
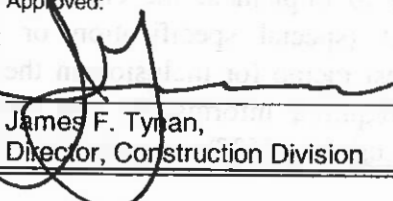


To: SUPERSEDED BY EI 04-042 EFFECTIVE 05/05/05		New York State Department of Transportation ENGINEERING INSTRUCTION	EI 04-007
Title: ITEM 637.3550---20 - CPM SCHEDULING			
Distribution: <input type="checkbox"/> Manufacturers (18) <input checked="" type="checkbox"/> Local Govt. (31) <input checked="" type="checkbox"/> Agencies (32) <input type="checkbox"/> Surveyors (33) <input checked="" type="checkbox"/> Consultants (34) <input checked="" type="checkbox"/> Contractors (39) <input type="checkbox"/> _____ ()		Approved:  James F. Tynan, Director, Construction Division Date 2-6-04	

ADMINISTRATIVE INFORMATION:

- This EI is effective with projects submitted for the letting of September 9, 2004. Application of this EI prior to this date is encouraged (See "IMPLEMENTATION" and EI 04-008).
- This EI supersedes EI 99-028, "Critical Path Method (CPM) Scheduling for DOT Construction Projects, Item 15637.61 M".
- This EI disapproves special specifications: "08637.3503 M - CPM Scheduling System" and "15637.61 M - Critical Path Method (CPM) Network Scheduling System".
- This EI issues special specification "Item 637.3550---20 - CPM Scheduling" with general-use approval.
- The special specification will be incorporated into the next revision of the Standard Specifications.

PURPOSE:

This EI transmits a revised contract specification and a revised special note relating to Critical Path Method (CPM) scheduling.

TECHNICAL INFORMATION:

- The project selection criteria for which contracts should incorporate CPM scheduling are in EI 04-008 released concurrently with this EI.
- Changes from the existing CPM scheduling specifications include:
 - ▶ The requirement for the Contractor to supply a computer and a printer as part of the CPM scheduling specification has been eliminated. Computers supplied to the Engineer's Office from other sources will be used to run the CPM scheduling applications.
 - ▶ The only software that now is to be supplied under this contract pay item is the latest version of Primavera SureTrak.
 - ▶ The requirement to report the activity cost as part of the activities data has been eliminated from the special specification.

IMPLEMENTATION:

- This EI disapproves the following special specifications:

Disapproved Contract Pay Items

<u>Contract Pay Item</u>	<u>Description</u>
08637.3503	CPM Scheduling System
15637.61	Critical Path Method (CPM) Network Scheduling System

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- This EI issues the following new Section 637 special specification:

New Contract Pay Item

<u>Contract Pay Item</u>	<u>Description</u>	<u>Pay Unit</u>
637.3550----20	CPM Scheduling	Lump Sum

- Action by Designer – For projects submitted for letting prior to September 9, 2004, for which the Designer chooses to implement the changes included in this EI, the Designer must include the appropriate insert (special specification or special note) with the PS&E transmittal and/or amendment request memo for inclusion in the construction contract bid documents. The Designer can obtain the required information and materials from the Department's Internet website at www.dot.state.ny.us/constr/637/section637.html.
- Action by Design Quality Assurance Bureau – Beginning with the effective letting date, the DQAB will be responsible for including the appropriate inserts as part of the contract proposal documents.

TRANSMITTED MATERIALS:

Special Note "Critical Path Method Schedule" and special specification "637.3550----20 - CPM Scheduling" are transmitted with this EI. In addition, the full text of the specification is available with the electronic version of this EI on our web site at www.dot.state.ny.us "Site Index", "S", "Special Specifications" in the area designated by the prefix number of the specification.

BACKGROUND:

Standard Specification §108-01, *Start and Progress of Work*, contains the contract provisions for planning, scheduling, and monitoring the work. The standard scheduling provision leaves the choice of scheduling technique up to the Contractor. Therefore, the Contractor can meet the requirements by submitting a bar chart, a CPM network diagram, or other suitable graphical representation of the proposed work plan. For projects with few activities or activities that can proceed without much interaction, bar charts are normally used and are an acceptable method of communicating the proposed work plan. The disadvantage of bar charts is their inability to depict the interrelationships between activities or identify activities that are critical to project completion. For projects that have many activities that must continuously interact, a CPM network diagram is more appropriate and should be used.

CONTACT:

Direct questions regarding this Engineering Instruction to Larry Palaski or Rob Howland of the Construction Division at Phone: (518) 457-6472, Email: mo-construction@dot.state.ny.us. Include the EI number and title along with the contact person's name in the phone message/email when making inquiries regarding this EI.

SPECIAL NOTE

CRITICAL PATH METHOD SCHEDULE

The schedule submitted in accordance with Special Specifications §108-01, *Start and Progress of Work*, shall be prepared using the critical path method (CPM). The cost of preparing the CPM schedule shall be included in the total amount bid for all contract items.

The construction of the project shall be planned and recorded with a conventional Critical Path Method (CPM) schedule in the form of an activity-on-node diagram based on the principles defined by the current issue of the Construction Planning & Scheduling Manual published by the Associated General Contractors of America. An activity on arrow diagram may be used if approved by the Engineer. The schedule shall be used for coordination and monitoring of all work under the contract including all activities of subcontractors, vendors, and suppliers. The Department will use the schedule to monitor the progress of construction, compare the work performed to the Contract time and phasing requirements, and to assign necessary resources for inspection and administration of the Contract.

A. Schedule Submittal

Within 15 calendar days of the Award of Contract, the Contractor shall submit for the Engineer's review a detailed CPM schedule. The schedule will be reviewed to determine whether it meets the requirements under Subsection B below and shall not exceed the Contract time requirements for any milestones or for the entire project.

Following the Engineer's review, revisions to the proposed schedule, if necessary, shall be made by the Contractor. The final proposed schedule must be completed within 30 calendar days of the Contract Award. Failure to provide a final schedule by that date will result in withholding all progress payment estimates pursuant to Article 8 of the contract.

Approval of the schedule by the Engineer shall not be construed to imply approval of any particular method or sequence of construction or to relieve the Contractor of providing sufficient materials, equipment and labor to guarantee completion of the project in accordance with the contract proposal, plans and specifications. Approval shall not be construed to modify or amend the agreement or the date of completion therein.

Failure by the Contractor to include in the CPM Construction Schedule any element of work required for the performance of the contract shall not excuse the Contractor from completing all work required within the completion date(s) specified in the contract notwithstanding approval of the Schedule by the Engineer.

A 60-calendar-day preliminary schedule of proposed activities by the Contractor may be submitted to the Engineer to enable beginning of Contract work preparation such as material orders, preparation of working drawings, and mobilization of equipment while the CPM schedule is being prepared.

No Contract work may be pursued on the project site unless there is a 60-calendar-day preliminary schedule or a detailed CPM schedule meeting the Contract requirements.

B. Schedule Requirements

All activity on node diagrams shall include:

- Activity Nodes with identification numbers
- Activity Description
- Activity Duration

The activity on node diagram shall show the sequence and interdependence of all activities required for complete performance of all items of work under this Contract, including shop drawing submittals and approvals and fabrication and delivery activities.

No activity duration shall be longer than 15 work days without the Engineer's approval.

The activities are to be described so that the work is readily identifiable and the progress of each activity can be measured. For each activity, the Contractor shall identify the trade or entity performing the work, the duration of the activity in days worked, the resources involved by trade, the equipment involved, the location of the work and the total dollar value.

The Contractor shall also provide the work days per week, holidays, number of shifts per day, number of hours per shift, and major equipment to be used for each activity. If requested by the Engineer, the Contractor shall furnish production rates or other information needed to justify the reasonableness of activity time durations.

Expected seasonal weather conditions, such as precipitation and temperature, shall be included by the Contractor in the planning and scheduling of activities.

The Contractor shall not constrain the start or completion of any activity unless specifically required by the contract or approved by the Engineer.

The activity on node diagram submitted may either be hand drawn or computer plotted. Regardless of the type of diagram, the network must be legible, readable, and understandable by the Engineer. Network diagrams shall be on 279 mm x 425 mm size sheets and not a continuous diagram.

All network diagram submissions shall include three copies. The Contractor shall also provide three copies of the following sorts:

- Activity number sort
- Total Float / Early Start sort

C. List of Submittals

Within thirty (30) calendar days of the contract award, the Contractor shall provide a list of submittals required under the contract, i.e., shop drawings, required permits, erection/demolition plans, etc. The list shall show a scheduled submission date for each submittal and identify the earliest activity affected by each of these submittals. This list shall be revised and updated monthly with each schedule submission.

D. Contingency within the Schedule

Any contingency within the Schedule, i.e., a difference in time between the project's early completion and required contract completion date, and "float" in the Approved CPM Construction Schedule belongs to the project and not to any party to the contract.

E. Float Manipulation Not Permitted

The Contractor shall not sequester "float" through such strategies as calendar manipulation, or extending durations to fill up available float time.

F. Schedule Updating

The Contractor shall update the schedule monthly. Each update shall show actual dates of activities started and completed, the percent of work completed to date on each activity started but not yet completed, the current allocation of staff resources and major equipment and the status of procurement of critical materials. The Contractor also shall provide updated activity number sorts, total float early start sorts, a 60-day look-ahead bar chart, and a narrative report. The narrative report shall include a description of problem areas, current and anticipated delaying factors and their estimated impact on performance of other activities and mandated contract dates, and the explanation of corrective action taken or proposed.

The Engineer shall conduct a monthly review of the updated schedule. The review shall occur after receipt of the Contractor's updated information and shall serve as the forum to discuss slippages, remedies, revisions, and other relevant issues. The Contractor's appropriate field and scheduling personnel shall attend these working sessions. These reviews may result in the need for submission of revised schedules.

G. Changes to the Approved Project Schedules

The CPM Construction Schedule shall accurately reflect the manner in which the Contractor intends to proceed with the project and shall incorporate the impact of delays and Orders-on-Contracts when these factors can be accurately determined. All changes made to the schedule, i.e., the addition of activities, changes in logic, or changes in the activity durations shall be submitted in writing and are subject to approval by the Engineer before inclusion in the CPM Construction Schedule.

To initiate changes to the approved schedule, the Contractor shall meet with the Engineer and provide the information necessary to prepare a revised (updated) Activity-on-Node Diagram.

No revision to any contract milestones, or contractually mandated schedule provision will be permitted, without written authorization from the Engineer.

H. Compliance with the Schedule

The Contractor shall employ and supply a sufficient force of workers, materials and equipment and shall prosecute the work with such diligence so as to maintain the rate of progress indicated on the approved

schedule to prevent work stoppage and ensure completion of the project within the contract time. Any additional or unanticipated costs or expense required to maintain the schedule shall be solely the Contractor's obligation and shall not be charged to the Department unless provided for in other provisions of the contract.

In the event a notice is received of a change to the contract which is likely to cause or is causing delays, the Contractor shall notify the Engineer in writing within 10 calendar days, of the effect, if any, of such change or extra work or suspension or other conditions upon the Project Construction Schedule and shall state in what respects, if any, the Approved CPM Construction Schedule should be revised with the reasons therefore. The reasons for these revisions must be succinct, comprehensive, and factual to merit consideration.

If the Contractor fails to comply with the provisions of this special note, the Engineer may withhold approval of all progress payment estimates pursuant to Article 8 of the contract.

DESCRIPTION:

§108-01, *Start and Progress of Work*, is hereby amended to require that the Contractor furnish and participate in a computerized CPM (critical path method) network scheduling system.

