

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULES - CPM

PART 1 - GENERAL

1.1 SUMMARY

- A. Scheduling of Work under the Contract shall be performed by Contractor in accordance with requirements of this Section.
 - 1. Development of Schedule Submittals shall employ computerized Critical Path Method (CPM) scheduling.
 - 2. The Baseline Schedule and Project Schedule Updates shall be cost and resource loaded based on the Schedule of Values as approved by the City.

1.2 RELATED SECTIONS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-01 Specification Sections, apply to this Section.

1.3 GENERAL REQUIREMENTS

- A. CPM Schedule Submittals: Contractor shall submit the digital file with a .XER or .XML extension for all reviews, including but not limited to, the Baseline Schedule, Progress Schedule, Recovery Schedule, Notices of Delay, Time Impact Analysis, and all Claims.
- B. Contractor is required to involve all subcontractors in the development, implementation, and updating process of its schedule.
- C. Acceptance or approval of the CPM Schedule Submittals is of general nature only. Failure by Contractor to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date, notwithstanding the City approval of the CPM diagrams. Items missing from the schedule after City approval are assumed to be incidental work, and at not cost to the city the Contractor may submit a revised schedule to include these items. The revised schedule is subject to review and approval by the City as described in "Revised Schedule" clause. No extension of time will be granted because of errors or omissions on the schedule. It is Contractor's responsibility to incorporate all necessary activities to cover the work required by the Contract Documents.
- D. The Baseline Schedule and analysis when approved by the City shall constitute the official project work schedule throughout the construction period. No alteration of the logic, duration of activities, etc. will be allowed without the approval of the City.

1.4 SUBMITTALS

- A. The Baseline Schedule, Progress Schedule Update, Revise Schedule, Recovery Schedule, and reports prepared by Contractor shall be used for planning, organizing, directing, controlling, and reporting all work required by the Contract Documents.

- B. The CPM Schedule Submittals shall be at a minimum of three (3) hard copies and a CD-ROM in a case, or other acceptable digital format. Digital submittal shall be the original and editable file with a .xer or .xml file extension.
- C. The timely submission of the following is required:
 - 1. Digital copy and three (3) hard copies of the Baseline Schedule fourteen (14) calendar days prior to commencing the Work of the Contract;
 - 2. Progress Schedule Update including written narrative as per specifications on a monthly basis;
 - 3. Activity Schedule on a weekly basis at the weekly progress meetings;
 - 4. Revised schedule within ten (10) working days when requested by the City;
 - 5. Resubmittal of any rejected Baseline Schedule, Progress Schedule Update, or revised schedule within five (5) working days after receipt of the returned schedule marked "RESUBMIT," if necessary;
 - 6. Daily Construction Reports, per section 1.11 of this specification.
- D. Failure to comply with timely submission of any schedule will be just cause to withhold the progress payment of any portions thereof by the City and will trigger liquidated damages listed in Section 00 73 02.
- E. Schedule Reviews: Unless otherwise stated, the City will review and respond to scheduling submittals within ten (10) working days after the submittal is received. If the schedule is not accepted, Contractor shall re-submit within five (5) working days after receipt of the City's response if changes or additional information is requested. This review and resubmittal cycle will repeat until the schedule has been accepted by the City.

1.5 PLAN OF OPERATION

- A. At the Pre-Construction Conference, the Contractor shall submit for the City's review a Plan of Operation for the first 60 days of the Contract commencing after the Notice to Proceed. This schedule shall serve the project schedule needs until the Baseline Schedule has been accepted. Sufficient detail shall be included for the identification of submittals, permits, equipment procurement, construction activities.

1.6 CPM SCHEDULE SUBMITTALS

- A. The CPM Schedule shall be prepared by Contractor using the precedence method of network diagramming.
- B. Time Scaled Graphic network diagram showing the critical path shall not be larger than 24" x 48".
- C. Activity Description: Each Activity shall have a unique narrative description consisting of a work function and location.
- D. All submittals that require City review and approval shall be incorporated in the CPM Schedules.
- E. All Activities shall have succeeding Activities except Work completion. At least one successor shall be a FF or FS relationship.

- F. Contractor shall disclose in detail how weather delays, as specified in the General Provisions of the Contract, will be incorporated into the Baseline Schedule. Contractor must keep a current "weather delay registry" that would be reviewed and agreed to by both parties during the Monthly Schedule Update submittal process.
- G. Contractor shall furnish the following computer-generated reports with the project identification, schedule and run date, and sort-type on the first page of each report.
 - 1. List of all activities sorted by total float including ES, LS, EF, LF, and Total Float duration.
 - 2. List of all activities sorted numerically including ES, LS, EF, LF, and Total Float duration.
 - 3. List of all activities sorted numerically including ES, LS, EF, LF, Total Float duration, and Predecessor/Successor information of precedence network.
 - 4. List of all activities sorted by responsibility including ES, LS, EF, LF and Total Float duration.
 - 5. List of activities on the critical path sorted numerically including ES, LS, EF, and LF.
 - 6. List of near critical activities (activities with total float less than ten (10) working days) sorted numerically including ES, LS, EF, and LF.
- H. All CPM activity time duration in working days shall be specified in five (5) day work weeks excluding holidays to be identified by Contractor, unless specifically allowed by the Contract.
- I. A maximum of fifteen (15) days duration shall be given to each CPM construction activity. Any activity in excess of the fifteen (15) days shall be broken down in detail so that each detail activity will not exceed the fifteen (15) days maximum.

1.7 BASELINE SCHEDULE

- A. Fourteen (14) calendar days prior to start of Work, Contractor shall furnish a Baseline Schedule showing in detail the proposed sequence of activities. The City will not process any progress payments until the required schedule is submitted and accepted by the City.
- B. The Baseline Schedule shall be calendar-based, using a precedence method network diagram in the CPM format indicating the critical path for the execution of the work utilizing the entire contract time.
- C. Baseline Schedule shall include the following tabulated information for each Activity:
 - 1. Activity beginning and ending event numbers
 - 2. Estimated duration in working days
 - 3. Trade code (responsibility code including Contractor, all Subcontractors, Supplier, and Owner)
 - 4. Early start date (ES) and early finish date (EF) (calendar dated).
 - 5. Late start date (LS) and late finish date (LF) (calendar dated).
 - 6. Print the total and free float for each activity.
- D. The network diagram(s) level of detail shall include but not be limited to:

1. Required approvals, permits, notices, etc. necessary for Contractor's execution of the proposed work.
 2. Preparation of shop drawing and working drawing submittals.
 3. Administrative activities, procedures, and subsidiary actions that will affect the critical path, such as submittal and review of shop drawings, substitutions, alternative construction methods or alternative designs, and submittal to and review by the City and all utility companies involved including a schedule for coordination of all utility relocation work necessitated by Contractor's operations.
 4. Procurement of materials and equipment including ordering, fabrication, and delivery.
 5. Construction activities and sub activities tasks, including all activities shown on the Schedule of Values.
 6. Order and delivery of long lead items.
 7. Approvals and permits required by regulatory agencies or other third parties.
 8. Schedules for Subcontractor's Work, including engineering and design services.
 9. Actual tests, submission of test reports and approval of test results.
 10. Testing, training and assistance required under the Contract.
 11. Punchlist and final cleanup.
 12. Scheduled completion date shall be as specified within the time allowed.
- E. The Baseline Schedule shall provide a practical schedule of activities performed within the specified contract completion time and within the contract bid price to complete the Work. A schedule extending beyond the contract completion date will not be accepted.
- F. Contractor shall incorporate all Milestones into the Baseline Schedule. These include, but are not limited to Substantial Completion and Milestones. These are unique zero (0) duration Activities containing corresponding dates and logic ties. Designate these Activities as start or finish Milestones. If necessary, utilize constraints of "start on or after" or "finish on or before" for Contract requirements. The use of float suppressing date constraints including "start on," "finish on," "mandatory start," and "mandatory finish" are not allowed.
- G. In preparing the Baseline Schedule, Contractor shall consider the nature and complexity of each submittal and shall allow ample time for review, revisions or corrections. Under no circumstances will an extension of time be given for any submittal for which a re-submittal is required and a re-submittal time was not included in the Baseline Schedule.
- H. Time impacts resulting from submittals and re-submittals of shop drawings are Contractor's responsibility.
- I. All constraints, dates, and lags will require the City's approval. All activities shall have succeeding activities except project completion. Contractor shall demonstrate the necessity of having any dummy activities.
- J. Negative float will not be allowed on the Baseline Schedule on the initial submittal. Initial Baseline Schedule with negative floats shall be rejected immediately. Contractor shall provide sufficient manpower (multiple crews) and maximize working hours (extended hours and /or weekend work) to perform the required work within the specified completion time and contract bid price.

