of coordination. Consideration of materials, crews, and equipment shall be addressed to ascertain their respective availability. The meeting shall identify actions necessary to provide adherence to the Bi-Weekly Work Schedule and the overall network for the project defined above. The Contractor will take meeting minutes. All meeting minute entries will be keyed to the schedule activity number(s) being addressed. Within one day of the meeting, the Contractor will provide a draft copy of the meeting minutes to the Contracting Officer for review and comment. Final copies of the minutes containing the comments provided by the Contracting Officer, will be issued within 3 days of the meeting.

]1.15 CORRESPONDENCE AND TEST REPORTS

All correspondence (e.g., letters, Requests for Information (RFIs), e-mails, meeting minutes, Production and QC Daily Reports, material delivery tickets, photographs, etc.) shall reference the Schedule Activity Number(s) that are being addressed. All test reports (e.g., concrete, soil compaction, weld, pressure, etc.) shall reference the Schedule Activity Number(s) that are being addressed.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --