

## Preconstruction Timing Analysis Requirements

### Description:

The Timing Analysis shall reflect a prudent Contractor's anticipated work plan for constructing the project using a Critical Path Method Project Schedule (CPM). This CPM schedule shall include all work specified in the Contract Documents including all anticipated activities of subcontractors, vendors, suppliers, utilities, railroads, the Department, and all other parties associated with construction of the project. All work activities including but not limited to submittals, shop drawings, major procurement, fabrication, delivery of critical or special materials and equipment, utility construction / relocation, and construction activities shall also be included. The Timing Analysis shall be based upon the entirety of the Contract Documents. Primavera software shall be used to prepare the CPM schedule.

### Float:

The CPM utilizes float. Float is defined as the amount of time between when an activity "can start or finish" and when an activity "must start or finish". Total float is float shared with all other activities and is defined as the amount of time a scheduled activity may be delayed from its early start without delaying the project finish date.

### Weather Float:

In developing the Timing Analysis CPM schedule, the calendar day schedule and all calendars defined in the project data dictionary shall reflect the monthly anticipated adverse weather days as determined by Table 1 below. The total number of these days shall be considered Project Weather Float and reported with the assumptions in the written narrative. Consider and make appropriate scheduling and operational allowances for seasonal weather conditions and ambient temperatures.

Table I: Delaware monthly anticipated adverse weather days  
(Based on a seven (7) calendar day week)

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
12	10	5	5	4	2	4	3	4	3	2	6

Adverse weather is defined as daily precipitation equal to or exceeding 0.25 inches and / or maximum daily temperature not exceeding 32 degrees F as recorded at the Wilmington Airport.

### Schedule:

The project schedule shall show the sequence and interdependence of activities required for complete performance of the construction project. It is critical that all work sequences are logical and show a coordinated plan of the work requirements. The CPM format shall be the Precedence Diagram Method with days as the Planning Unit and shall be based on Calendar Days. Schedules with calendars based on Working Days shall not be used. At a minimum, the schedule shall include:

- a work breakdown structure (WBS),
- working drawing schedule,
- phasing (staging) schedule,
- materials schedule,
- crew deployment (resource) schedule,
- a bridge construction and erection schedule,
- a paving schedule, and
- a utility construction schedule.

**Narrative:**

The CPM Schedule Narrative is a written explanation of phasing progression, intervals, assumptions, and coordination with and dependency on completion of utility work and the work of any adjacent contracts. The Scheduler is free to make assumptions regarding field conditions, estimated quantities, and / or subsurface conditions. Assumptions shall be described in the written narrative and included as part of the Timing Analysis CPM schedule submittal to the Department. Generally, the following information is addressed:

- Phasing / Staging
- Durations
- Work coordination
- Utility impacts and phasing
- Adjacent contracts
- Anticipated issues
- Equipment Usage and Limitations
- Project completion dates
- Interim milestones
- Work restrictions including temperature sensitive activities
- Anticipated work hours / day and days / week
- Production data, and
- Calendars

**Calendars:**

Calendars allow activities to be scheduled only when allowed by the nature of or restraints on the work. Calendars shall include weekends, holidays, and any other anticipated Contractor non-work periods. Calendar non-work periods shall reflect the environmental restrictions for the location of the Contract work, customary days during the week that a Contractor does not work, expected adverse weather days from Table 1, and all legal holidays and other restrictions as set forth in Standard Specification Subsection 101.91. All activities shall be assigned their appropriate Calendar. The following Calendars shall be defined and used as a minimum:

- Full schedule,
- Winter condition,
- Concrete Work,
- Concrete Paving,
- GABC,

- Asphalt Base,
- Asphalt Surface, and
- Environmental.

Note: If planning on night paving include separate calendars for day / night work.

