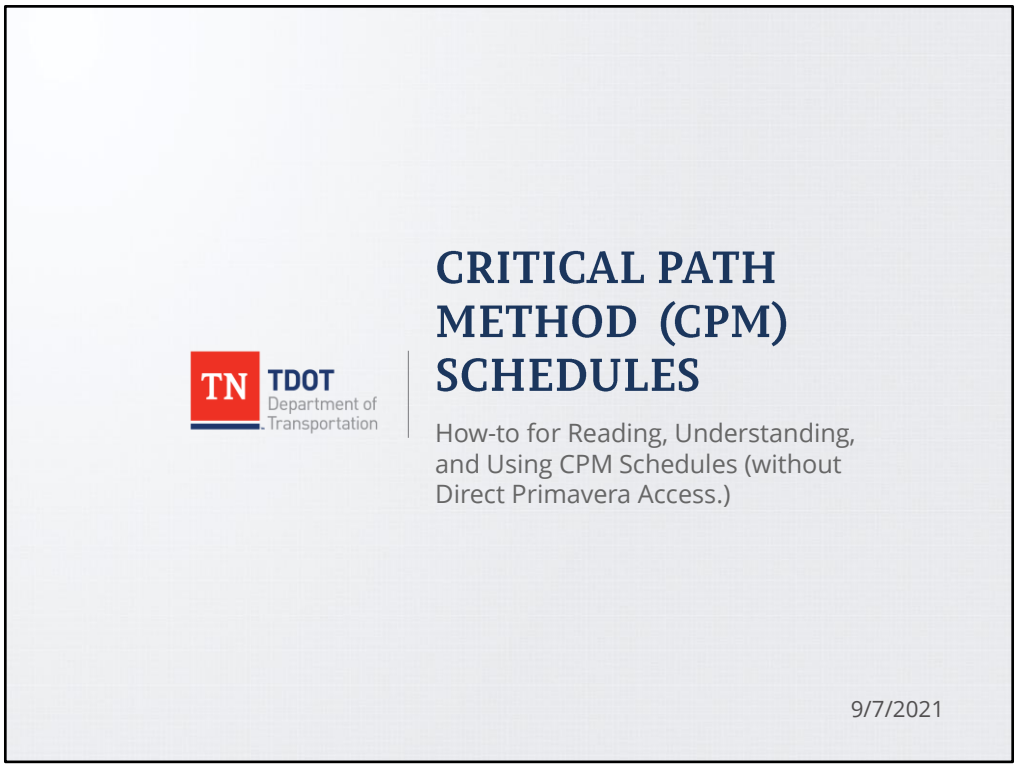
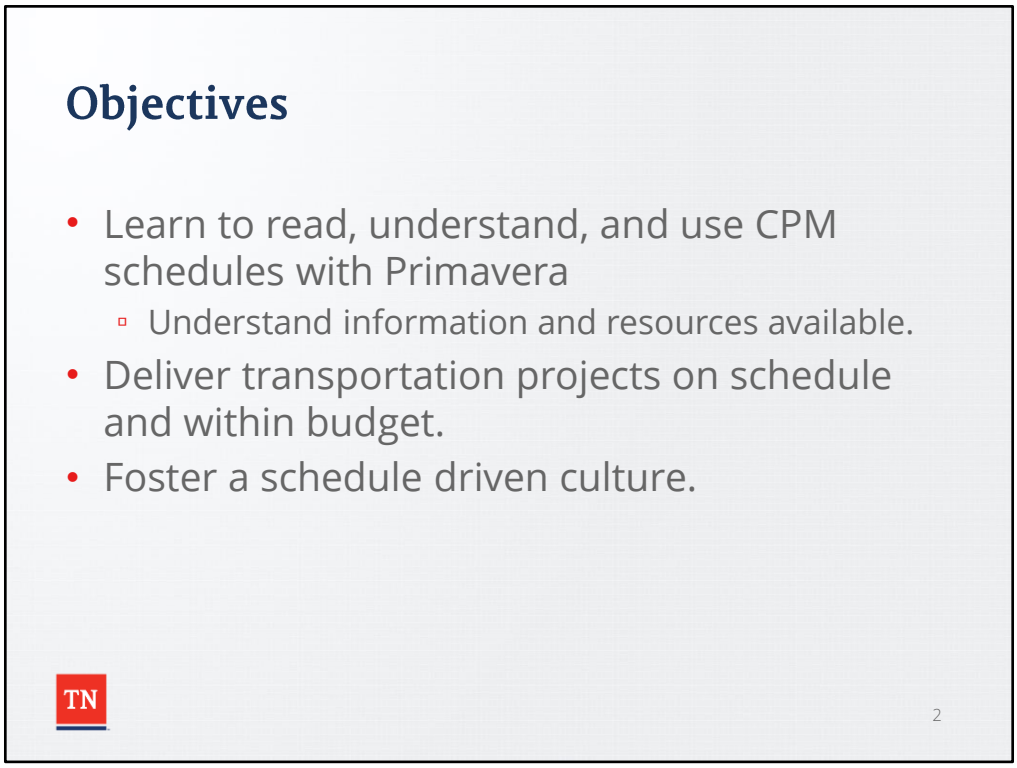
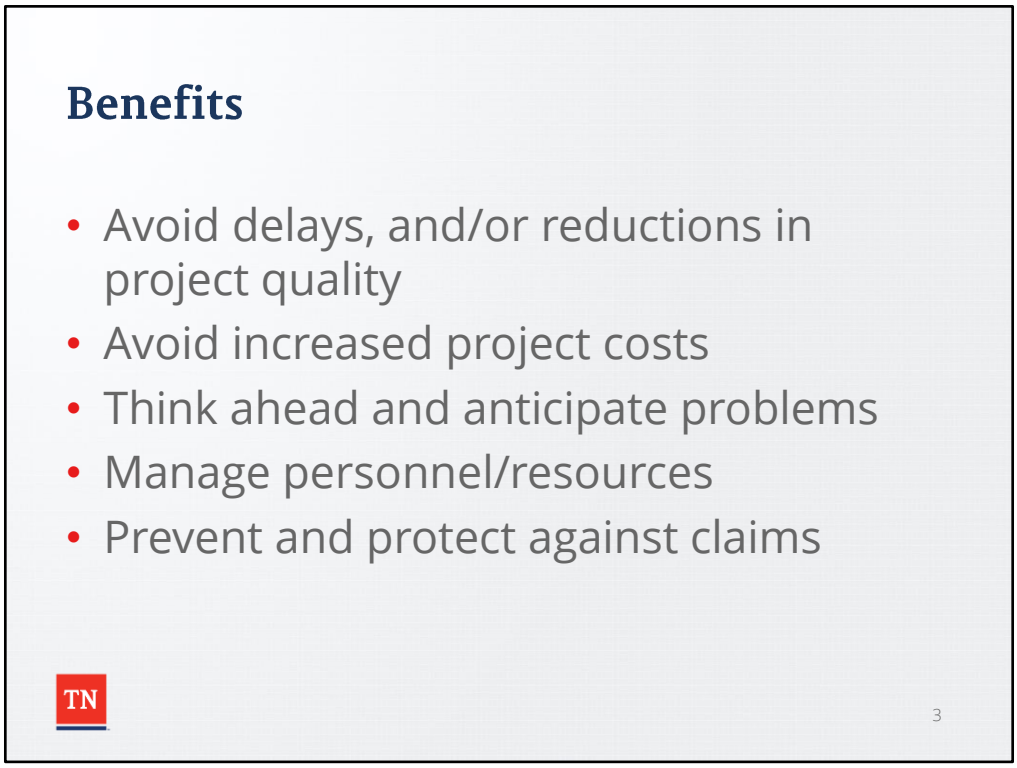

TN TDOT Department of Transportation
CRITICAL PATH METHOD (CPM) SCHEDULES
How-to for Reading, Understanding, and Using CPM Schedules (without Direct Primavera Access.)
9/7/2021



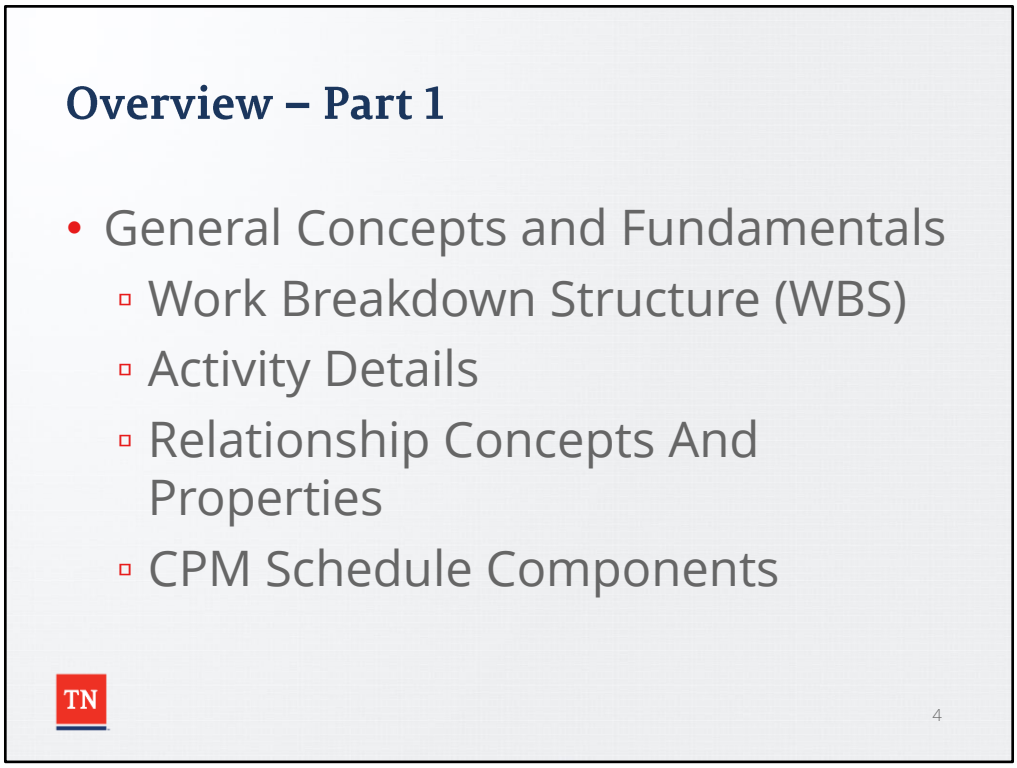
Objectives

- Learn to read, understand, and use CPM schedules (without direct Primavera access.)
    - Understand information and resources available.
- Deliver transportation projects on schedule and within budget.
- Foster a schedule driven culture.



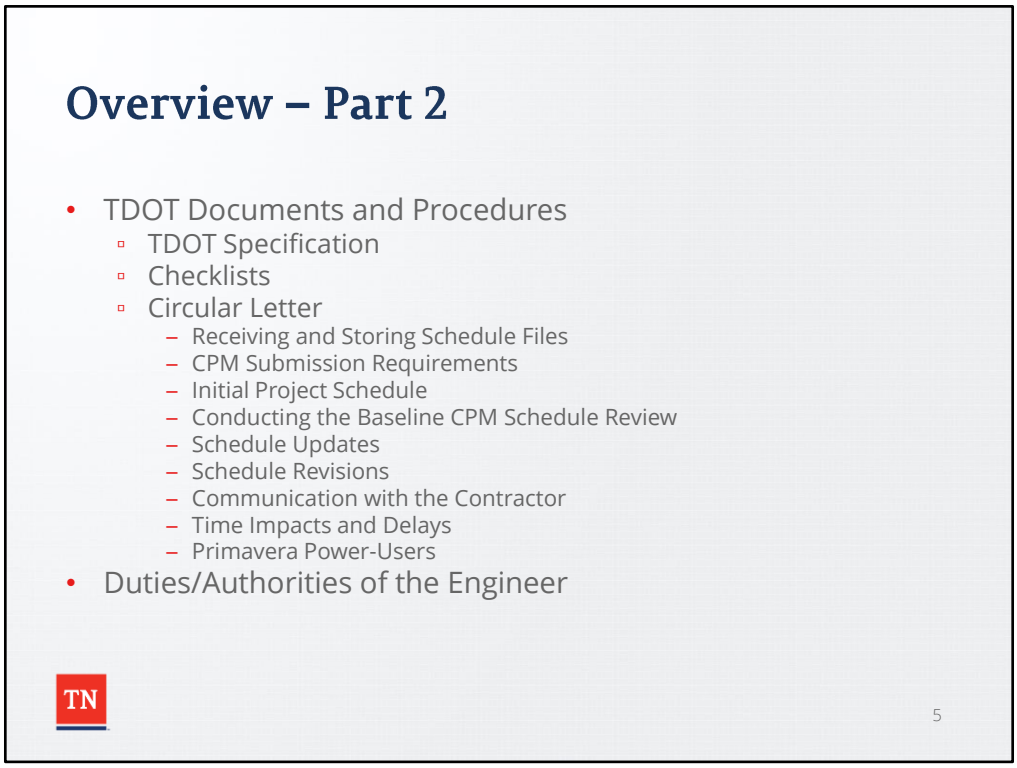
Benefits

- Avoid delays, and/or reductions in project quality
- Avoid increased project costs
- Think ahead and anticipate problems
- Manage personnel/resources
- Prevent and protect against claims



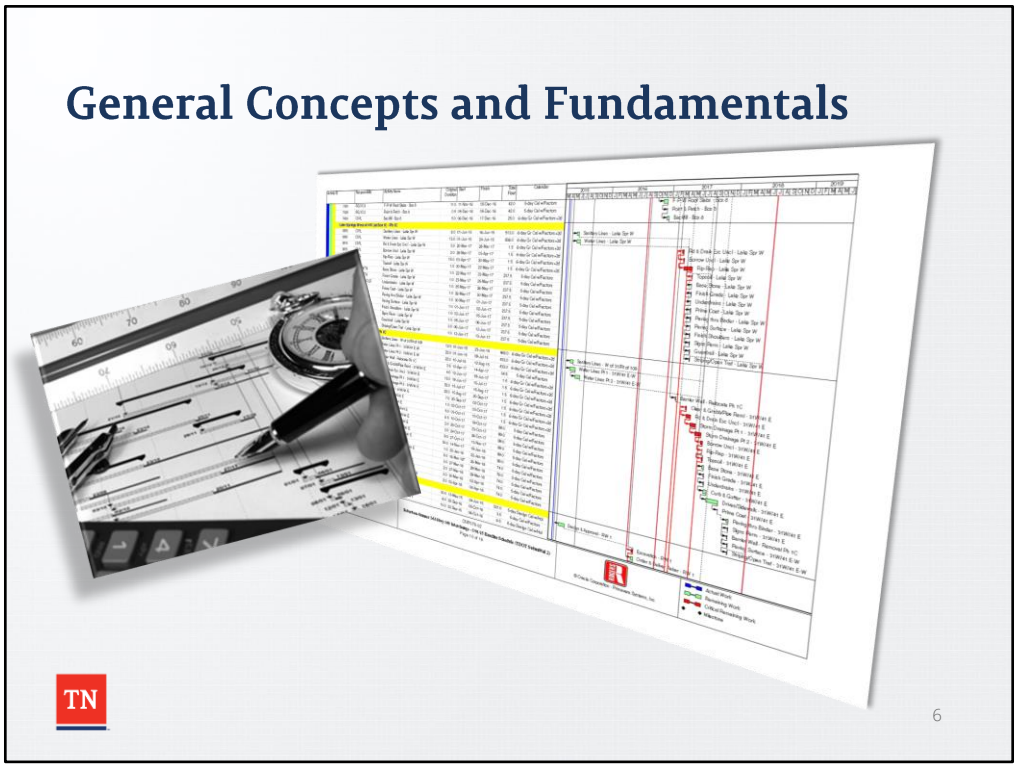
Overview – Part 1

- General Concepts and Fundamentals
  - Work Breakdown Structure (WBS)
  - Activity Details
  - Relationship Concepts And Properties
  - CPM Schedule Components

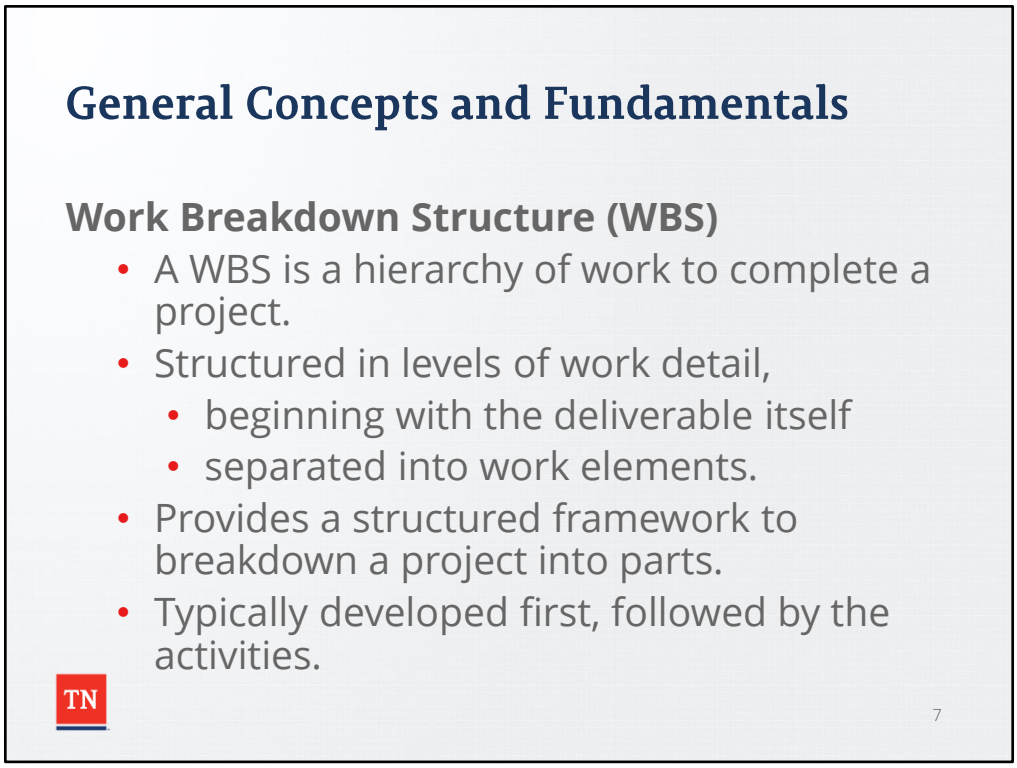


Overview – Part 2

- TDOT Documents and Procedures
  - TDOT Specification
  - Checklists
  - Circular Letter
    - Receiving and Storing Schedule Files
    - CPM Submission Requirements
    - Initial Project Schedule
    - Conducting the Baseline CPM Schedule Review
    - Schedule Updates
    - Schedule Revisions
    - Communication with the Contractor
    - Time Impacts and Delays
    - Primavera Power-Users
- Duties/Authorities of the Engineer

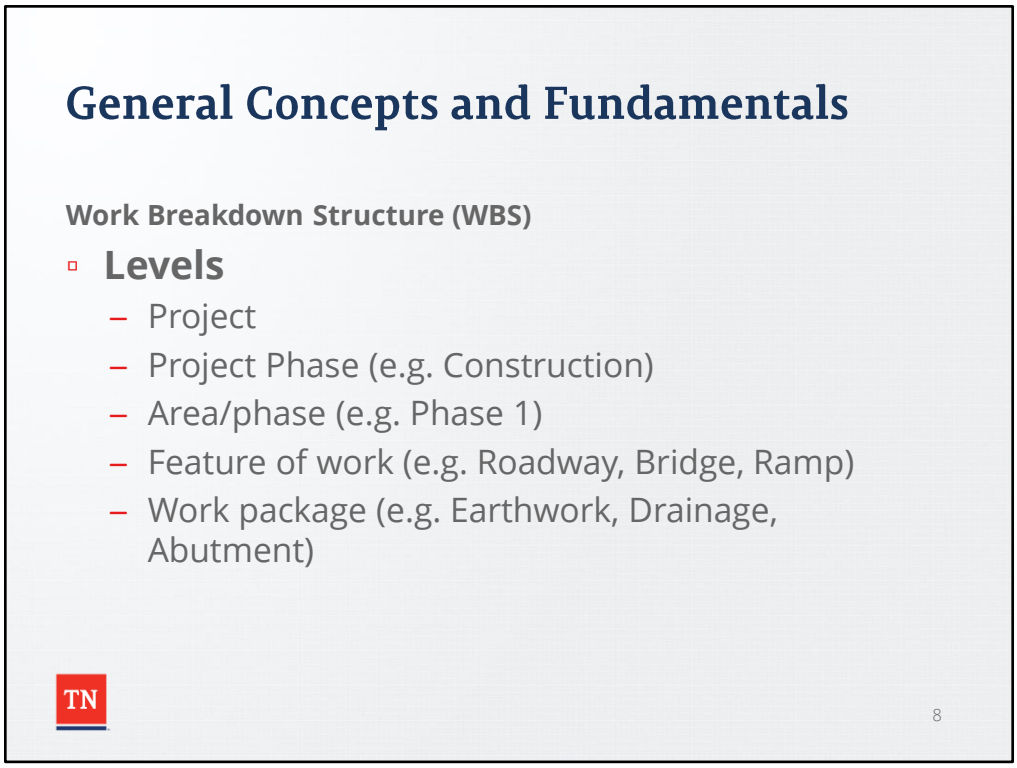


General Concepts and Fundamentals



General Concepts and Fundamentals

A WBS is a hierarchy of work that must be accomplished to complete a project. The WBS is structured in levels of work detail, beginning with the deliverable itself, and is then separated into identifiable work elements. WBS provides a structured framework with which to breakdown a project into meaningful and manageable parts. The WBS is typically developed first, followed by the activities for performing the work.



General Concepts and Fundamentals

Levels

- Project
- Project Phase (e.g. Construction)
- Area/phase (e.g. Phase 1)
- Feature of work (e.g. Roadway, Bridge, Ramp)
- Work package (e.g. Earthwork, Drainage, Abutment)

General Concepts and Fundamentals

Example:

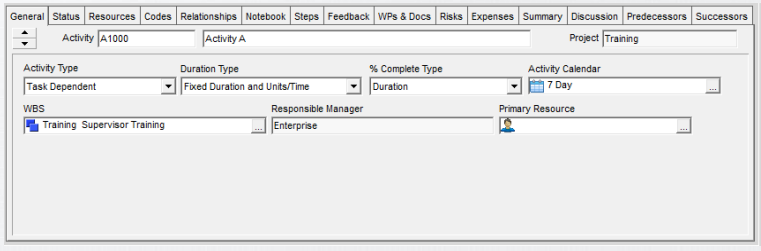
- Administration
- Procurement
  - Submittals
  - Fabricate & Deliver
- Construction
  - Roadway / Box Culverts
    - Grading
    - Culverts
    - Roadway
    - Side Roads
    - Ramps
    - Storm Drainage
  - Bridges
  - Walls
  - Utilities
    - Power & Communications
    - Water

General Concepts and Fundamentals

Activities

Activities= Well defined, measureable pieces of work with a measureable outcome.

- Usually developed after WBS
- Numerous details associated with each activity



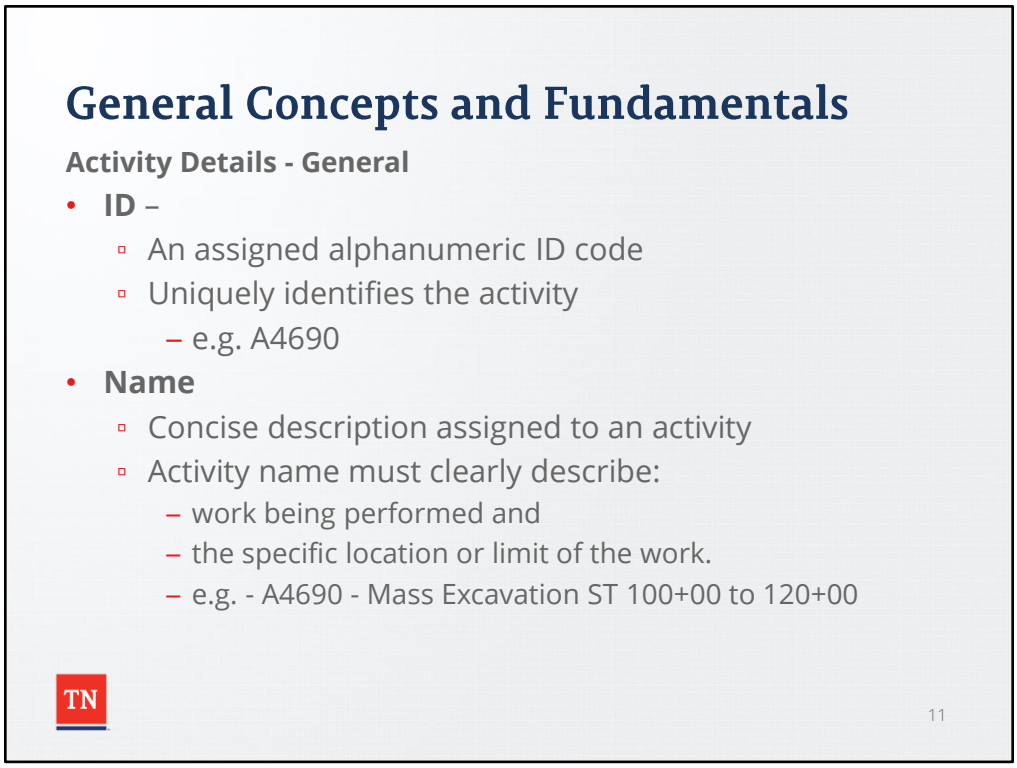
10

General Concepts and Fundamentals

Activities

Generally – Well defined, measureable pieces of work with a measureable outcome.

Activities are usually developed after the Work Breakdown Structure (WBS).
Numerous details are associated with each activity.



