Critical Path Method Schedule Development, Review and Analysis Guidelines

Mike Lehmann, P.E.
Texas Department of Transportation
District Construction Engineer
San Antonio District
Presentation Overview

- Background Information
- CPM Guide History
- Highlights of the Guide
- Where to get the Guide
- Future developments
Background Information

- **TxDOT workload**\(^{(1)}\) as of June 2005
  - 1,372 Active Construction Projects
  - $12.4 billion under contract

- **SAT district workload**
  - 108 Active Construction Projects
  - $994 million under contract

\(^{(1)}\) Includes some “active” projects that have yet to start and some that have been completed and have yet to be removed from active status.
Counties of San Antonio District
History and Background
Development of Expertise

- Used CPM since 1988
- Used CPM for the resolution of 50+ claims and disputes
- Developed and delivered 40+ in-house training classes
- Co-authored 1993 CPM spec
- Primary author of 2004 CPM spec
MEMORANDUM

TO: District Engineers
Division Directors
Office Directors

FROM: Amadeo Saenz, Jr., P.E.

SUBJECT: Accelerated Construction

November 8, 2001

In Mr. Johnson’s Transportation Working Group Report of August 22, 2001, “Texas Transportation Partnerships...Connecting You to the World,” the section on Streamlined Project Delivery established a goal of improved project delivery from conception to ribbon cutting on average, by 15% within 5 years. The goal was presented in the context of the cost of disruptions to traffic flow. Because of increased traffic and congestion we must heighten our attention to time requirements for projects and demand contractor’s uninterrupted prosecution of the work. The public, legislature and the Commission have asked us to implement strategies to reduce construction time beyond previous guidance. (Reference Mr. Heald’s July 14, 1998 memorandum) We are therefore revising the previous guidance to now require acceleration provisions for projects that disrupt traffic. The requirement will apply to projects beginning with the May 2002 letting.
History and Background
Development of the Guide

Guidelines were developed and finalized on December 7, 2001

Guidelines were posted to TxDOT Website, December 2001
“We recently stumbled on one of the more practical treatments of this approach at the Texas DOT website.”
“To the extent that unfamiliarity with the software is an impediment to use of CPM scheduling, these guidelines are a must-read for the project manager or scheduler who wishes to enhance project performance with better schedules. The TIA guidelines also contain valuable tips, even for the experienced scheduler. We strongly suggest downloading the Guidelines (also available at our website) and printing them out on a color printer.”

www.constructionclaims.com
Highlights of the Guide

**Chapter 1** - Development Of Critical Path Method Schedules For Contract Time Determination

**Chapter 2** - Review Process For Original Schedules

**Chapter 3** - Review Process For Updated or Revised Schedules

**Chapter 4** - Time Impact Analysis Process For CPM Schedules
# Chapter 1
Primavera Basics (P3 version 3.1)

## Terminology

<table>
<thead>
<tr>
<th>Terminology</th>
<th>Use</th>
<th>Symbol/Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Dial</td>
<td>To select one of several options</td>
<td>○</td>
</tr>
<tr>
<td>Pick List</td>
<td>To select system and user-defined data</td>
<td>▼</td>
</tr>
<tr>
<td>Plus button</td>
<td>To add an activity, relationship, etc., to the current window</td>
<td>+</td>
</tr>
<tr>
<td>Minus button</td>
<td>Removes the highlighted data from the current window</td>
<td>–</td>
</tr>
<tr>
<td>Menu or window option</td>
<td>Pull-down menus, buttons in active windows</td>
<td>Command</td>
</tr>
<tr>
<td>Area in active window or screen name</td>
<td>To help user locate specific data discussed in text</td>
<td>Italics</td>
</tr>
<tr>
<td>Titled areas, columns, etc.</td>
<td>To identify specific areas in active window</td>
<td>“Title”</td>
</tr>
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</table>
Chapter 1
Time Determination Basics

- Understand The Sequence Of Work And Traffic Control Plan In The PS&E
- Calculate/Estimate Quantities Of Work By Phase
- Determine Attainable Production Rates
Chapter 1
Schedule Development Steps

1. Break Down The Work Into Distinct Activities
2. Create The New Schedule
3. Set Up The Calendars
4. Set Up Coding
5. Enter Basic Activity Information
6. Add Relationships
7. Run The Schedule Calculations And Trouble-Shoot
Chapter 1
Schedule Development Steps

Set Up The Calendars
- Work Week
- Holidays
- Bad Weather Days
Chapter 1
Schedule Development Steps

Enter Basic Activity Information

- Activity ID Number
- Description
- Duration
- Assign Calendar
- Assign Coding
Chapter 1
Schedule Development Steps

Enter Relationships

- Finish to Start (F-S)
- Start to Start (S-S)
- Finish to Finish (F-F)
- Start to Finish (S-F)
Highlights of the Guide

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Chapter 2

Schedule Review Steps

1. Restore The Schedule
2. Open The File
3. Review The Calendars
4. Review Activity Coding Structure
5. Review Resource Loading, If Required
6. Defining The Critical Path
7. Organizing The Schedule (Layouts)
8. Calculate The Schedule
9. Review Constraints
10. Prepare Plots And Prints
11. Complete The Schedule Review
Chapter 2
Schedule Review Steps

Defining The Critical Path

“Total Float Less than” option allows:
- Making all activities show as critical
- Making selected activities show as critical
- Making no activities show as critical
- Using constraints to force float calculations and drive the critical path

Recommend using “Longest Path”
# CPM Schedule Review Checklist for Original Schedules