- K. The Baseline Schedule's critical activities shall not exceed fifteen percent (15%) of the total number of activities. Critical activities are those which have the least float.
- L. Submit a written narrative with the Baseline Schedule that discusses basic assumptions, productivity and installation rates, construction staging plans, maintenance of traffic quantities, manpower and crew development, construction equipment planned, and other element related to developing the schedule.
 - 1. Explain Activity durations and describe Contractor's approach for meeting Contract Milestone dates. Include as a minimum: basis and assumptions used in preparing the schedules, including crew sizes, equipment requirements, and anticipated delivery dates; restraints; critical path activities; production rates; Activities requiring overtime or additional shifts; holidays, City-specific events; potential problem areas; permits; coordination; required with SFMTA, railroads, utilities and other parties; and long lead delivery items requiring more than thirty (30) days from order to delivery. Identify Work items that may be expedited by use of overtime or additional shifts. Identify and explain sequencing and other constraints such as manpower, material and equipment.
 - 2. All constraints, dates, and lags will require City's approval and shall be clearly identified and explained in the narrative.
 - 3. Description and analysis of the Critical Path.

1.8 PROGRESS SCHEDULE UPDATE

- A. The Baseline Schedule shall be updated monthly by Contractor and submitted to the City for review as a Progress Schedule Update. It shall not have any change in the logic of the network or in the duration of activities.
- B. Each Progress Schedule Update shall continue to show all work activities including those already completed. Computer calculations of the updated schedule will be made starting from the current date to the end of the project. Work completed shall be shown with actual start and finish dates for each activity. Work in progress shall be shown with the actual start date and the percentage completed for each activity.
- C. Progress Schedule Updates shall include the requirements stated above and the additional requirements:
 - 1. Include resource requirement as required.
 - 2. Actual start and completion dates of completed activities.
 - 3. Actual start dates and percent completion of activities in progress.
 - 4. Print the total and free float for each activity.
 - 5. Project percentage completed.
- D. The Progress Schedule Update shall, at all times, represent the actual history of accomplishment of all activities as well as Contractor's current projected plan for orderly completion of the work. Contractor shall, at monthly intervals, evaluate work progress with the City by reviewing the actual accomplishments since the previous update.
- E. In conjunction with each monthly Progress Schedule Update, Contractor shall submit to the City a written narrative report of the status of the Project as specified herein.
- F. Contractor's monthly written narrative of the critical path analysis shall include the following:

1. Description of critical path and progress on Contract Milestones with explanations for any lack of work on critical path activities planned to be performed during last month;
 2. Anticipated completion time of entire work;
 3. Description of problem area;
 4. Current and anticipated delaying factors and their impacts;
 5. Explanation of corrective action taken or proposed to bring project back on schedule if delays have occurred;
 6. Description of critical activities scheduled to be performed next month;
 7. Discuss the incorporation of any approved Change Orders. Identify a proposed schedule Change Orders submitted during the last reporting period.
 8. Status of major material and equipment procurement.
- G. Progress Schedule Update reports, and the information contained therein, shall not be construed as claims, notice of claims, notice of delay, or requests for changes or compensation.
- H. Actual start and finish date and Work in progress shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual start and finish dates shall be updated manually and shall represent actual history and match daily reports. Work in progress shall be shown with the actual start date, the remaining duration will represent the current expected completion date, and the physical percent completed for each activity. The remaining Activities should represent Contractor's current projected plan for orderly completion of the Work.
- I. This Progress Schedule Update shall not have any change in the logic of the network or in the duration of activities.
- J. Contractor during the course of the construction desires to make changes in its method of operating and scheduling, it shall notify the City in writing stating the reasons for the change. Any change to the schedule in the logic, order, or sequence of work, duration activities, etc. shall constitute a revised schedule. A revised schedule will not be in effect until it is approved by the City.
- K. If a COR for a schedule adjustment in the Contract duration is approved, the logic revisions and their relationship to other activities shall be reflected on the Progress Schedule Update.
- L. The Progress Schedule Update for the same period as the Application for Payment shall be submitted showing all work completed as of that date as a precedent to making progress payment Applications.

1.9 ACTIVITY SCHEDULE

- A. Contractor shall present and discuss the Activity Schedule at the progress meetings, or as directed by the City.
- B. The Activity schedule shall be in the bar chart format and include the following:
1. Completed activities for last week.
 2. Scheduled activities for the succeeding two weeks.