General Concepts and Fundamentals

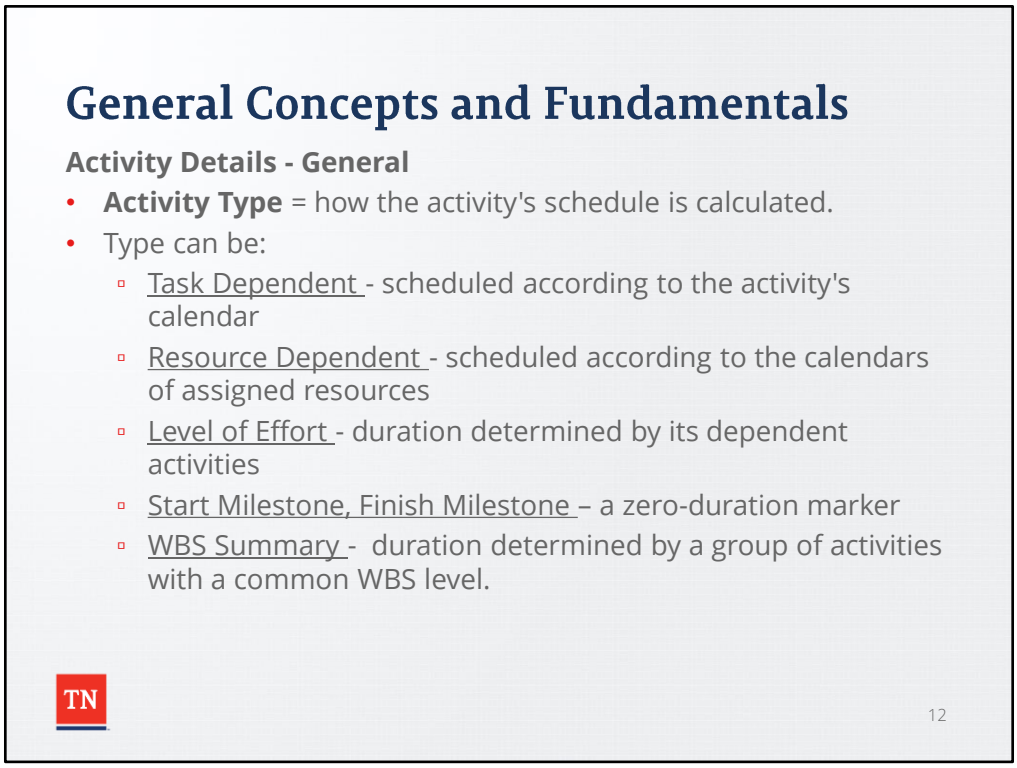
Activity Details - General

ID - An alphanumeric ID code assigned to an activity that is used to uniquely identify the activity.

e.g. A4690

Name - A meaningful yet concise description assigned to an activity that is used to uniquely describe the work or event that the activity represents. Activity name must clearly describe the work being performed and the specific location or limit of the work.

e.g. - A4690 - Mass Excavation ST 100+00 to 120+00

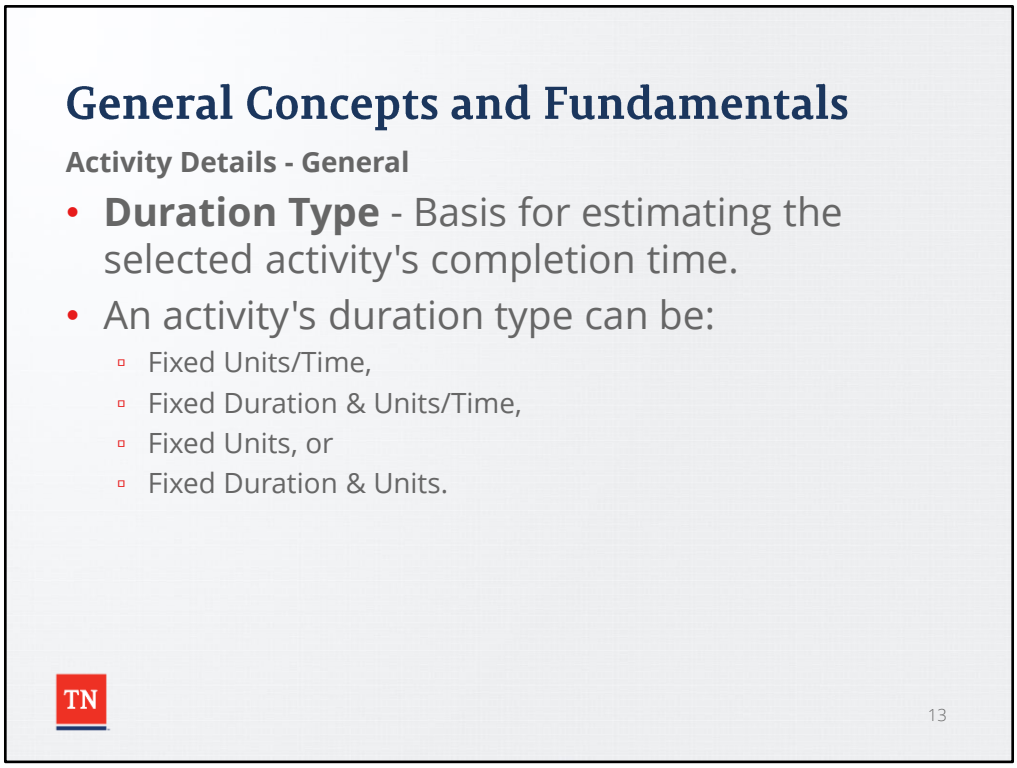


General Concepts and Fundamentals

Activity Details - General

Type - the selected activity's type or how the activity's schedule is calculated. An activity's type can be Task Dependent, Resource Dependent, Level of Effort, Start Milestone, Finish Milestone, or WBS Summary.

- A Task Dependent activity is scheduled according to the activity's calendar rather than calendars of assigned resources.
- A Resource Dependent activity is scheduled according to the calendars of assigned resources. This activity type is used when several resources are assigned to the same activity, but may work separately.
- A Level of Effort activity has a duration which is determined by its dependent activities. Administration-type activities are typically Level of Effort.
- A Start/Finish Milestone is a zero-duration activity with no resources, marking a significant project event.
- A WBS summary activity has a duration which is determined by a group of activities that share a common WBS level. Resources that drive activity dates cannot be assigned to WBS summary activities.



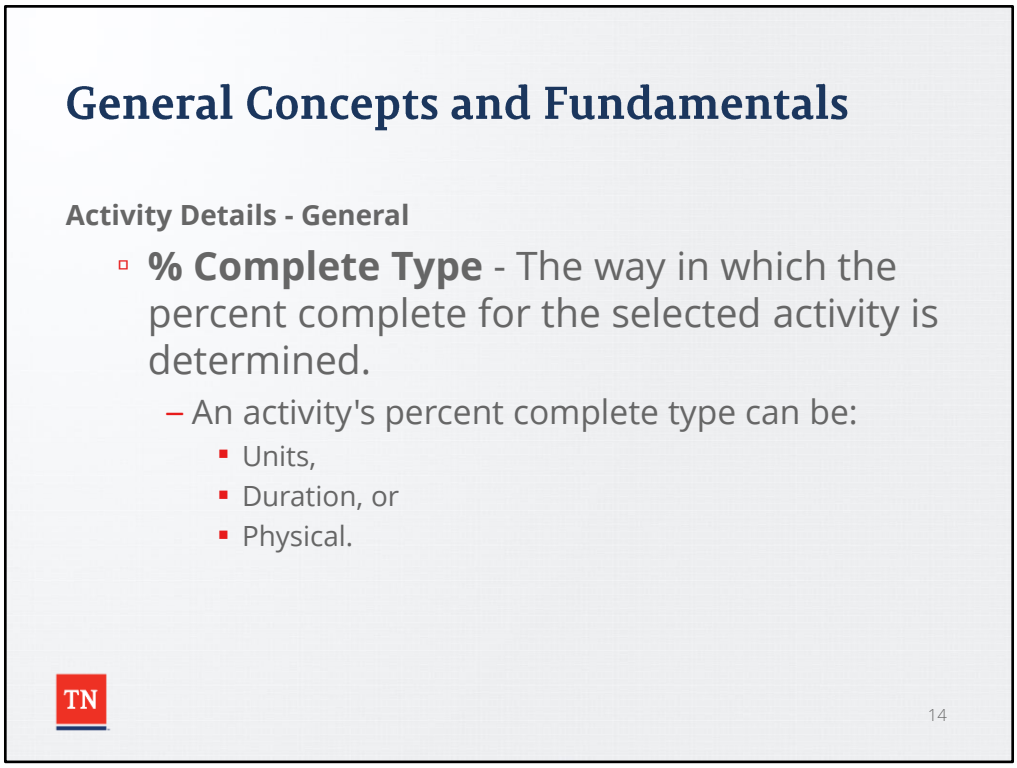
General Concepts and Fundamentals

Activity Details - General

Duration Type - The basis for estimating the selected activity's completion time. An activity's duration type can be Fixed Units/Time, Fixed Duration & Units/Time, Fixed Units, or Fixed Duration & Units.

- For Fixed Units/Time, the resource units per time are constant when the activity duration or units are changed. This type is used when an activity has fixed resources with fixed productivity output per time period. You most often choose this duration type when you are using resource dependent activities.
- For Fixed Duration & Units/Time, the activity duration is constant and the units are changed. This type is used when the activity is to be completed within a fixed time period regardless of the resources assigned. You most often choose this duration type when you are using task dependent activities.
- For Fixed Units, the activity units are constant when the duration or resource units per time are changed. This type is used when the total amount of work is fixed, and increasing the resources can decrease the activity duration. You most often choose this duration type when you are using resource dependent activities.
- For Fixed Duration & Units, the activity duration is constant and the units/time are changed. This type is used when the activity is to be completed within a fixed time period and the total amount of work is

fixed. You most often choose this duration type when you are using task dependent activities.



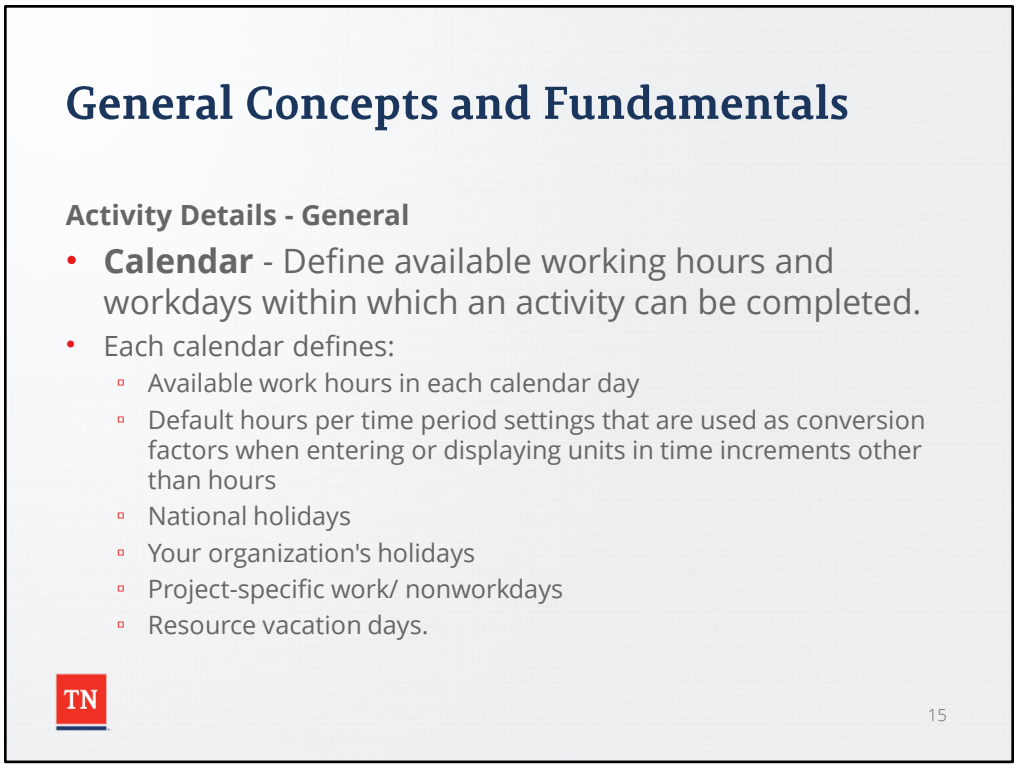
General Concepts and Fundamentals

Activity Details - General

% Complete Type - The way in which the percent complete for the selected activity is determined.

An activity's percent complete type can be Units, Duration, or Physical.

Units % Complete = (Actual Labor Units + Actual Nonlabor Units)
Duration % Complete = (Original or Planned Duration – Remaining Duration)
Physical= A percent complete that is entered manually by the user instead of being calculated by the software.



General Concepts and Fundamentals

Activity Details - General

Calendar - Calendars define available working hours and workdays within which an activity can be completed.

Each calendar defines:

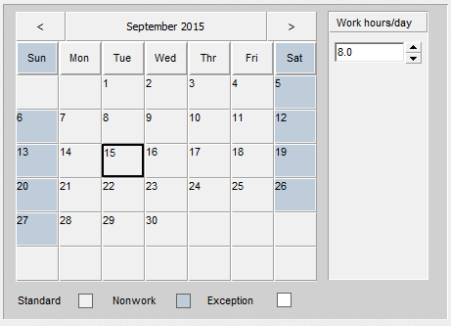
- Available work hours in each calendar day
- Default hours per time period settings that are used as conversion factors when entering or displaying units in time increments other than hours
- National holidays
- Your organization's holidays
- Project-specific work/ nonworkdays
- Resource vacation days.

General Concepts and Fundamentals

Activity Details – General/Calendar

Standard 5-Day Work Calendar:

- defined in terms of a standard 5-day or 6-day workweek schedule
- use as the default working calendar for majority of the activities on the project



16

General Concepts and Fundamentals

Activity Details - General

Calendar - Standard 5-Day Work Calendar:

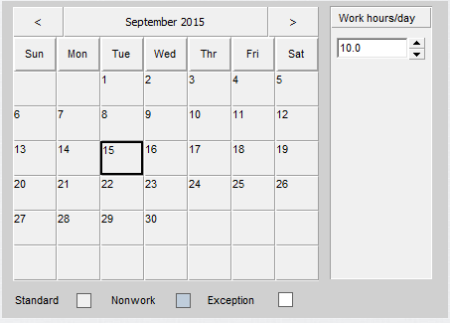
A standard calendar that defines the normal working schedule for each day, week, and month for use as the default working calendar for majority of the activities on the project. The standard work calendar may be defined in terms of a standard 5-day or 6-day workweek schedule, excluding as applicable, nonworkdays for week-ends and holidays. When a 5-day or 6-day calendar is assigned to an activity, the activity duration must be specified in workdays.

General Concepts and Fundamentals

Activity Details – General/Calendar

Standard 7-Day Work Calendar:

- not constrained by weekends, holidays, weather, or other non-workday restrictions
- activity duration must be specified in calendar days



17

General Concepts and Fundamentals

Activity Details - General

Calendar - Standard 7-Day Work Calendar:

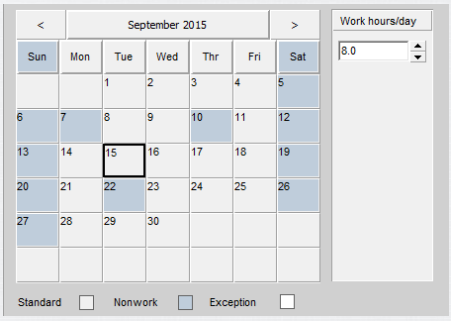
A standard calendar that defines the normal working schedule for each day, week, and month for use on activities that are not constrained by weekends, holidays, weather, or other non-workday restrictions. Such activities may include, but are not limited to procurement/fabrication of long lead materials, curing, load test, settlement or surcharge periods, WBS summary, or level of effort. A 7-day calendar will also be used when the Contract specifies calendar day durations for certain activities. When a 7-day calendar is assigned to an activity, the activity duration must be specified in calendar days.

General Concepts and Fundamentals

Activity Details – General/Calendar

Standard 5-Day Weather Calendar:

- For activities that may be affected by adverse weather.
- reduced for the number of estimated weather days anticipated each month
- randomly changing available workdays to non-workdays.



18

General Concepts and Fundamentals

Activity Details - General

Calendar - Standard 5-Day Weather Calendar:

A standard calendar that defines the normal working schedule for each day, week, and month for use on activities that may be affected by adverse weather. The standard weather calendar may be defined in terms of a standard 5-day or 6-day workweek schedule, excluding as applicable, non-workdays for week-ends and holidays. Additionally, the number of workdays available each month will be reduced for the number of estimated weather days (days lost due to weather) anticipated each month by randomly changing available workdays to non-workdays.

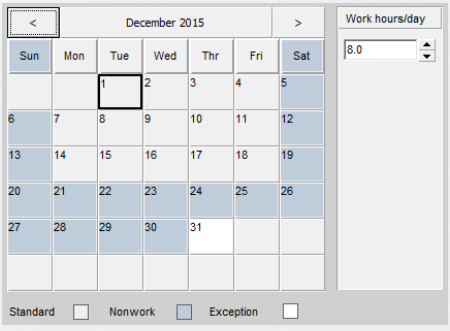
In lieu of a weather calendar, a weather contingency activity may be added to the schedule for the total number of estimated weather days anticipated over the duration of the project. The weather contingency activity will then be linked between the project completion milestone activity and the last activity on the critical path that may be affected by adverse weather. An adjustment will be made each month to reduce the weather contingency activity duration by the number of weather days lost during the month.

General Concepts and Fundamentals

Activity Details – General/Calendar

Winter Shut-down Calendar:

- weather sensitive activities that cannot be performed during the winter periods due to temperature requirements



19

General Concepts and Fundamentals

Activity Details - General

Calendar - Winter Shut-down Calendar:

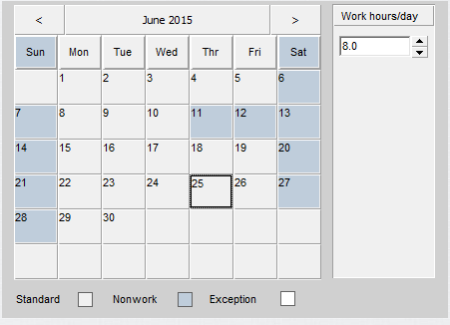
A calendar that defines the normal working schedule for each day, week, and month for use on weather sensitive activities such as asphalt paving that cannot be performed during the winter periods due to temperature requirements. Winter shut-down calendars may be defined based on a standard work calendar or weather calendar, excluding as applicable, non-workdays for week-ends, holidays, and weather days. Additionally, available workdays during the winter shut-down periods will be changed to non-work days accordingly.

General Concepts and Fundamentals

Activity Details – General/Calendar

Special Event or Environmental Calendar:

- Activities with special event, environmental, or other specified time of year restriction.
  - e.g. CMA Festival June 11-14



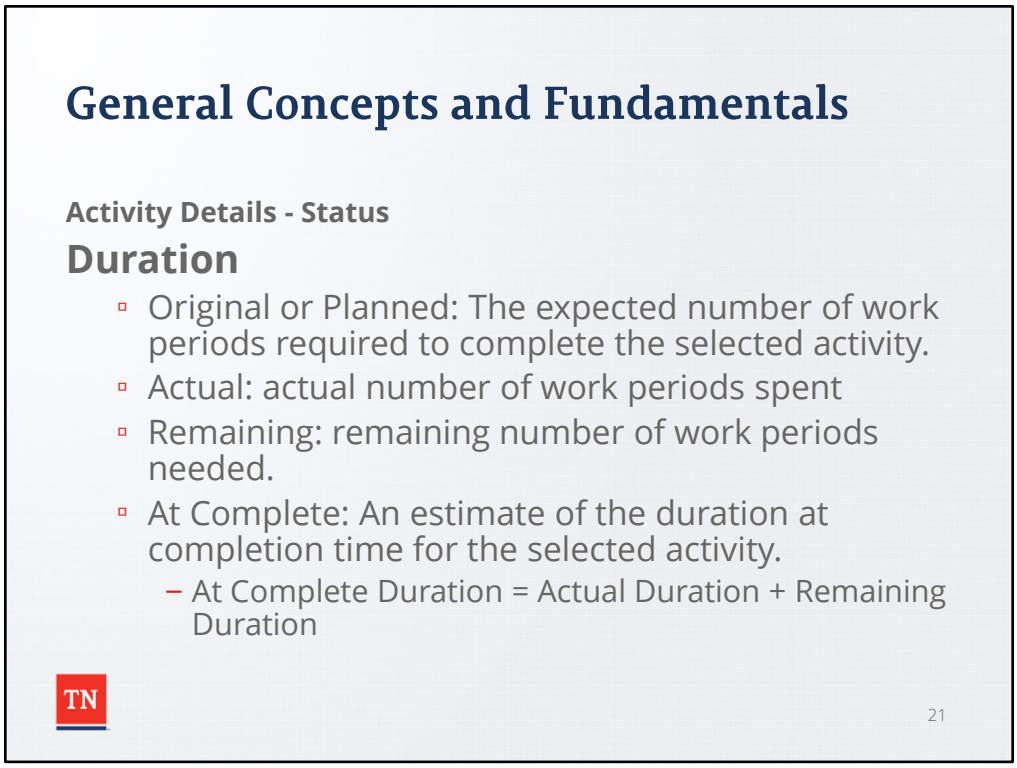
20

General Concepts and Fundamentals

Activity Details - General

Calendar -Special Event or Environmental Calendar:

A calendar that defines the normal working schedule for each day, week, and month for use on activities with special event, environmental, or other specified time of year restriction. Special event or environmental calendars may be defined based on a standard work calendar or weather calendar, excluding as applicable, non-workdays for week-ends, holidays, and weather days. Additionally, available workdays will be changed to non-work days accordingly, for the specified time of year restriction. A separate calendar must be defined for each special event or environmental time of year restriction, if the times of year restrictions are not concurrent.

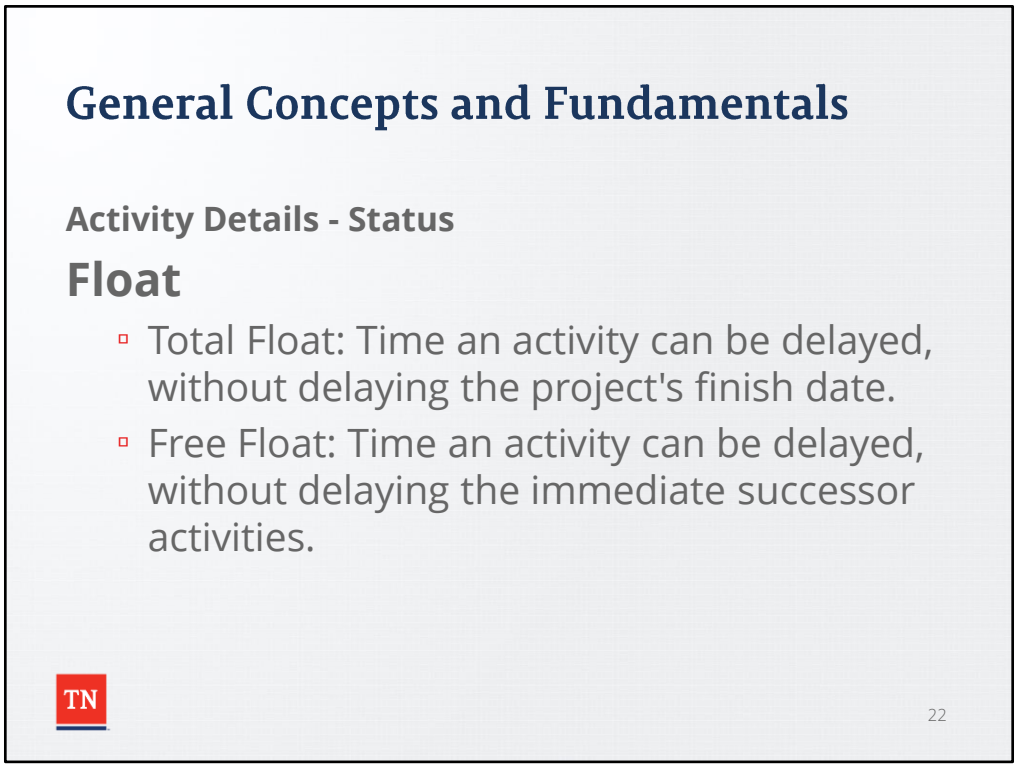


General Concepts and Fundamentals

Activity Details - Status

Duration

- Original or Planned: The expected number of work periods required to complete the selected activity.
- Actual: The actual number of work periods spent on the selected activity.
- Remaining: The remaining number of work periods needed to complete the selected activity.
- At Complete: An estimate of the duration at completion time for the selected activity. (At Complete Duration = Actual Duration + Remaining Duration).

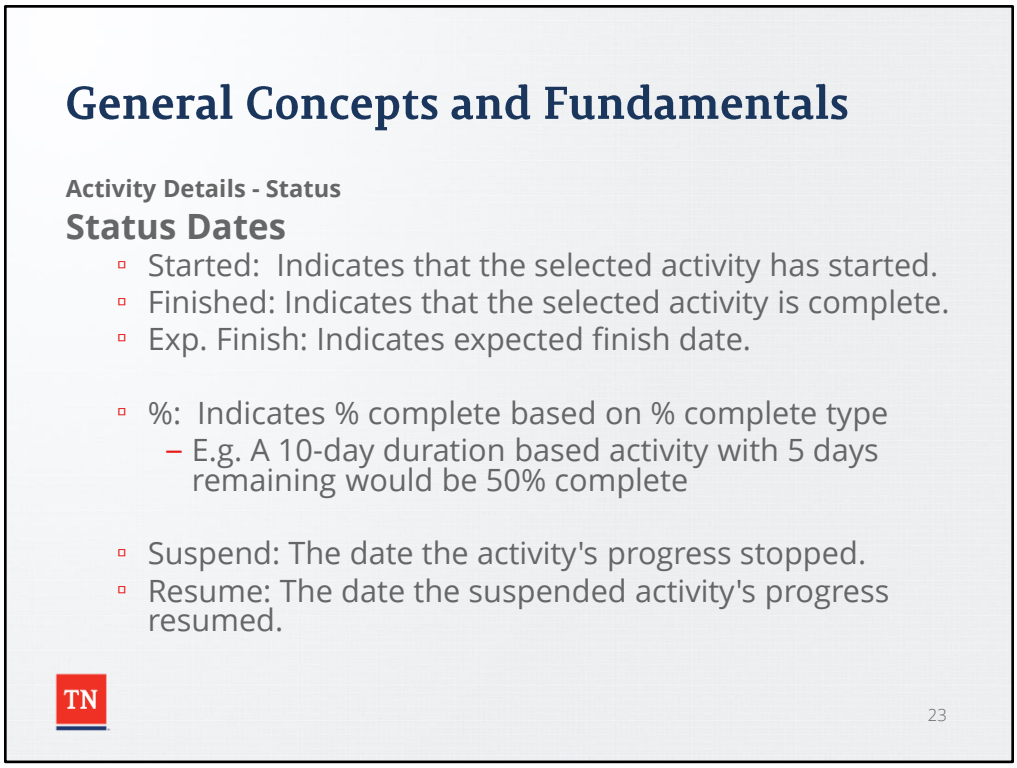


General Concepts and Fundamentals

Activity Details - Status

Float

- Total Float: The amount of time the selected activity can be delayed, without delaying the project's finish date.
- Free Float: The amount of time the selected activity can be delayed, without delaying the immediate successor activities.

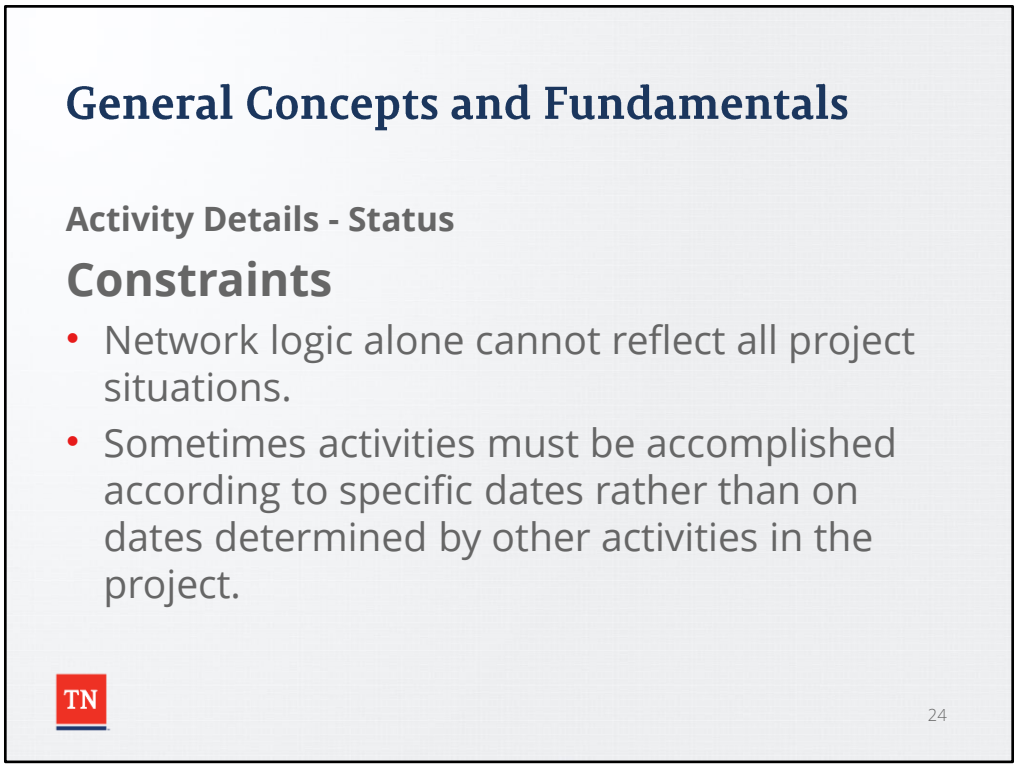


General Concepts and Fundamentals

Activity Details - Status

Status Dates

- Started: Indicates that the selected activity has started. If the activity has started or is complete, the activity's actual start date shows.
- Finished: Mark to indicate that the selected activity is complete. The field beside this checkbox displays the activity's remaining finish date. If the activity is complete, the activity's actual finish date shows.
- Exp Finish: Indicates expected finish date.
- %: Indicates % complete based on % complete type
  - For example, a 10-day duration based activity with 5 days remaining would be 50% complete.
- Suspend: The date on which the activity's progress stopped.
- Resume: The date on which the suspended activity's progress resumed.



General Concepts and Fundamentals

Activity Details - Status

Constraints –Network logic alone cannot reflect all project situations. Sometimes activities must be accomplished according to specific dates rather than on dates determined by other activities in the project.

General Concepts and Fundamentals

Activity Details - Status

Constraint Types

- Types:
  - Start on
  - Start on or after
  - Start on or before
  - Finish on

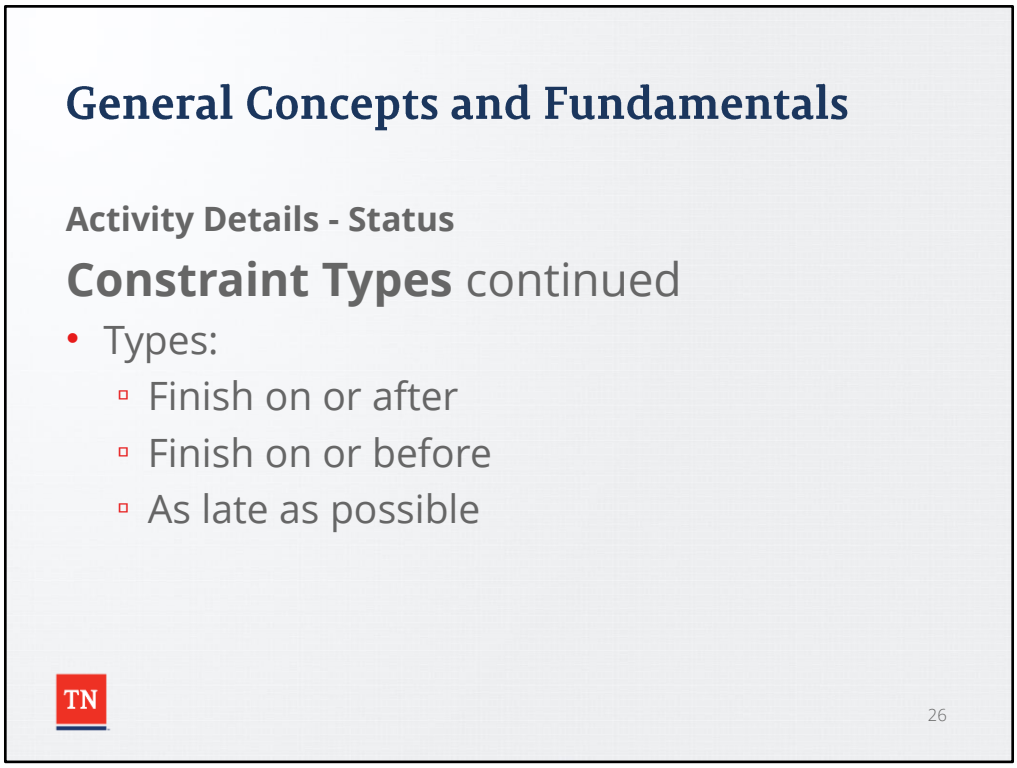
25

General Concepts and Fundamentals

Activity Details - Status

Constraints Types

- Start on - A restriction you place on an activity by imposing a start date. The start on constraint can delay an early start or accelerate a late start to satisfy the imposed date.
- Start on or after - A restriction you impose on an activity that limits the earliest time it can begin. When calculating a schedule, the start on or after constraint is used in the forward pass only if the calculated early start date will be earlier than the imposed date. This constraint affects only early dates.
- Start on or before - A restriction you impose on an activity that limits the latest date it can start. When calculating a schedule, the start on or before constraint is used in the backward pass only if the calculated late start date will be later than the imposed date. This constraint may decrease total float. It only affects late dates.
- Finish on - A restriction you place on an activity by imposing a finish date. The finish on constraint can delay an early finish or accelerate a late finish to satisfy the imposed date.

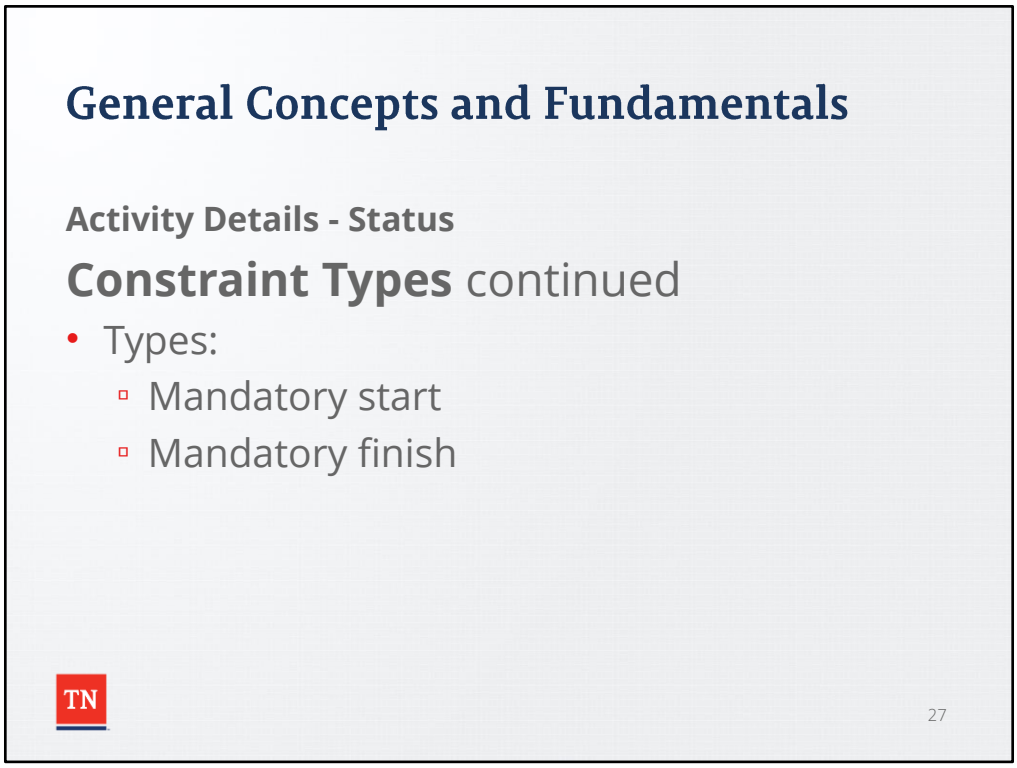


General Concepts and Fundamentals

Activity Details - Status

Constraints Types

- finish on or after- A restriction you impose on an activity that limits the earliest time it can complete. The finish on or after constraint reduces float to coordinate parallel activities, ensuring that the finish of an activity is not scheduled before the specified date. It is usually applied to activities that have few predecessors that must finish before the next phase of a project.
- finish on or before - A restriction you impose on an activity that limits the latest time it can be finished. The finish on or before constraint affects only late dates. Use this constraint to ensure that the late finish date of an activity is not later than the date you impose.
- as late as possible - A restriction you impose on an activity or work unit with positive float that allows it to start as late as possible without delaying its successors. This constraint sets the early dates as late as possible without affecting successor activities.

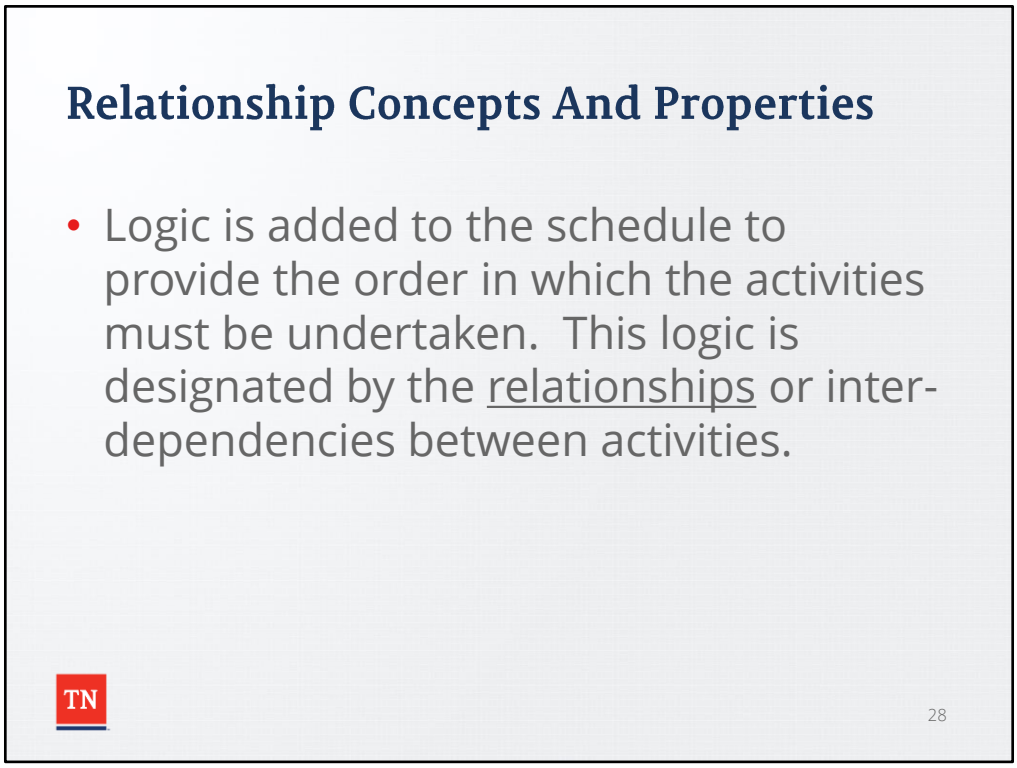


General Concepts and Fundamentals

Activity Details - Status

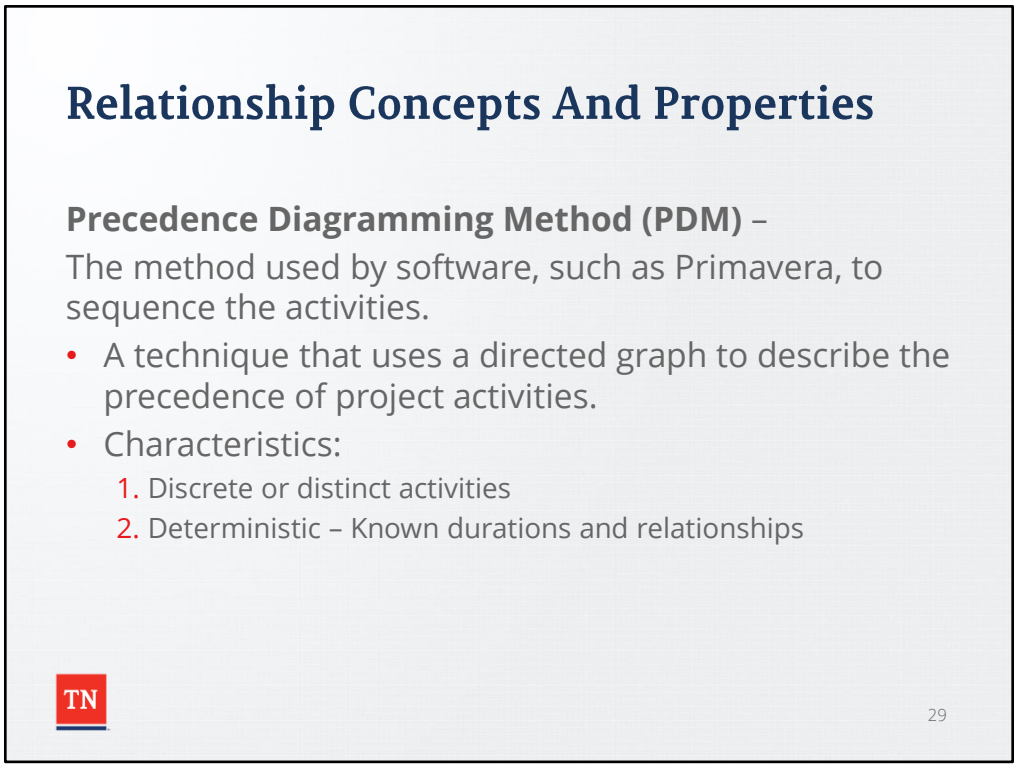
Constraints Types

- mandatory start - A restriction you impose on an activity that sets its early and late start dates equal to the date you specify. The mandatory early start date is used regardless of its effect on network logic. A mandatory early start date could affect the late dates for all activities that lead to the constrained activity and all early dates for the activities that lead from the constrained activity.
- mandatory finish - A restriction you impose on an activity that sets its early and late finish dates equal to the date you specify. The mandatory finish date is used regardless of its effect on network logic. This constraint affects the late dates for all activities that lead to the constrained activity and all early dates for the activities that lead from the constrained activity.



Relationship Concepts And Properties

Logic is added to the schedule to provide the order in which the activities must be undertaken. This logic is designated by the relationships or inter-dependencies between activities.



Relationship Concepts And Properties

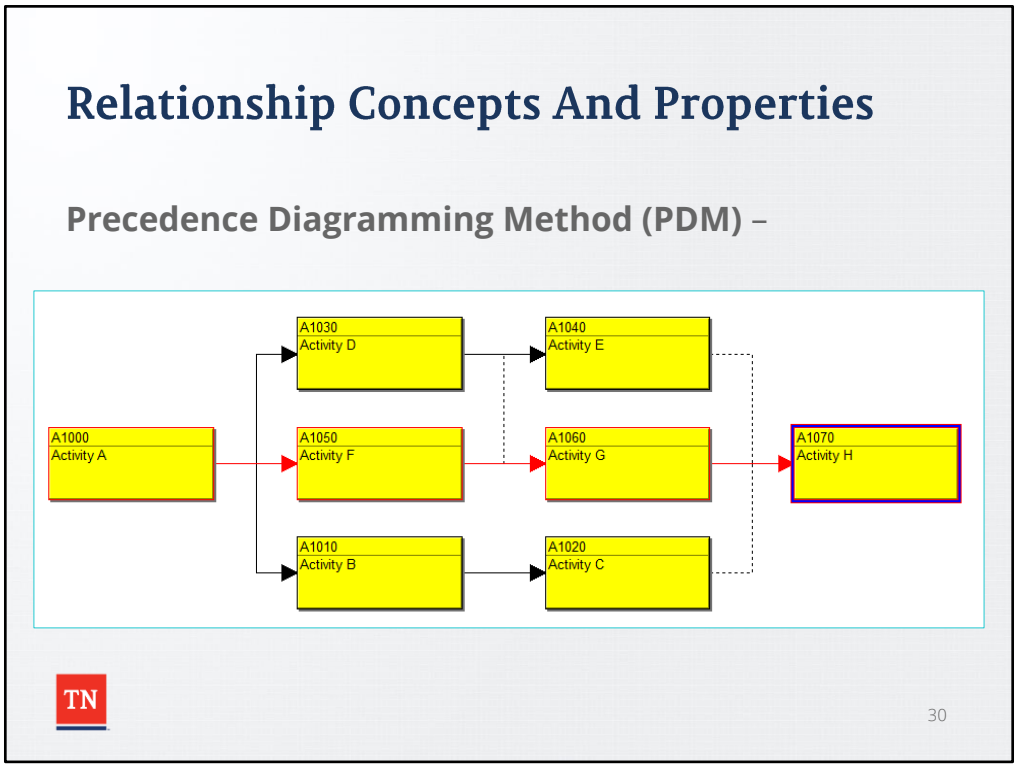
Precedence Diagramming Method (PDM) –

The method used by software, such as Primavera, to sequence the activities.

A technique that uses a directed graph to describe the precedence of project activities.

Characteristics:

1. Discrete or distinct activities
2. Deterministic – Known durations and relationships



Relationship Concepts And Properties

Precedence Diagramming Method (PDM) –

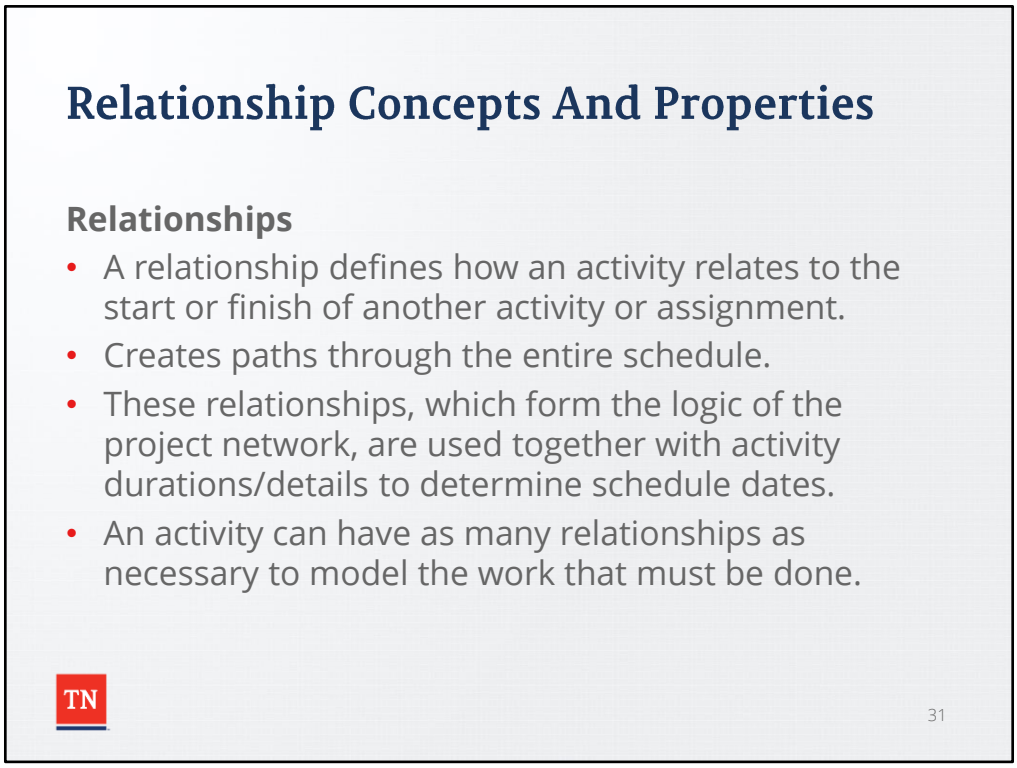
The method used by software, such as Primavera, to sequence the activities.

A technique that uses a directed graph to describe the precedence of project activities.

Characteristics:

1. Discrete or distinct activities
2. Deterministic – Known durations and relationships

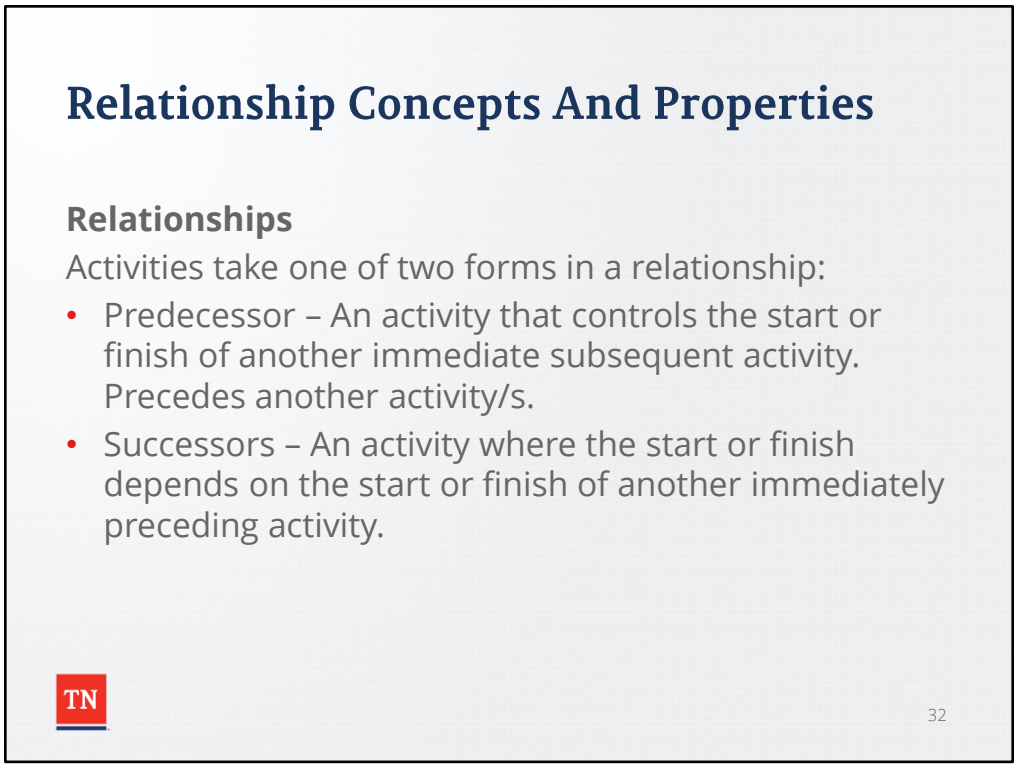
The Activity-on-Node Network shown is an example of PDM.



Relationship Concepts And Properties

Relationships –

A relationship defines how an activity relates to the start or finish of another activity or assignment. Relationships are added between activities to create a path through the schedule from the first activity to the last activity. These relationships, which form the logic of the project network, are used together with activity durations/details to determine schedule dates. An activity can have as many relationships as necessary to model the work that must be done.



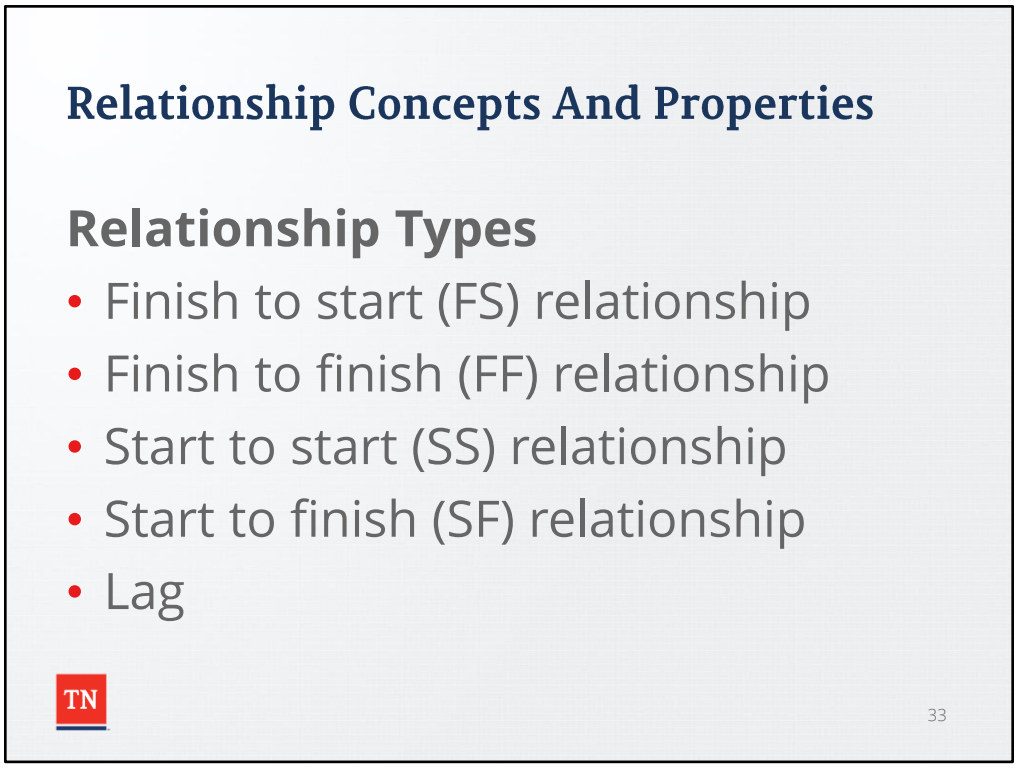
Relationship Concepts And Properties

Relationships

Activities take one of two forms in a relationship:

Predecessor – An activity that controls the start or finish of another immediate subsequent activity. Precedes another activity/s.

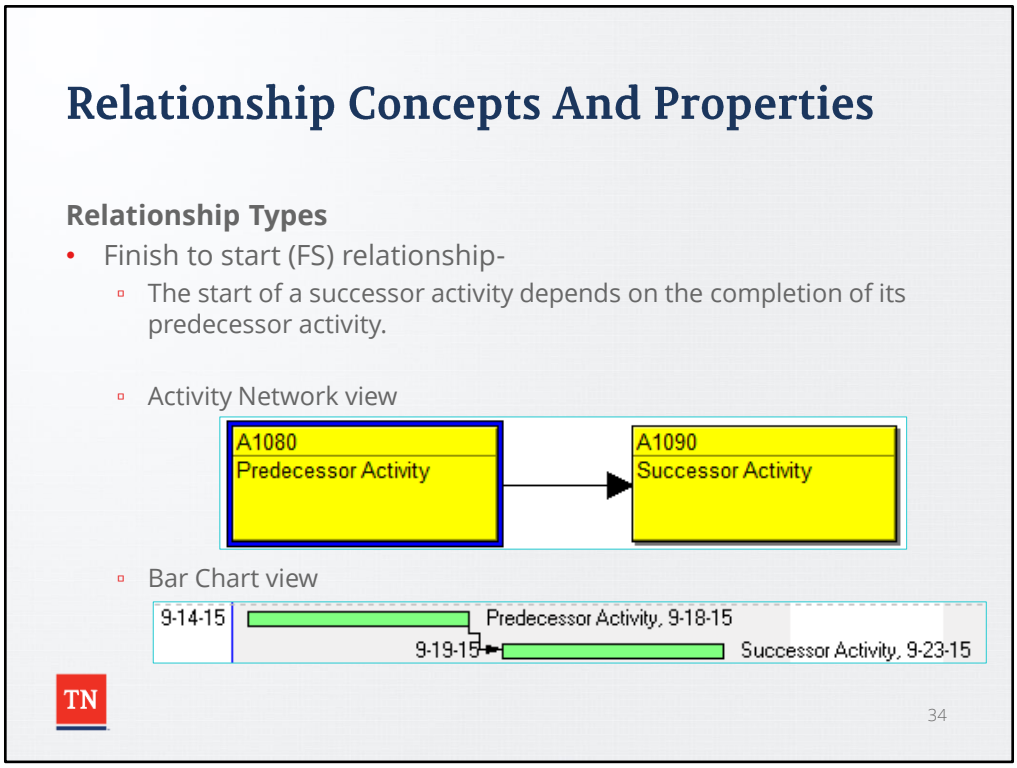
Successors – An activity where the start or finish depends on the start or finish of another immediately preceding activity.



Relationship Concepts And Properties

Relationship Types

- Finish to start (FS) relationship
- Finish to finish (FF) relationship
- Start to start (SS) relationship
- Start to finish (SF) relationship
- Lag



Relationship Concepts And Properties

Relationship Types

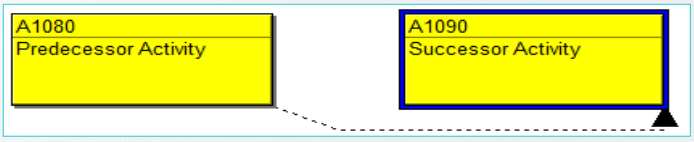
Finish to start (FS) relationship-

A relationship in which the start of a successor activity depends on the completion of its predecessor activity.

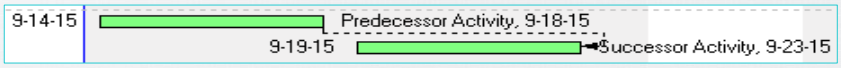
Relationship Concepts And Properties

Relationship Types

- Finish to finish (FF) relationship –
  - The finish of a successor activity depends on the finish of its predecessor activity.
  - Activity Network view



  - Bar Chart view



TN

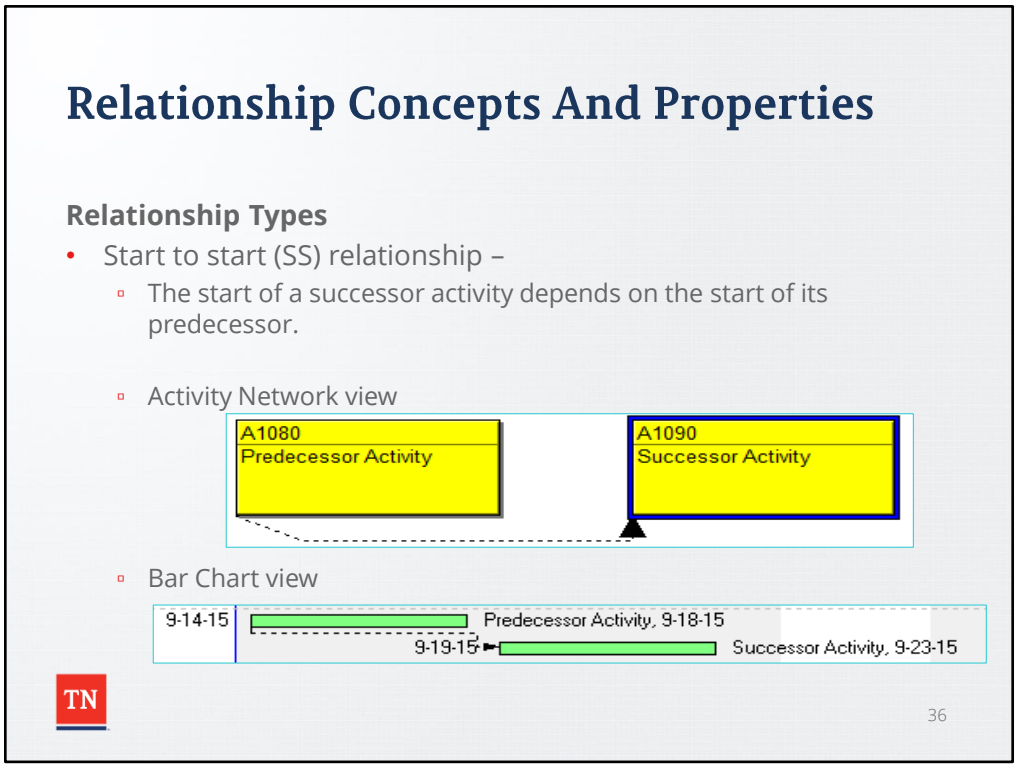
35

Relationship Concepts And Properties

Relationship Types

Finish to finish (FF) relationship –

A relationship in which the finish of a successor activity depends on the finish of its predecessor activity.

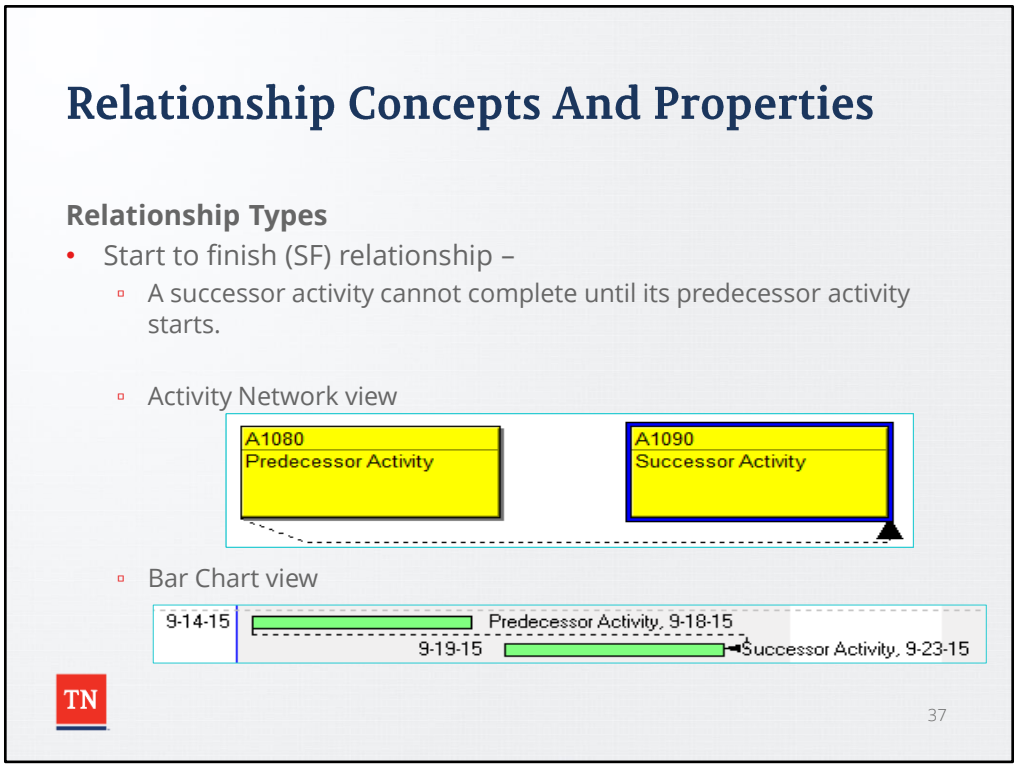


Relationship Concepts And Properties

Relationship Types

Start to start (SS) relationship –

A relationship between activities in which the start of a successor activity depends on the start of its predecessor.

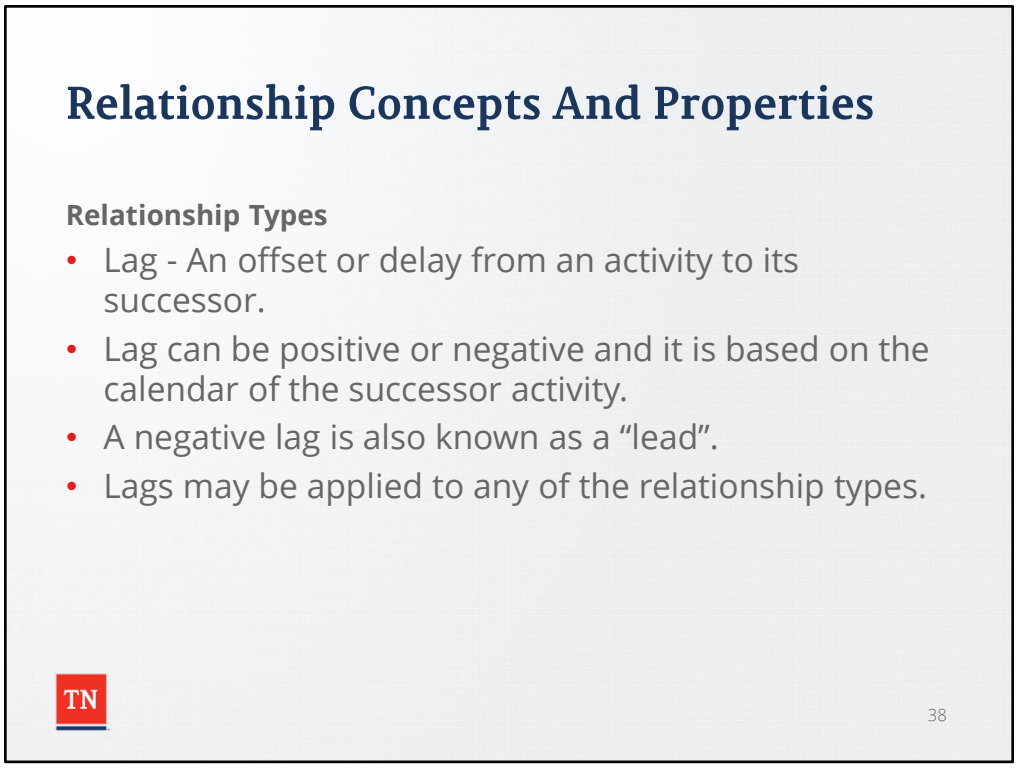


Relationship Concepts And Properties

Relationship Types

Start to finish (SF) relationship –

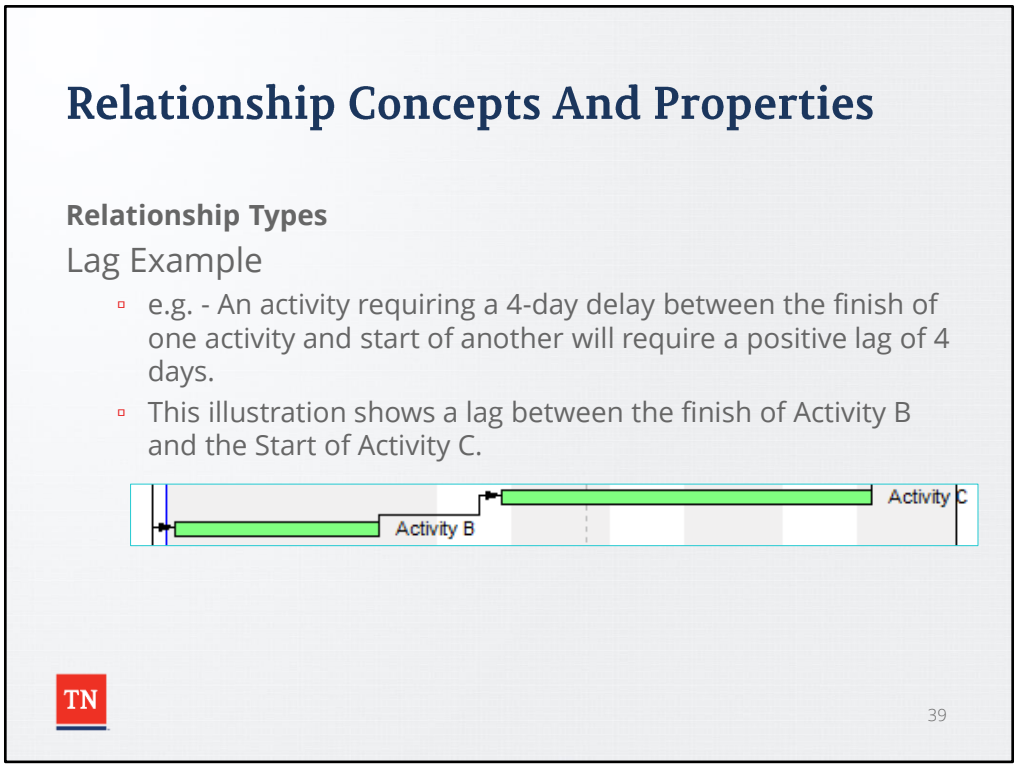
A relationship between activities in which a successor activity cannot complete until its predecessor activity starts.



Relationship Concepts And Properties

Relationship Types

Lag - An offset or delay from an activity to its successor. Lag can be positive or negative and it is based on the calendar of the successor activity. A negative lag is also known as a “lead”. Lags may be applied to any of the relationship types.



Relationship Concepts And Properties

Relationship Types

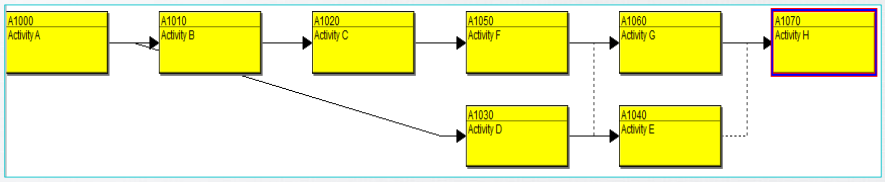
Lag - e.g. - An activity requiring a 4-day delay between the finish of one activity and start of another will require a positive lag of 4 days.

This illustration shows a lag between the finish of Activity B and the Start of Activity C.

Relationship Concepts And Properties

Closed Networks –

- The logic should create a closed network. In a closed network, all activities have one or more predecessors and one or more successors except:
  - The Notice to Proceed, or start milestone (has no predecessors), and
  - Completion Notice, or finish milestone, (has no successors).



40

Relationship Concepts And Properties

Closed Networks –

The logic should create a closed network. In a closed network, all activities have one or more predecessors and one or more successors except:

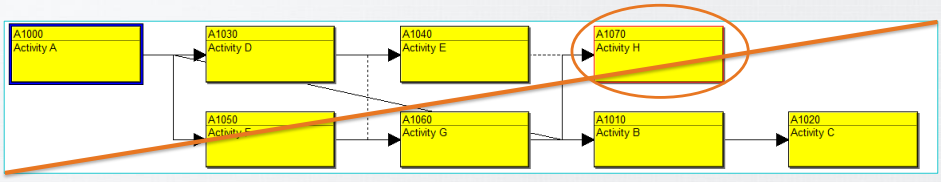
The Notice to Proceed, or start milestone (has no predecessors), and
Completion Notice, or finish milestone, (has no successors).

The illustration is an example of a closed network.

Relationship Concepts And Properties

****When the network is not closed, the Critical Path, Total Float, and Free Float will not calculate correctly.*

Notice that Activity H does not have any successors and is not linked to the Project Completion.

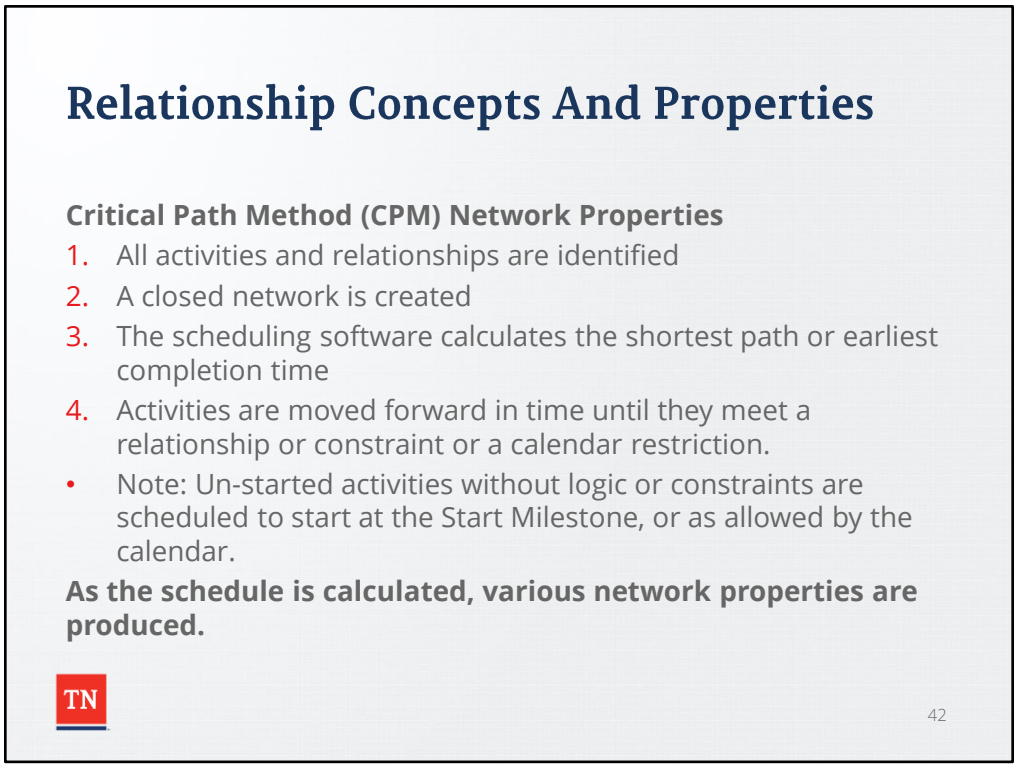


41

Relationship Concepts And Properties

****When the network is not closed, the Critical Path, Total Float, and Free Float will not calculate correctly.*

Notice that Activity H in the illustration does not have any successors and is not linked to the Project Completion.



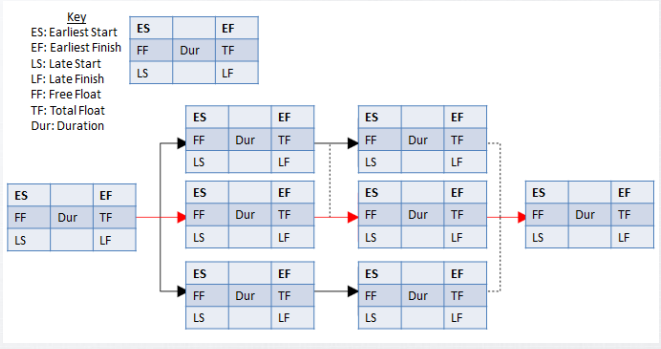
Relationship Concepts And Properties

Critical Path Method (CPM) Network Properties – Once all activities and relationships are identified in a manner that creates a closed network, the scheduling software calculates the shortest time that the project can be completed. Activities are moved forward in time until they meet a relationship or constraint or a calendar restriction. Un-started activities without logic or constraints are scheduled to start at the Start Milestone, or as allowed by the calendar.

Relationship Concepts And Properties

Critical Path Method (CPM) Network Properties

- Early Dates
  - Early Start
  - Early Finish
- Late Dates
  - Late Start
  - Late Finish
- Float
  - Free Float:
  - Total Float
  - Negative Float

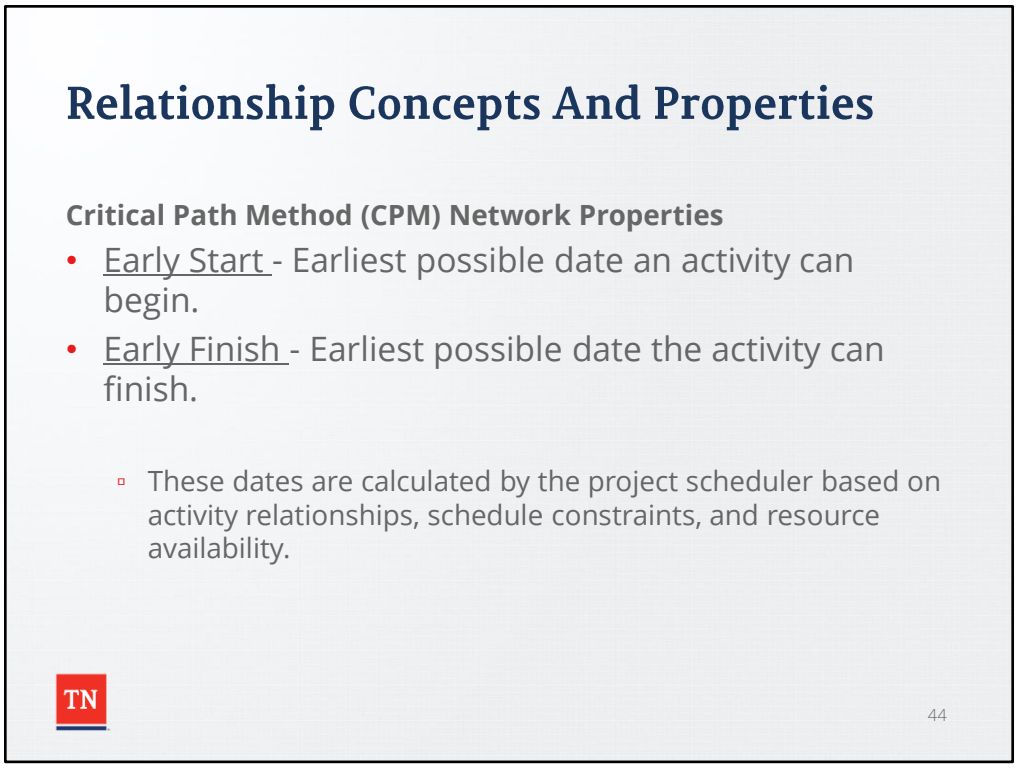


43

Relationship Concepts And Properties

Properties produced after calculating the schedule include:

- Early Dates
  - Early Start
  - Early Finish
- Late Dates
  - Late Start
  - Late Finish
- Float
  - Free Float:
  - Total Float
  - Negative Float

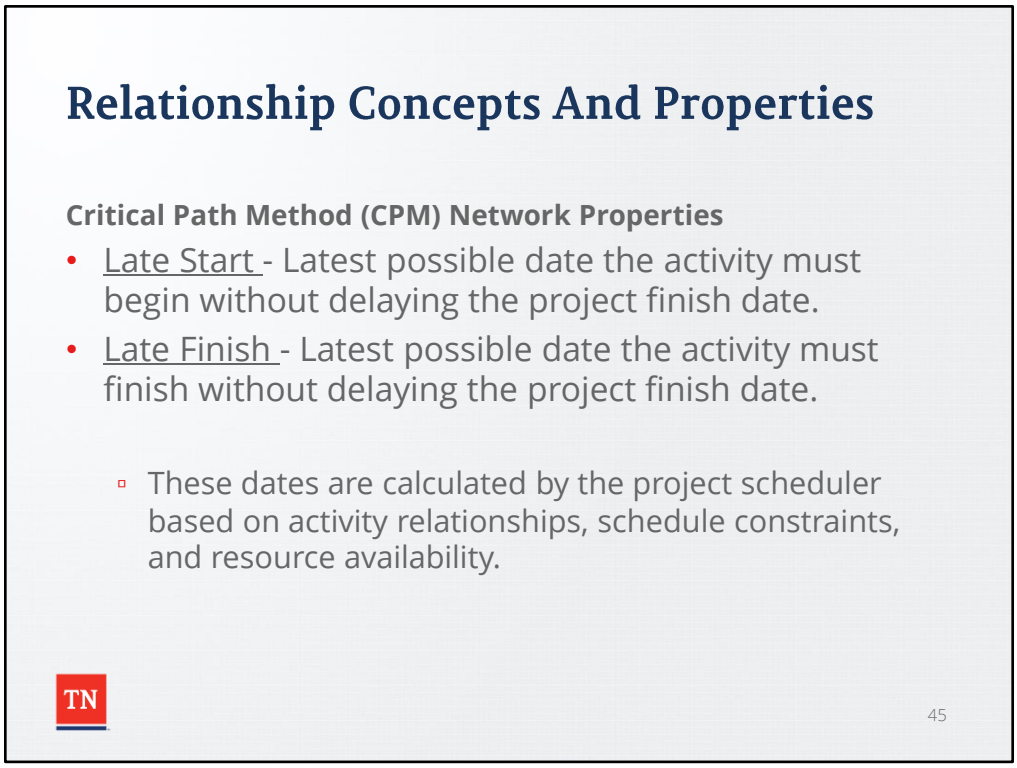


Relationship Concepts And Properties

Early Dates

Early Start - The earliest possible date the remaining work for the activity can begin. This date is calculated by the project scheduler based on activity relationships, schedule constraints, and resource availability. The Early Start equals the Remaining Start unless the scheduler preserves the scheduled early dates during leveling.

Early Finish - The earliest possible date the activity can finish. This date is calculated by the project scheduler based on activity relationships, schedule constraints, and resource availability. The Early Finish equals the Remaining Finish unless the scheduler preserves the scheduled early dates during leveling.

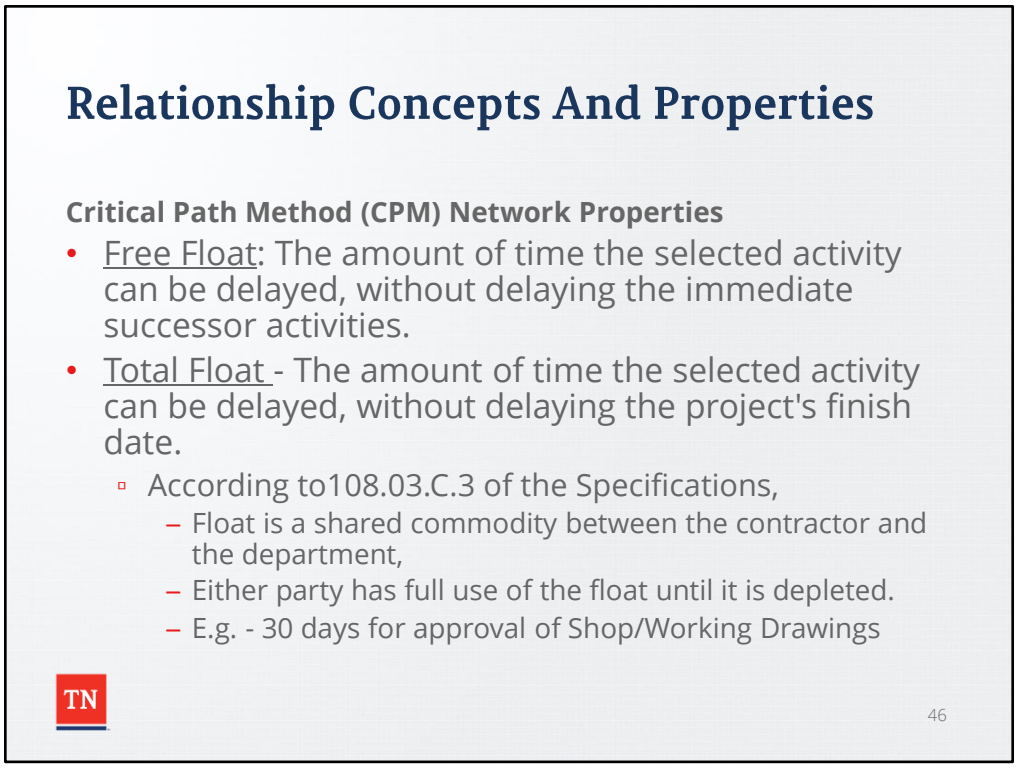


Relationship Concepts And Properties

Late Dates

Late Start - The latest possible date the remaining work for the activity must begin without delaying the project finish date. This date is calculated by the project scheduler based on activity relationships, schedule constraints, and resource availability. The Late Start equals the Remaining Late Start unless the scheduler preserves the scheduled late dates during leveling.

Late Finish - The latest possible date the activity must finish without delaying the project finish date. This date is calculated by the project scheduler based on activity relationships, schedule constraints, and resource availability. The Late Finish equals the Remaining Late Finish unless the scheduler preserves the scheduled late dates during leveling.



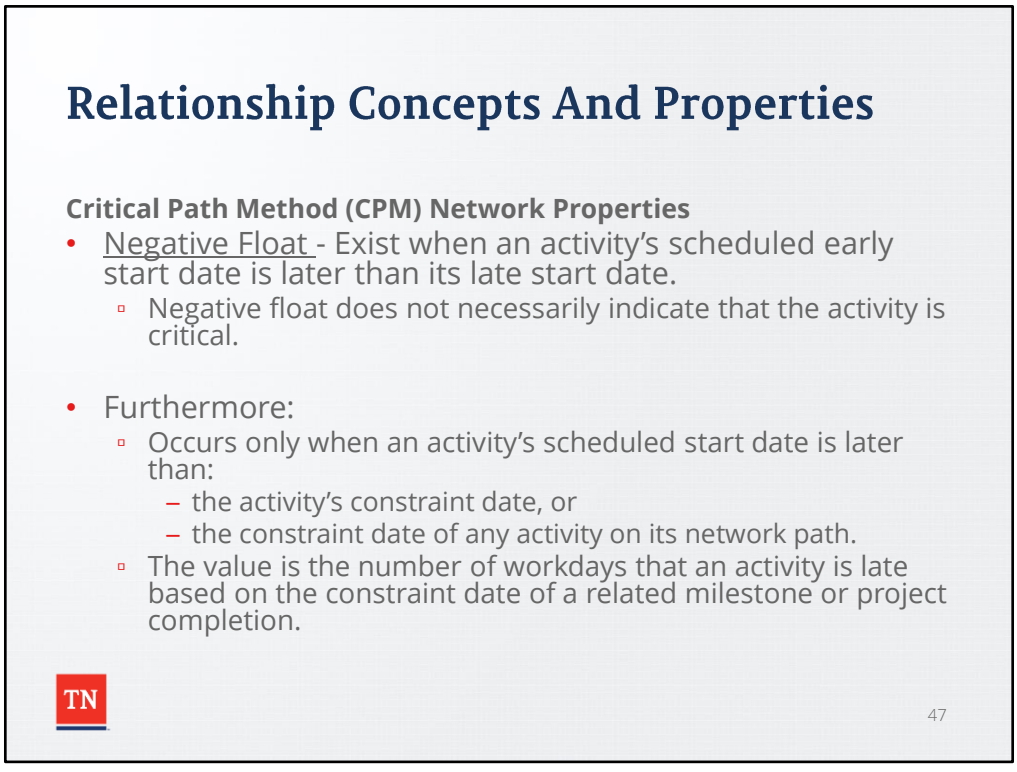
Relationship Concepts And Properties

Float

Free Float: The amount of time the selected activity can be delayed, without delaying the immediate successor activities.

Total Float - The amount of time the selected activity can be delayed, without delaying the project's finish date.

- According to 108.03.C.3. of the Specifications, float is a shared commodity between the Contractor and the Department, and either party has full use of the float until it is depleted.
- E.g. - Complete Shop Drawing, Working Drawing, or Erection Plan packages submitted for review, acceptance, or approval by the Department will be approved or denied within thirty (30) days of receipt per submittal. If approval is given in fewer than 30 days, those days move the contractor ahead of schedule, which can be used later to offset delays or claims for extensions of time.



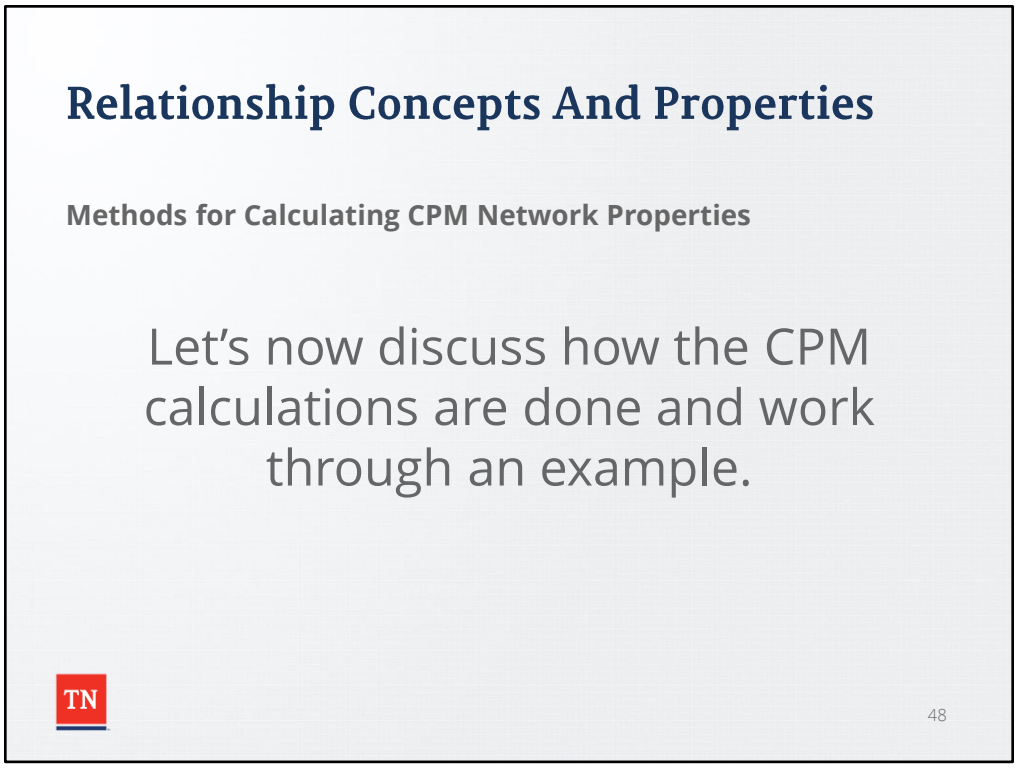
Relationship Concepts And Properties

Float

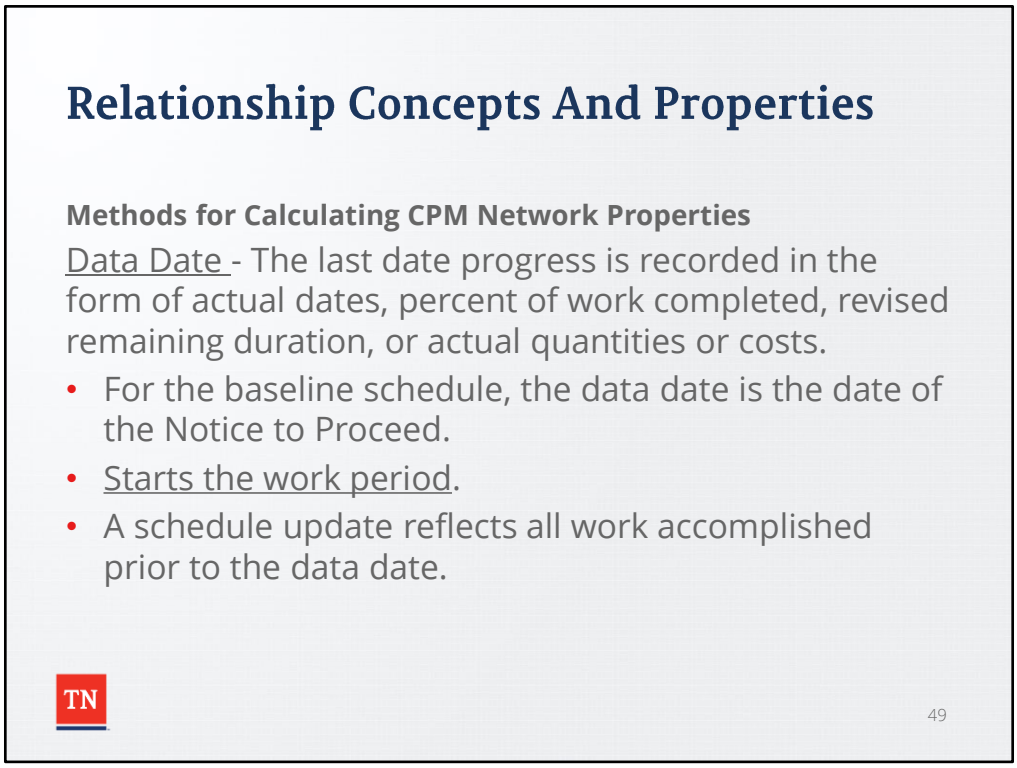
Negative Float - Exist when an activity's scheduled early start date is later than its late start date. That is, the earliest that an activity can be started is later than the date that it must be started to avoid delaying completion of a milestone or the project. Negative float does not necessarily indicate that the activity is critical.

Furthermore:

1. Negative float occurs only when an activity's scheduled start date is later than the activity's constraint date or the constraint date of any activity on its network path.
2. Negative float value is the number of workdays that an activity is late based on the constraint date of a related milestone or project completion.



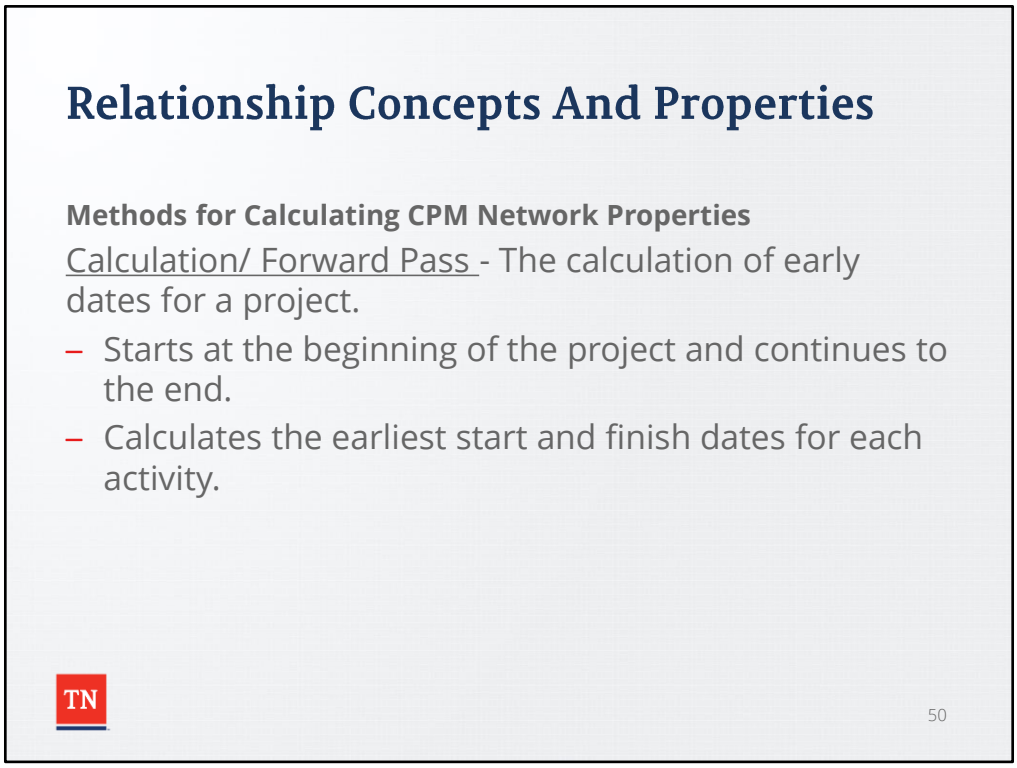
Relationship Concepts And Properties
Methods for Calculating CPM Network Properties



Relationship Concepts And Properties

Methods for Calculating CPM Network Properties

Data Date - The data date is the last date progress is recorded in the form of actual dates, percent of work completed, revised remaining duration, or actual quantities or costs. For the initial or baseline schedule, the data date is the date of the Notice to Proceed. The data date starts the work period. A schedule update will reflect all work accomplished prior to the data date. Activities completed on or after the data date will not be treated as finished on the schedule.



Relationship Concepts And Properties

Methods for Calculating CPM Network Properties

Calculation/ Forward Pass - The calculation of early dates for a project. The forward pass starts at the beginning of the project and continues to the end to calculate the earliest start and finish dates for each activity.

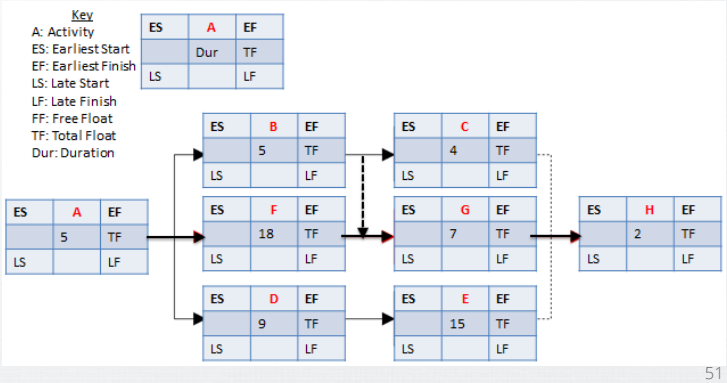
Relationship Concepts And Properties

Methods for Calculating CPM Network Properties

Calculation/ Forward Pass :

Step 1: Enter Durations

Activity Name	Original Duration
Activity A	5
Activity B	5
Activity C	4
Activity D	9
Activity E	15
Activity F	18
Activity G	7
Activity H	2



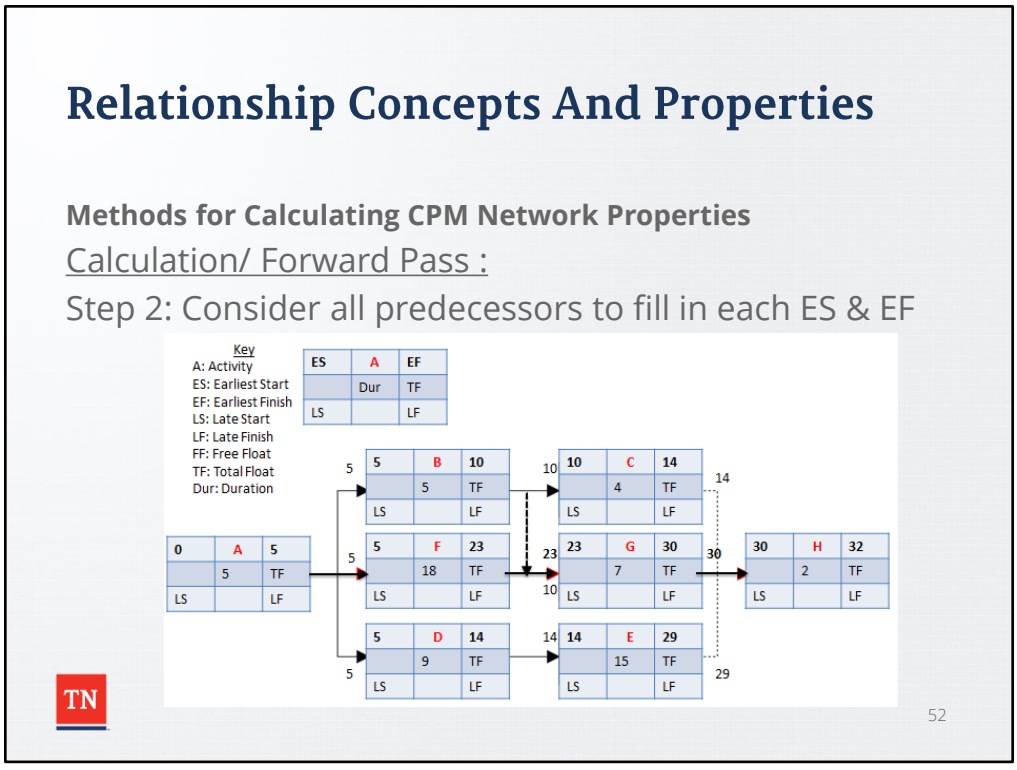
51

Relationship Concepts And Properties

Methods for Calculating CPM Network Properties

Calculation/ Forward Pass

Step 1: Enter Durations



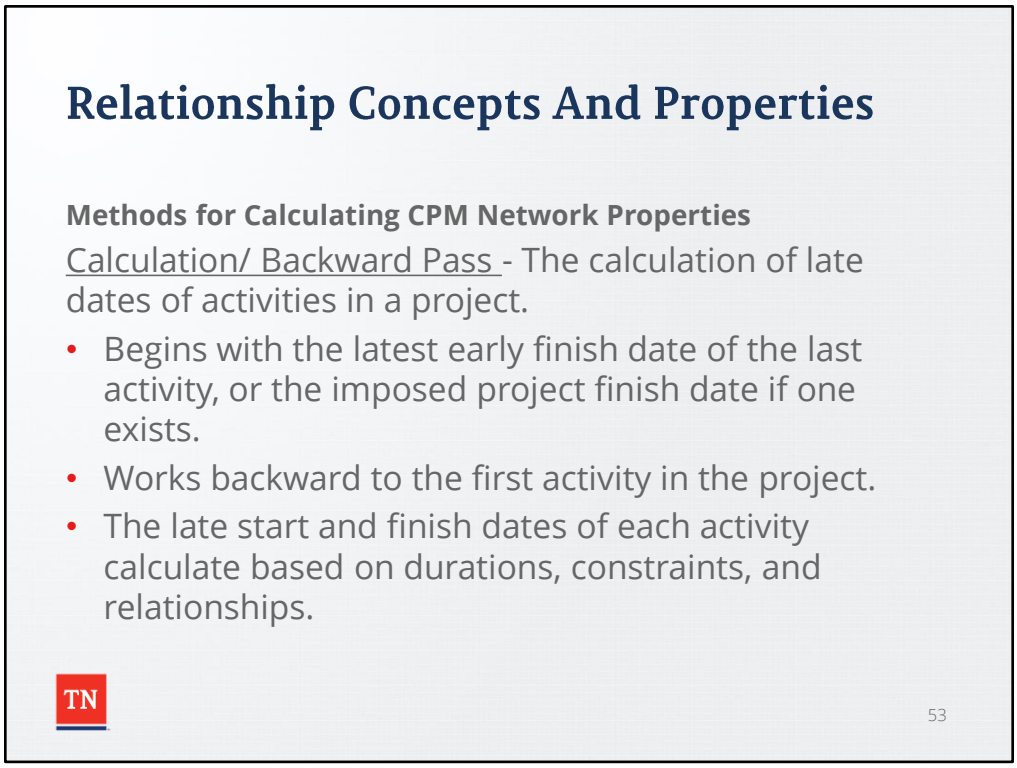
Relationship Concepts And Properties

Methods for Calculating CPM Network Properties

Calculation/ Forward Pass

Step 2: Consider all predecessors to fill in each ES & EF

1. Place the project start time or date in the ES and EF positions of the start activity. The start time is zero for relative calculations.
2. Once all predecessors have been marked in the EF and ES positions, mark an activities ES position with the largest number marked in the EF of those predecessors.
3. Add the duration to the ES time and write this in the EF box for each activity.



Relationship Concepts And Properties

Methods for Calculating CPM Network Properties

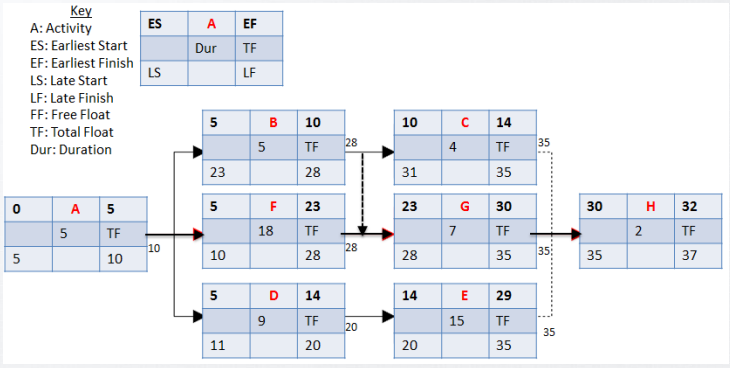
Backward Pass - The calculation of late dates of activities in a project. The backward pass begins with the latest early finish date of the last activity, or the imposed project finish date if one exists, and works backward to the first activity in the project. The late start and finish dates of each activity calculate based on durations, constraints, and relationships.

Relationship Concepts And Properties

Methods for Calculating CPM Network Properties

Calculation/ Backward Pass :

Step 3: Consider all successors to fill in each LS & LF



TN

54

Relationship Concepts And Properties

Methods for Calculating CPM Network Properties

Calculation/ Backward Pass :

Step 3: Consider all successors to fill in each LS & LF

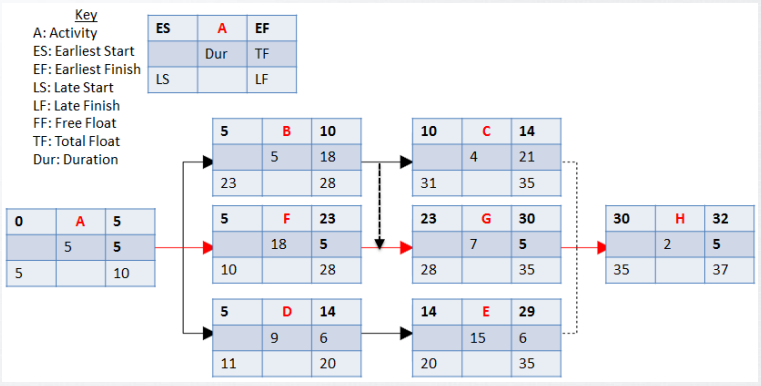
1. A late finish, or desired completion time, must be assumed. For the example we'll assume 37 days.
2. Place the value of the latest finish date in the LF box of the last activity, then fill in the latest start date.
3. Once all successors have been marked in the LF and LS positions, mark an activities LF position with the smallest number marked in the LS of those successors.
4. The LS for each activity is LF minus its activity duration.

Relationship Concepts And Properties

Methods for Calculating CPM Network Properties

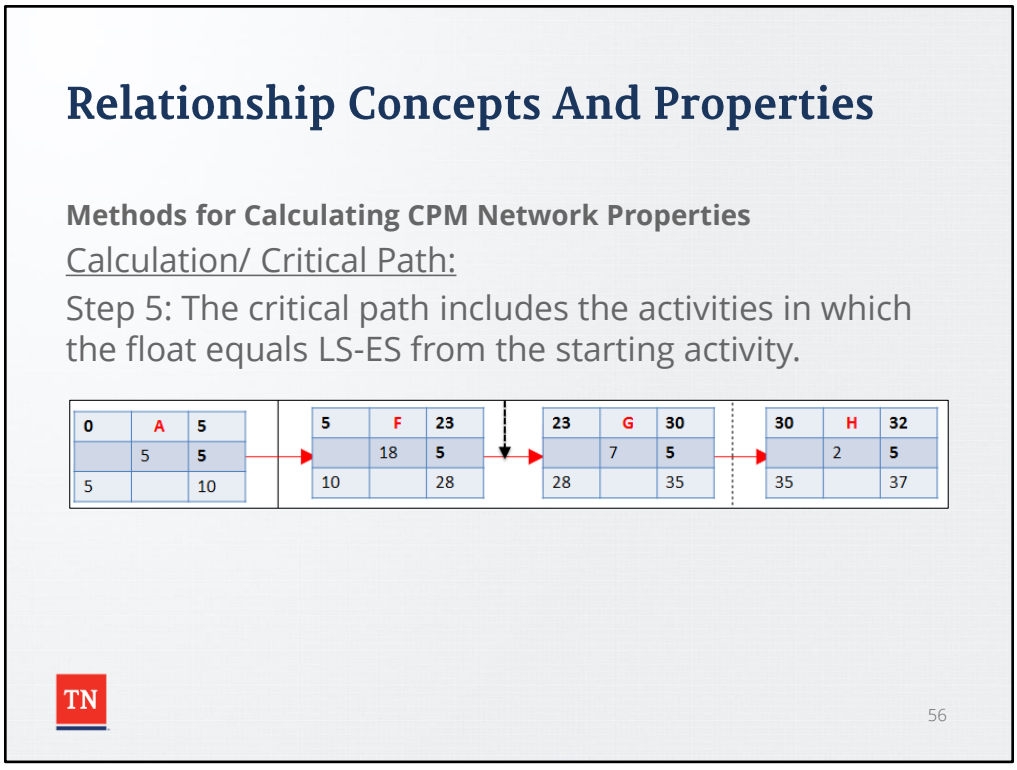
Calculation/ Total Float:

Step 4: Calculate Total Float (TF) as TF=LS-ES



55

Relationship Concepts And Properties
Methods for Calculating CPM Network Properties
Calculation/ Total Float:
Step 4: Calculate Total Float (TF) as TF=LS-ES



Relationship Concepts And Properties

Methods for Calculating CPM Network Properties

Calculation/ Critical Path:

Step 5: The critical path includes the activities in which the float equals LS-ES from the starting activity. In this case, 5. Therefore, the critical path includes activities A, F, G, & H.

General Concepts and Fundamentals - Recap

- What we've covered so far…
  - General Concepts and Fundamentals
    - Work Breakdown Structure (WBS)
    - Activity Details
    - Relationship Concepts And Properties
  - The "**logic**"
- Why?
  - We've established an understanding of the structure, details and relationships/properties that drive the Critical Path Method.

TN

57

Recap of what we've covered so far…

General Concepts and Fundamentals

Work Breakdown Structure (WBS)

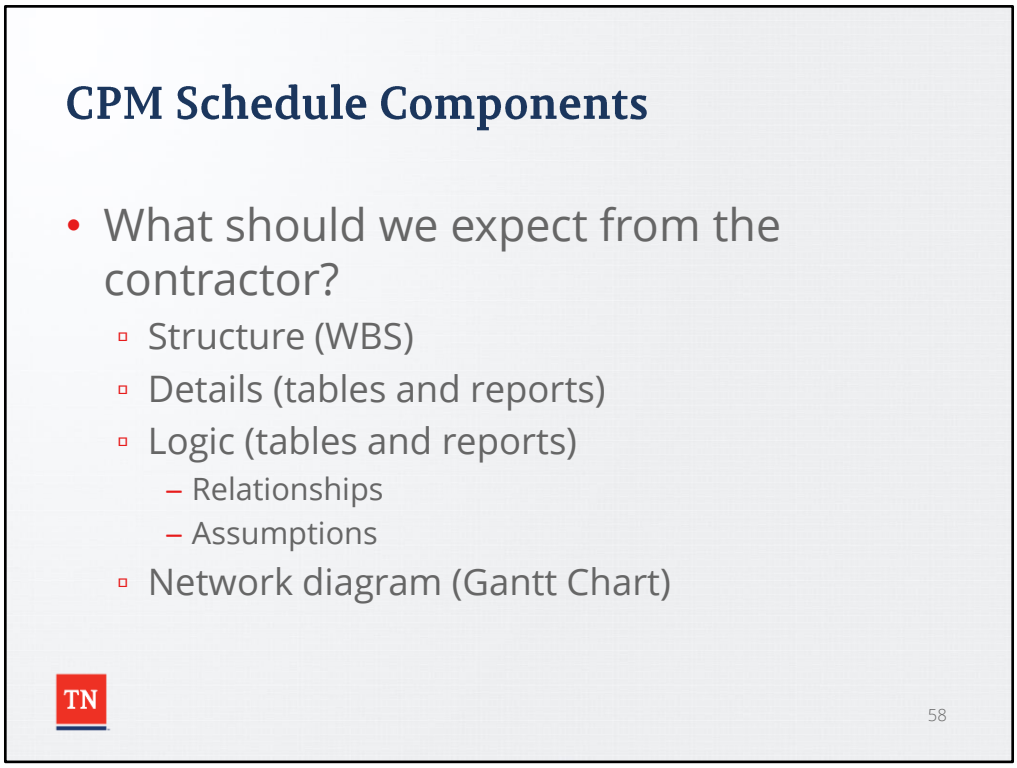
Activity Details

Relationship Concepts And Properties

The "**logic**"

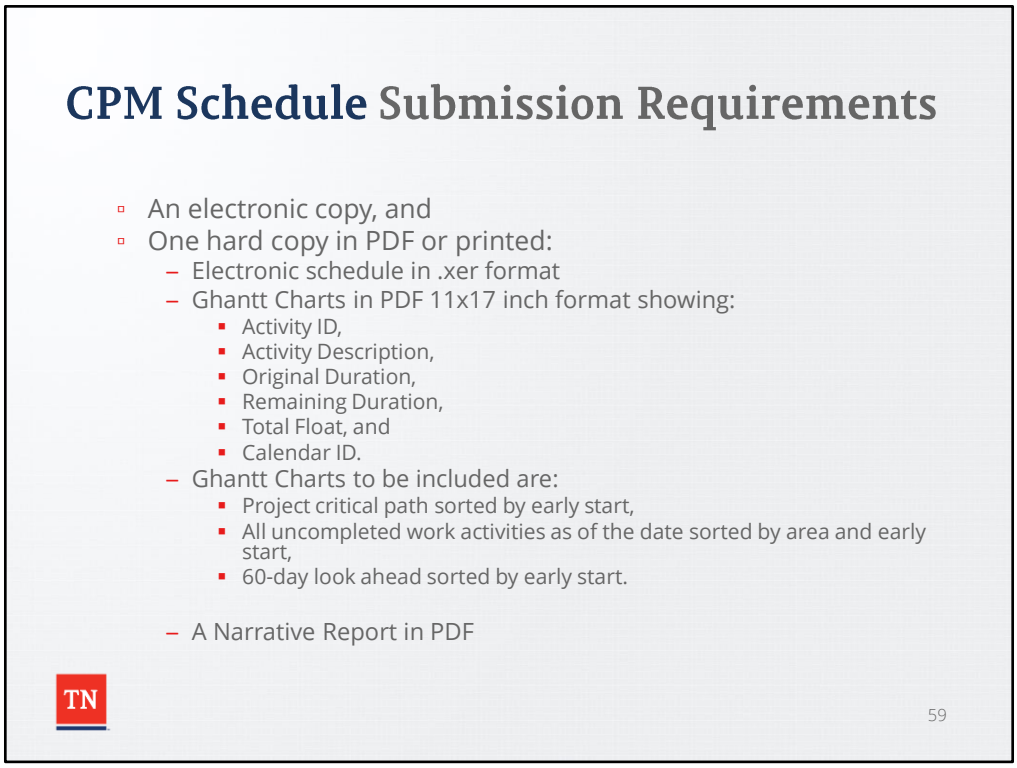
Why?

We've established an understanding of the structure, details and relationships/properties that drive the Critical Path Method



What should we expect to receive from the contractor?

- Deliverables
  - Structure
  - Details about activities
  - Logic
    - Relationships
    - Assumptions
  - Network diagram (Gantt Chart)



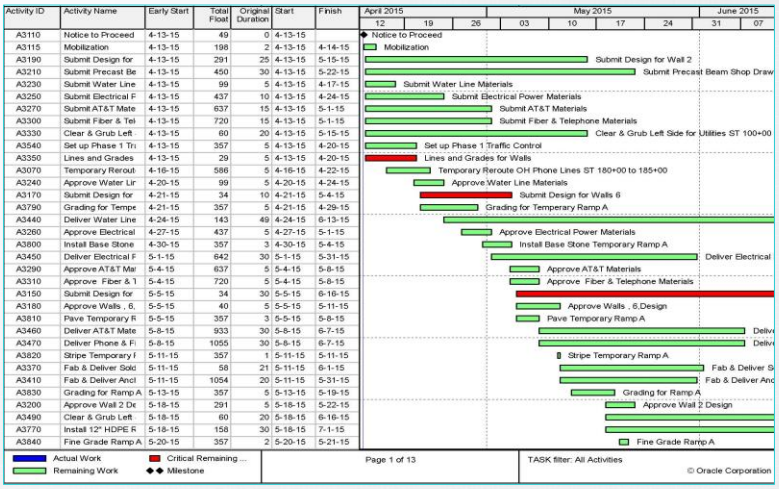
CPM Schedule Submission Requirements

The deliverables expected from the Contractor include the electronic copy (.xer format) and one hard copy Printed or PDF of:

- *Ghantt charts in PDF 11 x 17 inch format showing:*
  - *Activity ID,*
  - *Activity Description,*
  - *Original Duration,*
  - *Remaining Duration,*
  - *Total Float, and*
  - *Calendar ID.*
- *Ghantt Charts to be included are:*
  - *Project critical path sorted by early start,*
  - *All uncompleted work activities as of the date sorted by area and early start,*
  - *60-day look ahead sorted by early start.*
- *A Narrative Report in PDF*

CPM Schedule Components

Logic Diagrams/bar charts (without relationship lines)



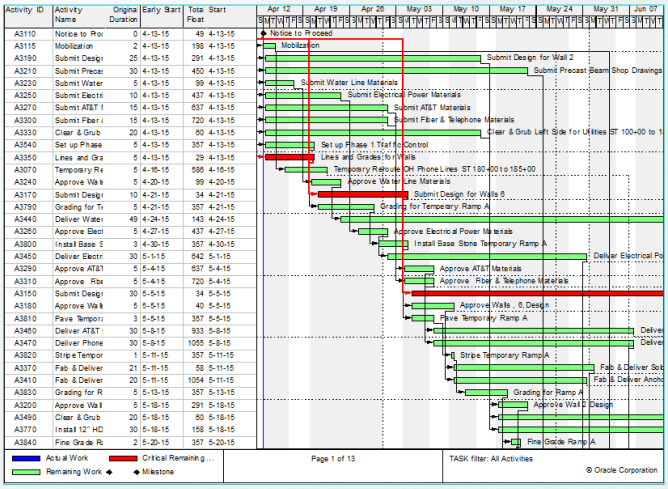
60

CPM Schedule Components
Logic Diagrams/bar charts (without relationship lines)

Also known as “Gantt Chart”. The activity details can be customized and the information can be sorted in various ways.

CPM Schedule Components

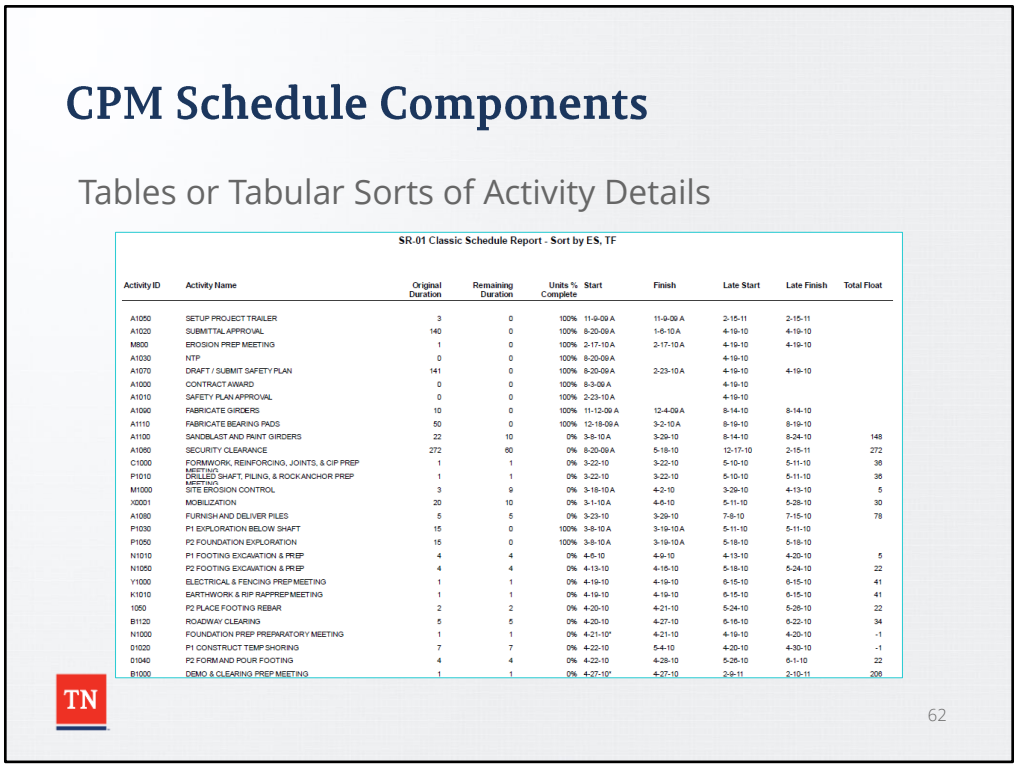
Logic Diagrams/bar charts (with relationship lines)



61

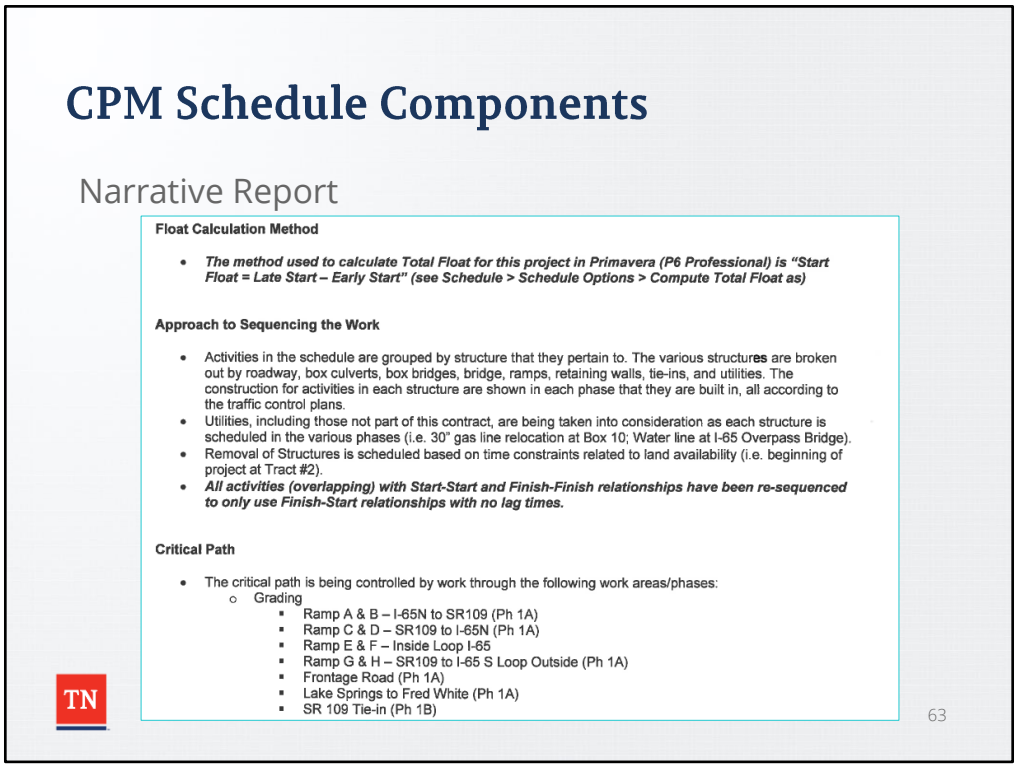
CPM Schedule Components
Logic Diagrams/bar charts (with relationship lines)

Also known as “Gantt Chart”. The activity details can be customized and the information can be sorted in various ways.



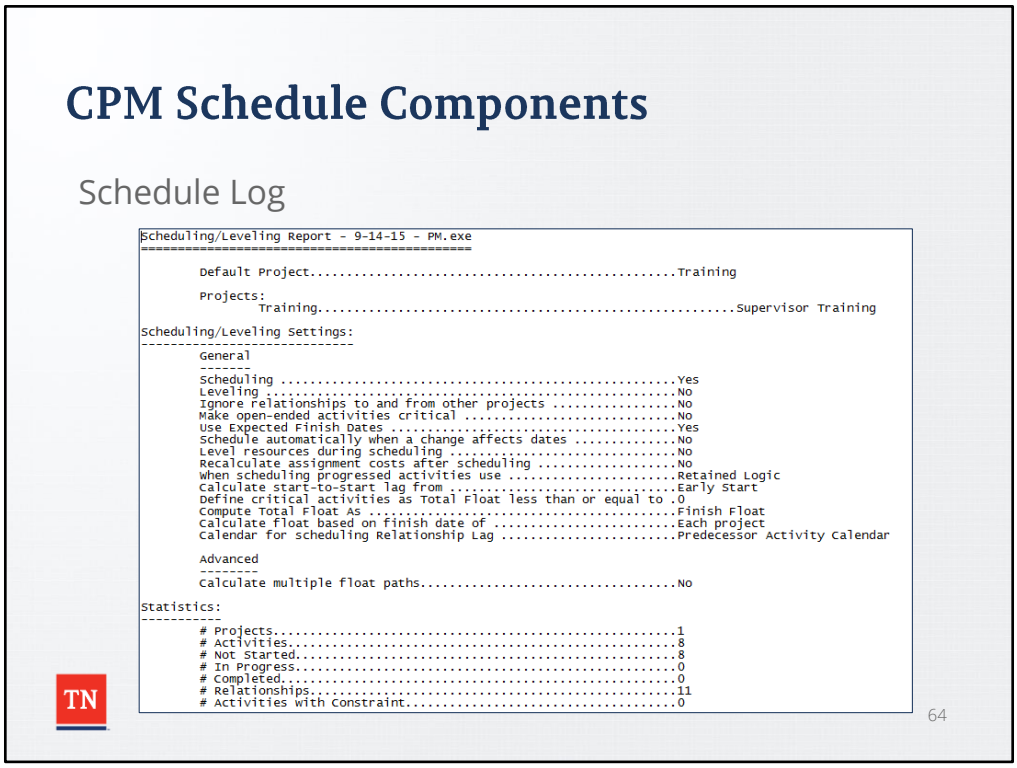
CPM Schedule Components
Tables or Tabular Sorts of Activity Details

Tables can also be customized and sorted depending on the needs.



CPM Schedule Components
Narrative Report

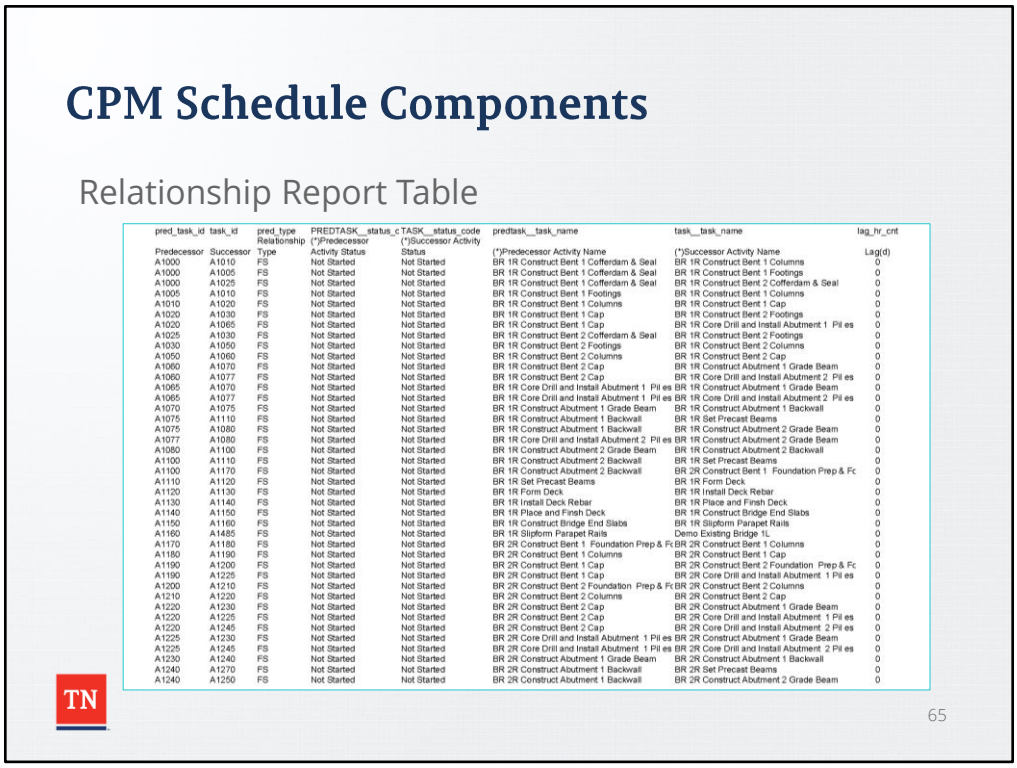
The written Narrative shall describe the Contractor's complete overall work plan and sequence in which the Work will be accomplished. The schedule narrative adds and supports understanding of the basis and assumptions in the schedule. The Narrative shall be prepared in accordance with **108.03.C.1.c** of the Specifications.



CPM Schedule Components
Schedule Log

Also known as the “Scheduling/Leveling Report”. This report is produced after the schedule is calculated. It contains valuable information on:

- Scheduling/Leveling Settings,
- Statistics,
- Errors, Warnings,
- Scheduling/Leveling Results,
- and Exceptions.

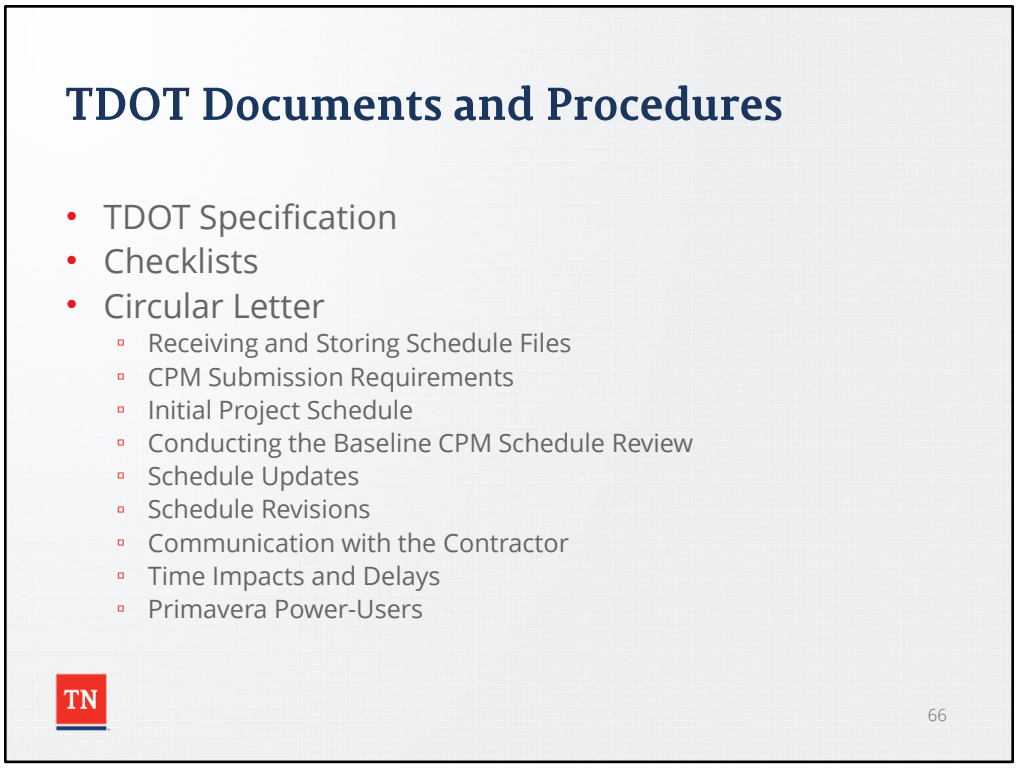


pred_task_id	task_id	pred_type	PREDTASK__status_c	TASK__status_code	predtask__task_name	task__task_name	lag_hr_cnt
Predecessor	Successor	Relationship Type	(*)Predecessor Activity Status	(*)Successor Activity Status	(*)Predecessor Activity Name	(*)Successor Activity Name	Lag(d)
A1000	A1010	FS	Not Started	Not Started	BR 1R Construct Bent 1 Cofferdam & Seal	BR 1R Construct Bent 1 Columns	0
A1000	A1005	FS	Not Started	Not Started	BR 1R Construct Bent 1 Cofferdam & Seal	BR 1R Construct Bent 1 Footings	0
A1000	A1025	FS	Not Started	Not Started	BR 1R Construct Bent 1 Cofferdam & Seal	BR 1R Construct Bent 2 Cofferdam & Seal	0
A1005	A1010	FS	Not Started	Not Started	BR 1R Construct Bent 1 Footings	BR 1R Construct Bent 1 Columns	0
A1010	A1020	FS	Not Started	Not Started	BR 1R Construct Bent 1 Columns	BR 1R Construct Bent 1 Cap	0
A1020	A1030	FS	Not Started	Not Started	BR 1R Construct Bent 1 Cap	BR 1R Construct Bent 2 Footings	0
A1020	A1065	FS	Not Started	Not Started	BR 1R Construct Bent 1 Cap	BR 1R Core Drill and Install Abutment 1 Pil es	0
A1025	A1030	FS	Not Started	Not Started	BR 1R Construct Bent 2 Cofferdam & Seal	BR 1R Construct Bent 2 Footings	0
A1030	A1050	FS	Not Started	Not Started	BR 1R Construct Bent 2 Footings	BR 1R Construct Bent 2 Columns	0
A1050	A1060	FS	Not Started	Not Started	BR 1R Construct Bent 2 Columns	BR 1R Construct Bent 2 Cap	0
A1060	A1070	FS	Not Started	Not Started	BR 1R Construct Bent 2 Cap	BR 1R Construct Abutment 1 Grade Beam	0
A1060	A1077	FS	Not Started	Not Started	BR 1R Construct Bent 2 Cap	BR 1R Core Drill and Install Abutment 2 Pil es	0
A1065	A1070	FS	Not Started	Not Started	BR 1R Core Drill and Install Abutment 1 Pil es	BR 1R Construct Abutment 1 Grade Beam	0
A1065	A1077	FS	Not Started	Not Started	BR 1R Core Drill and Install Abutment 1 Pil es	BR 1R Core Drill and Install Abutment 2 Pil es	0
A1070	A1075	FS	Not Started	Not Started	BR 1R Construct Abutment 1 Grade Beam	BR 1R Construct Abutment 1 Backwall	0
A1075	A1110	FS	Not Started	Not Started	BR 1R Construct Abutment 1 Backwall	BR 1R Set Precast Beams	0
A1075	A1080	FS	Not Started	Not Started	BR 1R Construct Abutment 1 Backwall	BR 1R Construct Abutment 2 Grade Beam	0
A1077	A1080	FS	Not Started	Not Started	BR 1R Core Drill and Install Abutment 2 Pil es	BR 1R Construct Abutment 2 Grade Beam	0
A1080	A1100	FS	Not Started	Not Started	BR 1R Construct Abutment 2 Grade Beam	BR 1R Construct Abutment 2 Backwall	0
A1100	A1110	FS	Not Started	Not Started	BR 1R Construct Abutment 2 Backwall	BR 1R Set Precast Beams	0
A1100	A1170	FS	Not Started	Not Started	BR 1R Construct Abutment 2 Backwall	BR 2R Construct Bent 1 Foundation Prep & Fc	0
A1110	A1120	FS	Not Started	Not Started	BR 1R Set Precast Beams	BR 1R Form Deck	0
A1120	A1130	FS	Not Started	Not Started	BR 1R Form Deck	BR 1R Install Deck Rebar	0
A1130	A1140	FS	Not Started	Not Started	BR 1R Install Deck Rebar	BR 1R Place and Finish Deck	0
A1140	A1150	FS	Not Started	Not Started	BR 1R Place and Finish Deck	BR 1R Construct Bridge End Slabs	0
A1150	A1160	FS	Not Started	Not Started	BR 1R Construct Bridge End Slabs	BR 1R Slipform Parapet Rails	0
A1160	A1485	FS	Not Started	Not Started	BR 1R Slipform Parapet Rails	Demo Existing Bridge 1L	0
A1170	A1180	FS	Not Started	Not Started	BR 2R Construct Bent 1 Foundation Prep & Fc	BR 2R Construct Bent 1 Columns	0
A1180	A1190	FS	Not Started	Not Started	BR 2R Construct Bent 1 Columns	BR 2R Construct Bent 1 Cap	0
A1190	A1200	FS	Not Started	Not Started	BR 2R Construct Bent 1 Cap	BR 2R Construct Bent 2 Foundation Prep & Fc	0
A1190	A1225	FS	Not Started	Not Started	BR 2R Construct Bent 1 Cap	BR 2R Core Drill and Install Abutment 1 Pil es	0
A1200	A1210	FS	Not Started	Not Started	BR 2R Construct Bent 2 Foundation Prep & Fc	BR 2R Construct Bent 2 Columns	0
A1210	A1220	FS	Not Started	Not Started	BR 2R Construct Bent 2 Columns	BR 2R Construct Bent 2 Cap	0
A1220	A1230	FS	Not Started	Not Started	BR 2R Construct Bent 2 Cap	BR 2R Construct Abutment 1 Grade Beam	0
A1220	A1225	FS	Not Started	Not Started	BR 2R Construct Bent 2 Cap	BR 2R Core Drill and Install Abutment 1 Pil es	0
A1220	A1245	FS	Not Started	Not Started	BR 2R Construct Bent 2 Cap	BR 2R Core Drill and Install Abutment 2 Pil es	0
A1225	A1230	FS	Not Started	Not Started	BR 2R Core Drill and Install Abutment 1 Pil es	BR 2R Construct Abutment 1 Grade Beam	0
A1225	A1245	FS	Not Started	Not Started	BR 2R Core Drill and Install Abutment 1 Pil es	BR 2R Core Drill and Install Abutment 2 Pil es	0
A1230	A1240	FS	Not Started	Not Started	BR 2R Construct Abutment 1 Grade Beam	BR 2R Construct Abutment 1 Backwall	0
A1240	A1270	FS	Not Started	Not Started	BR 2R Construct Abutment 1 Backwall	BR 2R Set Precast Beams	0
A1240	A1250	FS	Not Started	Not Started	BR 2R Construct Abutment 1 Backwall	BR 2R Construct Abutment 2 Grade Beam	0

CPM Schedule Components
Relationship Report Table

Since two activities are required to form a relationship, the relationship information is not available on the tables of activity details. Relationship information, such as the relationship type or lag, between a predecessor and successor must be gathered in a relationship report or table.

Note: The use of leads or lags must be approved by the **District Supervisor**.

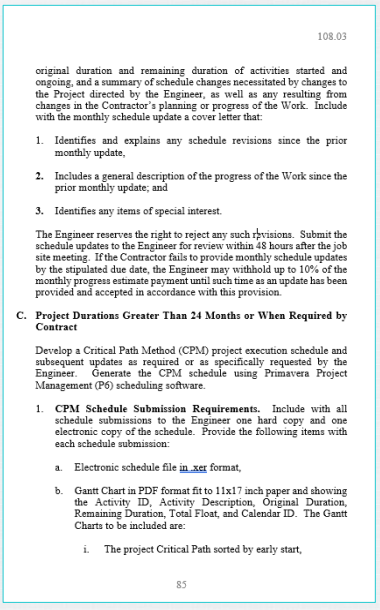


TDOT Documents and Procedures

- TDOT Specification
- Checklists
- Circular Letter
  - Receiving and Storing Schedule Files
  - CPM Submission Requirements
  - Initial Project Schedule
  - Conducting the Baseline CPM Schedule Review
  - Schedule Updates
  - Schedule Revisions
  - Communication with the Contractor
  - Time Impacts and Delays
  - Primavera Power-Users

TDOT Specification

- Subsection:
  - 108.03 Prosecution of Construction
- Role:
  - Serves as the basis for Acceptance/Rejection.
  - All other documents and procedures are based on the Specification.



108.03

original duration and remaining duration of activities started and ongoing, and a summary of schedule changes necessitated by changes to the Project directed by the Engineer, as well as any resulting from changes in the Contractor's planning or progress of the Work. Include with the monthly schedule update a cover letter that:

1. Identifies and explains any schedule revisions since the prior monthly update,
2. Includes a general description of the progress of the Work since the prior monthly update; and
3. Identifies any items of special interest.

The Engineer reserves the right to reject any such revisions. Submit the schedule updates to the Engineer for review within 48 hours after the job site meeting. If the Contractor fails to provide monthly schedule updates by the stipulated due date, the Engineer may withhold up to 10% of the monthly progress estimate payment until such time as an update has been provided and accepted in accordance with this provision.

C. Project Durations Greater Than 24 Months or When Required by Contract

Develop a Critical Path Method (CPM) project execution schedule and subsequent updates as required or as specifically requested by the Engineer. Generate the CPM schedule using Primavera Project Management (P6) scheduling software.

1. **CPM Schedule Submission Requirements.** Include with all schedule submissions to the Engineer one hard copy and one electronic copy of the schedule. Provide the following items with each schedule submission:
   a. Electronic schedule file in .xer format,
   b. Gantt Chart in PDF format fit to 11x17 inch paper and showing the Activity ID, Activity Description, Original Duration, Remaining Duration, Total Float, and Calendar ID. The Gantt Charts to be included are:
      i. The project Critical Path sorted by early start,

85

67

TDOT Documents and Procedures

TDOT Specification

Subsection:

108.03 Prosecution of Construction

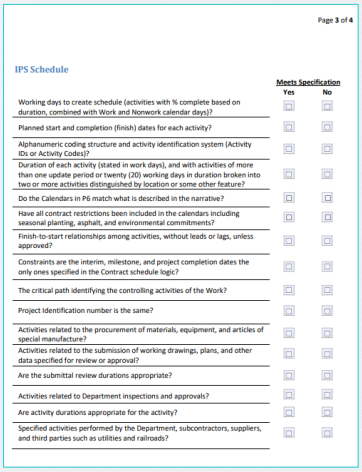
Role:

Serves as the basis for Approval/Disapproval.

All other documents and procedures are based on the Specification.

Checklists

- Role:
  - Designed to check the requirements of the Specification in an easy format to follow.
  - Checklists for:
  - Initial Project Schedule
  - Baseline CPM Schedule
  - CPM Schedule Updates



Page 3 of 4

IPS Schedule

	Meets Specification Yes	No
Working days to create schedule (activities with % complete based on duration, combined with Work and Nonwork calendar days)?	☐	☐
Planned start and completion (finish) dates for each activity?	☐	☐
Alphanumeric coding structure and activity identification system (Activity IDs or Activity Codes)?	☐	☐
Duration of each activity (stated in work days), and with activities of more than one update period or twenty (20) working days in duration broken into two or more activities distinguished by location or some other feature?	☐	☐
Do the Calendars in P6 match what is described in the narrative?	☐	☐
Have all contract restrictions been included in the calendars including seasonal planting, asphalt, and environmental commitments?	☐	☐
Finish-to-start relationships among activities, without leads or lags, unless approved?	☐	☐
Constraints are the interim, milestone, and project completion dates the only ones specified in the Contract schedule logic?	☐	☐
The critical path identifying the controlling activities of the Work?	☐	☐
Project Identification number is the same?	☐	☐
Activities related to the procurement of materials, equipment, and articles of special manufacture?	☐	☐
Activities related to the submission of working drawings, plans, and other data specified for review or approval?	☐	☐
Are the submittal review durations appropriate?	☐	☐
Activities related to Department inspections and approvals?	☐	☐
Are activity durations appropriate for the activity?	☐	☐
Specified activities performed by the Department, subcontractors, suppliers, and third parties such as utilities and railroads?	☐	☐

68

TDOT Documents and Procedures

Checklists

Role:

- Designed to check the requirements of the Specification in an easy to follow format.
- Checklist for reviewing the Initial Project Schedule.
- Checklist for reviewing the Baseline Schedule.
- Checklist for reviewing Schedule Updates.

Circular Letter

Subsection: 108.03 Prosecution of Construction

Number: 108.03.C

Subject: Critical path method (CPM) Schedules

Role: Provide general guidance and supporting information for checklists and Specification.

Page 1 of 9

CIRCULAR LETTER

SECTION: 108.03 PROSECUTION OF CONSTRUCTION
NUMBER: 108.03.C
SUBJECT: CRITICAL PATH METHOD (CPM)
SCHEDULES DATE: FEBRUARY 5, 2021

All projects with durations longer than 24 months or when required by contract must follow the scheduling process outlined within this Circular Letter and the meet requirements in 108.03.C. The **Initial Project Schedule (IPS)**, the **Baseline CPM Project Schedule**, and **Subsequent Updates** shall be generated using Primavera Project Management (P6) scheduling software.

Receiving and Storing Schedule Files

Once a schedule and related materials are received from the contractor, these files shall be stored under the respective contract folder on the CMS/File Management Drive (a.k.a. Unit Drive):

Within the contract's folder, create a folder titled "CPM Schedules".

CPM Submission Requirements

One hard copy in PDF or printed and one electronic copy in .wer format.

A Gantt Chart in PDF format to fit 11x17 inch paper. Gantt Charts to be included are;

Project Critical Path sorted by early start;

All uncompleted work activities as of data date sorted by area and early start;

60 day look ahead sorted by early start.

Narrative report in PDF file format to fit 8.5x11 inch paper.

