

SECTION 01 32 16  
CPM SCHEDULES AND REPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Administrative and procedural requirements for schedules and reports required for proper performance of the work.

1.2 QUALITY ASSURANCE

- A. Scheduler: Submit documentation of Contractor's personnel specializing in CPM scheduling with five years minimum experience in scheduling construction work of complexity comparable, and having use of computer facilities capable of delivering readout within 24 hours.
- B. Contractor's Administrative Personnel: Submit documentation of five years minimum experience in using and monitoring CPM schedules on comparable projects.

1.3 PROCEDURE

- A. Provide information and input required for development of Project Schedule in accordance with requirements of this Section. Purpose of schedule shall be:
  - 1. Assure adequate planning, scheduling and reporting during execution of work by Contractor.
  - 2. Ensure coordination of work of Contractor and various subcontractors and subsubcontractors.
  - 3. Assist Contractor and Owner in monitoring progress of Work and evaluating proposed changes to Contract and Project Schedule.
  - 4. Assist Owner and Contractor in preparation and evaluation of Contractor's monthly progress payments.
- B. Use Critical Path Method (CPM) for planning, scheduling and reporting Work to be performed under Contract. Display graphic portions of Project Schedule by Activity-on-Arrow Diagramming Method (ADM).
- C. Include Preliminary Network, Detailed Network, and computer produced Schedule and Cost Reports.
- D. Provide Preliminary Network to monitor progress of Work during development and acceptance of Detailed Network.
- E. Contractor and major subcontractors shall meet with Owner within seven calendar days after date of Notice to Proceed to conduct joint review of Project Schedule requirements to assure mutual understanding by parties involved.

#### 1.4 INITIAL SCHEDULE DEVELOPMENT (FORMAT)

- A. Propose Critical Path Method arrow diagram format consisting of project activities, sequences and duration, submittals, procurement and completion of work.
- B. Submit to Architect from each major subcontractor letter confirming work schedule for the individual trade.
- C. Submit initial network analysis schedule development within seven days of Notice-to-Proceed, or at Preconstruction Scheduling Meeting, to Architect for review.
- D. Incorporate revisions deemed necessary by Architect and resubmit within additional 7 days.
- E. Upon acceptance of network analysis format, begin data input and development of Preliminary Network.

#### 1.5 PRELIMINARY NETWORK DEVELOPMENT

- A. After acceptance of initial schedule format by Architect, Contractor to submit to Architect Preliminary Network within 14 calendar days of acceptance of schedule format, but not more than 21 days after Notice to Proceed. Submit four copies of Preliminary Network neatly organized and drawn non-time scaled from left to right on either 24 inches by 36 inches 610 mm by 915 mm) or 30 inches by 42 inches (760 mm by 1065 mm) standard size sheets with suitable notation relating interface points among sheets. Cover following project phases and activities:
  - 1. Proposed procurement activities, including shop drawings, product data and sample submittals, and fabrication and delivery of critical and long lead time procurements.
    - a. Indicate intended submittal dates and realistic delivery dates for fabrication and delivery items.
    - b. Incorporated into Detailed Network (described below), including requested revisions.
  - 2. Proposed construction activities to be accomplished during first 90 calendar days of Contract.
    - a. Activity durations shall be in units of whole working days and shall be limited to maximum 15 days for each activity.
    - b. Incorporate proposed 90 calendar day construction activities into Detailed Network, including requested revisions.
  - 3. Include in proposed procurement and construction activities same information required for Detailed Network described below.
  - 4. Summary activities not included above which are necessary to properly indicate following:
    - a. Approach to scheduling remaining work areas or phases of work. work for each phase or area must be represented by at least one summary activity such that they cumulatively indicate entire Project Schedule.
    - b. Show approximate cost and duration for each summary activity on Preliminary Network and include best estimate of work.

- B. Show sequence and interdependence of activities subject to requirements.
- C. Preliminary Network shall be basis for progress payments during first 90 days of Contract while Detailed Network (described below) is being developed and accepted.
- D. Updated on monthly basis while Detailed Network is being developed. Monthly updating of Preliminary Network shall be consistent with procedures and requirements for Schedule Updating, except computer produced Schedule and Cost Reports shall not become part of Project Schedule until after acceptance of Detailed Network.
- E. Use as follows for time extension analysis during first 90 calendar days of Contract:
  - 1. When Change Orders (and Proposed Changes) are initiated, delays are experienced, or Contractor desires to revise Preliminary Network, submit to Architect written Time Impact Analysis as required below, except included activities and event times in Analysis from current Preliminary Network update.
  - 2. Determine final determination with regard to extent of time extension allowed in accordance with requirements for Time Impact Analysis, subsequent to development, review and acceptance of Detailed Network.
- F. Within seven days of Architect's receipt of Preliminary Network, Architect shall notify Contractor of concerns to Preliminary Network. Furnish written response to Architect's comments prior to or concurrent with submittal of Detailed Network. Resolve comments and concerns before consideration of Detailed Network can commence.

#### 1.6 DETAILED NETWORK DEVELOPMENT

- A. Schedule development by Contractor: Within 28 days after Notice to Proceed, submit proposed Detailed Network to Architect. Cover entire Contract Time period and incorporate in detail first 90 calendar days of Preliminary Network, including requested revisions. Organize and drawn non-time scaled from left to right on either 24 inches by 36 inches 610 mm by 915 mm) or 30 inches by 42 inches (760 mm by 1065 mm) standard size sheets with suitable notation relating interface points among sheets. Detailed Network shall include, but not be limited by, following as minimum:
  - 1. Proposed procurement activities, including activities and information used in Preliminary Network. Recommended sequence would be as follows:

Duration	Description
---- --00	0 (restraint from NTP)
--00	--02-SUB
--02	--04-APP
--04	--06-F/D
--06	--081ARR
--08	----0(restraint to installation)
  - 2. In above sequence, activity --00 --02 is submittal activity which precedes --02 --04, "approval". Activity --04 --06 is fabrication and delivery time which precedes --06 --08, "arrival". Begin each activity description with three character verb abbreviation standard in procurement item scheduling for purposes of computer report selection. Arrival activity, "ARR", is included for purpose of pinpointing

cashflow. Load arrival activity with amount due contractor upon delivery of line item in question. Each activity of this type shall have "duration" of one day.

3. Proposed construction activities, including activities and information used in Preliminary Network. Develop construction sequencing separately from procurement. Construction activity sequence shall appear as though it were developed under assumption that materials are immediately available to Project. Link procurement activities grouped together on network diagram (preferably above construction logic), to various installation activities by restraints (dummies) from "J" nodes of "arrival" activities.
4. Proposed durations for construction activities.
5. Proposed sequencing of construction activities.
6. Proposed activity manpower, cost and equipment loading.

B. Depict following for each activity:

1. "I" and "J" (beginning and ending) event nodes and numbers, respectively. Utilize numerical designations to identify each and every event node. Do not utilize alpha-numeric event node numbering. Each "J" node number shall be larger than preceding "I" node numbers.
2. Concise description of Work represented by activity. As requested by Architect, either prior or subsequent to acceptance of Detailed Network, furnish graphic explanation of relationship of activities in comparison with work areas identified on prints of Contract Documents, at no additional cost to Owner.
3. Activity duration in whole working days, with maximum 15 work days each, unless otherwise directed by Architect, except for non-construction activities such as procurement and fabrication of materials, delivery of materials, and curing of concrete. When single activity requires more than 15 days, subdivided into identifiable elements of less than 15 working days each.
4. Performance responsibility by discipline code: MECH, ELEC, or other acceptable abbreviations accepted by Architect.
5. Assigned dollar value (cost loading) of each activity of Detailed Network, which cumulatively equal total Contract Sum. Mobilization, bond and insurance costs may be shown separately. Prorate other General Requirement costs, overhead, and profit throughout activities. For this purpose, assume rate of activity value installation into work as linear with time.
6. Manpower loading of each activity. Prepare and submit (separate) manpower summary analysis in graphic format depicting manpower by principle trades and aggregate. Graph(s) shall show number of man-days of effort, by month, over duration of Project Schedule.
7. Assignment to applicable activities of Detailed Network of major construction equipment to be utilized by Contractor, subcontractors, and sub-subcontractors in executing Work.

C. Computer Printout:

1. Early Start and Early Finish dates.
2. Late Start and Late Finish dates.
3. Activity Float Time.

4. Actual Start and Finish dates.
- D. Clearly identify activities illustrating accomplishment of time(s) for completion of project set forth in Contract. If schedule indicated earlier completion time(s) than that set forth in Contract, show float (or slack) between schedule and Contract dates on computer printout shall be part of total float available.
  - E. Produce computer printouts sorts and summaries, providing sorts and breakdowns as follows:
    1. I-J.
    2. Total float.
    3. Performing organization.
    4. Early start date.
    5. Schedule of Values.
    6. Monthly cash flow.
  - F. Develop network diagram logic so that no activity having duration greater than zero shall share I-node or J-node designation with other activities having duration greater than zero. There shall be no converging or diverging logic patterns involving more than one activity of duration greater than zero.
    1. Include contractor and subcontractor work at tiers.
  - G. Show sequence and interdependence of activities required for complete performance of Work in logical sequence and coordinated plan of work.
  - H. Estimate proposed durations assigned to each activity of time required to complete activity considering scope and resources planned for activity. Upon request by Architect, furnish written description of determination of each duration of critical activities. Include in request:
    1. Explain number of crews, crew composition, number of shifts per day, number of hours in shift, and number of work days per week.
    2. Provide major item list of construction equipment for activity, including types, number of units, unit capacities, and proposed time each piece of equipment will be on job keyed to activities on which equipment will be used.
    3. Other pertinent data affecting specific activity duration.
  - I. Failure by Contractor to include elements of work required for performance of Contract shall not excuse Contractor from completing work within Contract Time, regardless of acceptance of Detailed Network.
  - J. Consider seasonal weather conditions and included in planning and scheduling of work influenced by high or low ambient temperatures or precipitation to ensure completion of Work within Contract Time. Determine Seasonal weather conditions by assessment of average historical climatic conditions based upon preceding 10 year records published for locality by U.S. Weather Bureau Service.
    1. Show Architect that critical activity path has been delayed by loss of days in excess of number indicated above before consideration of extension will be given.

2. In execution of interior work, Contractor must show to satisfaction of Architect that interior work has been delayed by adverse weather in excess of number of allowable days above.
- K. Indicate holidays, vacations and non-work days applicable to schedule.
- L. If Architect questions Contractor's proposed logic, durations, manpower, cost or equipment loading, within seven calendar days of receipt of written request, furnish satisfactory revision or adequate justification.
- M. Joint Review, Revision, and Approval of Detailed Network:
1. Within 14 calendar days of receipt of Contractor's proposed Detailed Network, and within seven calendar days of receipt by Architect of Contractor's response, Architect, Contractor and Owner shall meet for joint review, correction or adjustment of proposed Detailed Network. Areas which, in opinion of Architect, conflict with timely completion of Project shall be subject to revision by Contractor.
  2. If Contractor fails to define element of work, activity or logic, and Architects review does not detect this error or omission, such error or omission, current at next monthly update without change to Contract Time.
  3. Within 7 calendar days after joint review, revise Network in accordance with agreements reached during review and submit one reproducible annotated electronic PDF File and three prints of revised Network.
  4. Within 7 calendar days of receipt by Architect of revised Detailed Network, three copies of each revised Network and computer produced Schedule and furnish Cost Reports to Architect by Contractor. Include computer produced cashflow analysis generated by both early start and late start activity dates.
  5. Upon establishment of agreed upon Project Schedule, sign on face of documents (Detailed Network and Schedule and Cost Report), indicating acceptance of Schedule.
  6. Upon acceptance of Detailed Network by Owner, cost loaded values of Network shall become basis for determining progress payments.
  7. Acceptance of Project Schedule by Owner does not relieve Contractor of responsibilities for accuracy or feasibility of schedule, or Contractor's ability to meet Contract Completion date, nor does acceptance warrant, acknowledge or admit reasonableness of logic, durations, manpower or equipment loading of Project Schedule.

#### 1.7 PROJECT SCHEDULE UPDATING

- A. Updated on monthly basis throughout Contract Time and until Substantial Completion. Meet with Owner and Architect each month at Schedule Update meeting to review actual progress made through date of schedule update, including following:
1. Progress made to date, activities started and completed to date, and percentage of Work complete to date on each activity started but not complete.
  2. Evaluate percentage of completed work with Contractor prepared estimates and supporting data.

3. Submit contractor prepared estimates of percentage completion of each activity and supporting data on or before 14th day preceding progress payment submittal deadline, including following information:
  - a. One marked up copy of previous months Schedule Update Network indicating progress on schedule activities and revised (current) remaining durations. Legibly mark up copy with felt tip markers and red ink.
  - b. One original and three reproduced marked up copies of previous months Schedule Update reports coordinated with other requirements above and indicating actual activity start or completion dates, revised (current) remaining durations, and percent complete with regard to activity cost.
  - c. Indicate in writing those activities Contractor plans to work on during following update month and current or anticipated conditions which may delay work.
- B. In case of disagreements at Schedule Update meeting concerning actual progress to date, Architect's determination shall govern.
- C. Upon completion of Schedule Update meeting, which occurs on or before 7th day preceding progress payment submittal deadline, use input from meeting to revise Network to reflect progress as of date of Schedule Update and agreed revisions. Execute computer produced calculation to determine status of Project Schedule. Use percentage completions as required for preparation of monthly request for progress payment.
- D. Forward two copies of each updated Project Schedule Architect including
  1. Description of activities completed during preceding month.
  2. Description of progress made on activities listed as started but not completed.
  3. Description of revisions to schedule logic, initial activity durations, or activity costs.
  4. Prints of updated Network indicating progress made up to date of Schedule Update and indicating revisions to Network.
  5. Following computer produced reports:
    - a. I-J.
    - b. Total float.
    - c. 60-day Early Start by I-J.
    - d. 60-day Early Start by Responsibility Code.
    - e. Cost report.
  6. Include I-J, Total Float, and 60-day Early Start Schedule Reports listed for reach activity listed on Network:
    - a. I-J Event Node Number(s).
    - b. Activity Description.
    - c. Original Destination.
    - d. Remaining Duration.
    - e. Activity Responsibility Code.
    - f. Activity Early Start Date.
    - g. Activity Early Finish Date.
    - h. Activity Late Start Date.