3. Correlation to appropriate Baseline Schedule including Activity ID, description, start and finish, duration, responsible party performing the Work and pertinent remarks on Activity status.

1.10 REVISED SCHEDULE

- A. Contractor shall submit to the City a revised critical path schedule with a description and justification of the changes within ten (10) working days whenever a schedule revision is requested or any of the following occurs:
 1. A change order affects the completion date or the sequence of the activities;
 2. Progress of any critical activity falls significantly behind schedule;
 3. Delay on a non critical activity changes the course of the critical path; or
 4. Contractor elects to change any sequence of activities affecting the critical path.
- B. The revised schedule shall be submitted in writing to the City Representative for review and approval. The submission of a revised schedule shall not relieve the Contractor of the responsibility for the notification required by Section 6.22H.2.d of the San Francisco Administrative Code and as required by subparagraph 7.02.D – Notice of Delay of the General Conditions.

1.11 DAILY CONSTRUCTION REPORTS

- A. On a daily basis, Contractor shall submit to the City a Daily Construction Report for each working day, including weekends and holidays, when worked. Include in report:
 1. Project name and Contract number
 2. Contractor's name and address
 3. Weather, temperature, and any unusual site conditions.
 4. Brief description and location of the day's scheduled activities and any special problems and accidents, including Work of Subcontractors. Descriptions shall be referenced to CPM scheduled activities.
 5. Worker quantities, names, and labor classifications for its own Work force and for Subcontractors of any tier.
 6. Equipment, other than hand tools, utilized by Contractor and Subcontractors by description and number.
- B. Failure to submit a copy of the Daily Construction Report by the end of the next working day will result in an assessment of \$100.00 for liquidated damages per report to be deducted from the Progress Payment.

1.12 LIQUIDATED DAMAGES

- A. Failure to submit any one of the above schedules will result in an assessment of two hundred dollars (\$200) per calendar day as liquidated damages per schedule to be deducted from the contract until the required submittals are provided by Contractor.
- B. Liquidated damages are in addition to any remedies taken by the City under the Supplementary Conditions of this Contract.

1.13 APPROVED STANDARD

- A. CPM, as required by this section, shall be interpreted to be generally as outlined and defined in "CPM in Construction Management" by James O'Brien, McGraw-Hill Company, latest issue, Chapters 1 through 7.
- B. Free float is defined as the amount of time that any activity can be delayed without adversely affecting any succeeding activity for the project completion.
- C. Total float is defined as the amount of time that an activity can be delayed without adversely affecting the overall time for the project completion.

1.14 ADJUSTMENT OF THE CONTRACT TIME AND CHANGE ORDER

- A. Adjustments of the contract time due to delays, additional work, or any other cause will only be issued through a contract change order and only for causes specified in the Contract Documents.
 - 1. In the event that the Contractor requests an adjustment of the contract time, it shall submit a Change Order Request (COR) with such justification and supporting evidence as the City may deem necessary for a determination as to whether or not the Contractor is entitled to an adjustment of time under the provisions of the Contract.
 - 2. The latest version of the Progress Schedule Update shall clearly indicate that Contractor has used, in full, all the float time available for work involved in the request.
 - 3. Total and free float are not for the exclusive use of benefit of either the City or Contractor, but is a resource available to both parties on a first needed basis. Contractor shall not be entitled to additional compensation due to schedule impacts for change order work that extends the contract beyond the scheduled completion date, but not beyond the contract completion date.
 - 4. The City determination as to the adjustment of the contract time will be based upon the latest version of the Progress Schedule Update accepted at the time of the alleged delay, and all other relevant information.
 - 5. Actual delays in activities which, according to the Progress Schedule Update, do not affect the critical path work will not be the basis for an adjustment to the Contract time.
 - 6. No contract time extensions will be allowed for contract change orders for which there are concurrent contract work delays, unless the excusable delays affect the critical path in the schedule and after all available float has been used.
- B. Contractor shall include, as part of each COR for which it is requesting an adjustment in the Contract duration, a sub network showing logic revisions, duration changes, and cost changes for the work in question and its relationship to other activities on the Progress Schedule Update. Contractor shall incorporate each Change Order into the revised schedule.
- C. The City will, within ten (10) working days after receipt of such request and supporting evidence, review the facts and issue to the Contractor a written merit determination accepting or rejecting the COR in whole or in part.
- D. The new revised schedule, if accepted by the City shall be in compliance with the requirements under "Revised Schedule" as defined within this section.