Detailed approach to sequencing the work, including assumptions and restrictions considered in development and updates of the schedule;

Description of the Critical Path;

Description of the near-critical paths, defined as those activities not on the Critical Path with total float less than 20 days of total float;

Identification of potential conflicts that may affect the schedule and how they might be mitigated;

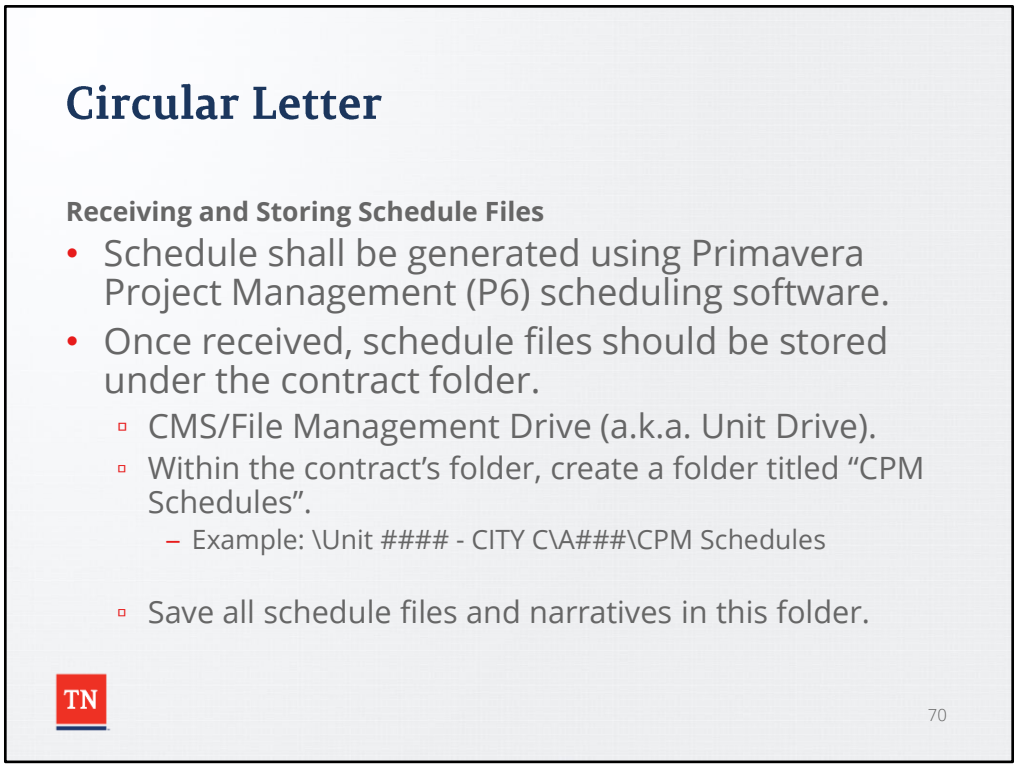
Identification of submittal approvals necessary for the work to proceed as shown;

69

TDOT Documents and Procedures
Circular Letter

Subsection: 108.03 Prosecution of Construction
Number: 108.03.C
Subject: Critical path method (CPM) Schedules

Role: Provide general guidance and supporting information for checklists and Specification.



TDOT Documents and Procedures
Circular Letter
Receiving and Storing Schedule Files

Schedule shall be generated using Primavera Project Management (P6) scheduling software.
Once a schedule and related materials are received by the contractor, these files shall be stored under the respective contract folder on the CMS/File Management Drive (a.k.a. Unit Drive).

Within the contract's folder, create a folder titled "*CPM Schedules".*

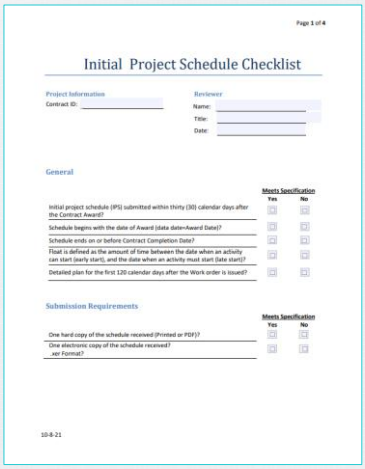
Example*: \Unit #### - CITY C\A###\CPM Schedules*

Save all schedule files and narratives in this folder.

Circular Letter

Conducting the Initial Project Schedule (IPS) Review

- Contractor submits IPS within 30 calendar days after Contract Award. The detailed plan completed as described in the baseline CPM schedule for the first 120 calendar days after the Work Order.
- Use Form ***Initial Project Schedule Checklist*** to assist in determining whether the schedule meets the requirements of 108.03.C.2 of the Specifications.



Page 1 of 4

Initial Project Schedule Checklist

Project Information
Contract ID: _____

Reviewer
Name: _____
Title: _____
Date: _____

General

	Meets Specification Yes	No
Initial project schedule (IPS) submitted within thirty (30) calendar days after the Contract Award?	☐	☐
Schedule begins with the date of Award (date date=Award Date)?	☐	☐
Schedule ends on or before Contract Completion Date?	☐	☐
Float is defined as the amount of time between the date when an activity can start (early start), and the date when an activity must start (late start)?	☐	☐
Detailed plan for the first 120 calendar days after the Work order is issued?	☐	☐

Submission Requirements

	Meets Specification Yes	No
One hard copy of the schedule received (Printed or PDF)?	☐	☐
One electronic copy of the schedule received? .xer Format?	☐	☐

10-8-21

TN

71

TDOT Documents and Procedures
Circular Letter
Conducting the Initial Project Schedule (IPS) Review

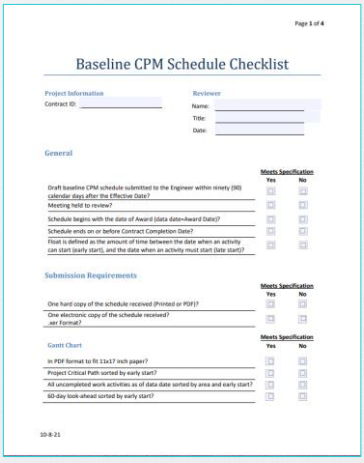
Contractor submits IPS within 30 calendar days after Contract Award. The detailed plan completed as described in the baseline CPM schedule for the first 120 calendar days after the Work Order.

FORM INITIAL PROJECT SCHEDULE CHECKLIST to assist in determining whether the schedule meets the requirements of **108.03.C.2**.

Circular Letter

Conducting the Baseline CPM Schedule Review

- Within 90 calendar days after Effective Date, Contractor to arrange meeting to review and submit a draft baseline CPM schedule.
- Use Form ***Baseline CPM Schedule Checklist*** to assist in determining whether the baseline schedule meets the requirements of 108.03.C.3 of the Specifications.



Page 1 of 4

Baseline CPM Schedule Checklist

Project Information
Contract ID: _____

Reviewer
Name: _____
Title: _____
Date: _____

General

	Meets Specification Yes	No
Draft baseline CPM schedule submitted to the Engineer within ninety (90) calendar days after the Effective Date?	☐	☐
Meeting held to review?	☐	☐
Schedule begins with the date of Award (data date=Award Date)?	☐	☐
Schedule ends on or before Contract Completion Date?	☐	☐
Float is defined as the amount of time between the date when an activity can start (early start), and the date when an activity must start (late start)?	☐	☐

Submission Requirements

	Meets Specification Yes	No
One hard copy of the schedule received (Printed or PDF)?	☐	☐
One electronic copy of the schedule received? ...ser Format?	☐	☐

Gantt Chart

	Meets Specification Yes	No
In PDF format to fit 11x17 inch paper?	☐	☐
Project Critical Path sorted by early start?	☐	☐
All uncompleted work activities as of data date sorted by area and early start?	☐	☐
60-day look-ahead sorted by early start?	☐	☐

10-8-21

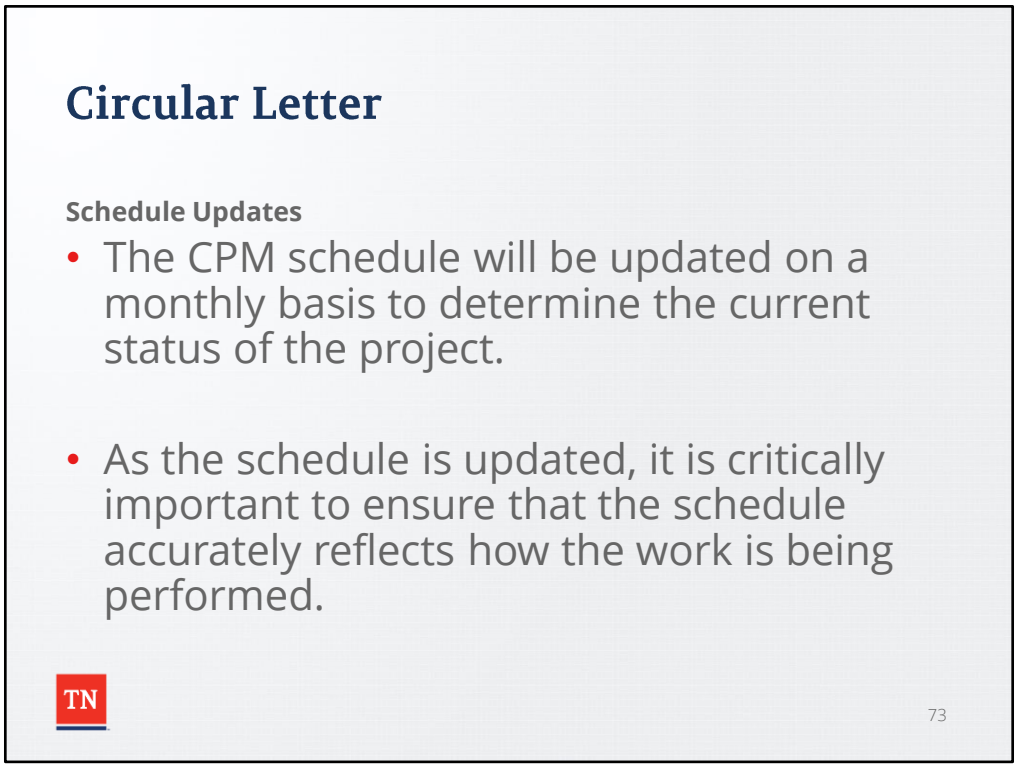
TN

72

TDOT Documents and Procedures
Circular Letter
Conducting the Baseline CPM Schedule Review

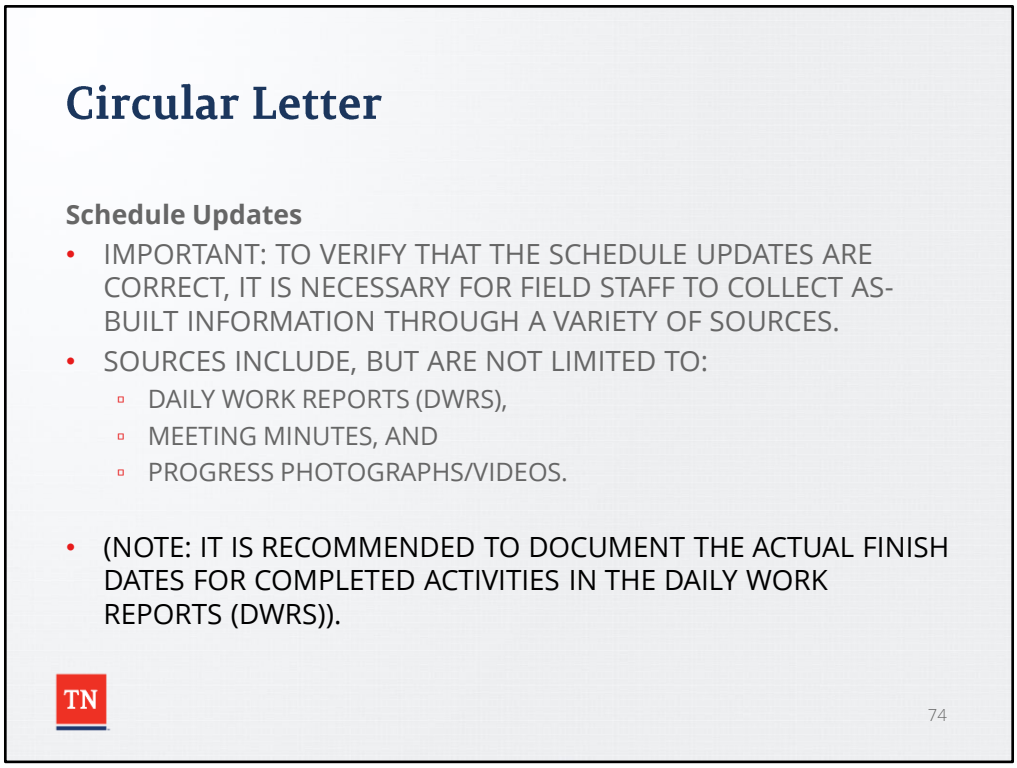
Within fifteen 90 calendar days after Effective Date, contractor to arrange a meeting to review and submit a draft baseline CPM schedule. The purpose of the meeting is to discuss the Contractor's plan to execute the work by the completion date set forth in the Proposal. This meeting also allows discussion of potential conflicts that may affect the schedule and how they might be mitigated.

FORM BASELINE CPM SCHEDULE CHECKLIST assist in determining whether the baseline schedule meets the requirements of **108.03.C.3** of the specifications.



TDOT Documents and Procedures
Circular Letter
Schedule Updates

The CPM schedule will be updated on a monthly basis to determine the current status of the project. As the schedule is updated, it is critically important to ensure that the schedule accurately reflects how the work is being performed.



TDOT Documents and Procedures
Circular Letter
Schedule Updates

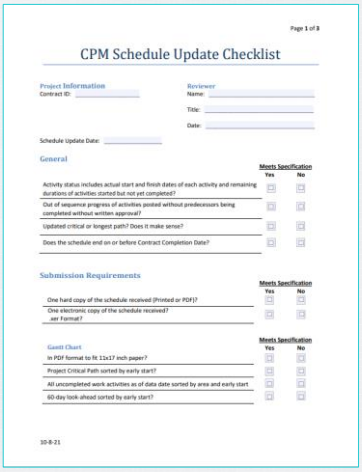
IMPORTANT: TO VERIFY THAT THE SCHEDULE UPDATES ARE CORRECT, IT IS NECESSARY FOR FIELD STAFF TO COLLECT AS-BUILT INFORMATION THROUGH A VARIETY OF SOURCES. SOURCES INCLUDE, BUT ARE NOT LIMITED TO: DAILY WORK REPORTS (DWRS), MEETING MINUTES, AND PROGRESS PHOTOGRAPHS/VIDEOS.

(NOTE: IT IS RECOMMENDED TO DOCUMENT THE ACTUAL FINISH DATES FOR COMPLETED ACTIVITIES IN THE DAILY WORK REPORTS (DWRS)).

Circular Letter

Schedule Updates

- Use Form **CPM SCHEDULE UPDATE CHECKLIST** to analyze the current progress, meet requirements of 108.03.C.4 of the Specifications, and determine potential needs for a schedule revision.



Page 1 of 3

CPM Schedule Update Checklist

Project Information
Contract ID:

Reviewer
Name:
Title:
Date:

Schedule Update Date:

General

	Meets Specification Yes	No
Activity status includes actual start and finish dates of each activity and remaining durations of activities started but not yet completed?	☐	☐
Out of sequence progress of activities posted without predecessors being completed without written approval?	☐	☐
Updated critical or longest path? Does it make sense?	☐	☐
Does the schedule end on or before Contract Completion Date?	☐	☐

Submission Requirements

	Meets Specification Yes	No
One hard copy of the schedule received (Printed or PDF)?	☐	☐
One electronic copy of the schedule received? ...ser Format?	☐	☐

Gantt Chart

	Meets Specification Yes	No
In PDF format to fit 11x17 inch paper?	☐	☐
Project Critical Path sorted by early start?	☐	☐
All uncompleted work activities as of data date sorted by area and early start	☐	☐
60-day look ahead sorted by early start?	☐	☐

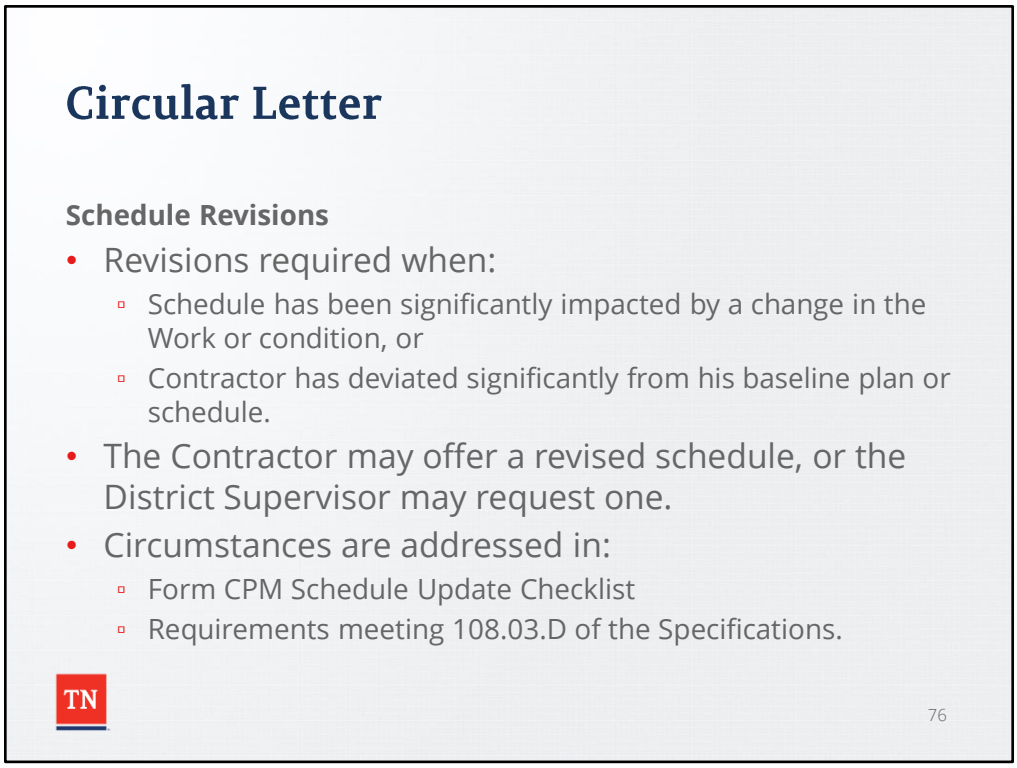
10-8-21

TN

75

TDOT Documents and Procedures
Circular Letter
Schedule Updates

Use **FORM CPM SCHEDULE UPDATE CHECKLIST** to analyze the current progress, meet requirements of **108.03.C.4** of the Specifications, and determine potential needs for a schedule revision.



TDOT Documents and Procedures
Circular Letter
Schedule Revisions

A revision of the baseline CPM schedule is required when the schedule has been significantly impacted by a change in the Work or condition or the Contractor has deviated significantly from his baseline plan or schedule.

The Contractor may offer a revised schedule, or the **District Supervisor** may request one. Circumstances that may lead to requesting a revised schedule are addressed in **FORM CPM SCHEDULE UPDATE CHECKLIST** and in **108.03.D** of the Specifications.

If the Contractor cannot justify unsatisfactory progress, administrative actions can be made in accordance with **108.03.D** of the Specifications.

Circular Letter

Communication with the Contractor

Upon review of the CPM schedule and related materials, the District Supervisor will either:

- Provide review comments,
- Request additional information,
- Accept the CPM schedule, or
- Reject the CPM schedule

Template Letters are available on the Construction Division's Website.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
«Your_Office_Street_Address»
«Your_Office_City_State_and_Zip_Code»

JOSEPH GALBATO, III
BILL LEE

Click here to enter a date.

Recipient's Name
Contractor Firm
Contractor Address

Contract
Project No.:
Reference No.:
County:

On Click here to enter a date., we received a Critical Path Method (CPM) schedule. This schedule identifies and includes the required information stated in the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction* **Section 108.03(C)**. Therefore, at this time, the schedule is acceptable to be used for measuring progress and monitoring change. It is your responsibility to schedule, sequence, and prosecute the Work to comply with the Contract requirements.

If you have any questions or concerns, please contact at (XXX) XXX-XXXX or myself.

Sincerely,

Title
TDOT Operations Division

77

TDOT Documents and Procedures
Circular Letter
Communication with the Contractor

Upon review of the CPM schedule and related materials, the **District Supervisor** will either:

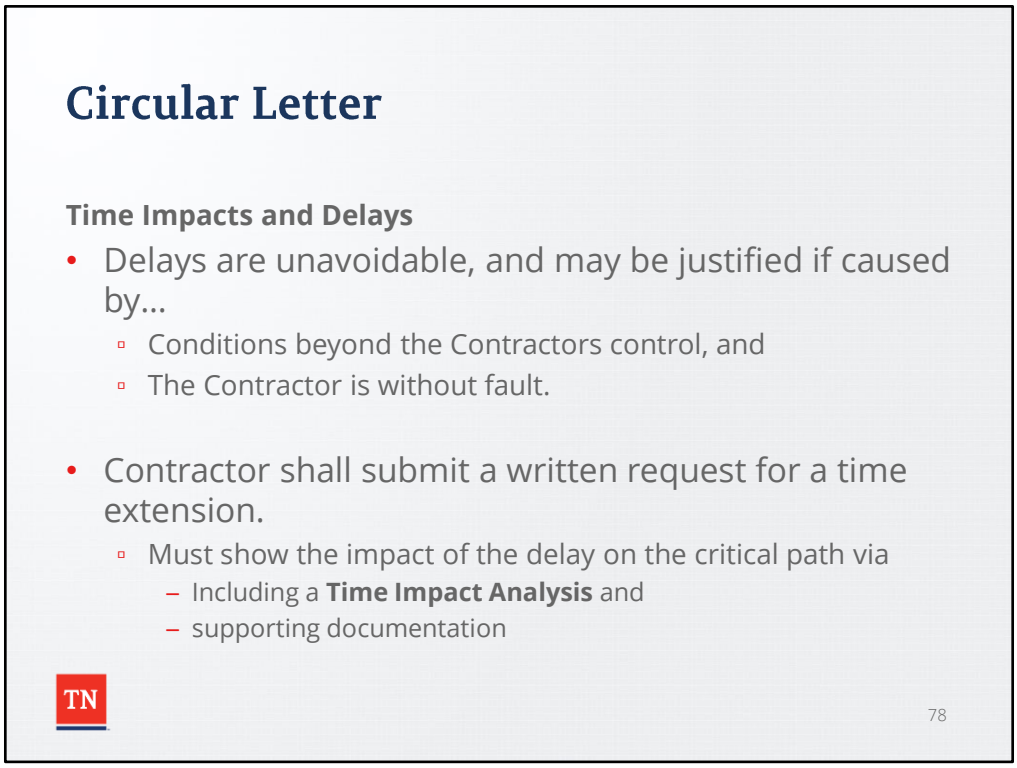
- ***Provide review comments,***
- ***Request additional information,***
- ***Accept the CPM schedule, or***
- ***Reject the CPM schedule***

Providing review comments

General review comments may be provided verbally, or in writing. No formal letter is required.

Template Letters

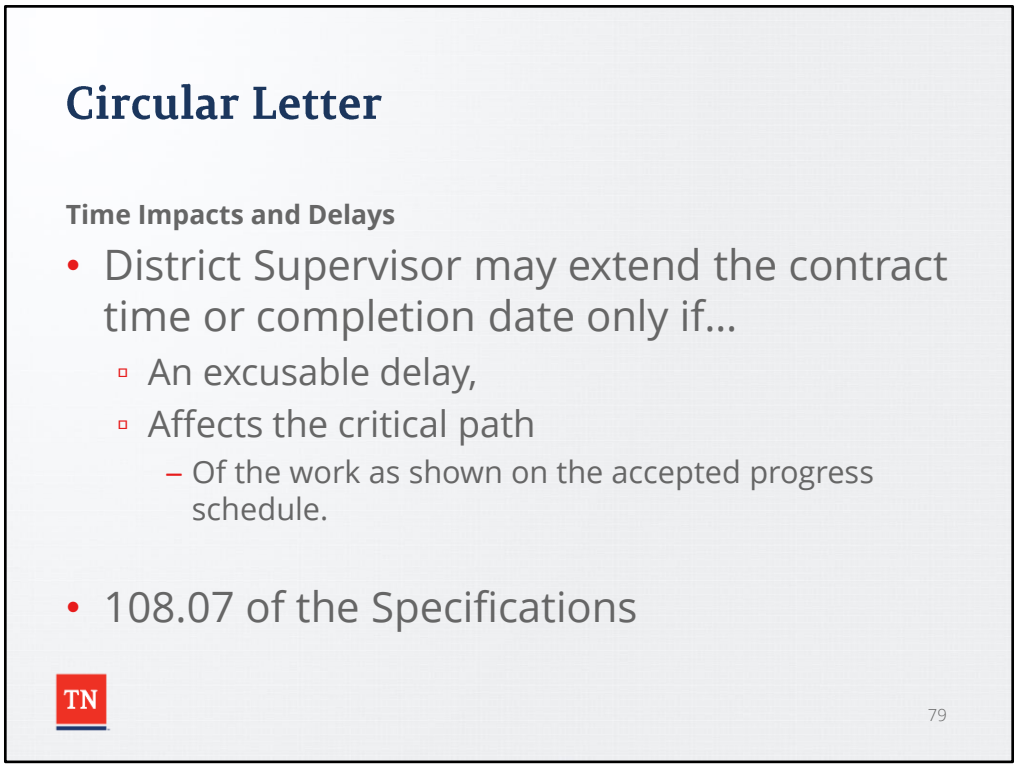
Template Letters are available on the Construction Division's Website.



TDOT Documents and Procedures
Circular Letter
Time Impacts and Delays

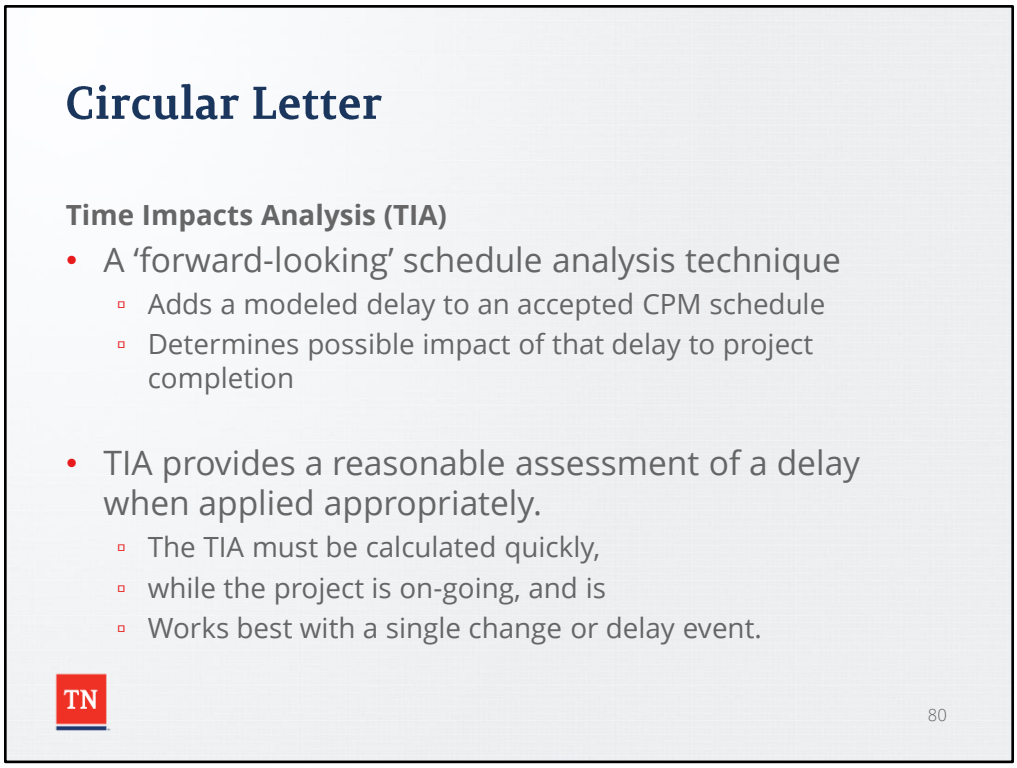
Delays on construction projects are unavoidable. If the contractor has been delayed because of conditions beyond their control and they are without fault, then a time extension may be justified.

The Contractor shall notify the **District Supervisor** in accordance with **104.03** of the Specifications and submit a written request for a time extension. The written request shall include a Time Impact Analysis and supporting documentation showing the impact of the delay on the critical path.



