

MICHIGAN  
DEPARTMENT OF TRANSPORTATION  
  
SPECIAL PROVISION  
FOR  
**CRITICAL PATH METHOD SCHEDULE**

CFS:BD

1 of 14

APPR:MB:JJG 04-10-17  
FHWA:APPR:04-14-17

**a. Description.** Prepare and submit a critical path method (CPM) schedule that provides the level of detail necessary for the Department to understand the Contractor's plan to complete the contract. In addition, the CPM Schedule must meet the specified completion dates. Approval of the CPM Schedule does not constitute the Department's endorsement of the Contractor's plan or give authorization to deviate from the contract requirements.

**b. Terminology.**

**Baseline Schedule.** A Baseline Schedule is a fixed CPM schedule that reflects the original scope of work for the project, and the Contractors' intended sequence for completing the original scope of work that is the standard by which project performance is measured.

**Contract Completion Date.** The date established by the contract for completion of all work for the project.

**Critical Path.** The critical path is the longest continuous path of activities through the contractual completion milestones in the CPM schedule that establishes the project scheduled completion date. The critical path is typically the path of activities with the least total float. The critical path may follow different paths of activities at different times during the performance of the work due to the progress of the work or revisions made to the schedule. Any operation on the critical path is a Controlling Operation.

**Current Schedule.** The latest approved CPM Schedule.

**Impacted Schedule.** A CPM Schedule that reflects the pending modifications (contract modifications, change orders, and/or delays) that may affect the Critical Path.

**Interim Completion Date.** A date(s) stipulated in the contract that requires a portion(s) of the project to be completed prior to the contract completion date.

**Interim Project Schedule.** A schedule that depicts the planned activities for the first 90 days of the project, and is integrated into the fully developed Baseline Schedule.

**Master Schedule.** A consolidated CPM schedule incorporating multiple, related projects or parts of a project so that they may be monitored and controlled as a unit.

**Milestone.** A zero duration activity or event that is used to denote a particular point in time for reference or measurement. Milestones are not true activities in that they do not consume time or resources. Often used for management summary reporting.

**Near Critical.** A schedule activity with minimal total float as compared with the critical path(s), and for which there is some risk of delay that will cause the near-critical activity to become critical. The amount of float that management perceives to be near-critical is project-dependent and open to professional judgment.

**Negative Lag.** The duration assigned to a predecessor to allow acceleration of its successor (before completion). Also, referred to as Lead.

**Positive Lag.** The duration assigned to a predecessor activity to delay the start of its successor. Also, referred to as Lag.

**Project Scheduler.** Qualified project controls professional, either Contractor staff member or consultant, identified by the Contractor to be responsible for development and maintenance of the CPM schedule including planning, preparing, and updating all engineering, procurement, and construction schedules. The Project Scheduler confers with MDOT and Contractor management to determine the status of projects.

**Recovery Plan.** A plan, typically presented as a CPM schedule, which depicts actions and special efforts required to recover lost time with regard to the baseline schedule.

**Revised Schedule.** New CPM schedule that is produced when an impact occurs that completely alters the schedule.

**Scheduled Completion Date.** The date established by the CPM schedule by which all work for the project is to be completed.

**Unimpacted Schedule.** A CPM schedule that reflects the status of the project prior to circumstances necessitating development of a Revised Schedule. The latest approved Update Schedule may be used as the Unimpacted Schedule, if the Update Schedule Data Date is appropriate to the circumstances.

**Update Schedule.** A CPM schedule in which only progress is updated from the prior Data Date to the current Data Date.

**c. Staff Qualifications.** Employ experienced scheduling personnel qualified to use Primavera Project Management software. Employees may be direct personnel or may be a consultant for this purpose. Designate to the Engineer a single Project Scheduler responsible for administering the Project Schedule. If requested, provide documented confirmation that scheduling personnel are directly employed or that a consultant has been hired who meets the requirements set forth in this section. Documented confirmation of the Project Scheduler must include the following:

1. Identify the individual who will be responsible for creation and management of the CPM Schedule at the Preconstruction Meeting or at any time if requested by the Engineer.