The purpose of the computerized CPM network scheduling system is to assure adequate planning and execution of the work, assist the Engineer in evaluating the reasonableness of the Contractor's proposed schedule, and measure progress of the work. The Contractor shall operate a scheduling system that can produce a CPM network diagram using the Precedence Diagramming Method and other reports and graphics as described within this specification. In addition, the Contractor shall provide CPM scheduling software for use by the Engineer in monitoring the scheduling system. This software requirement may be deleted from the Contract at the discretion of the Engineer. The CPM schedule shall be prepared based on the principles defined by the current issue of the Construction Planning & Scheduling Manual published by the Associated General Contractors of America.

MATERIALS:

The Contractor shall provide the latest version of Primavera SureTrak software.

CONSTRUCTION DETAILS:

A. 90-Day Schedule

Within fifteen (15) calendar days following the contract award, the Contractor shall submit to the Engineer a detailed schedule for the first ninety (90) days of construction and a generalized schedule for the balance of the work. The detailed portion of this schedule shall meet the requirements of section B of this specification, "Detailed CPM Construction Schedule."

The 90-Day Schedule will be reviewed by the Engineer and revised by the Contractor to incorporate the Engineer's comments and to correct deficiencies. Upon acceptance by the Engineer, the 90-Day Schedule shall be used for all project scheduling activities, and updated monthly until the issuance of the Approved Detailed CPM Construction Schedule.

B. Detailed CPM Construction Schedule

Within sixty (60) calendar days following the contract award, the Contractor shall prepare and submit to the Engineer a Detailed CPM Construction Schedule for the entire project.

The Contractor will incorporate into this Schedule, all site construction activities, activities for the placement of orders, and anticipated delivery dates of materials and equipment, activities assigned to subcontractors, activities assigned to the Department or the Engineer and other outside agencies (such as shop drawing reviews, permit reviews, etc.), and all private utility work or work by other Contractors within or near the contract limits.

1. Schedule Requirements

The Contractor's Detailed CPM Construction Schedule shall meet the following requirements:

a. CPM Schedule Format

The Contractor shall use the Precedence Diagramming Method.

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b. Project Calendars

Holidays and nonworking days shall be established in coordination with the Engineer. Additional project calendars shall be used for activities that have contract imposed time restrictions such as seasonal limitations for asphalt paving.

c. Activities Data

- i. Activity Identification Number - Each activity shall have a unique identification number.
- ii. Activity Description - Each activity shall be clearly described. Use of descriptions referring to percent of a multi element item (i.e., construct deck 50%) will not be acceptable. Separate activities shall represent different elements of multi element items (i.e., construct forms, install rebar, pour concrete, etc.) Multiple activities with the same work description shall include a location description.
- iii. Activity Duration - the Contractor shall subdivide the work into individual activities having durations of no longer than 15 (fifteen) working days each. Exceptions to this rule will be reviewed by the Engineer on an activity-by- activity basis. If multiple shifts and/or overtime are anticipated during the development of activity durations, a list of affected activities and the shift/overtime assumptions shall be provided to the Engineer. If requested by the Engineer, the Contractor shall furnish production rates or other information needed to justify the reasonableness of activity-time durations.
- iv. Weather - Expected seasonal weather conditions, such as precipitation and temperature, shall be included by the Contractor in the planning and scheduling of activities.
- v. Start and Finish Dates - The earliest start date, earliest finish date, latest start date, and latest finish date shall be shown for each activity.
- vi. Total Float - Total float shall be shown for each activity. Total float is the full amount of time by which the start on an activity may be delayed without causing the project to last longer.
- vii. Activity Codes - Activities shall be coded to allow for the following summaries:
 - Responsible party for the accomplishment of each activity, i.e., Prime Contractor, Subcontractor, Department of Transportation, Utility Co., etc. The name of each Subcontractor shall be included as soon as they are approved by the Department. Only one party can be responsible for an activity.
 - Phase/Stage during which activity is planned to be accomplished.
 - Area/Location (i.e., Bridges, Ramps, Mainline station, etc.).
- viii. Activity Constraints - The Contractor shall not constrain the start or completion of any activity unless specifically required by the contract or approved by the Engineer.
- ix. Activity Resources - The required labor and equipment shall be shown for each activity.