- E. Where the City has not yet made a final determination as to the adjustment of the contract time, and the parties are unable to agree to the amount of the adjustment to be reflected in the Progress Schedule, the current schedule will be in effect and be updated regularly every month until a revised schedule is agreed and approved by the City.

1.15 EARLY COMPLETION SCHEDULE

- A. Contractor may submit a Monthly Schedule Update which contains a Milestone or Substantial Completion dates earlier than the dates specified in the Contract. Contractor agrees to the following:
 - 1. The time difference between the Contractor's early scheduled completion date and the Contract completion date will be considered as absolute float.
 - 2. The absolute float is not for the exclusive use of benefit of either the City or Contractor, but is a resource available to both parties on a first needed basis.
 - 3. Contractor's original bid has included all cost for the full duration of the Project from the date of NTP through the official Contract completion date. Specifically, Contractor has provided through its bid the overhead, construction equipment and facilities cost including overhead, field office, home office, other off-site yard, and extended overhead cost for the duration of the Project in its Bid Items on the Schedule of Bid Prices or Bid Proposal as specified.
 - 4. If the City requires additional work through a Change Order, which shall be done after the early proposed Substantial Completion Date, but prior to the Contract Time Substantial Completion Date, then no additional money will be paid to the Contractor for extended overhead.
 - 5. Contractor waives any and all claims or right of action against the City for damages, loss of profit or other additional compensation based on the Engineer's rejection or approval of a proposed Early Completion Schedule.

1.16. RECOVERY SCHEDULE

- A. Submit a Recovery Schedule within seven (7) Days, if the Monthly Schedule Update, reflects negative float of minus fourteen (-14) Days or more for a Contract Milestone Activity.
- B. Use a fragnet showing Activities that delayed the Contract Milestones Date. Submit a similar fragnet showing Contractor's plan to mitigate delay or disruption and subsequent impacts to schedule. Provide the digital schedule files, as well as, hard copies of the analysis. Provide a written narrative describing circumstances, extent of delay or disruption, and the methodology used to determine extent of delay or disruption. Submission of such fragnet does not constitute permission to proceed with plan.
- C. Addition of equipment or construction forces, increasing Work hours or other methods, manner, or procedures to return to the Contract completion date shall not be justification for a Change Order, nor shall it be treated as compensable acceleration where the need for a recovery schedule is due to or arises from any action of Contractor and/or its Subcontractors or Suppliers, at any tier.
- D. Contractor shall implement the Recovery Schedule after acceptance from the Engineer without additional cost to City and provide for completion of the Work in accordance with the remaining Milestone dates without a time extension. Should the logic and/or durations of the Recovery Schedule not receive acceptance of the Engineer, Contractor is

responsible to use concurrent operations, additional manpower, additional shifts, overtime, etc., as required to put the Project back on schedule at no additional cost to the City.

1.17 TIME IMPACT ANALYSIS SCHEDULE (TIA)

- A. Prepare a Time Impact Analysis (TIA) Schedule: When unforeseen conditions or delays are experienced by Contractor and a time extension is requested. Contractor shall submit a written TIA illustrating the influence of each change or delay on the Contract Milestone completion date to the level of detail that the Engineer may require to determine whether Contractor is entitled to an extension of time.
- B. Actual delays in activities, which according to the Progress Schedule Update do not affect the Critical Path work, shall not be the basis for an adjustment to the contract time.
- C. To prepare the TIA, Contractor shall use the most recent version of the Progress Schedule Update that has been accepted by the City at the time of the alleged delay. Contractor shall use a sub network or fragnet of the Activities with the proposed delay. The impacted fragnet will show new Activities for the work in question and its relationship to other activities in the schedule. Provide the electronic schedule files as well as hard copies of the analysis. Provide a written narrative describing the time impact analysis and all other relevant information.
- D. After the City's review and acceptance of the TIA, Contractor shall incorporate it into the Progress Schedule Updates and Revised Baseline Schedules.
- E. Because float within Progress Schedule Updates is jointly owned, delays to the Work that are outside the control of Contractor may be offset by time savings realized

1.18 AS-BUILT SCHEDULE

- A. The last Monthly Progress Schedule update with all dates actualized will be considered the As-Built Schedule. This schedule will have incorporated all actual start and finish dates and all the accepted Change Orders, Contract Modifications and TIAs. Schedule and approval of the Schedule will be a condition precedent to reduction/release of final Contract retention.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION