

## **Part 1        General**

### **1.1        REFERENCES**

#### **.1        Definitions:**

- .1        Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2        Bar Chart (Gantt chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars.
- .3        Baseline: original approved plan (for Project, work package, or activity), plus or minus approved scope changes.
- .4        Completion Milestones: they are firstly Substantial Completion and secondly Final Certificate.
- .5        Constraint: applicable restriction or limitation, either internal or external to project, that will affect performance of Project. Factors that affect activities can be scheduled.
- .6        Control: process of comparing actual performance with planned performance, analyzing variances, evaluating possible alternatives, and taking appropriate corrective action as needed.
- .7        Critical Activity: any activity on a critical path.
  - .1        Most commonly determined by using critical path method.
- .8        Critical Path: sequence of activities that determines duration of Project. Generally, it is the longest path through Project.
  - .1        Usually defined as those activities with float less than or equal to specified value, often zero.
- .9        Critical Path Method (CPM): network analysis technique used to determine the amount of scheduling flexibility (amount of float) on various logical network paths in Project schedule network, and to determine the minimum total Project duration.
- .10       Duration: total number of work periods (not including holidays or other non-working periods) required to complete activity or other Project element.
  - .1        Usually expressed as workdays or work weeks.
- .11       Master Schedule: summary-level schedule that identifies major deliverable; work breakdowns structure and key milestones.
- .12       Milestone: significant point or event in Project, usually completion of major deliverable.
- .13       Project Schedule: planned dates for performing activities and planned dates for meeting milestones.

## **1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Scheduling:
  - .1 Planning: ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made.
  - .2 Ensure project schedule efficiencies through monitoring of Project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that has started but are not yet completed.
  - .3 Monitor sufficiently often so that causes of delays can immediately be identified and removed.
- .2 Project monitoring and reporting:
  - .1 Keep team aware of changes to schedule, and possible consequences as project progresses.
  - .2 Use narrative reports to provide advice on seriousness of difficulties and measures to overcome them.
  - .3 Begin narrative reporting with statement on general status of Project followed by summarization of delays, potential problems, corrective measures and Project status criticality.
- .3 Critical Path Method (CPM) Requirements:
  - .1 Ensure Master Plan and Detail Schedule are practical and remain within specified Contract duration.
  - .2 Revise Master Schedule and Detail Schedule deemed impractical by Departmental Representative and resubmit for approval.
  - .3 Change to Contract Duration:
    - .1 Acceptance of Master Schedule and Detail Schedule showing scheduled Contract duration shorter than specified Contract duration does not constitute change to Contract.
    - .2 Duration of Contract may only be changed through bilateral Agreement.
  - .4 Consider Master Schedule and Detail Schedule deemed practical by Departmental Representative, showing Work completed in less than specified Contract duration, to have float.
  - .5 First Milestone on Master Schedule and Detail Schedule will identify start Milestone with an "ES" constraint date equal to Award of Contract date.
  - .6 Calculate dates for completion milestones from Plan and Schedule using specified time periods for Contract.
  - .7 Interim Certificate with "LF" constraint equal to calculated date.
  - .8 Calculations on updates to be such that if early finish of Interim Certificate falls later than specified Contract duration then float calculation to reflect negative float.

- .9 Delays to non-critical activities, those with float may not be basis for time extension.
- .10 Do not use float suppression techniques such as imposed dates other than required by Contract.
- .11 Allow for and show Master Plan and Detail Schedule adverse weather conditions normally anticipated.
  - .1 Specified Contract duration has been predicated assuming normal amount of adverse weather conditions.
- .12 Provide necessary crews and manpower to meet schedule requirements for performing Work within specified Contract duration.
  - .1 Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.
- .13 Arrange participation on and off site of subcontractors and suppliers, as required by Departmental Representative, for purpose of network planning, scheduling, updating and progress monitoring.
  - .1 Approvals by Departmental Representative of original networks and revisions do not relieve Contractor from duties and responsibilities required by Contract.
- .14 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

### **1.3 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Refer to article "PROGRESS MONITORING AND REPORTING" of this specification Section for frequency of Project control system submittals.
- .3 Submit impact analysis of schedule for changes that result in extension of contract duration.
  - .1 Include draft schedule update and report as outlined in article "PROGRESS MONITORING AND REPORTING".
- .4 Submit Project planning, monitoring and control system data as part of initial schedule submission and monthly status reporting in following form.
  - .1 Master Schedule Bar Chart.
  - .2 Construction Detail schedule Bar Chart.
  - .3 Listing of project activities including milestones and logical connectors, networks (sub-networks) from Project start to end. Sort activities by activity identification number and accompany with descriptions. List early and late start and finish dates together with durations, codes and float.
  - .4 Criticality report listing activities and milestones with zero total float used as first sort for ready identification of critical paths through entire project. List early and late starts and finishes dates, together with durations, codes and float for critical activities.