- Labor may be shown by trade; however, as a minimum the Engineer will accept total person-workdays per activity or crew-workdays per activity. If crew workdays are used, the crew size shall be indicated in the coding, i.e., a crew designated as "PAVE4" = 4 person paving crew.
 - Major equipment such as pile drivers, large cranes, asphalt paving equipment, concrete finishing machines, etc., shall be shown for each activity.
- x. Material Quantities - Material quantities for each activity shall be indicated in the resource fields. Material descriptions such as concrete, asphalt, guide railing, signs, etc., shall be used. Material quantities will be used to verify the reasonableness of the activity durations and to ensure that all work required by the contract is accounted for within the schedule.
- xi. Contract Pay Item Designations - Contract pay item designations for labor, material, and equipment shall be included in the cost account fields for each activity resource. It is not intended that each and every contract pay item designation in the contract be identified. Similar items installed during an operation may be combined and a prefix identifier included (i.e., Box beam guide railing = 606.10, signs = 645.7x, planting = 611.0x, etc.).

d. Sequence of Operations

The Logic Diagram or PERT chart shall show the sequence and interdependence of activities required for complete performance.

2. Contingency Within the Schedule

Any contingency within the Schedule (i.e., a difference in time between the project's early completion and required contract completion date) and "float" in the Approved Detailed CPM Construction schedule belongs to the project and not to any party to the contract.

3. Float Manipulation Not Permitted

The Contractor shall not sequester "float" through such strategies as calendar manipulation, or extending durations to fill up available float time.

4. Review of the Detailed CPM Construction Schedules

The Contractor shall submit to the Engineer three copies of the Logic Diagram (PERT chart) and three copies of the following activities listings:

- a. Activity Number Sort - Activities listed in ascending order of their numbers.
- b. Total Float/Early Start Sort - Activities listed in ascending order based on amount of their float with consideration of activity Early Start dates.

Diskettes (or other acceptable electronic data media/transfer method) with a backup copy of the computerized Detailed CPM Construction Schedule shall also be provided.

The Engineer will review the Detailed CPM Construction Schedule and then hold a discussion meeting with the Contractor. Within two weeks from this meeting the Contractor shall make

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adjustments to the Detailed CPM Construction Schedule to eliminate conflicts, objections, and ambiguities found by the Engineer. The Contractor shall submit for review three copies of the revised schedule materials as described above.

Upon completion of the final review by the Engineer, the Contractor shall incorporate the final revisions and submit two copies of the schedule diskettes containing the computerized Detailed CPM Construction Schedule and three copies of each of the revised Logic Diagram (PERT chart) and computer printouts. The Logic Diagram (PERT chart) shall be on 279 mm x 425 mm (11"x17") size sheets and not a continuous diagram. This final submission shall be submitted for approval within one week of the Contractor's receipt of the revisions.

Approval of the schedule by the Engineer shall not be construed to imply approval of any particular method or sequence of construction or to relieve the Contractor of providing sufficient materials, equipment, and labor to guarantee completion of the project in accordance with the contract proposal, plans, and specifications. Approval shall not be construed to modify or amend the agreement of the date of completion therein.

Failure by the Contractor to include in either the 90-Day Schedule or the Detailed CPM Construction Schedule any element of work required for the performance of the contract shall not excuse the Contractor from completing all work required within the completion date(s) specified in the contract notwithstanding approval of the Schedule by the Engineer.

5. List of Submittals

Within sixty (60) calendar days of the contract award, the Contractor shall provide a list of submittals required under the contract (i.e., shop drawings, required permits, erection/demolition plans, etc.). The list shall show a schedule submission date for each submittal and identify the earliest activity affected by each of these submittals. This list shall be revised and updated monthly with each schedule submission.