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>NA</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Has the Contractor submitted a disk in accordance with time frames in special provision?</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Is the schedule submitted in specified format?</td>
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<tr>
<td></td>
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<td></td>
<td>Full CPM</td>
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<tr>
<td></td>
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<td>Is the schedule compatible with Primavera Project Planner or SureTrak as required?</td>
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<td>Has the Contractor identified a qualified Project Scheduler?</td>
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<td>Are all activity durations less than 20 working days?</td>
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<td></td>
<td></td>
<td>If not, are exceptions acceptable?</td>
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<tr>
<td></td>
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<td></td>
<td>Does the schedule follow the planned Traffic Control Plan?</td>
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<td></td>
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<td>If not, has the Contractor submitted a written request to change TCP?</td>
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<tr>
<td></td>
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<td></td>
<td>Is the project completion date within allowed number of working days and months?</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Days Allowed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Days Required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Has the Contractor included resource loading if required?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Is/are critical path(s) clearly discernible and accurately identified?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Is all contract work included?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Are activity durations reasonable for amount and complexity of work?</td>
</tr>
</tbody>
</table>
Highlights of the Guide

Chapter 1 - Development Of Critical Path Method Schedules For Contract Time Determination

Chapter 2 - Review Process For Original Schedules

Chapter 3 - Review Process For Updated or Revised Schedules

Chapter 4 - Time Impact Analysis Process For CPM Schedules
Chapter 3

Updated Schedule Review Process

1. Restore The Schedule
2. Open The File
3. Review The Schedule For Conformance To The Specifications
4. Set Up Target Schedules
5. Review Status Of Updated Schedule
6. Recalculate The Schedule
7. Prepare Plots And Prints
8. Decide If The Schedule Has Been Updated Or Revised
9. Document The Schedule Update Status
10. Prepare Look-ahead Schedule Plot
Chapter 3
Updated Schedule Review Process

Update or Revision?

- A *schedule update* is defined as the addition of actual start dates and/or actual finish dates to activities that have been started and/or completed, and revising the percent complete figure or the remaining duration figure for started activities.

- A *schedule revision* is defined as adding or deleting activities, relationships, resources, or any other component of the schedule, or changing durations.
## Project Schedule Status Report

**Project:** STP 2005(01)  
**CSJ:** 0001-01-001

<table>
<thead>
<tr>
<th>Schedule Name</th>
<th>Data Date</th>
<th>Completion Date</th>
<th>Working Days</th>
<th>Calendar Days</th>
<th>Working Days</th>
<th>TxDOT Loss</th>
<th>Calendar Days</th>
<th>Working Days</th>
<th>Explanation for Loss/Gain</th>
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<tbody>
<tr>
<td>GUOR</td>
<td>5/1/2000</td>
<td>11/30/2000</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Good production on subgrade widening</td>
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<tr>
<td>GU02</td>
<td>7/1/2000</td>
<td>12/14/2000</td>
<td>112</td>
<td>-29</td>
<td>-14</td>
<td>-3</td>
<td>8</td>
<td>14</td>
<td>0 4 working day delay, Time Suspension already granted - compare GU02 to GUOR</td>
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<tr>
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<td>8/1/2000</td>
<td>12/14/2000</td>
<td>112</td>
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<td>-14</td>
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<tr>
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<tr>
<td>GU07</td>
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<td>12/14/2000</td>
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<td>-3</td>
<td>8</td>
<td>14</td>
<td>0 4 working day delay, Time Suspension already granted - compare GU02 to GUOR</td>
</tr>
</tbody>
</table>

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### Working Days

**Calendar Days**
- **Period Gain/Loss:**
  - GU02: 7/1/2000 to 12/14/2000
  - GU03: 8/1/2000 to 12/14/2000
  - GU04: 9/1/2000 to 12/14/2000
  - GU05: 10/1/2000 to 12/14/2000
  - GU06: 11/1/2000 to 12/14/2000
  - GU07: 12/1/2000 to 12/14/2000
  - GU08: 1/1/2001 to 3/30/2001
  - GU09: 2/1/2001 to 5/22/2001
  - GU10: 3/1/2001 to 5/22/2001

**Cumulative Gain/Loss:**
- GU02: 7/1/2000 to 12/14/2000
- GU03: 8/1/2000 to 12/14/2000
- GU04: 9/1/2000 to 12/14/2000
- GU05: 10/1/2000 to 12/14/2000
- GU06: 11/1/2000 to 12/14/2000
- GU07: 12/1/2000 to 12/14/2000
- GU08: 1/1/2001 to 3/30/2001
- GU09: 2/1/2001 to 5/22/2001
- GU10: 3/1/2001 to 5/22/2001
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Chapter 4
Time Impact Analysis

Types of Time Impact Analyses

- The As-Planned Impacted Schedule Analysis
- The As-Built But-For Schedule Analysis
- The Contemporaneous Schedule Analysis
Chapter 4
Time Impact Analysis

Time Impact Analysis Steps – Contemporaneous Approach

1. Determine the status of the project immediately before the impact begins.
2. Predict the effect of the impact on the project completion date.
3. Track the status of the project during the impact.
4. After the impact is over, determine the status of the project and compare it to the status before the impact began.
Chapter 4
Time Impact Analysis

Time Impact Analysis Steps – Two Different Approaches

1. Pre-Impact TIA
   - Includes Steps 1 and 2 only

2. Post-Impact TIA
   - Includes Steps 1, 2, 4 and possibly 3 if impact is long duration
Where to get the Guide

http://www.dot.state.tx.us/cst/construction_strategies.htm
Future Developments

- Planned Revision for 2004 Spec Book
- Possible conversion to P3 e/c
- Addition to SAT District Construction Office Intranet Website, along with other tools
Questions?
Thank You!

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