

# Why your linear project needs linear schedules

and how to create from your CPM Schedules

# Contents

- The problem today
- What are Linear Schedules?
- The benefits of using Linear Schedules
- Methods of creating Linear Schedules
- Using CPM schedules to create Linear Schedules
- Hints and Tips

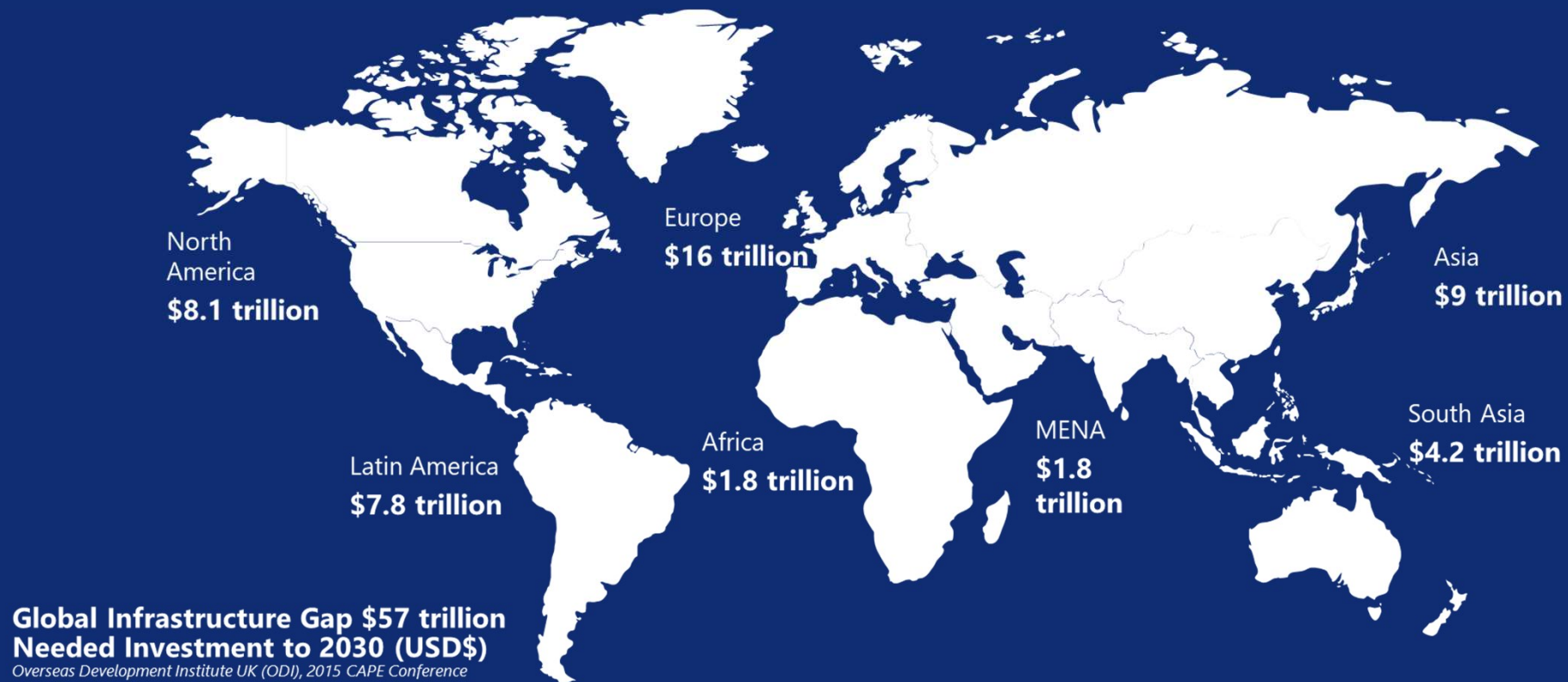
# Context - Infrastructure

- Modern infrastructure is central to economic development and to quality of life.
- From the roads and railways needed to transport people and goods, to the power plants and communications networks that underpin economic and household activity, to the basic human need for clean water and sanitation

*(Oxford Economics, Global Infrastructure Outlook (July, 2017))*



# Why worry about Infrastructure projects?



# Project Risk!

01

## Approvals

Environmental, Planning and Regulatory Approvals  
Site Access / Land Acquisition  
Financing

02

## Design

Review and Approval periods  
Design Scope Growth (time for design)  
Sustainable design

03

## Procurement

Equipment Availability  
Production / Manufacturing Lead times  
Shipping / Transit

04

## Site Establishment / Enabling Works

Land Acquisitions and access to Sites  
Utilities  
Demolition / Contamination

05

## Operations

Productivity  
Resource Availability  
Material Supply  
Access Restrictions  
Interfacing and Interferences from other operations  
Plant & Equipment Failure

06

## Project Wide Issues

Weather  
Industrial  
Safety  
Community  
Environmental  
Multi-Project Interfaces

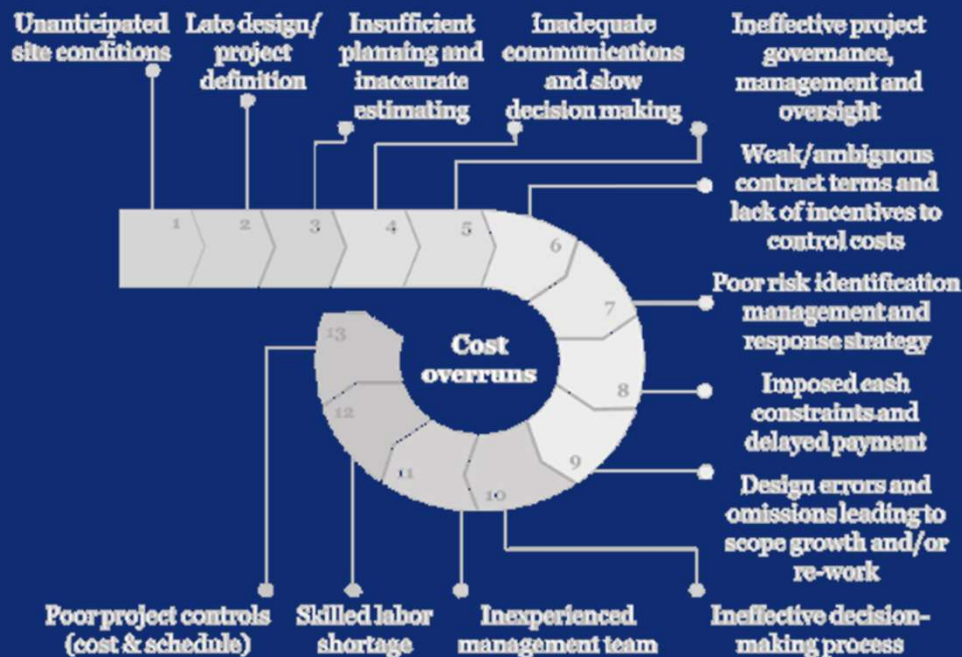
07

## Systemic Risks

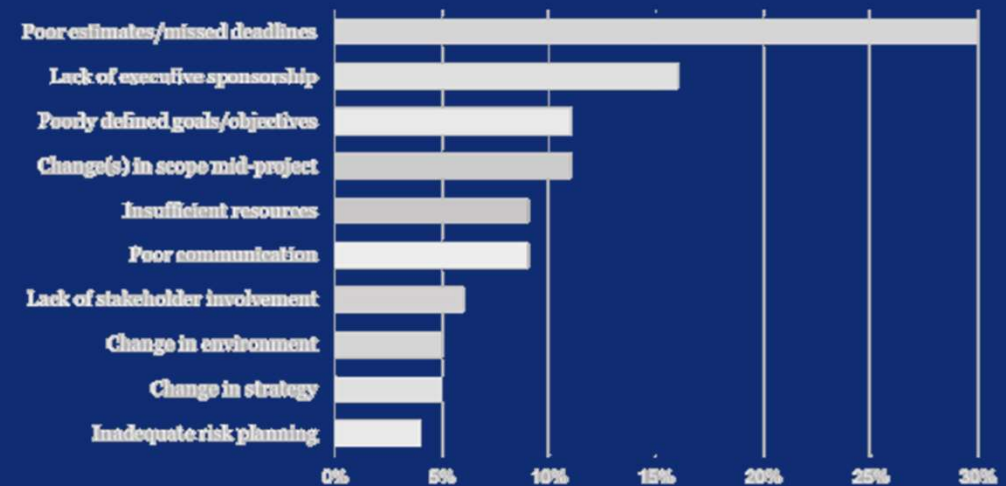
Company Culture  
Maturity  
Complexity  
Political



# What causes problems?



## Why do projects veer off course?

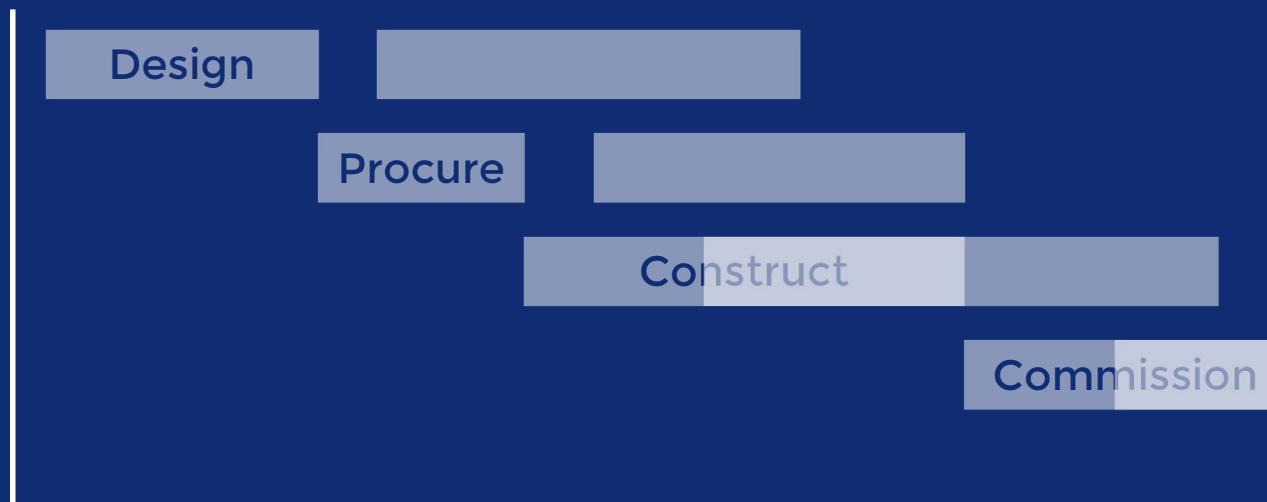


Source: *Insights and Trends: Current profiles, Programs, and Project Management Practices* (Third global survey on the current state of project management, PwC, 2012)

# Schedule Preparation



# The End Result





# What are Linear Projects?

- Works progress in a repetitive manner and/or in continuous linear directions over the project's physical location
- Works occur in a fixed locations that interface with the linear works
- Classic examples of linear projects include:



ROADS



TUNNELS



LINEAR  
NETWORKS



VERTICAL  
BUILDINGS

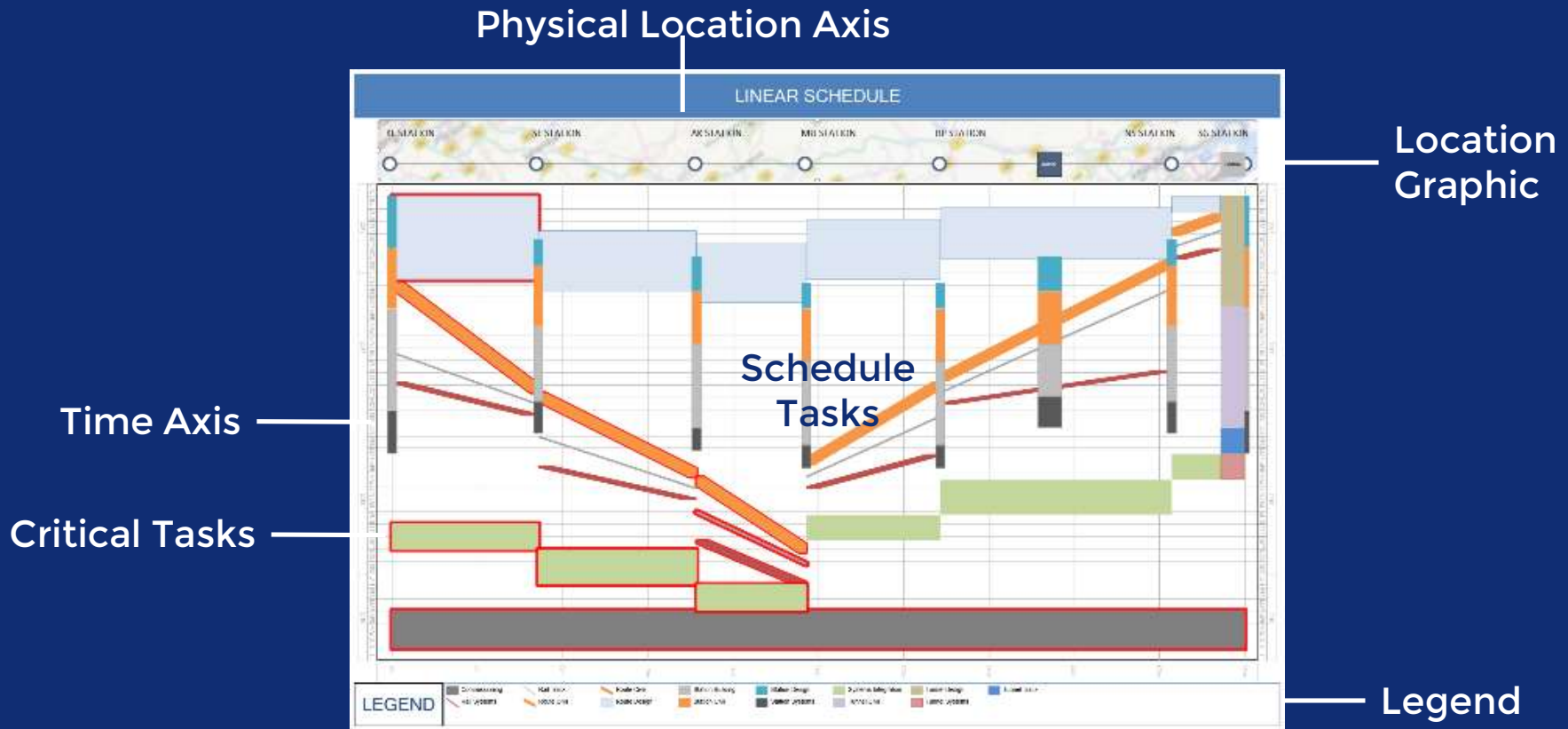


RAILWAYS

# What are Linear Schedules

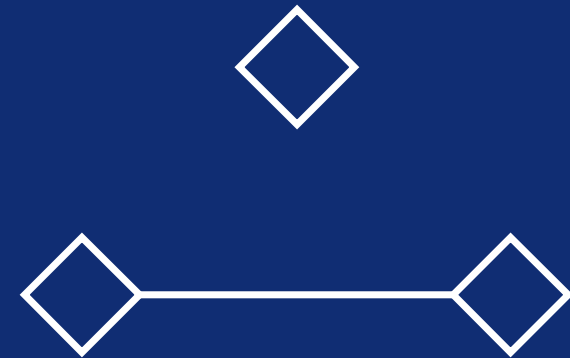
- An alternative method of presenting schedules
- One axis represents time, second axis represents physical locations
- Other names include:
  - Time Distance (TD) charts,
  - Time Chainage charts,
  - Line of Balance,
  - March Charts,
  - Flow Lines,
  - Location Based Schedules,
  - Velocity Diagrams

# Key features of Linear Schedules



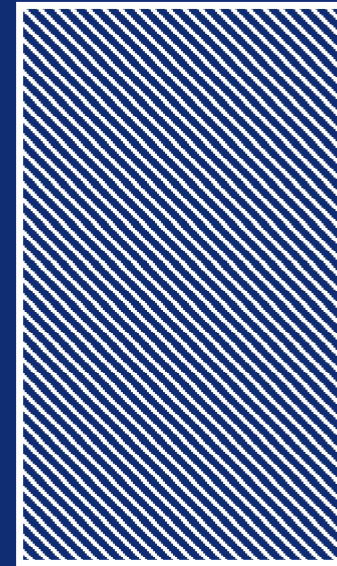
# Representing Tasks - Milestones

- Milestones for specific points in time
- But can also cover a specified linear range



# Representing Tasks - Areas

- Represent tasks that occupy specified region over a time range.
- No direction or rate of progress
- Production rate is implied by duration





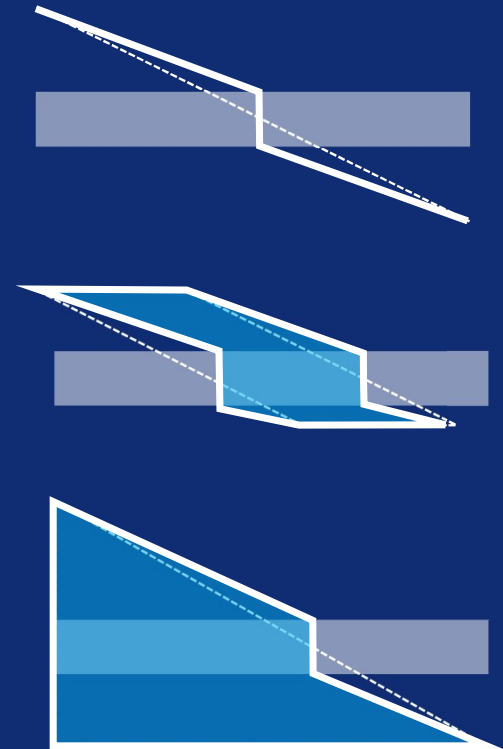
# Representing Tasks - Gradients

- Lines, Parallelograms, Triangles
- Angle of the gradient represents rate of production
- Directional



# Representing Tasks - Gradients

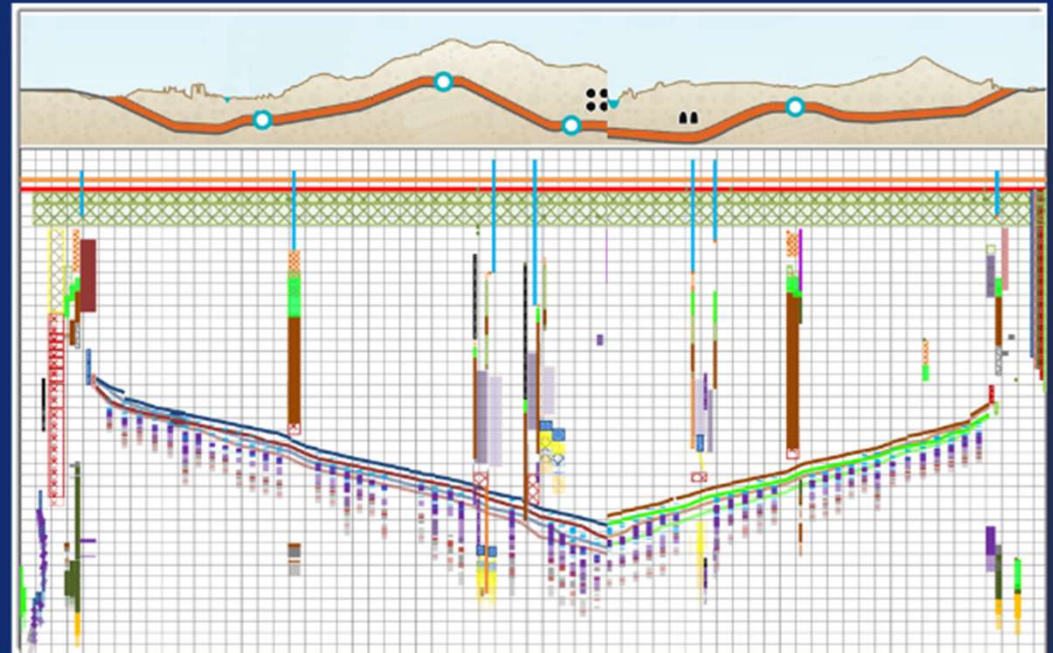
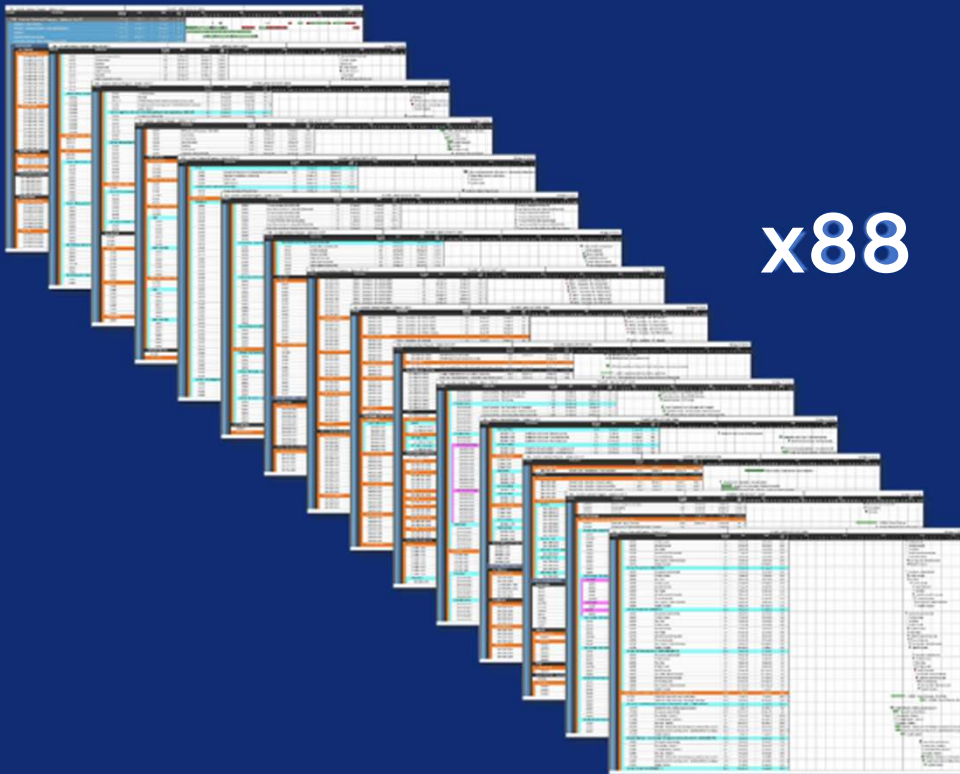
- Can also represent non-work periods



# Why Use Linear Schedules?

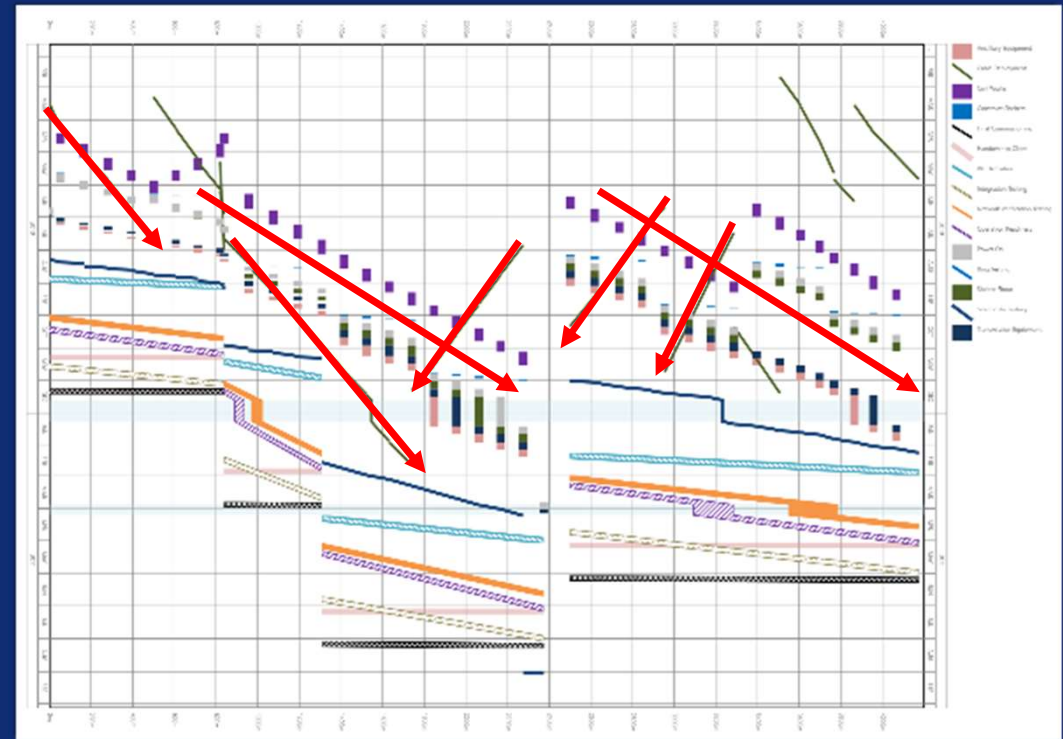
- Improve schedule communication and analysis
- Engage and inform wider audiences
- Replace traditional Gantt chart reports with a single page

# Why Use Linear Schedules?



# Work and Crew Sequence are clear and readily identified

- Sequencing and direction of works/crews
- Rates of Progress





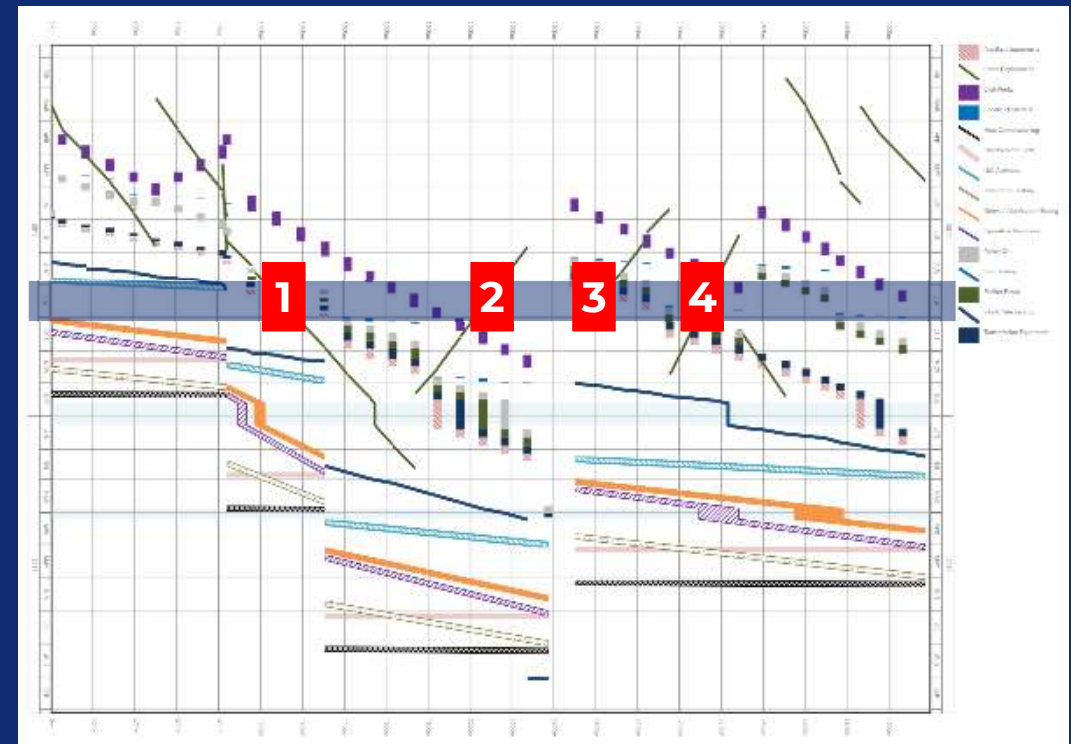
# Clashes and Schedule Errors

- Intersection of tasks – can this physically occur?
- Identify issues and errors with durations, logic or methodology



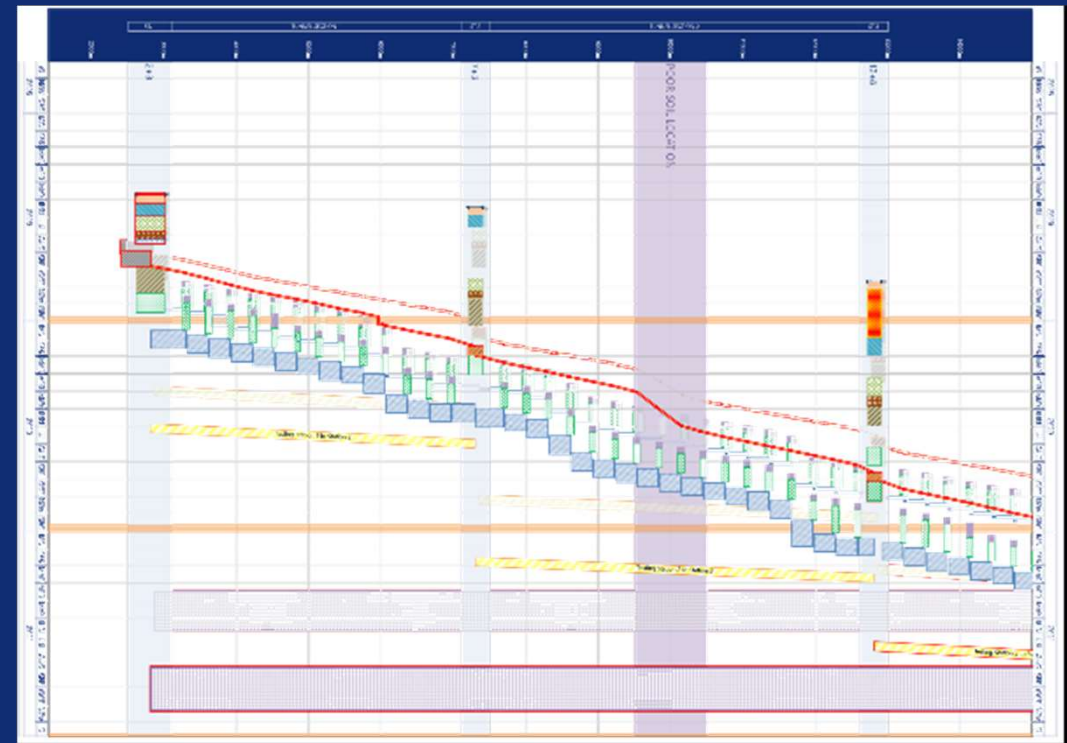
# Visual Resource Analysis

- Assess works performed through any given period
- Identify the location of resources



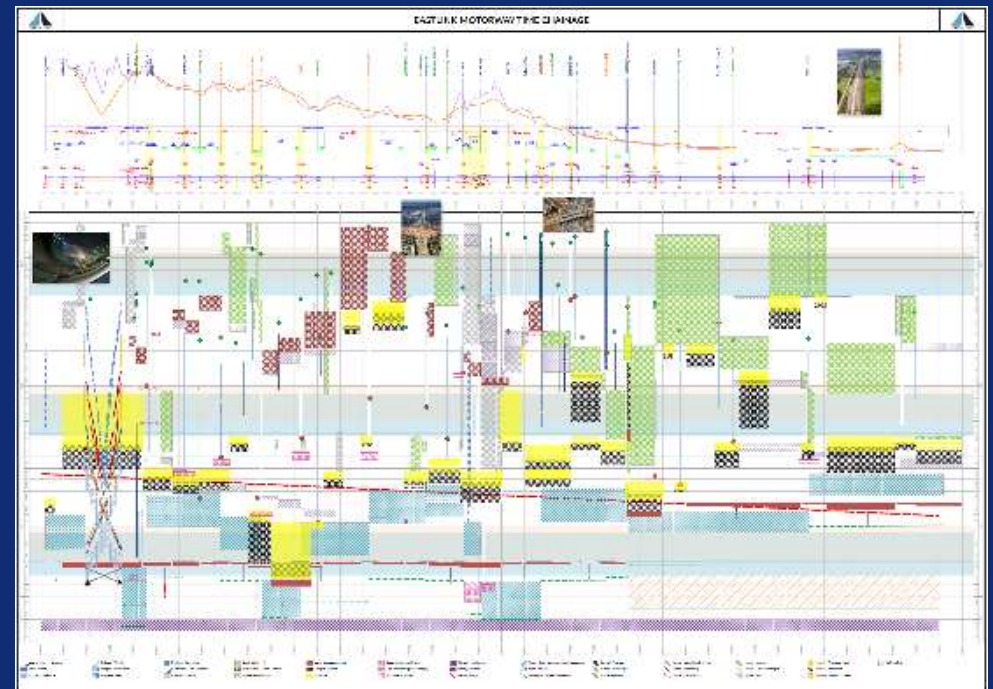
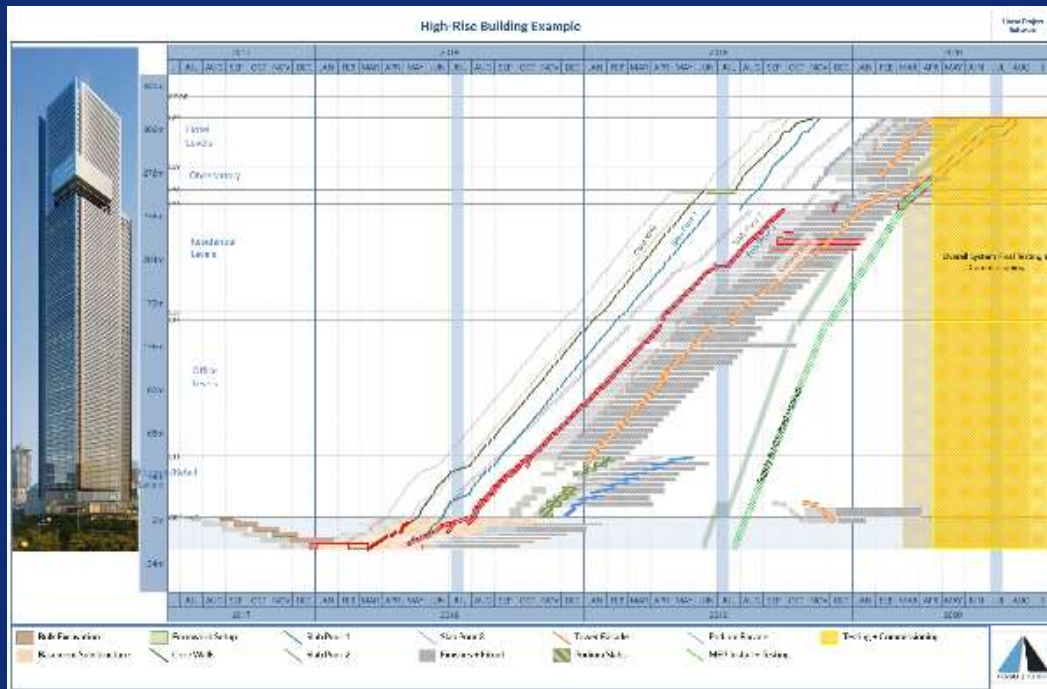
# Schedule Comparisons

- Compare scenarios



# Linear Schedule Examples (# of Tasks displayed)

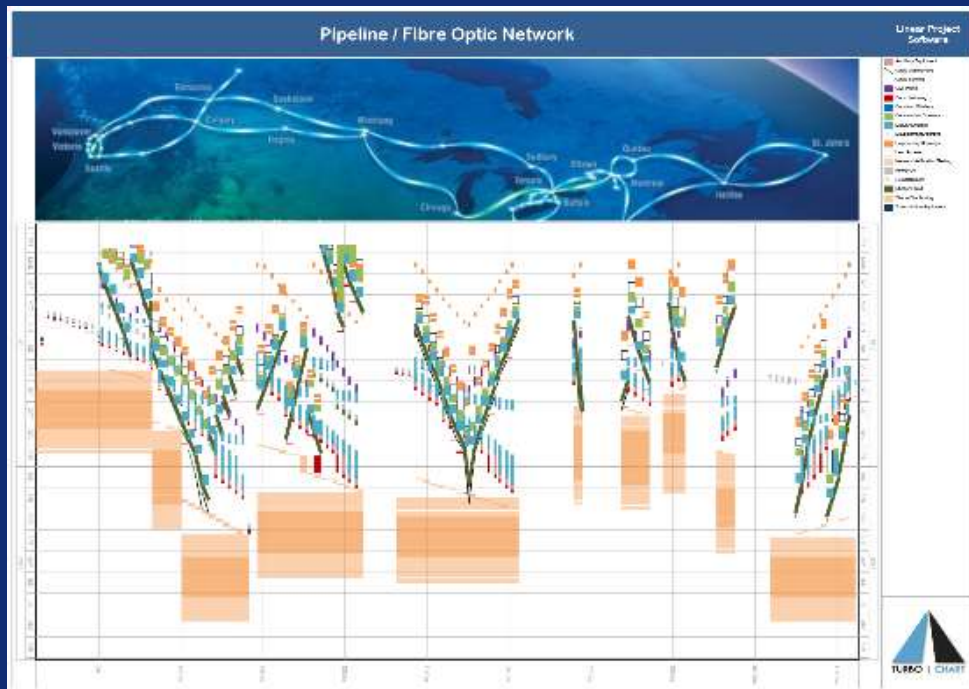
- Vertical High Rise Building (455)
- Motorway Construction (930)



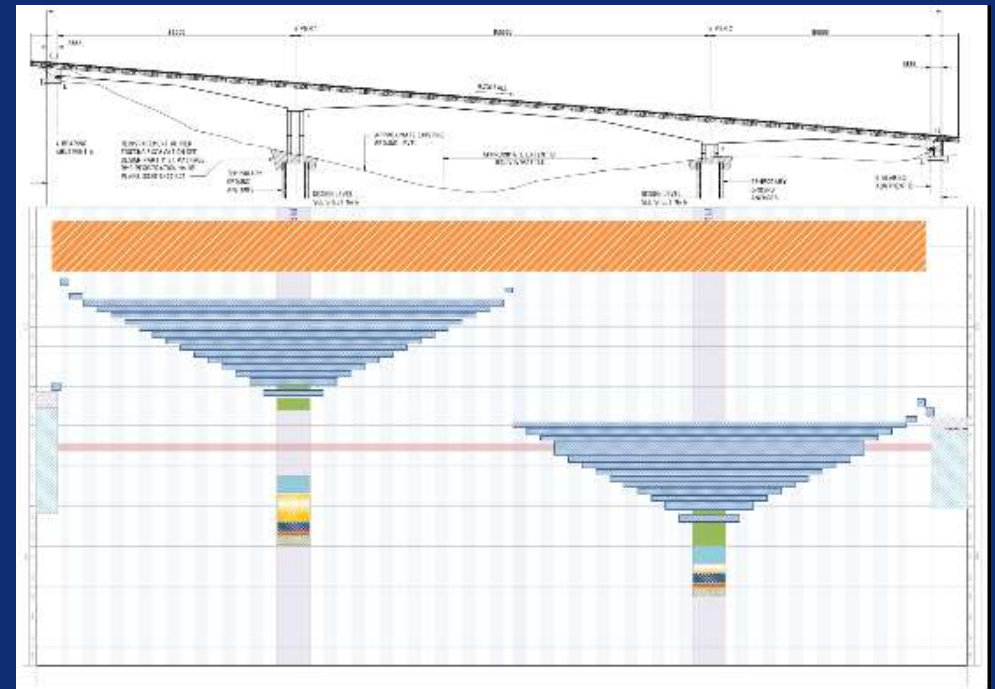


# Linear Schedule Examples (# of Tasks displayed)

- Fibre Optic Network (3,605)

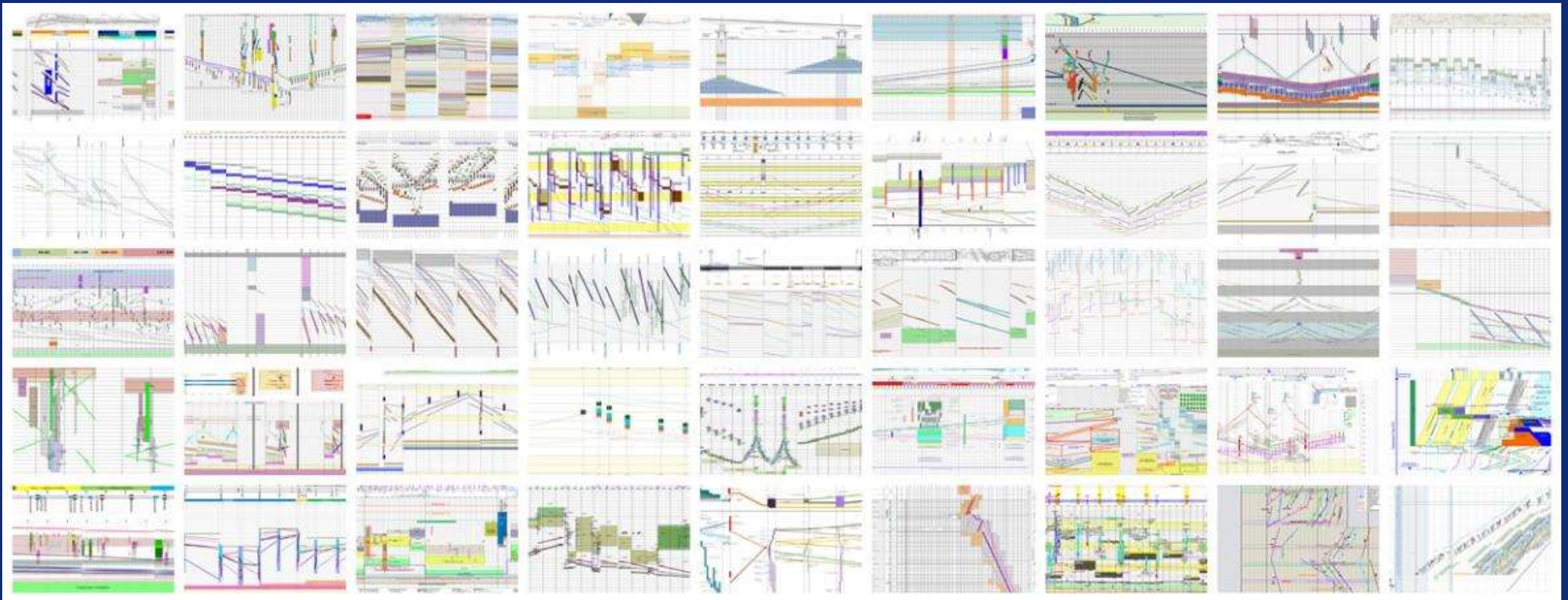


- Segmental Bridge (248)





# Linear Schedule Examples



# How to Create Linear Schedules

## Bespoke Tools

- AutoCad, Graphical Tools, Spreadsheets
- Manual interpretation of schedule data, can be prone to translation errors
- Limited capabilities on presentation
- Non-scalable solution

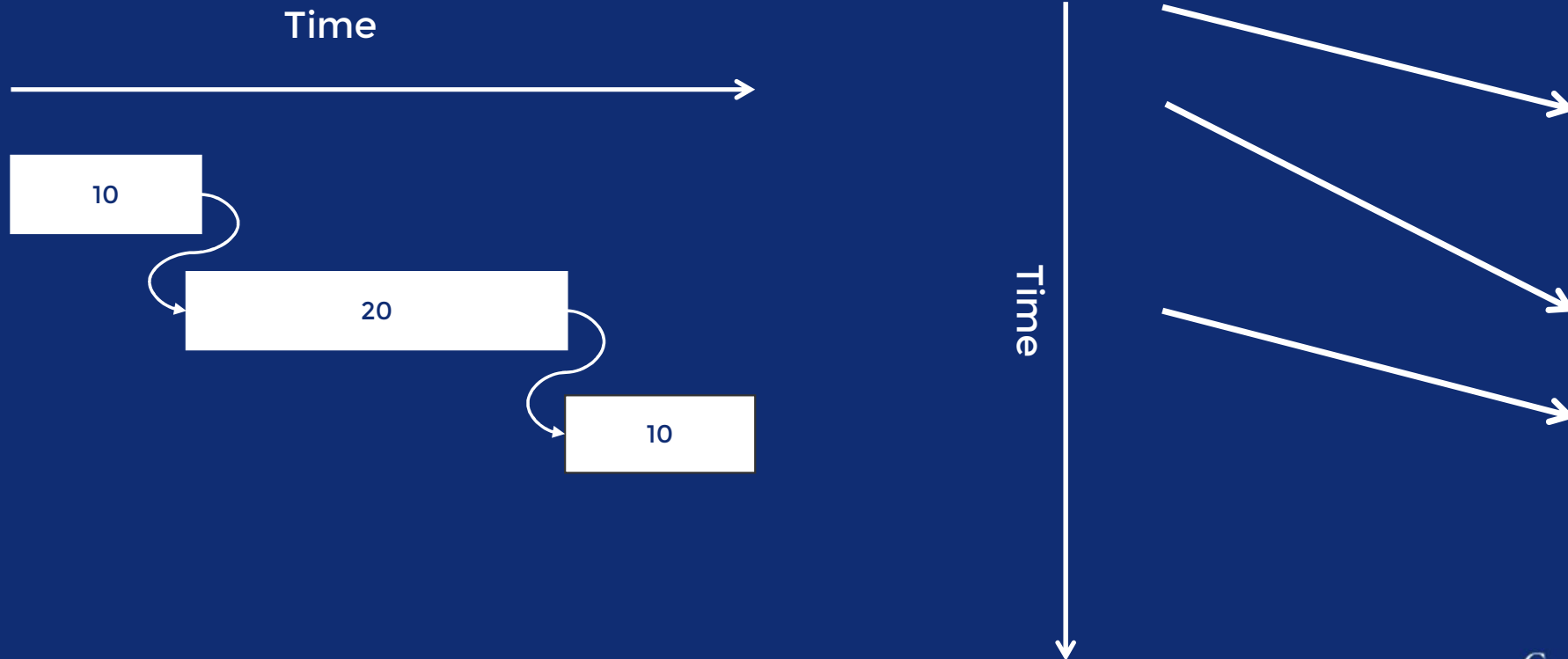
## Specialised Tools

- Ideal for Location Based or Linear elements of project
- Manipulate Linear Schedule to re-calculate schedule
- Expensive
- Complex
- Difficult to learn
- May duplicate schedule

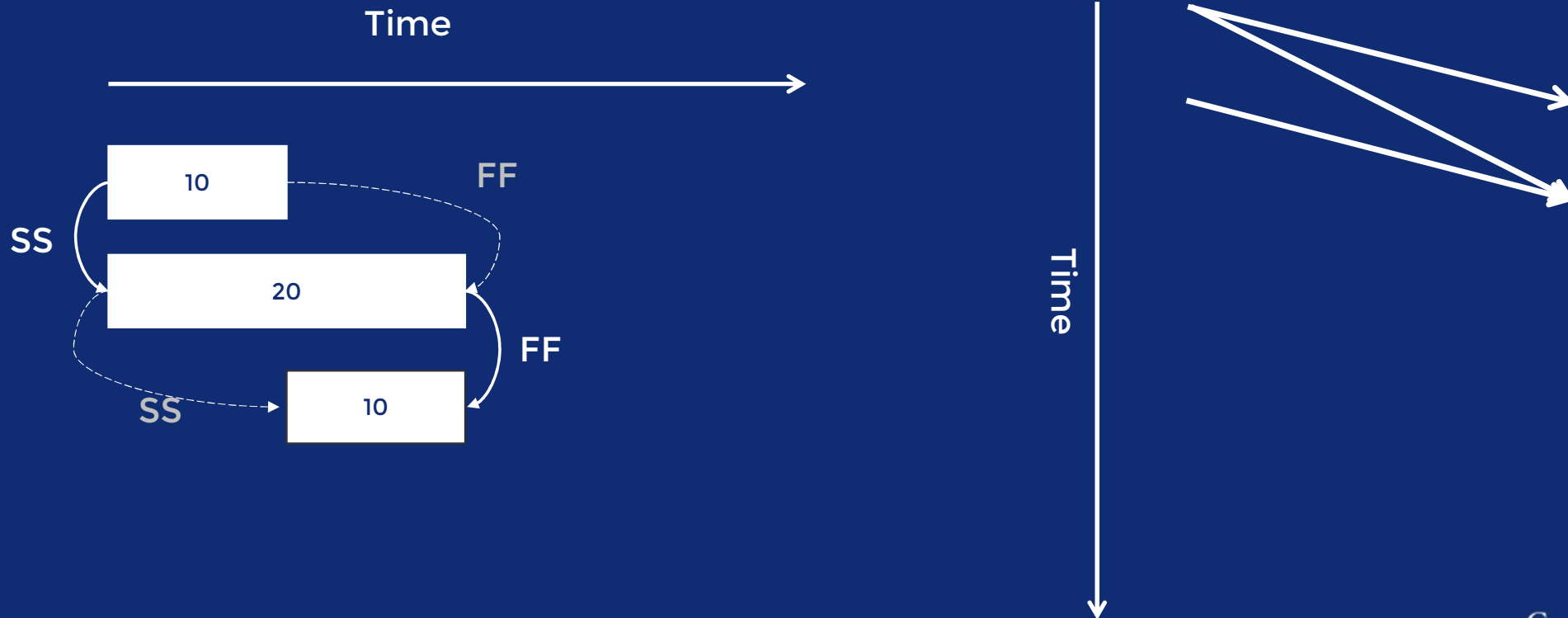
# Hybrid method for Linear Schedules

- Append Data to existing CPM Schedules
- Exchange Data from CPM schedule to Linear Schedule (one way)
- Modifications/Updates are made in CPM schedules
- Linear Schedule is updated to reflect changes

# CPM Logic in Linear Schedule Format

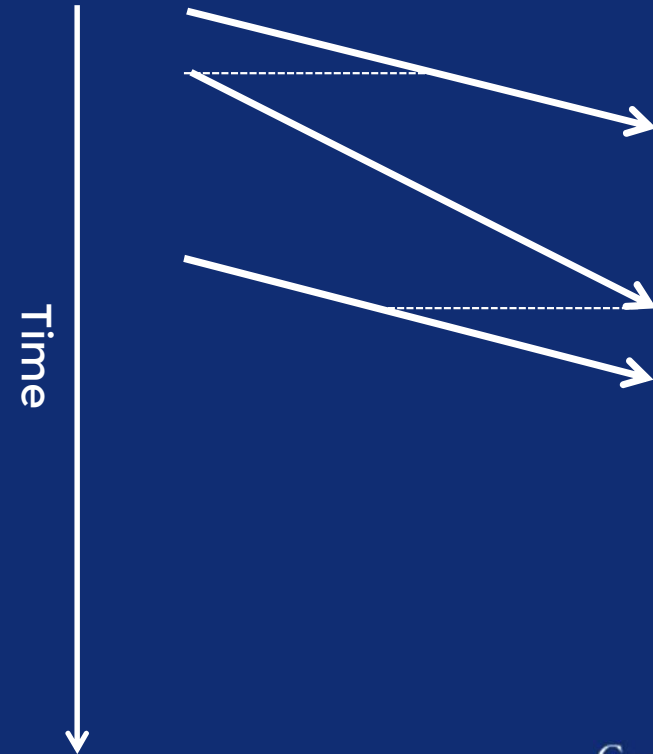
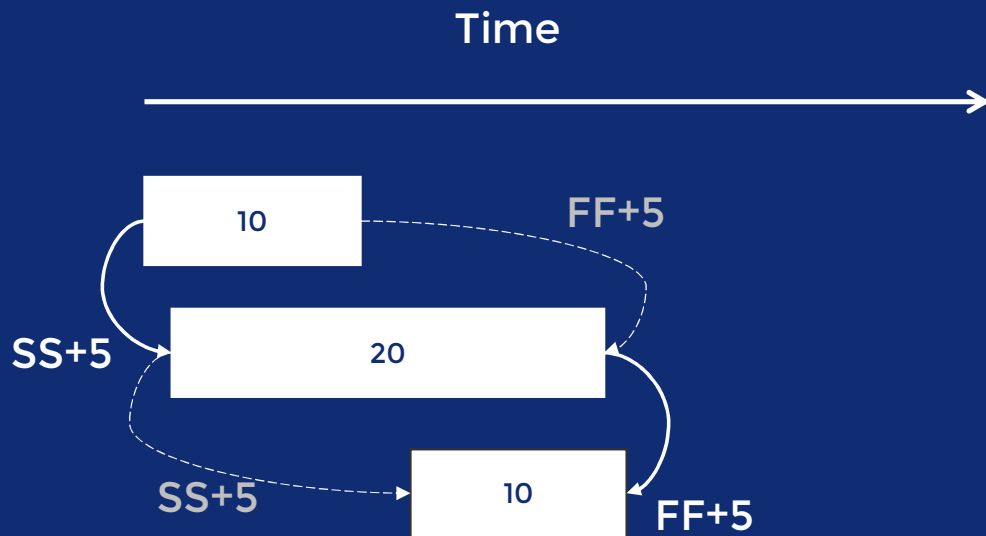