C. Schedule Updating

1. Monthly Progress Reports & Projections

The Contractor shall update the schedule monthly. Each update shall show actual dates of activities started and completed, the percent of work completed to date on each activity started but not yet completed, and the status of procurement of critical materials. The updated schedule data shall be submitted to the Engineer on computer diskette. The Contractor also shall provide updated Activity Number and Total Float/Early Start sorts, a 60-day look-ahead bar chart by early start, and a narrative report. The narrative report shall include a description of problem areas, current and anticipated delaying factors along with their estimated impact on performance of other activities and mandated contract dates, and the explanation of corrective action taken or proposed.

The Engineer shall conduct a monthly review of the updated schedule. The review shall occur after receipt of the Contractor's updated information and shall serve as the forum to discuss slippages, remedies, revisions, and other relevant issues. The Contractor's appropriate field and scheduling

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personnel shall attend these working sessions. These reviews may result in the need for submission of revised schedules.

2. Logic Diagram (PERT chart) Updates

The logic diagram (PERT chart) shall be updated by the Contractor every four months.

D. Changes to the Approved Project Schedules

The Detailed CPM Construction Schedule shall accurately reflect the manner in which the Contractor intends to proceed with the project and shall incorporate the impact of delays and Orders-on-Contract when these factors can be accurately determined. All changes made to the schedule (i.e., the addition of activities), changes in logic, or changes in activity durations shall be submitted in writing and are subject to approval by the Engineer before inclusion in the Detailed CPM Construction Schedule.

To initiate changes to the approved schedules, the Contractor shall meet with the Engineer and provide the information necessary to prepare a revised (updated) Logic Diagram (PERT chart) and computer-generated schedule listing.

No revision to any contract milestones or contractually mandated schedule provisions will be permitted without written authorization from the Engineer.

E. Compliance with the Schedule

The Contractor shall employ and supply a sufficient force of workers, materials, and equipment. The Contractor shall prosecute the work with such diligence so as to maintain the rate of progress indicated on the approved schedule to prevent work stoppage and ensure completion of the project within the contract time. Any additional or unanticipated costs or expense required to maintain the schedule shall be solely the Contractor's obligation and shall not be charged to the Department unless provided for in other provisions of the contract.

In the event a notice is received of a change to the contract which is likely to cause or is causing delays, the Contractor shall notify the Engineer in writing within ten (10) calendar days, of the effect, if any, of such change, or extra work, or suspension or other conditions upon the Project Construction Schedule, and shall state in what respects, if any, the Approved Detailed CPM Construction Schedule should be revised with the reasons therefore. The reasons for these revisions must be succinct, comprehensive, and factual to merit consideration.

F. Software

The Contractor shall provide the Engineer with CPM software. The software furnished shall be subject to approval by the Engineer. Refer to the "Materials" section of this specification for further details concerning the CPM software to be provided.

METHOD OF MEASUREMENT:

The critical path method scheduling system will be measured for payment on the Lump Sum (LS) Basis.

BASIS OF PAYMENT:

The lump sum price bid for the CPM scheduling system shall include the cost of furnishing CPM software, preparation and submission of the 90-day schedule, preparation and submission of detailed CPM

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construction schedule, and preparation and submission of monthly updates. Payment will be made as follows:

- A. Upon providing the CPM software. 10%
- B. Upon acceptance of the 90-day schedule. 10%
- C. Upon acceptance of the Detailed CPM Construction Schedule. 10%
- D. The balance will be paid in equal monthly payments distributed over the contract life. 70%
These payments will be contingent upon the submission of acceptable monthly updates.

If the Contractor fails to comply with the provision of this specification, the Engineer may withhold approval of any milestone payment shown above or all progress payment estimates pursuant to Article 8 of the contract.

If the Contractor is required to provide additional items during the construction phase of a project, they shall be incorporated by Order-on-Contract and the Contractor will be reimbursed for the costs of items plus 5% for profit and overhead.