- i. Activity Late Finish Date.
  - j. Total Float.
- E. If Contractor does not record exceptions to published Project Schedule Update within 14 calendar days after its issuance, Contract shall be deemed to have accepted revisions.
- F. Monthly updating of Project Schedule shall be integral part and basic element of estimate upon which progress payments will be made. If, in opinion of Architect, Contractor fails or refuses to provide information required to accomplish complete Update, Contractor shall be deemed to have not provided required estimate upon which progress payments are based and shall not be entitled to progress payment until completed Update has been provided in accordance with requirements to satisfaction of Architect.

#### 1.8 PROJECT SCHEDULE REVISIONS

- A. Updating Project Schedule to reflect actual progress made up to date of Update shall not be considered revisions to Project Schedule.
- B. If Project Schedule no longer represents actual progress of work, submit revision to Schedule.
- C. If Contractor desires to make changes in Project Schedule to reflect revisions in method of operating and scheduling of work, notify Architect in writing, stating reason for proposed revision.
- D. If revision to Schedule is contemplated, Contractor or Owner shall advise each other in writing at least 14 calendar days in advance of next Schedule Update meeting, describing revision and describing reasons for revision.
- E. Reasonable requests by Contractor for revisions will be implemented by Owner.
- F. Owner directed revisions to Project Schedule will not be incorporated into Schedule without written response from Contractor within 14 calendar days. Contractor's failure to respond within 14 days will be considered acceptance of Owner requested revisions, and revisions will be incorporated into Schedule.
- G. Make requests for revisions of activity manpower, activity costs, or redistribution of activity costs in accordance with requirements.

#### 1.9 ADJUSTMENT OF TIME FOR COMPLETION

- A. Time for Completion will be adjusted as follows:
- B. Accompany request for adjustment of time for completion because of changes or alleged delays with complete Time Impact Analysis submitted for within 30 calendar days after initial notice of delay.
- C. Furnish information justifying request and stating extent of adjustment requested for each specific change or alleged delay. Each Analysis shall be on form and content

acceptable to Architect. Include but do not limit to, general information set forth in this Clause appropriate to type of request (change or alleged delay) plus following:

1. Fragmentary CPM network illustrating how Contractor proposes to have change or alleged delay incorporated into current Update Schedule.
2. Identification of activities in current updated Project Schedule which are proposed to be amended due to change or alleged delay, together with engineering estimates and other appropriate data justifying proposal.
3. Include total allowable time of activity float time available for work involved in request.

#### 1.10 TIME IMPACT ANALYSIS

- A. When change Orders (including Proposed Change Orders) are initiated, delays are experienced, or Contractor desires to revise Project Schedule, submit to Architect written Time Impact Analysis illustrating influence of each Change Order, delay, or Contractor request on current Contract Completion date.
- B. Base Time Impact Analysis on dates when change or changes were issued, or dates when alleged delay or delays began, status of work at that time, and include time computations for affected activities.
- C. Activity delays shall not automatically mean that extension of Contract Time is warranted or due Contractor.
- D. Float is not for exclusive use or benefit of either Owner or Contractor. Contract Time extensions will be granted only to extent equitable time adjustments to activity or activities affected by Change Order or delay exceeds total (positive or zero) float of critical activity (or path) and extends Contract Date.
- E. Submit three copies of each Time Impact Analysis within 14 calendar days after commencement of delay or notice of direction for Change Order is given to Contractor.
- F. Upon Architects review of Time Impact Analysis, to extension of time for completion of immediate contract milestone, time(s) for completion of such milestone(s) will be adjusted by Architect, whether or not time for completion of overall Project Schedule is changed accordingly.
- G. If Architect finds, after review of Time Impact Analysis that Contractor is entitled to extension of time for completion, time for completion will be adjusted by Architect and Owner will allow revision to Project Schedule.
- H. Upon failure to submit Time Impact Analysis for change or alleged delay within 14 calendar days, or provide additional information as Architect may require, Architect will determine time impact of change or alleged delay. If this results in determination that adjustments should be made, Architect will issue direction at next Update meeting.
- I. Incorporate Time Impact Analysis related to Change Order work or Contract Time extensions, into and attached to applicable Change Order.

1.11 RESPONSIBILITY FOR COMPLETION

- A. Furnish sufficient forces. Include offices, facilities and equipment works hours, night shifts and overtime operations, as necessary to ensure execution of work in accordance with monthly Project Schedule Update.

PART 2 - PRODUCTS  
Not used.

PART 3 - EXECUTION  
Not used.

END OF SECTION