2. Endorse the designated Project Scheduler's knowledge, skills, and abilities by describing construction projects, spanning a minimum of 3 years' of experience, on which the individual has successfully applied CPM scheduling techniques utilizing scheduling software. Proficiency with Primavera Project Management software is preferred, but not required.

**d. General Schedule Requirements.** These requirements are applicable to all schedule submittals. Use Primavera Project Management software to prepare the schedule. Ensure the following requirements are met:

1. Provide a CPM Schedule that shows the various activities of work in sufficient detail to demonstrate a reasonable and workable plan to complete the project by the original contract dates. Show the order and interdependence of all activities so that the Engineer can readily identify the work and measure the progress of each activity.

2. The CPM Schedule must reflect the scope of work, required phasing, maintenance of traffic requirements, interim completion dates, the completion date, and other project milestones established in the contract. Include activities for subcontractors, suppliers, vendors, the Department, permitting agencies, utilities submittals, working drawings, shop drawing preparation, submittal review time as specified in the contract, material procurement and fabrication, and the delivery of materials, plant, and equipment, and other contract related activities.

3. If the Project scope or contractual milestones prevent a logically defined critical path, a Master Schedule will be required. It may be necessary to have multiple schedules on a project in order to have a logically defined critical path. This necessity may be driven by but not limited to: complex project scope, multiple work seasons, or project scope extraneous to, and extending beyond, the contractual completion dates.

4. Failure to include any element of work required for performance of the contract will not excuse the Contractor from completing all work by the completion date in the Progress Clause. The Engineer's review of the CPM Schedule entails a review for compliance with the specifications and contract requirements. Approval by the Engineer will not relieve the Contractor of any of their responsibilities for the accuracy or feasibility of the schedule.

5. All submittals of the CPM Schedule must contain the following information:

A. Electronic Files.

(1) An electronic file of the schedule in Primavera .xer format that is completely compatible with and may be directly imported into the Department's version of Primavera without any loss or modification of data or need for any conversion or other software.

(2) Use the file-naming convention outlined in Table 1. If the schedule is not accepted, resubmit under the file name as modeled for the 2nd version, etc. For all other submittal documents, use MDOT standard file naming convention for e-construction.

**Table 1: Primavera .xer Filename Convention**

Schedule Submittal Type	File Naming Convention
	1 <sup>st</sup> Version
1 <sup>st</sup> Interim Project Schedule	CPM_Contract ID_DD_1IPS
1 <sup>st</sup> Baseline CPM Schedule	CPM_Contract ID_DD_1BS
2 <sup>nd</sup> Baseline CPM Schedule	CPM_Contract ID_DD_2BS
1 <sup>st</sup> Update Schedule	CPM_Contract ID_DD_1SU

2 <sup>nd</sup> Update Schedule, etc.	CPM_Contract ID_DD_2SU
1 <sup>st</sup> Revised Schedule	CPM_Contract ID_DD_1RV
2 <sup>nd</sup> Revised Schedule	CPM_Contract ID_DD_2RV
1 <sup>st</sup> Impacted Schedule	CPM_Contract ID_DD_1IS
1 <sup>st</sup> Recovery Schedule	CPM_Contract ID_DD_1RC
Final As-Built Schedule	CPM_Contract ID_DD_ABS
Replace "DD" with Schedule's "Data Date." Data Date (DD) will be in the format of YYYY-MM-DD. If there is more than one version of the same file, use -2, -3, etc. for 2 <sup>nd</sup> , 3 <sup>rd</sup> , etc. versions.	

(3) Electronic files of Gantt Charts as described below, in .pdf format that are compatible with and may be directly imported into the latest version of Adobe Acrobat without any loss or modification of the date or need for any conversion or other software.

(4) Gantt Chart Names. Provide the following Gantt Charts and name them accordingly:

(a) "All Activities Chart". All activities, grouped by work breakdown structure (WBS) code and Start date, with the longest path indicated in red.

(b) Any other Gantt chart requested by the Engineer.