**Development of the Timing Analysis, Critical Path Method (CPM) Schedule:**

- (a) Work Breakdown Structure (WBS) and Activity Codes shall be used to identify the breakdown levels needed to illustrate the work components required for the project's completion. The Scheduler shall determine the breakdown of work from South to North and West to East.
- (b) Use a Coding Structure (CS) having a minimum of the following breakdown levels used:
  - a. Phase
  - b. Stage
  - c. Resource / Crew assignment
  - d. Bridge structures, footings, columns, caps
  - e. Roadway sections
- (c) Activities shall be identified by a name, stationing, and coding, and have a duration, Phase / Stage, sequence, predecessors, successors, and resources. Activity duration, or Original Duration, shall be reasonable and representative of the scope of the activity. Activity durations shall be based on Calendar Days and shall reflect all time necessary to complete the activity for a single resource unit. Original Durations may not exceed fifteen (15) calendar days unless approved by the Department's Master Scheduler. Productivity rates used to establish durations shall reflect the time periods when work can be scheduled and exclude the non-work period of the activity's calendar.
- (d) Activity sequencing shall be typical of proficient scheduling practice. Activities shall be sequenced to reflect resource apportionment. When one crew (resource) is being utilized to perform all of many similar activities, these activities must be linked together in some sequence to reflect that one crew is performing the work. Additionally, when several crews are performing similar activities, these activities must have separate linked sequences equal to the number of crews performing the work. Activities shall be logically connected and coded to reflect the crew (resource) performing the operation. A summary list of crews, their crew codes, and their operation(s) shall be included in the narrative with the schedule submission. Only finish to start dependency relationships (links) shall be used. Lag time may not be used unless specifically approved by the Department's Master Scheduler in advance. The submitted activity sequence and durations will generate a CPM Schedule showing the anticipated Contract Time and a critical path having zero total float.
- (e) Coding for crew assignments is required.

- (f) Activity responsibility shall be identified for each activity completed by others as a crew. Ex: Utility companies, sub contractors and contractors on adjacent contracts shall be identified by coding as required.
- (g) Production rate data for activities shall be addressed in the narrative.
- (h) Phasing (staging) shall be included as activities. Each phase (stage) in the phasing schedule shall be included as a zero (0) duration Start and Complete milestone activities. These activities shall also be correlated with the utility schedule. A separate activity shall be used to start / finish utility work.
- (i) Surcharge durations and special testing, if applicable, shall be included as activities. These activity durations may exceed fifteen (15) calendar days as required.
- (j) Project wide activities such as Maintenance of Traffic, Temporary Erosion Control, and Construction Engineering that are ongoing for long durations or the entire duration of the project and are basically complementary to other activities, shall be divided and condensed into “establish” and “conclude” activities to prevent this type of work from being the major portion of the critical path or its entirety.
- (k) The Project Start Date, or initial Data Date, of the Timing Analysis CPM Schedule shall be the anticipated project’s Plans, Specifications, and Estimate (PS&E) date. The first schedule activity related to productive construction work shall be entitled “First Chargeable Day” and shall have a zero duration.

**Note:**

1. Do not use an activity description to describe more than one (1) activity throughout the duration of the project.
2. As a guiding factor, provide enough activities to demonstrate the necessary interdependencies and the fineness of detail to five (5) calendar day activity durations.
3. Constraints shall not be applied to any work requirements.
4. Schedule calculations of the CPM database shall be based on retained logic, contiguous durations, and total float as finish float

**Submittals:**

The Timing Analysis CPM Schedule shall be submitted prior to the Final Construction Plan submission when the final quantities and utility schedules are known. The CPM schedule shall be prepared in Primavera P6 (or newer) software and submitted in .XER format. Submittals shall be accompanied by the written CPM schedule narrative as stated above. The Project Manager should schedule a timing meeting approximately thirty (30) days after the Timing Analysis CPM Schedule submission. Timing meetings shall include, at a minimum, the Consultant’s Project Manager and Scheduler and also the Department’s Project Manager, Construction Engineer, and Master Scheduler.

Include the following, as a minimum, in all Timing Analysis CPM schedule submittals:

- A Work Breakdown Structure (WBS),
- Coding Structure
- Calendars with anticipated adverse weather days shown each month in accordance with the chart herein,
- Activity number;
- Activity description with stationing references;
- Duration of Activity, in calendar days;
- Earliest start date;
- Earliest finish date,
- Latest start date,
- Latest finish date,
- Activity float;
- Indicate relationships between administrative activities, preconstruction activities and all related construction activities;
- A working drawing schedule correlated with the activities of the CPM Schedule; (as required)
- A detailed phasing (staging) schedule if the work has phasing or is to be performed in phases;
- Utility Bar Chart; and
- Written Narrative.