TDOT Documents and Procedures
Circular Letter
Time Impacts and Delays

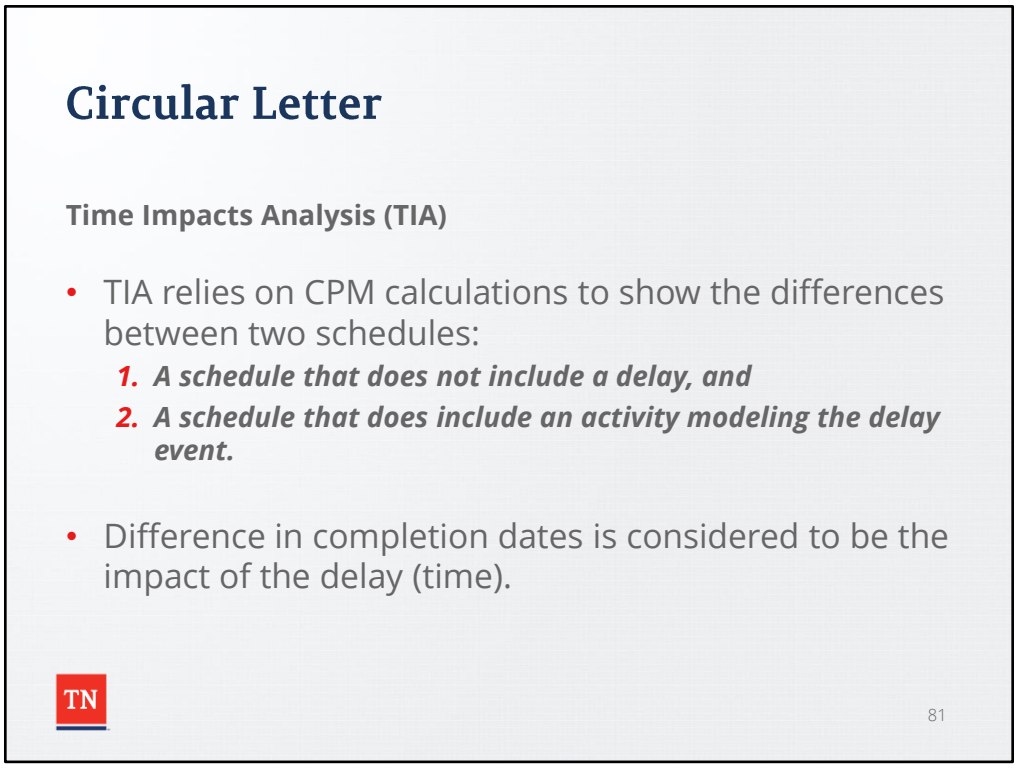
In accordance with **108.07** of the Specifications, the **District Supervisor** may extend the contract time or completion date only if an excusable delay affects the critical path of the work as shown on the accepted progress schedule.



TDOT Documents and Procedures
Circular Letter
Time Impacts Analysis (TIA)

Time Impact Analysis (TIA) is a 'forward-looking,' prospective schedule analysis technique that adds a modeled delay to an accepted CPM schedule to determine the possible impact of that delay to project completion. A TIA is performed to evaluate the most likely results of an unplanned event.

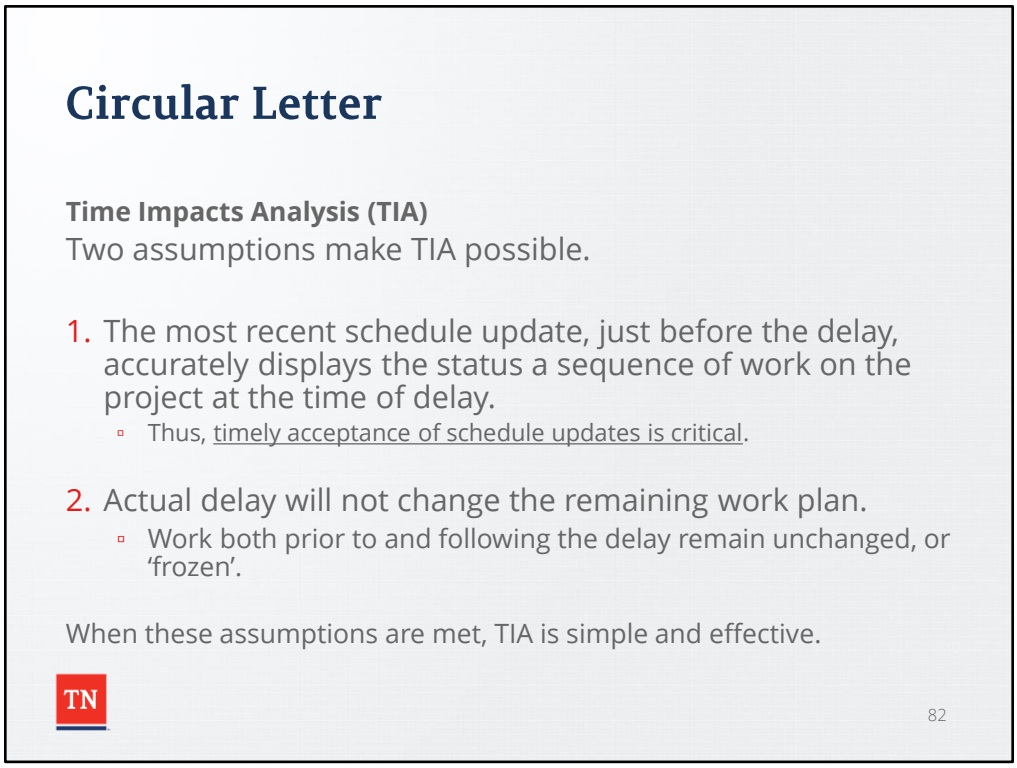
The TIA provides a reasonable assessment of a delay when applied appropriately. The TIA must be calculated quickly, while the project is on-going, and is best when modeling the effects of a single change or delay event.



TDOT Documents and Procedures
Circular Letter
Time Impacts Analysis (TIA)

TIA relies on the CPM calculations to show the differences between two schedules:
A schedule that does not include a delay, and
A schedule that does include an activity modeling the delay event.

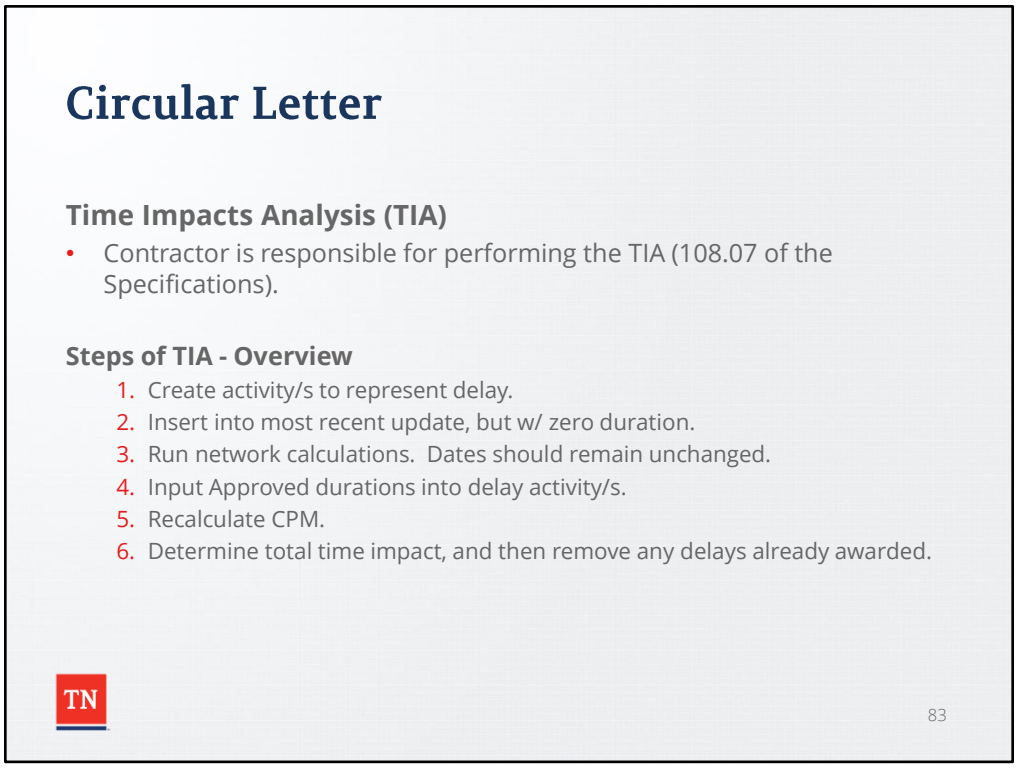
The difference in project completion dates is considered to be the impact of the delay for time duration considerations.



TDOT Documents and Procedures
Circular Letter
Time Impacts Analysis (TIA)

There are two assumptions that make TIA possible. The first assumption is that the most recent schedule update, just before the delay, accurately displays the status a sequence of work on the project at the time of delay. Therefore, timely acceptance of schedule updates is critical to the TIA success. The second assumption is that actual delay will not change the remaining work plan. Essentially, the work both prior to and following the delay remain unchanged, or 'frozen'.

When TIA is appropriate and all assumptions are met, it is a simple and effective method for modeling the effects of a delay.

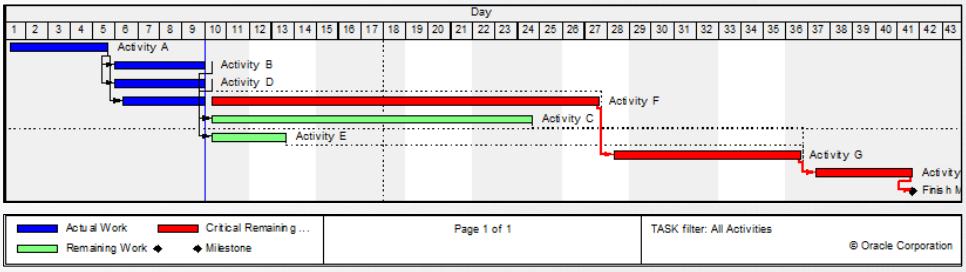


TDOT Documents and Procedures
Circular Letter
Time Impacts Analysis (TIA)
Steps of TIA

According to **108.07** of the Specifications, the Contractor is responsible for performing the TIA. These are the steps they are expected to perform:

1. Create activity/s to represent delay.
2. Insert into most recent update, but w/ zero duration.
3. Run network calculations. Dates should remain unchanged.
4. Input Approved durations into delay activity/s.
5. Recalculate CPM.
6. Determine total time impact, and then remove any delays already awarded.

TIA Example



- Activity C was delayed 14 days.
- The most recent schedule update had a data date of Day-10, so progress through Day-9 is shown as performed.

TN

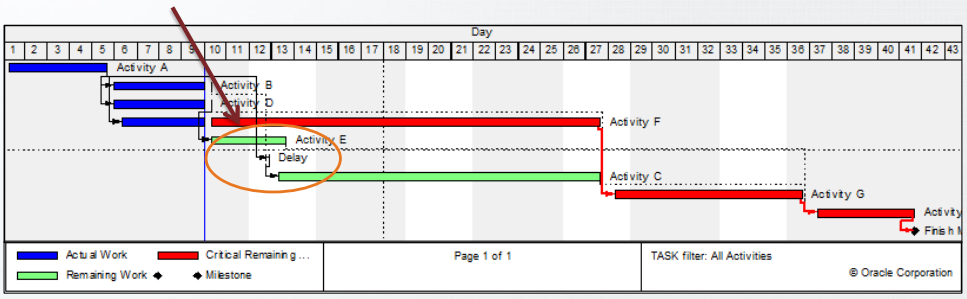
84

TIA Example

Activity C was delayed 14 days.

The most recent schedule update had a data date of Day-10, so progress through Day-9 is shown as performed.

TIA Example



- Delay inserted with zero duration.
- Network calculations ran.
- Finish Milestone remains on day 42.

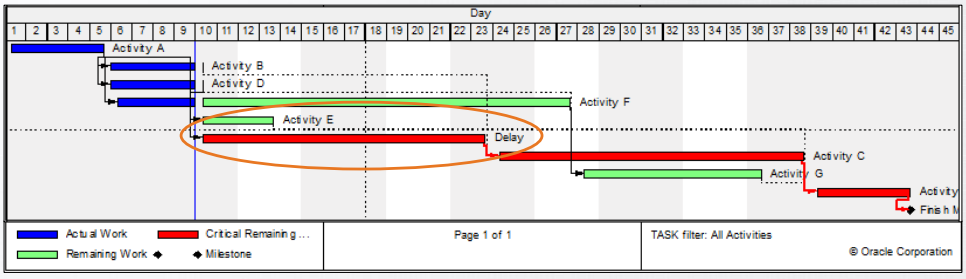
TN

85

TIA Example

1.Create delay activity to represent delay.
2.Insert into most recent update, but w/ zero duration.
3.Run network calculations. Dates should remain unchanged.

TIA Example

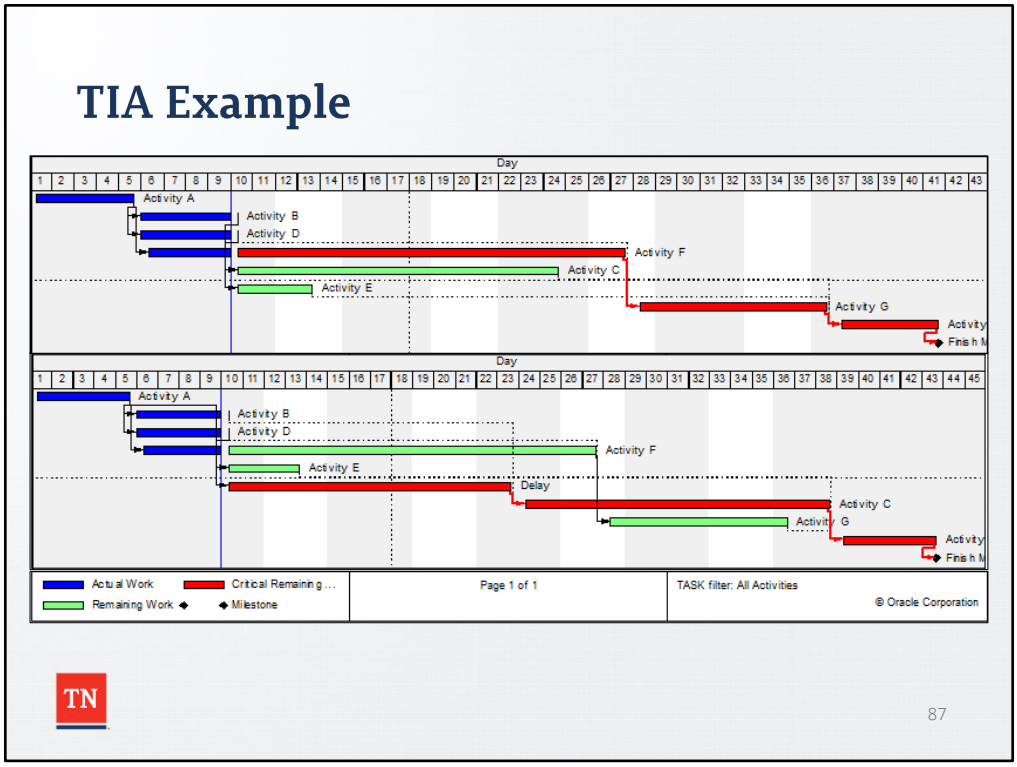


- Delay duration of 14 days entered
- Network calculations ran.
- Finish Milestone is moved to Day 44 (2 days).

86

TIA Example

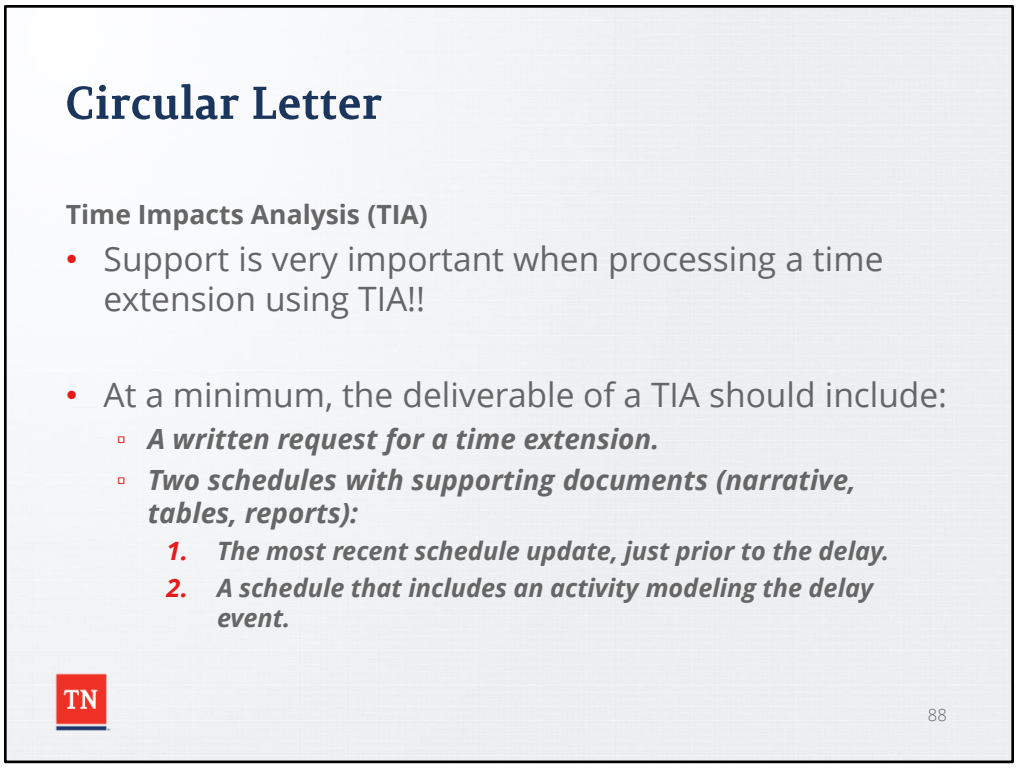
1. Input Approved durations into delay activity/s (14 days)
2. Recalculate CPM.
3. Determine total time impact, and then remove any delays already awarded.



TIA Example

In summary, the 14-day delay to Activity C resulted in an overall delay to the completion of 2 days. Additionally, the Critical Path changed from Activities A-F-G-H to Activities A-B-C-H.

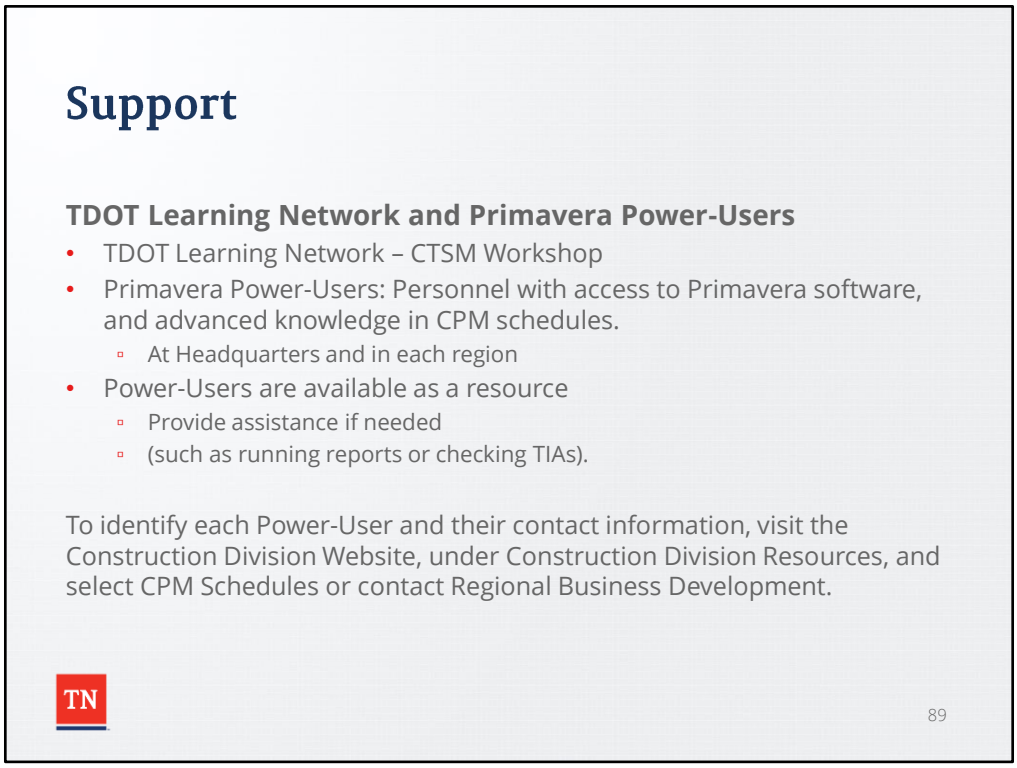
Both schedules are compared to prove the impact of the delay.



TDOT Documents and Procedures
Circular Letter
Time Impacts Analysis (TIA)

The support is very important when processing a time extension using TIA. At a minimum, the deliverable of a TIA should include:

- ***A written request for a time extension.***
- ***Two schedules with supporting documents (narrative, tables, reports):***
    1. ***The most recent schedule update, just prior to the delay.***
    2. ***A schedule that includes an activity modeling the delay event.***



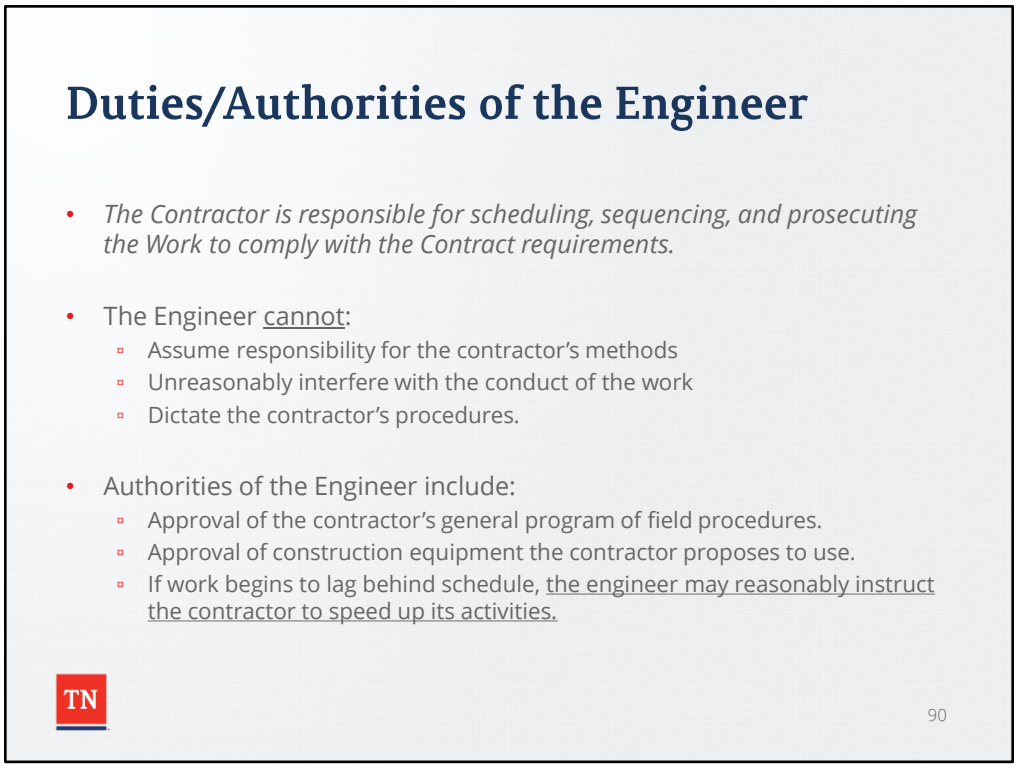
TDOT Documents and Procedures

Support:

TDOT Learning Network and Primavera Power-Users

- TDOT Learning Network – CTSM Workshop
- Primavera Power–Users: Personnel with access to Primavera software and advanced knowledge in CPM schedules.
    - At Headquarters and in each Region

Primavera Professional is the leading project management software used in the Construction Industry for scheduling. Within the Construction Division, both at Headquarters and regionally, there are Power-Users who have access to Primavera software, and advanced knowledge in CPM schedules. These Power-Users are available as a resource to provide assistance (such as running reports, or checking the TIA) as needed. To identify each Power-User and their contact information, visit the Construction Division Website, under Construction Division Resources, and select CPM Schedules or contact Regional Business Development.



Duties/Authorities of the Engineer

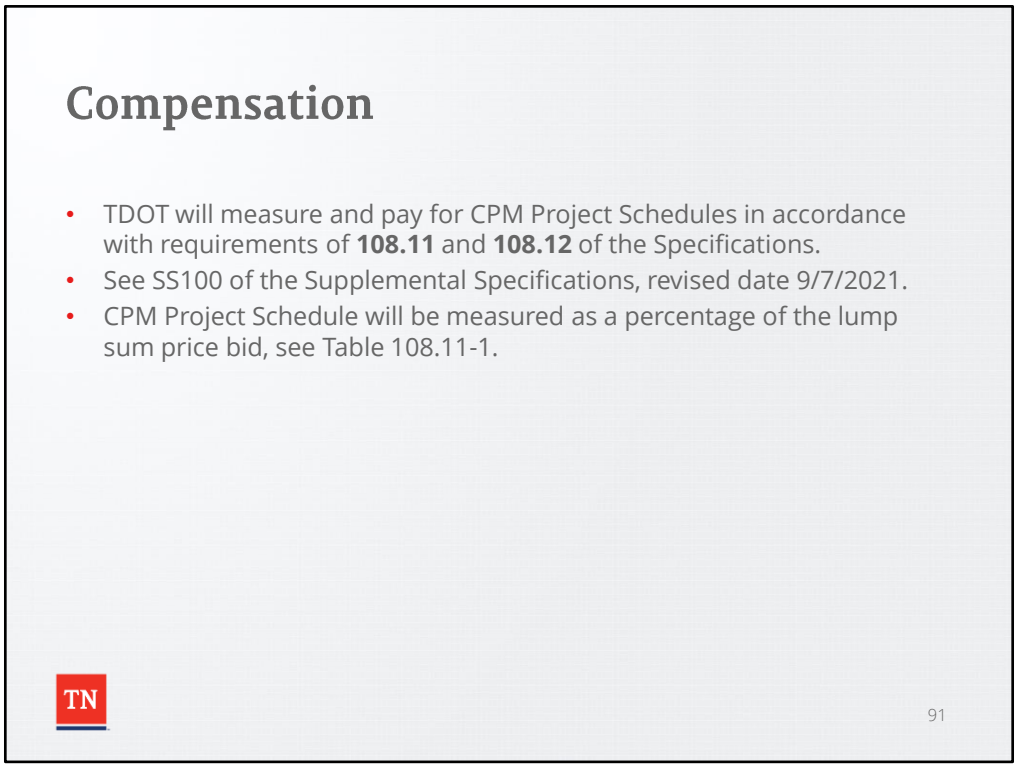
The Contractor is responsible for scheduling, sequencing, and prosecuting the Work to comply with the Contract requirements.

The Engineer has direct responsibility to oversee the progress of the work, and exercise the right of job inspection and approval of materials. While the Engineer is given considerable authority, they cannot:

- Assume responsibility for the contractor's methods
- Unreasonably interfere with the conduct of the work
- Dictate the contractor's procedures.

This does not imply, however, that the engineer is without responsibility for keeping the project on-schedule. In this regard, the authorities of the Engineer include:

- Approval of the contractor's general program of field procedures.
- Approval of construction equipment the contractor proposes to use.
- If work begins to lag behind schedule, the engineer may reasonably instruct the contractor to speed up its activities.



Compensation

- TDOT will measure and pay for CPM Project Schedules in accordance with requirements of 108.11 and 108.12 of the Specifications.
- See SS100 of the Supplemental Specifications, revised date 9/7/2021.
- CPM Project Schedule will be measured as a percentage of the lump sum price bid, see Table 108.11-1.

Sources

- Harris, Paul E. (2014, December 17). “Planning and Control Using Oracle Primavera P6 Versions 8.1 to 8.4 Professional Client & Optional Client”.
- Lindeburg PE , Michael R. (2011). “Civil Engineering Reference Manual for the PE Exam”. Twelfth Edition.
- Oracle Primavera P6 Professional Help
- Virginia Department of Transportation. (Draft Release 3: 10-5-12). VDOT Post-award Scheduling Guide: Guidelines for Establishing & Maintaining Schedule Control on Projects During the Construction Phase.

TN TDOT Department of Transportation

THANK YOU