(5) Gantt Chart Information. Each Gantt chart must contain:

(a) Activity ID, Activity Description, Original Duration, Remaining Duration, Start Date, Finish Date, Total Float, and Progress Bar.

(b) The title block must contain Data Date, Run Date, Gantt Chart Name, Contract ID, Project Name/Description, Contractor's Name, and Submission Date.

B. Scheduling/leveling report generated for the current schedule submittal. This report is generated in .txt format and must be named in accordance with the .xer file name convention.

C. A narrative for all schedule submittals. The specific requirements for narratives submitted with a Baseline, Update or Revised Schedule are described in this special provision.

6. Work Breakdown Structure (WBS). Divide the work elements to be performed on the project into manageable parts corresponding to key deliverables, phases and/or milestones while avoiding omission of major items of work. Depending on the Project, this could be done by staging, alignment and stationing, work element, etc. A separate WBS must be developed for deleted activities, Contract Modifications, other impacts or as requested by the Engineer.

7. Activity Codes. If requested, use activity codes for specific staging, responsibility, work type, or as requested to provide a means to view, group, or summarize activities within the schedule. All activity codes are project level and not global or Enterprise Project Structure (EPS) level activity codes.

## 8. Project Activities.

A. Activity Type. An activity will be assigned to an Activity Type of Task Dependent, Finish Milestone, Start Milestone, Level of Effort or WBS Summary. The logic of the schedule and any critical path must be determined by relationships between Task Dependent activities only. Resource Dependent is not an approved activity type, unless the schedule is resource loaded.

B. Activity Identification (ID). Assign each activity a unique ID number. Once accepted, the Activity ID must be used for the duration of the project. After the CPM Schedule has been approved, do not delete any activities from the schedule. If an activity must be removed, use the following procedure: zero out the Remaining Duration and status the activity as 100 percent complete. Delete predecessor and successor relationships. Add "(deleted)" to original activity description and reclassify to a WBS designated for deleted activities.

(1) It is recommended but not required that the activity ID numbering follow the naming convention indicated in Table 2. If encountered, the groupings indicated for SC and WO must be used.

**Table 2: Naming Convention for Activity IDs**

ID Group	ID Group Description
M	Milestones: Start, Finish, or Interim
DE	Design and Engineering
PR	Procurement; Shop Drawings, Materials including Fabrication and Delivery
UT	Utility Relocation, by Others
CN	Construction, by Contractor
SC	Scope Changes, Proposed and/or Potential
WO	Work Orders, Scope Changes Authorized by the Engineer

C. Activity Descriptions. Each activity must have a narrative description consisting of a verb or work function (e.g.; form, pour, excavate), an object (e.g.; slab, footing, underdrain), and a location (e.g.; Structure X, Roadway X, Station X+XX). Describe the activities so that the work is readily identifiable and the progress of each activity can be readily measured.

D. Activity Original Duration. Assign a planned duration in days for each activity. The duration must be calculated by taking the total quantities assigned to an activity, divided by the estimated productivity rate. Task dependent construction activities must be assigned an original duration of 1 to 20 days so that the progress can be readily measured for each activity. If the duration of a construction activity exceeds 20 days, provide an explanation in the narrative.

## E. Activity Relationships.

(1) All task dependent activities, except the first activity, must have a predecessor(s). All task dependent activities, except the final activity, must have a successor(s).

(2) Use Finish-to-Start, Start-to-Start, or Finish-to-Finish relationships to link activities.

(3) If a Start-to-Finish relationship is used, provide an explanation in the narrative.

(4) Negative lags are prohibited.

(5) If requested, provide an explanation in the narrative for the use of any positive lag.

F. Project Milestones. Provide all contractual milestones in the schedule, including start of the project, the completion of the project, interim contractual dates and any additional zero duration activities necessary to communicate the planned progress of work. The Activity Type for all Project Milestones will be a Start Milestone or a Finish Milestone.

G. Constraints. Use a constraint only for contractual milestones, including the incentive completion date(s) the Contractor plans to achieve. If constraints are used, use only "Finish on or Before" or "Start on or After" constraints.