- .5 Progress report in early start sequence, listing for each trade, activities or finished within 2 months from monthly update date. List activity identification number, description and duration. Provide columns for entry of actual start and finish dates, duration remaining and remarks concerning action required.

#### **1.4 WORK BREAKDOWN STRUCTURE (WBS)**

- .1 Prepare construction Work Breakdown Structure (WBS) within 5 working days of Award of Contract date.
  - .1 Develop WBS through at least five levels: project, stage, element, sub-element and work package.

#### **1.5 MASTER SCHEDULE**

- .1 Structure and base CPM construction networks system on WBS coding in order to ensure consistency throughout Project.
- .2 Prepare comprehensive construction Master Schedule (CPM logic diagram) within 5 working days of finalizing Agreement to confirm validity or alternates of identified milestones.
  - .1 Master Schedule will be used as baseline.
    - .1 Revise baseline as conditions dictate and as required by Departmental Representative.
    - .2 Departmental Representative as Project progresses will review and return revised baseline within 7 work days.
- .3 Reconcile revisions to Master Schedule and Cash Flow Projections with previous baseline to provide continuous audit trail.
- .4 Initial and subsequent Master Schedule will include:
  - .1 Bar chart identifying coding, activity durations, early/late and start/finish dates, total float, completion as percentile, current status and budget amounts.
  - .2 Network diagram showing coding, activity sequencing (logic), total float, early/late dates, current status and durations.

#### **1.6 DETAIL SCHEDULE**

- .1 Provide detailed project schedule (CPM logic diagram) within 5 working days of Award of Contract date showing activity sequencing, interdependencies and duration estimates. Include listed activities as follows:
  - .1 Shop drawings.
  - .2 Samples.
  - .3 Approvals.
  - .4 Procurement.
  - .5 Construction.
  - .6 Installation.

- .7 Site works.
- .8 Testing.
- .9 Commissioning and acceptance.
- .2 Relate Detail Schedule activities to basic activities and milestones developed and approved in Master Schedule.
- .3 Clearly show sequence and interdependence of construction activities and indicate:
  - .1 Start and completion of all items of Work, their major components, and interim milestone completion dates.
  - .2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:
    - .1 Time for submittals, resubmittals and review.
    - .2 Time for fabrication and delivery of manufactured products for Work.
    - .3 Interdependence of procurement and construction activities.
  - .3 Include sufficient detail to assure adequate planning and execution of Work. Activities should generally range in duration from 3 to 5 workdays each for phase 1. Activities should generally range in duration from 3 to 15 workdays each for phase 2.
- .4 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated and allow co-ordination and control of project activities. Show continuous flow from left to right.
- .5 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout length of Project to form "Critical Path". Increased number of critical activities is seen as indication of increased risk.
- .6 Insert Change Orders in appropriate and logical location of Detail Schedule. After analysis, clearly state and report to Departmental Representative for review effects created by insertion of new Change Order.

## **1.7 PROGRESS MONITORING AND REPORTING**

- .1 On ongoing basis, Detail Schedule on job site must show "Progress to Date". Arrange participation on and off site of subcontractors and suppliers, as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring. Inspect Work with Departmental Representative at least once bi-weekly to establish progress on each current activity shown on applicable networks.
- .2 Update and reissue project Work Breakdown Structure and relevant coding structures as project develops and changes.
- .3 Perform Detail Schedule update monthly with status dated (Data Date) on last working day of month. Update to reflect activities completed to date, activities in progress, logic and duration changes.

- .4 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.
- .5 Submit to Departmental Representative copies of updated Detail Schedule.
- .6 Requirements for bi-monthly progress monitoring and reporting are basis for progress payment request.
- .7 Submit bi-weekly written report based on Detail Schedule, showing Work to date performed, comparing Work progress to planned, and presenting current forecasts. Report must summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate any potential delay. Include in report:
  - .1 Description of progress made.
  - .2 Pending items and status of: shop drawings,.
  - .3 Status of Contract completion date and milestones.
  - .4 Current and anticipated problem areas, potential delays and corrective measures.
  - .5 Review of progress and status of Critical Path activities.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**