H. Calendars.

(1) All activities will be assigned a project level calendar not global or resource calendars. Base all calendars on the contract requirements. Incorporate non-work periods such as holidays, weekends, seasonal restrictions, or weather contingency (e.g. temperature and/or precipitation) and other non-work days as identified in the contract. Non-work days included in calendar(s) for weather contingency must be in accordance with subsection 108.08.D of the Standard Specifications for Construction.

(2) Activity calendars for non-field work activities, including but not limited to submittals, reviews, procurement, fabrication, cure times, and utility relocations performed by others, must not show any non-work days unless otherwise specified in the contract.

(3) Define the "work hour/day" in all calendars to match the Primavera Admin Preference "Hours per Time Period." For example, if the Hours per Time Period is defined as 8 hours/day, the "work hour/day" for the calendar is defined as 8 hours. All activity calendars must have the same start of shift time.

(4) Use Days as the planning unit, not hours. If a work activity will take 40 hours to complete and the Contractor is working 10 hour days, then the planned activity duration will be 4 days, not 40 hours. The planned duration of the activity will be 5 days if the Contractor is working 8 hours per day.

I. Schedule Calculation Options. The schedule must be calculated using retained logic. Show open ends as non-critical. Schedule durations are to be contiguous. Ensure total float is calculated as finish float. Ignore relationships to and from other projects. Ensure critical activities are defined using the "Longest Path" criteria. Ensure "Activity Percent Complete" is set to "physical."

J. Float.

(1) Use of float suppression techniques, such as; preferential sequencing (arranging critical path through activities more susceptible to Department caused delay), lag logic restraints, artificial activity times, or imposing unapproved constraint dates, will be cause for rejection of the project schedule or its updates.

(2) Ownership of Float. Float available in the schedule, at any time will not be considered for the exclusive use of either the Department or the Contractor. During the course of contract execution, any float generated due to the efficiencies of either party is not for the sole use of the party generating the float; rather it is a shared commodity to be reasonably used by either party. Efficiencies gained as a result of favorable weather within a calendar month, where the number of days of normally anticipated weather is less than expected, will also contribute to the Total Float. Float will be a resource available to both the Department and the Contractor.

(3) Negative Float. Negative float will not be a basis for requesting time extensions. Any extension of time will be addressed in accordance with section f. of this special provision. Schedule updates submitted with negative float can be cause for rejection.

**e. Baseline Schedule Requirements.** Submit a Baseline Schedule within 15 calendar days after Award. The Engineer will review the initial Baseline Schedule and any other required versions, and will either “approve”, “approve as noted”, or “reject” the schedule within 14 calendar days of receipt. If the Engineer does not provide documented notification regarding the disposition of the Baseline Schedule within 14 calendar days, the submission will be considered approved. For Baseline Schedules that are “approved as noted” or “rejected”, make the necessary revisions and resubmit the new Baseline Schedule within 14 calendar days.

The Baseline Schedule will be “approved” or “approved as noted” prior to the start of permanent field work. Permanent field work must not commence without an approved schedule unless approved by the Engineer. If it is determined that a Baseline Schedule will not be submitted and approved prior to the start of permanent construction activities, an Interim Project Schedule must be submitted.

1. The Interim Project Schedule must account for all work activities in the first 90 days of the project. The Interim Project Schedule must be submitted at least 10 calendar days prior to the start of permanent field work and will be approved before field work starts. The Engineer will review the Interim Project Schedule and will “approve”, “approve as noted”, or “reject” the schedule within 10 calendar days of receipt. If the Engineer does not provide documented notification regarding the disposition of the Interim Project Schedule within 10 calendar days, the submission will be considered approved. An approved Interim Project Schedule does not eliminate the need for an approved Baseline Schedule and must be incorporated into the fully developed Baseline Schedule.

The Engineer will only reject Baseline Schedules that are not in compliance with the contract requirements. For Baseline Schedules that are “rejected”, the Engineer will document all portions of the schedule that are not in compliance with the contract requirements, if possible. Depending on which portions of the schedule are not in compliance, it may not be possible to perform a complete review of the schedule. If necessary, the Engineer will conduct a meeting with the Contractor and the Contractor’s Project Scheduler within 7 calendar days of the Engineer’s documented notice. The purpose of this meeting is to discuss the schedule review

performed and resolve issues preventing the Baseline Schedule from being approved. Follow up meetings may be required. The Engineer may withhold all or part of contract payments for failure to develop an approved Baseline Schedule within 60 calendar days of contract award.

Delays related to the approval of the CPM Schedule will not be considered for an Extension of Time.

**f. Baseline Schedule Submittal Requirements.**

1. Electronic files as described in subsection d.5.A of this special provision.
2. The narrative that includes the following:
  - A. An explanation of the overall plan to complete the project, including where the work will begin and how the work and crews will progress through the project.
  - B. Statements comparing the scheduled completion date or duration to the contract completion date, all interim completion dates, and all closure periods.
  - C. A general description of the resources to be applied to the project. This includes the number of crews, types of crews, and key pieces of equipment such as cranes or pavers.
  - D. An explanation of the planned work schedule, including the planned number of workdays per week, planned number of shifts per day, whether night shifts are planned, the number of hours planned per shift, holidays planned to be observed, extent of work planned for the winter months, and how the schedule calendars accommodate the required number of adverse weather days for each month. If the Contractor intends to use multiple crews then, the Contractor must provide the above information for each crew.
  - E. A description of any unresolved actual or anticipated problems or delays, including identification of the type of delay, the cause of the delay, responsibility for the delay, identification of all delayed critical activities, the effect of the delay on other activities and project milestones and identification of actions required to mitigate the delay.
  - F. A description of the critical path that includes discussion about activities that may become critical if any delays occur.
  - G. An explanation of the use of any constraints, including the reason and purpose for each constraint.
  - H. A statement describing the status of any required permits, utility coordination or other 3rd party interfaces.
  - I. A statement describing the reason for the use of each lag.
  - J. A list of any proposed exceptions to this specification included in the schedule along with an explanation of why the exception is appropriate.
  - K. A description of any assumptions built into the schedule (productivity rates, weather, contingency, etc.).

**g. Update Schedule Requirements.** At a minimum, a monthly update must be submitted to the Engineer on or before 5 days after the Data Date. The Data Date will reflect an appropriate status cut-off, typically the first or fifteenth day of the month, and will be consistent on all monthly updates. The Data Date should be determined at the time of baseline schedule acceptance. The Engineer can request an update at any time if circumstances become known that make the current approved schedule an ineffective tool to accurately track progress. Adjustments to the update reporting period, Data Date and submission date may occur if approved by the Engineer. The Engineer will “approve”, “approve as noted”, or “reject” the schedule update within 7 calendar days of receipt. If the Engineer does not provide documented notification regarding the disposition of the Update Schedule within 7 calendar days, the submission will be considered approved. For Update Schedules that are “rejected,” make the necessary revisions and resubmit the Update Schedule within 7 calendar days. For Update Schedules that are “approved as noted,” make the necessary revisions on the subsequent Update Schedule. The Engineer may withhold pay estimates if the Update Schedule is not submitted as required by this section. When updating the schedule, sequentially perform each step of the following procedure:

1. Place a copy of the Current Schedule within the folder structure.
2. Rename the copied schedule file to reflect the update submittal as outlined in Table 1.
3. Update activities based on actual progress.
  - A. Identify the actual start and actual finish dates for all completed activities.
  - B. Identify the actual start date and remaining duration or expected finish for all in-progress activities. Determine the physical percent complete for each in-progress activity. If applicable, in-progress remaining activity durations must be calculated by taking the remaining material units divided by the estimated productivity rate to complete the activity.
  - C. Update activities in the following order, as applicable:
    - (1) Select the started checkbox.
    - (2) Enter Activity Actual Start date.
    - (3) Enter Physical Percent Complete.
    - (4) Enter Remaining Duration.
    - (5) Select the finish checkbox.
    - (6) Enter Activity Actual Finish date.
4. Move the Data Date forward to the first day of next update period.
5. Once the Data Date has been moved, do not move it to an earlier date or later date. If you need to change the Data Date, start over again at Step 1 listed in subsection g.1 of this special provision.
6. Calculate the schedule with the new Data Date.

7. Correct the out-of-sequence activities identified in the scheduling/leveling report located in the schedule log. Calculate the schedule again and view scheduling/leveling report to confirm out-of-sequence activities have been corrected. Repeat if necessary.

8. In the event the update shows minimal negative float, and it can be corrected without discussion, modify the schedule and address the changes in the narrative. If the negative float cannot be eliminated, contact the Engineer to discuss the need for a recovery plan and a Revised Schedule.

9. Recalculate the schedule after all changes have been made prior to creating the Update Schedule Submittal.

#### **h. Update Schedule Submittal Requirements.**

1. Electronic files as described in subsection d.5.A of this special provision.

2. An electronic copy of the 4 Week Look Ahead Schedule in .pdf format.

3. The Update Schedule narrative that includes the following:

A. Compare the scheduled completion date to the contract completion date and any change in the scheduled completion date from the previous accepted submittal and provide an explanation for any variances.

B. Compare the scheduled completion of work associated with each interim completion date, or closure period, in the contract, as well as any changes in these scheduled dates or closure periods from the previous accepted submittal and provide an explanation for any variances.

C. A list of activities that have been added or removed from the schedule since the last accepted submittal and an explanation for the addition or removal.

D. A list of all changes in activity relationships, predecessors, or successors since the last accepted submittal and an explanation for each change.

E. A list of activities with original durations that have been changed since the last accepted submittal along with an explanation.

F. A description of the work performed since the last accepted submittal.

G. A description of and explanation for any changes between the work performed since the last accepted submittal and the work planned at the time that submittal was made.

H. A detailed description of any schedule related unresolved problems, actual or anticipated.

I. A statement that identifies any unresolved actual and anticipated delays. The statement should include identification of the delayed activity and other impacted activities, the party apparently responsible for the delay, the type of delay, the cause of the delay,

the effect of the delay on other activities, and project milestones and identification of actions required to mitigate the delay.

J. A description of the critical path that includes discussion about activities that may become critical if any delays occur.

K. A list of activities that have become critical since the last accepted submittal.

L. A list of any changes to resources including but not limited to crew sizes, work shifts, and equipment.

4. If requested by the Engineer, produce a report which shows a schedule comparison between the newly submitted Update Schedule and the Current Schedule.

**i. Revised Schedule Requirements.** Work added and/or approved excusable delays encountered since the prior Data Date must be represented as a schedule revision as described in this special provision.

The need for a Revised Schedule may come from one of the following:

1. A contract revision or change in the scope of work.
2. Contractor requests to substantially alter the future sequence of work or the durations.
3. The Engineer discovers significant discrepancies between the updated schedule and actual documented work progress and/or the updated schedule is showing enough negative float to warrant a Recovery Plan.

**j. Revised Schedule Submittal Requirements.**

1. Electronic files as described in subsection d.5.A of this special provision.
2. An electronic copy of the 4 Week Look Ahead Schedule in .pdf format.
3. The Revised Schedule narrative that includes the following:
  - A. An explanation of the differences in the revised plan to complete the project.
  - B. Statements comparing the Revised Schedule completion date or duration to the contract completion date, all interim completion dates, and all closure periods to the original Baseline Schedule.
  - C. A description of any revisions to the resources on the project.
  - D. An explanation of revisions to the planned work schedule, including the planned number of workdays per week, planned number of shifts per day, whether night shifts are planned, the number of hours planned per shift, holidays planned to be observed, extent of work planned for the winter months, and how the schedule calendars accommodate the required number of adverse weather days for each month. If multiple crews are used provide the above information for each crew.

E. A description of any unresolved actual or anticipated problems or concurrent delays, including identification of the type of delay, the cause of the delay, responsibility for the delay, identification of all delayed critical activities, the effect of the delay on other activities and project milestones and identification of actions required to mitigate the delay.

F. A description of the critical path that includes discussion about activities that may become critical if any delays occur.

G. An explanation of the use of any revised constraints, including the reason and purpose for each constraint.

H. A statement describing the status of any required permits, utility coordination or other 3rd party interfaces.

I. A statement describing the reason for the use of each additional lag in the Revised Schedule.

J. A description of any additional assumptions built into the Revised Schedule (productivity rates, weather, contingency, etc.)

4. If requested by the Engineer, produce a report which shows a schedule comparison between the newly submitted Revised Schedule and the Current Schedule.

**k. Impacted Schedule for Time Extensions.** Requests for Extension of Time will not be considered unless notification as specified in subsection 108.09 of the Standard Specifications for Construction and the following required analysis is provided.

Subsections 108.07 and 108.08 of the Standard Specifications for Construction provide the excusable delays that the Engineer will grant time extensions for without assessing liquidated damages. The extension of time request submittal must include an impacted schedule and narrative as described in the section i - Revised Schedule Requirements of this special provision as support for the time request. If an extension of time is approved, update the Unimpacted Schedule to include the agreed to changes and that schedule will be referred to as the Revised Schedule.

Develop an impacted schedule and evaluate delays based on the following methods. For more information on these methods, or if the delay cannot be evaluated using the detailed methods noted herein, reference the Association of Cost Engineering, International (ACE) published documents, *Recommended Practice No. 52R-06: Time impact Analysis - As Applied in Construction* and *Recommended Practice No. 29R-03: Forensic Schedule Analysis*.

1. Use a Time Impact Analysis (TIA), for evaluating future delays (prospective). In general terms, complete the following steps:

A. Determine project progress prior to the circumstance(s) necessitating the time extension. The previous approved monthly update, updated to the day before the circumstance(s) alleging to have caused delay, must be used to display the prior progress of the project. This schedule is referred to as the Unimpacted Schedule.

B. Prepare a fragmentary network (fragnet) depicting the circumstance that is believed to have delayed the project.

C. Insert the fragnet into the Unimpacted Schedule, run the schedule calculation, and determine the finish date. This schedule is referred to as the Impacted Schedule.

D. Compare the Impacted Schedule finish date with the Unimpacted Schedule finish date in order to determine the duration of the impact. The time extension due, if any, will be based on this duration.

2. Use a retrospective/contemporaneous analysis (commonly known as a Windows Analysis) when evaluating delays that are currently occurring or have already occurred. In general terms, complete the following steps:

A. Identify the previously approved schedule that was most recent to the start of the delay being evaluated.

B. Identify each approved Update Schedule in effect during the delay and the schedule with a Data Date immediately following the conclusion of the delay.

C. Identify the critical path each day from immediately before the start of the delay to the schedule immediately following the delay.

D. Determine whether the delay falls on the critical path.

E. If the delay does not fall on the critical path, then no project delay occurred and no time extension is due.

F. If the delay falls on the critical path, then determine the number of days the critical path is delayed. The time extension due, if any, will be based on this delay.

**I. Final Updated Schedule.** As a condition of acceptance of this project, submit a final update, as-built schedule with accurate actual start and finish dates for the activities, within 30 calendar days after completion of all activities on the CPM Schedule.

**m. Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract price using the following pay item:

<b>Pay Item</b>	<b>Pay Unit</b>
Critical Path Method Schedule .....	Dollar

A budgeted amount of \$15,000 has been established for payment of the work detailed herein. **Critical Path Method Schedule** will be paid in accordance with the schedule in Table 3. No extra compensation will be paid for scheduling costs associated with revisions or delays to the project.

The development and maintenance of CPM Schedules, in accordance with the requirements in this special provision, and approval by the Engineer are required conditions prior to the Engineer authorizing any payments for this pay item.

**Table 3: Payment Milestones for CPM Schedule**

CPM Payment Schedule	Cumulative Percent of Budgeted Amount for CPM Schedule
Approved Baseline CPM Schedule	50
20% of Original Contract Amount Earned	60
40% of Original Contract Amount Earned	70
60% of Original Contract Amount Earned	80
80% of Original Contract Amount Earned	90
Approved Final Updated Schedule	100