# CPM Logic in Linear Schedule Format



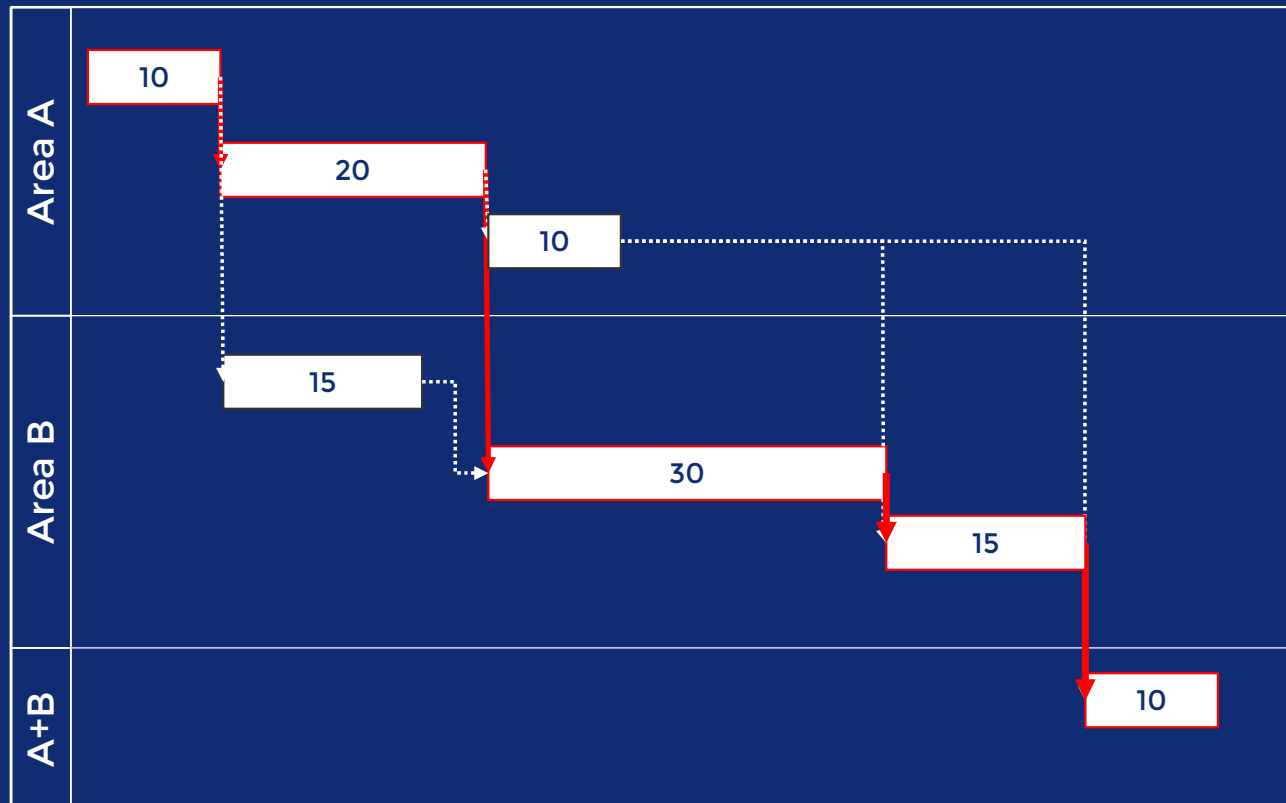


# CPM Logic in Linear Schedule Format



# Worked Example

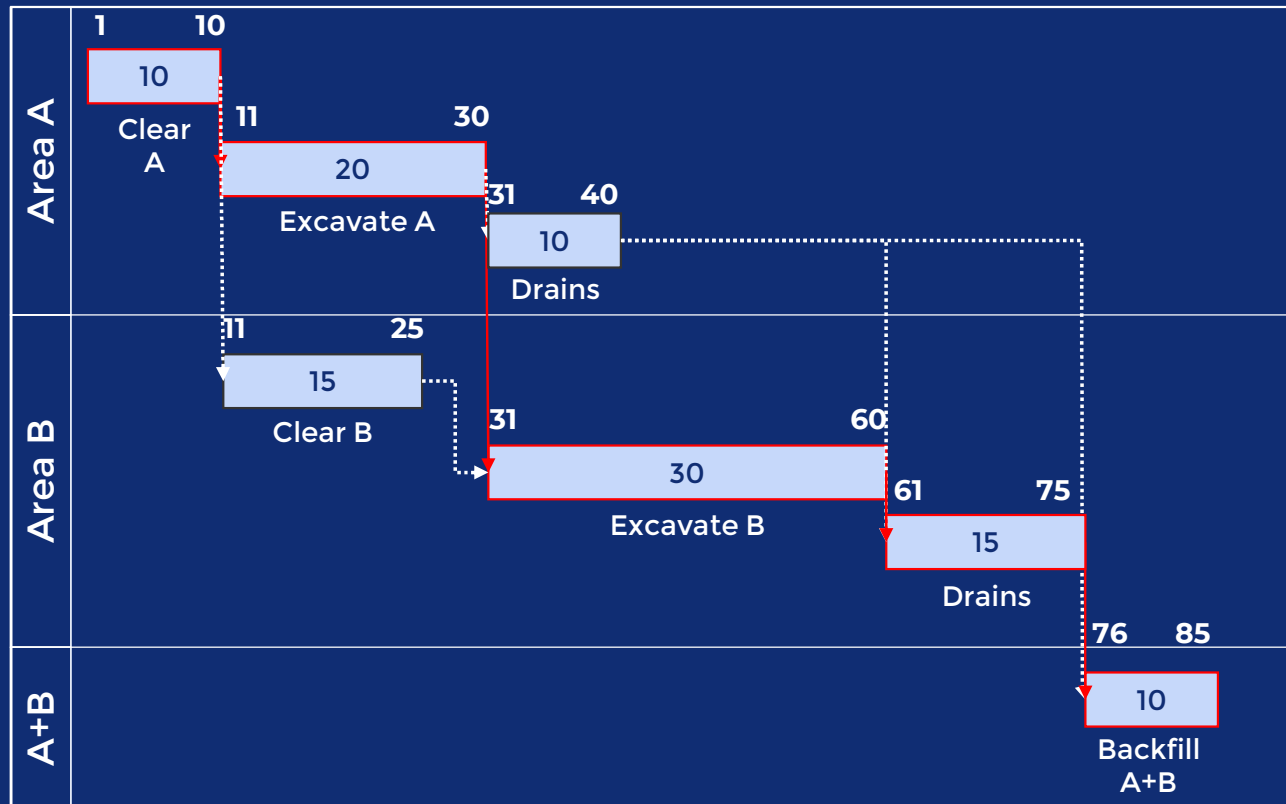
## Traditional CPM Schedule



- Construct Schedule as normal
- Works are divided into Area A + Area B
- Area B is 50% greater effort than A
- Includes one task that spans both areas

# Worked Example

## Determine Start and End Dates



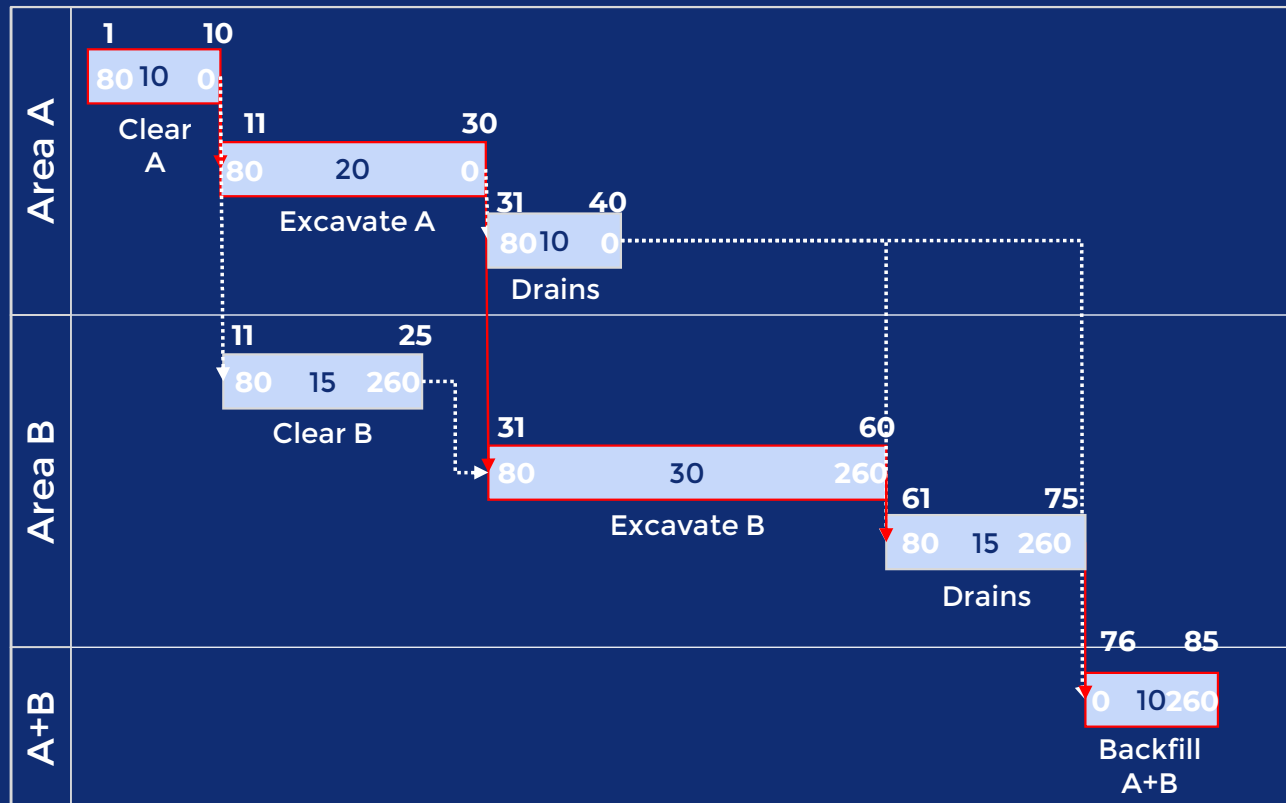
- Durations + Logic determine Dates

# Linear Alignment

- Use Project Alignment details to location values/codes for activities
- May use Zones or Areas of work to define the start + End locations
- Can also use any values along the continuous alignment

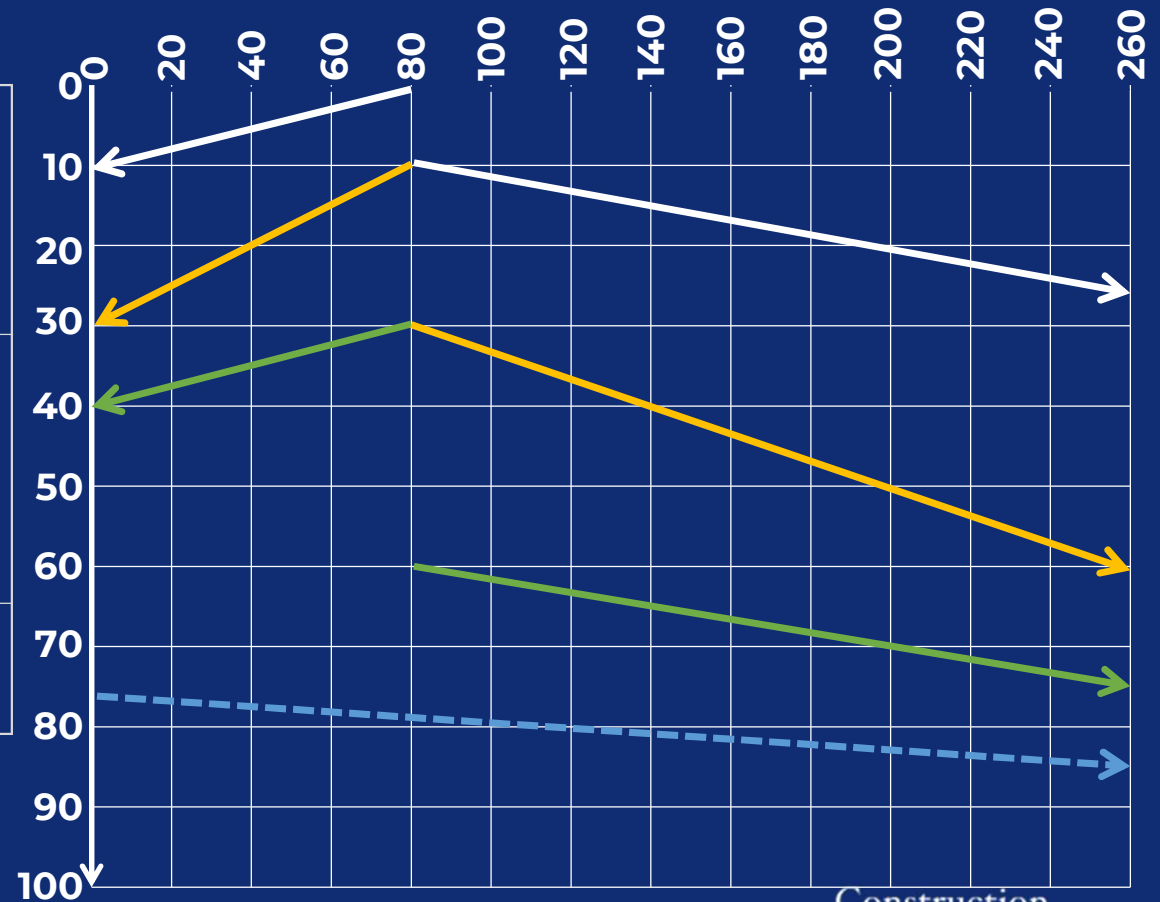
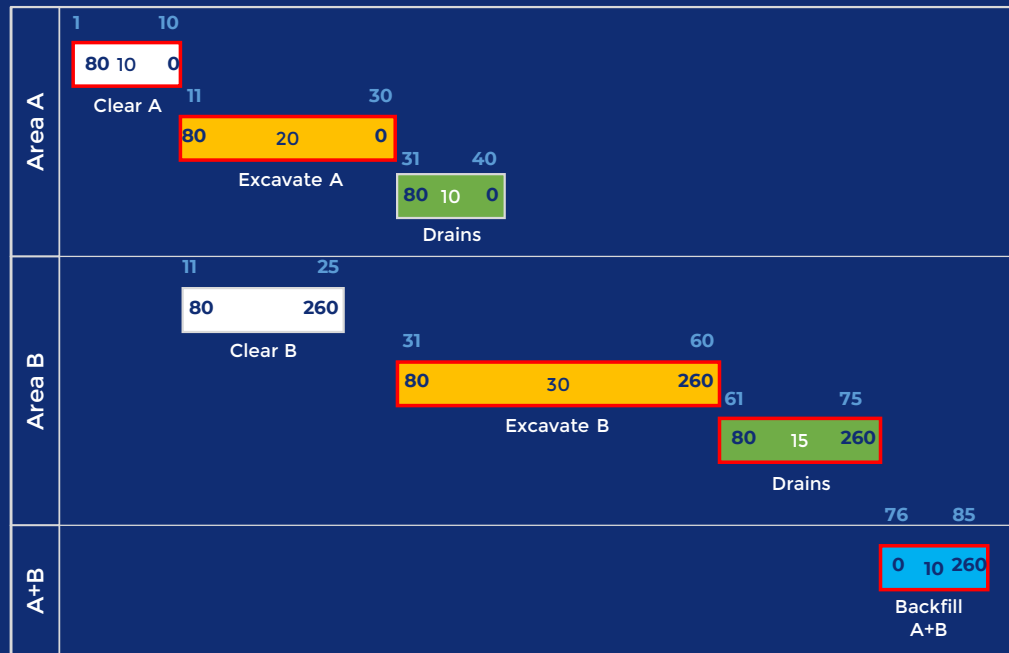


# Worked Example



- Location values for schedule tasks are known
- Add additional data for:
  - Start Location Value
  - Finish Location Value
- Note: order of start/finish is determined by the direction of the linear work

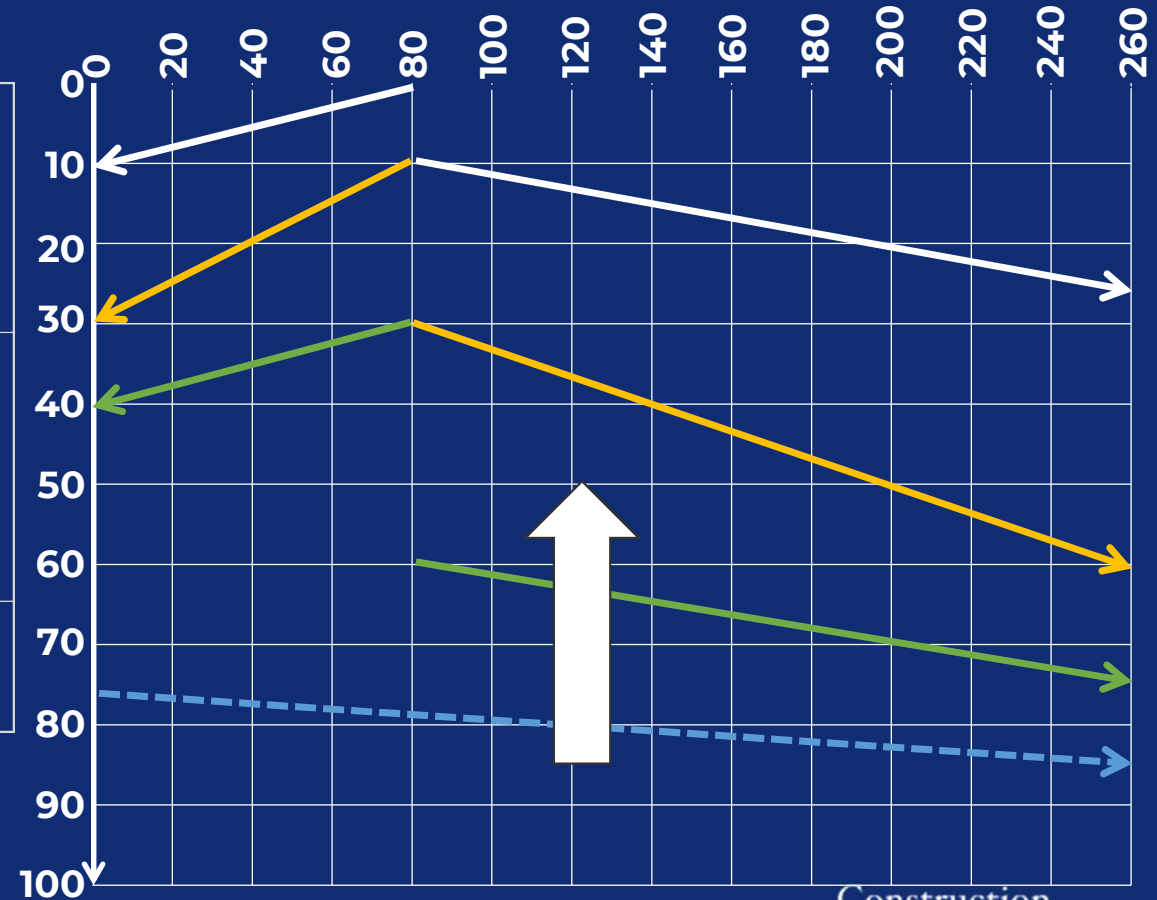
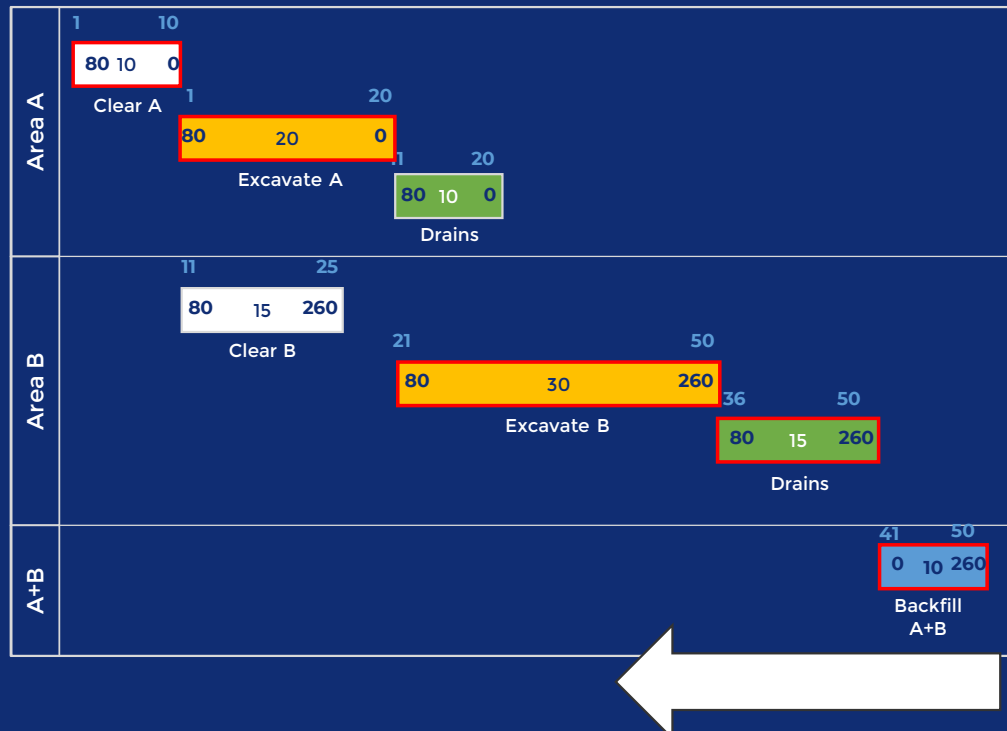
# Worked Example





# Worked Example Optimised

50d vs 85d



# About Turbo-Chart

## LINEAR PROJECT SOFTWARE Pty Ltd



**Santosh Bhat**  
CEO/Co-Founder  
Sydney, Australia

20+ years Infrastructure Planning  
/ Scheduling & Project Controls



**Russell "Rusty" Johnson**  
CTO/Co-Founder  
London, United Kingdom

20+ years Software Development  
CTO / Co-Founder of Sharp Cloud and Pertmaster

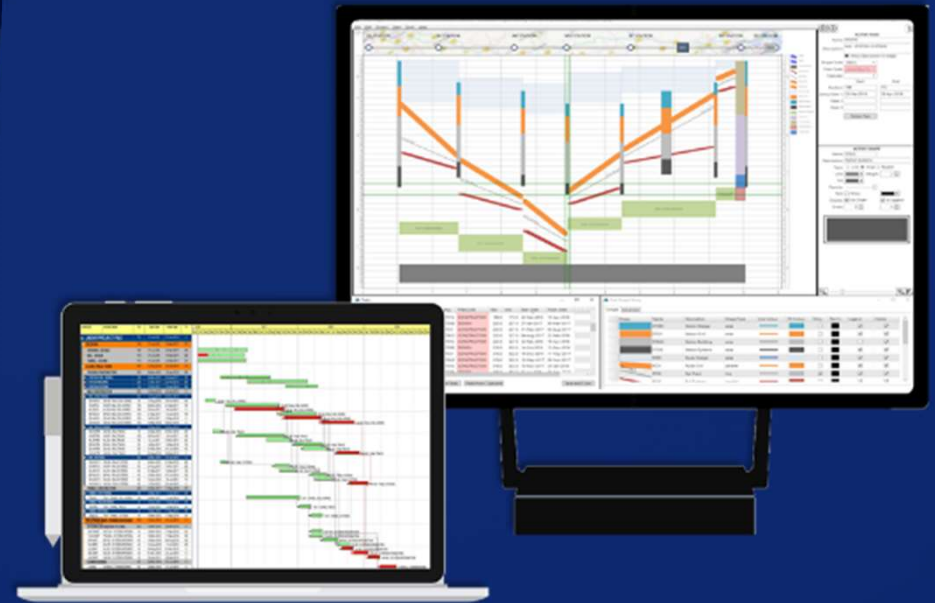
# “User Friendly”

## 1 Work with existing tools

Turbo-Chart is designed to work side-by-side with existing scheduling tools, not to replace them, without complicated import processes, allowing the data to be in a single source schedule

## 2 Quick to Learn, Easy to Use

Avoid training and learning complicated new scheduling tools, focus on Planning and Scheduling rather than spending time and effort in preparing and checking charts



**ORACLE®**  
PRIMAVERA



Safran Risk™



**Powerproject®**



# Turbo-Chart Features

Multiple  
Charts

Chart  
Annotations

Multiple  
Datasets

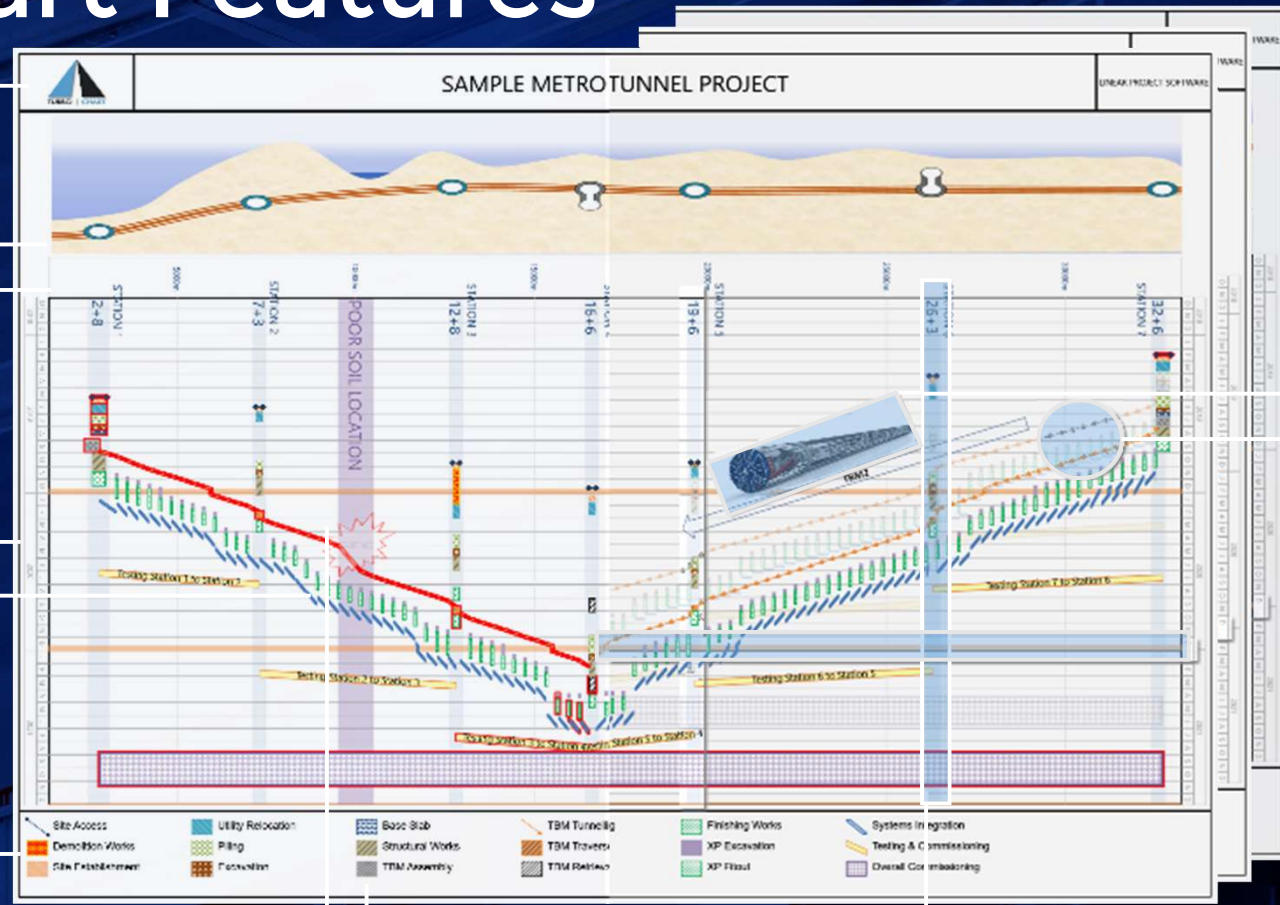
Schedule Activities

Time Grid

Location Grid

Chart Image

Print Layouts



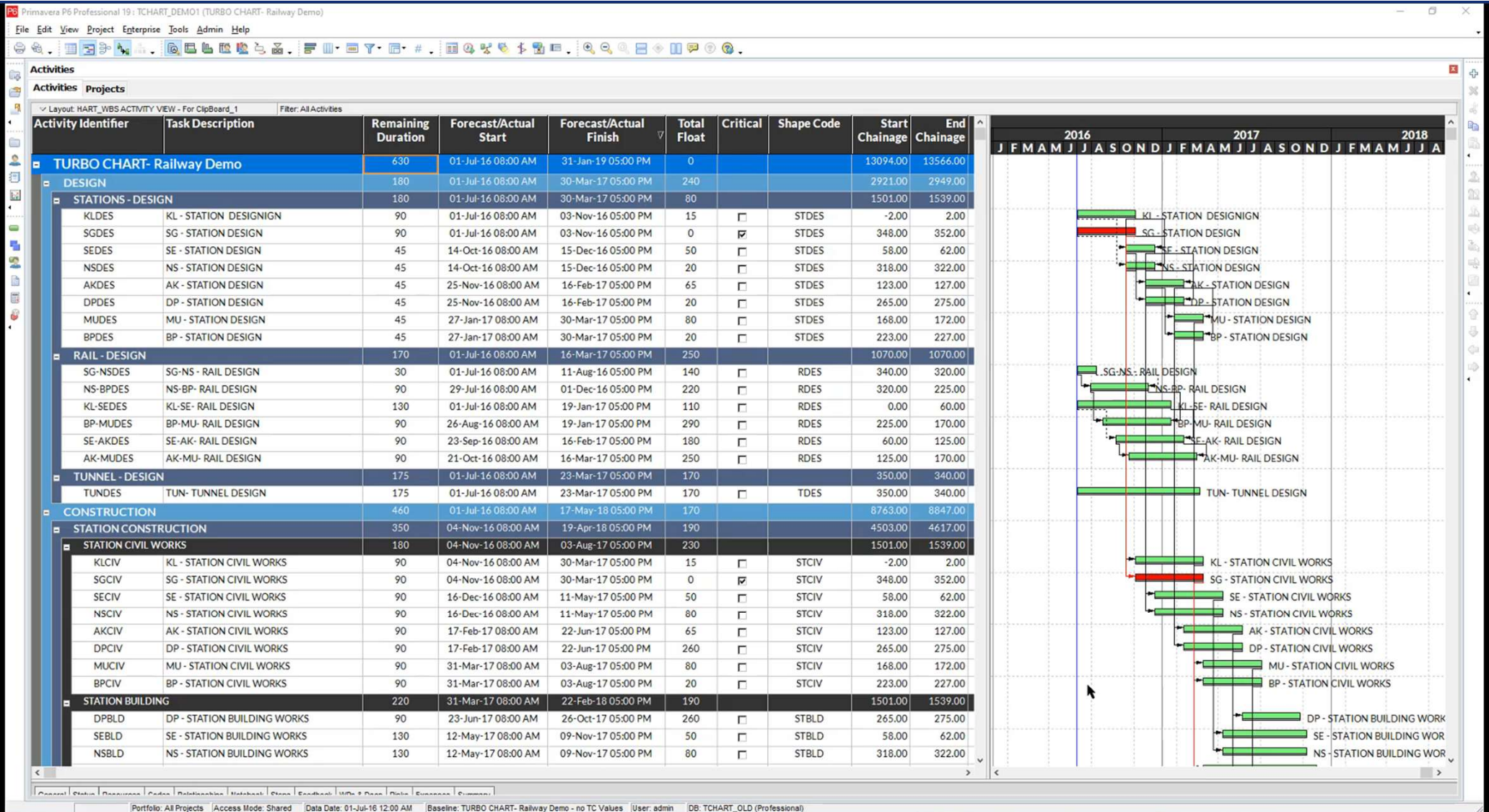
Critical Paths

Chart Legend

Chart Highlighters


# Demo Video





# Hints and Tips

- Use patterns, colours, line styles to distinguish tasks

	Utility Identification
	Install Traffic Barriers
	Clearing & Demolition
	Trenching
	Install Conduits
	Utility Approval Period
	Excavation
	Remove Stormwater
	Install New Drainage

	Substation
	Install Signals
	Backfill Conduits
	Backfill to Pavement
	Retaining Wall
	Street Lighting
	Cut Over Utilities
	Decommission Utilities
	Subsoil Drainage

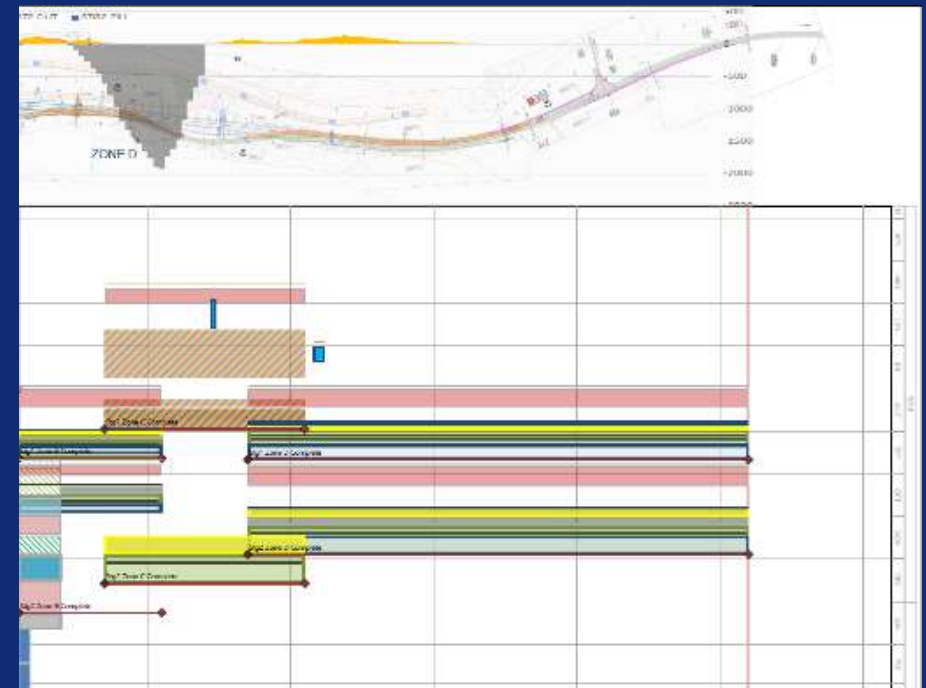
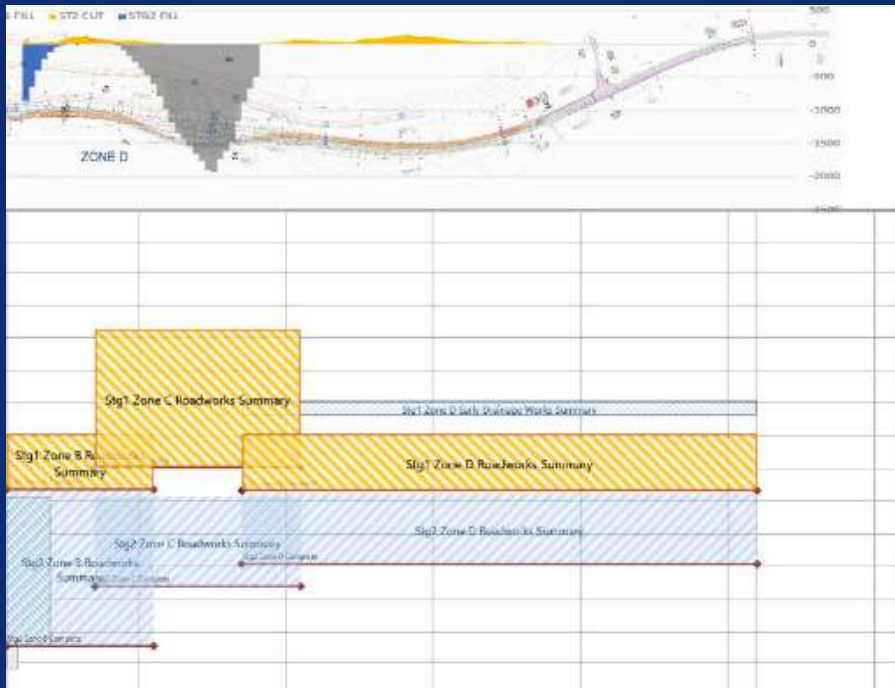
	Lean Mix + Curing
	No Fines Concrete + Kerb
	Final Concrete
	Flexible Pavement
	Landscaping, Kerbs & Gutters
	Signs, Linemarking + Road Furn.
	Bus Stop Relocation

# Hints and Tips

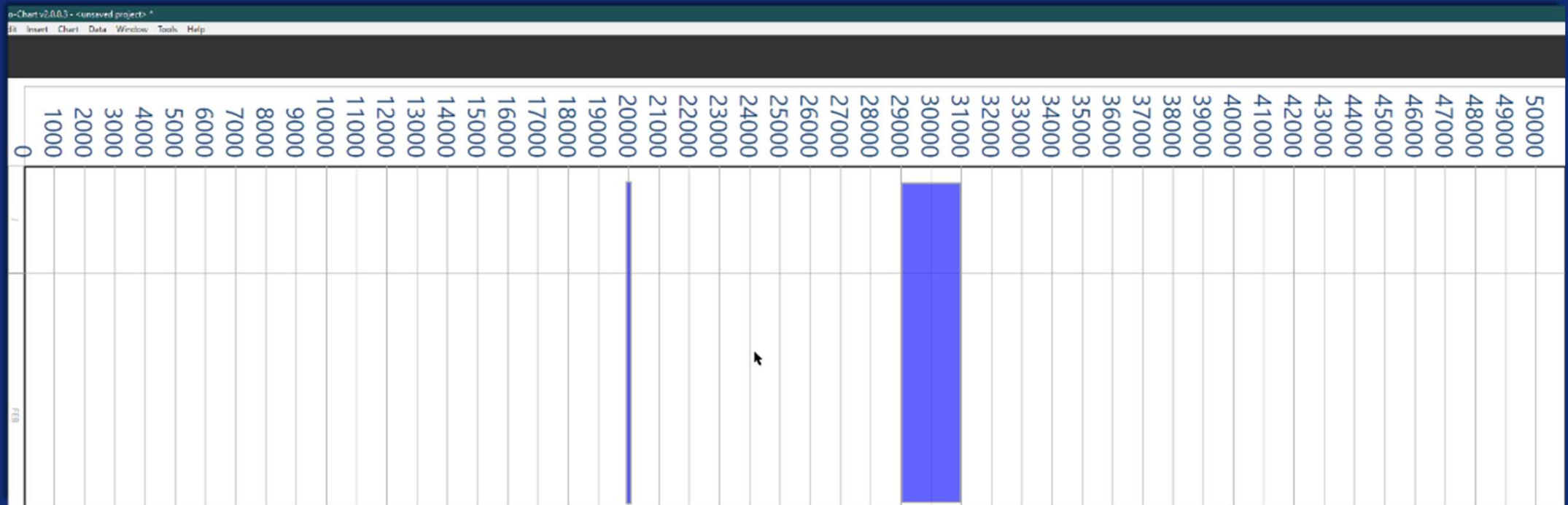
Summary

vs

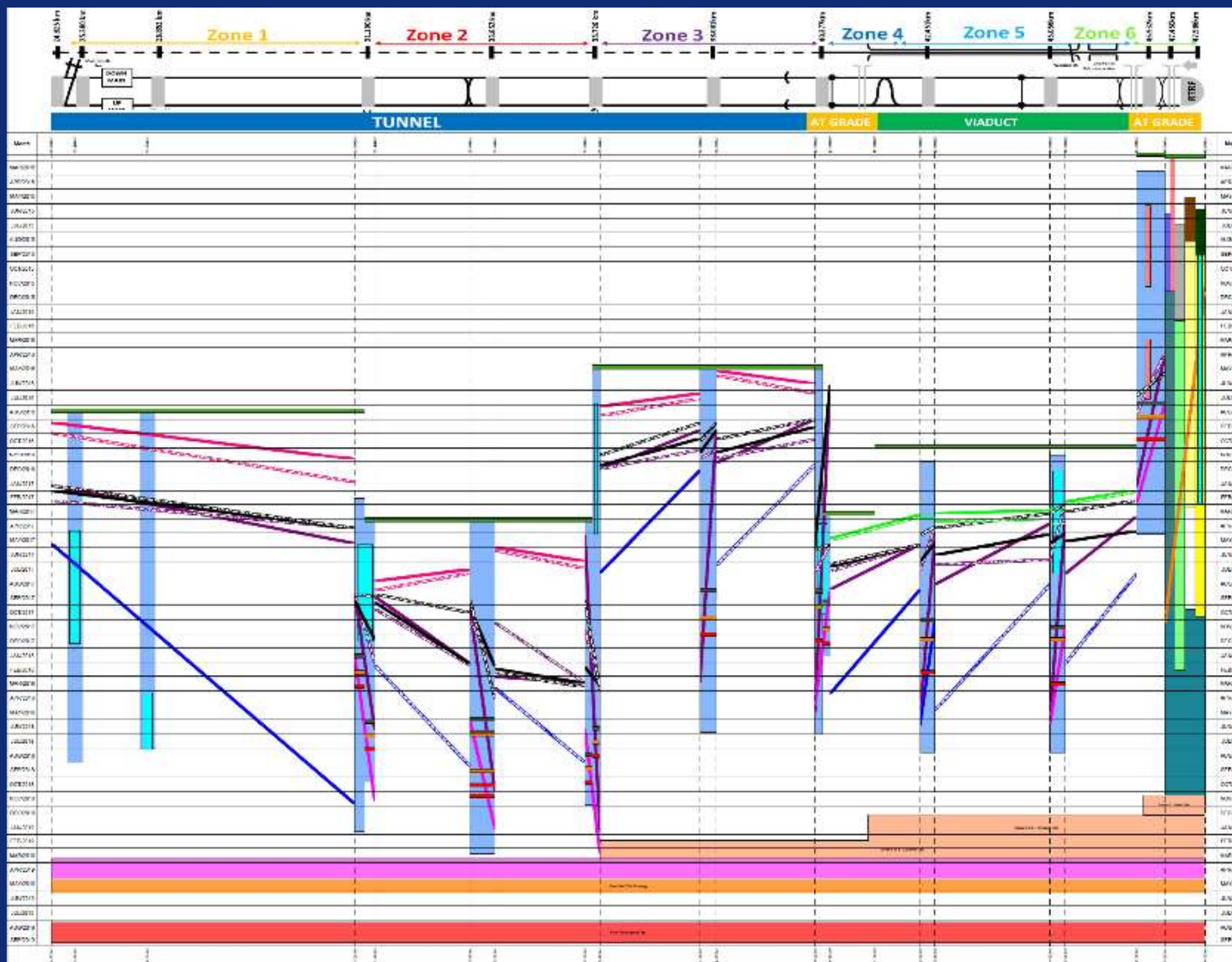
Detail



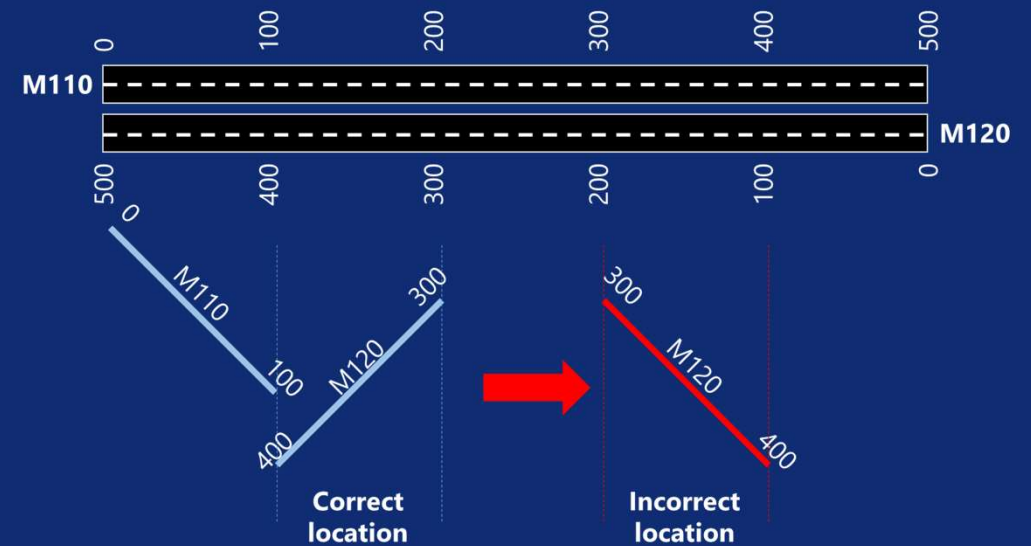
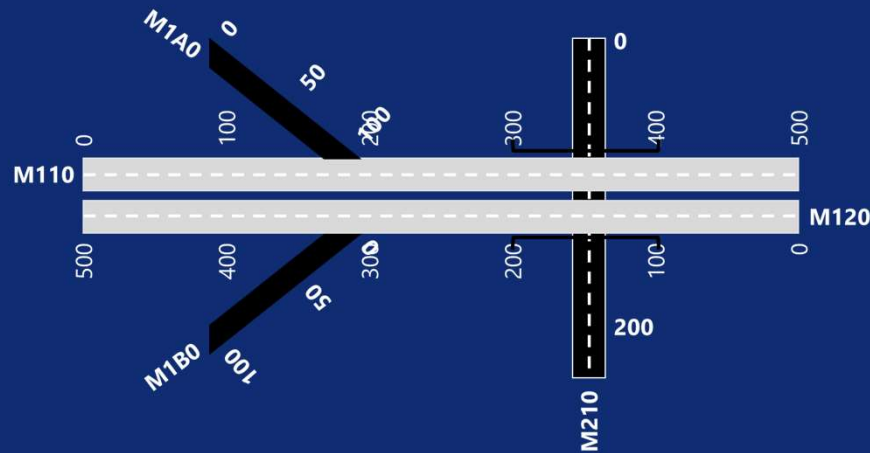
# Location Exaggeration





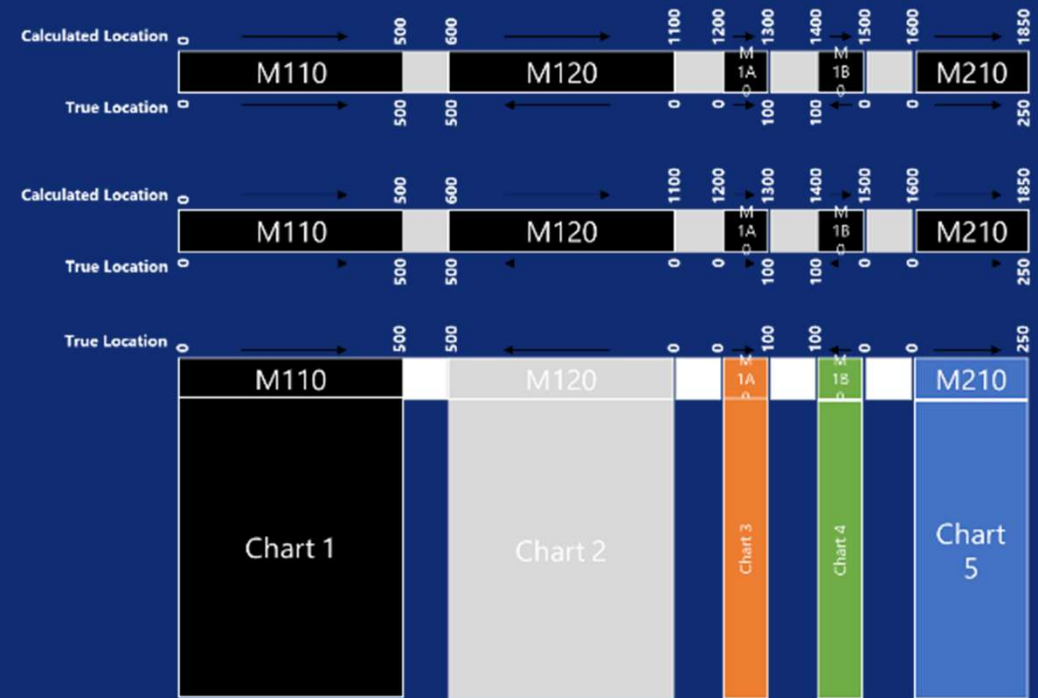
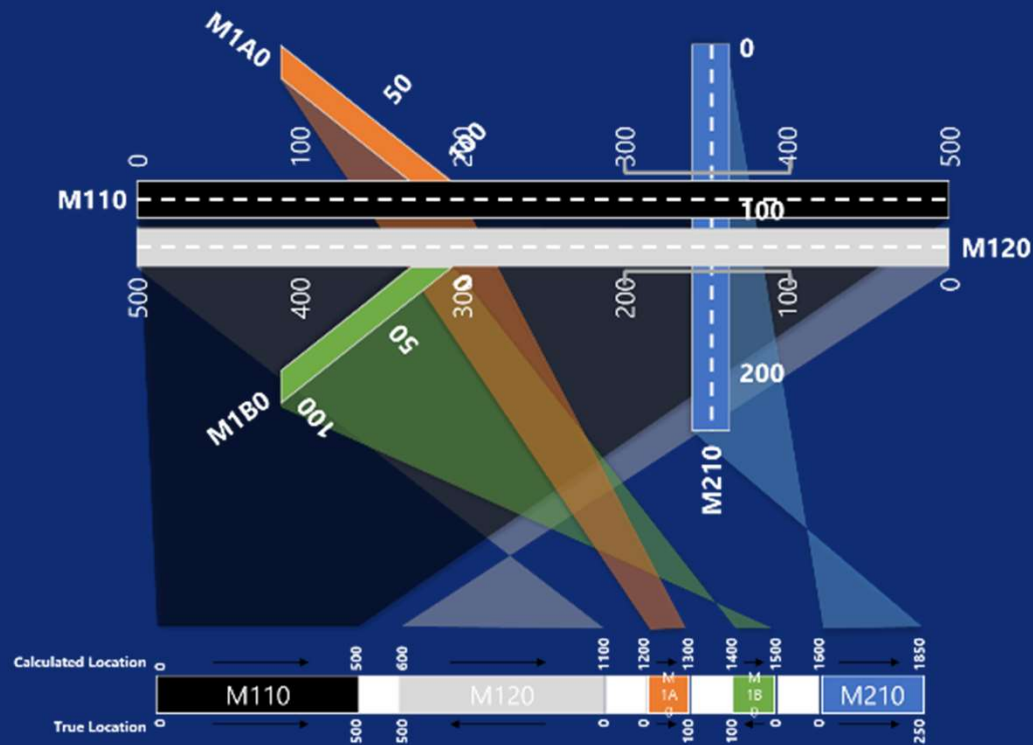


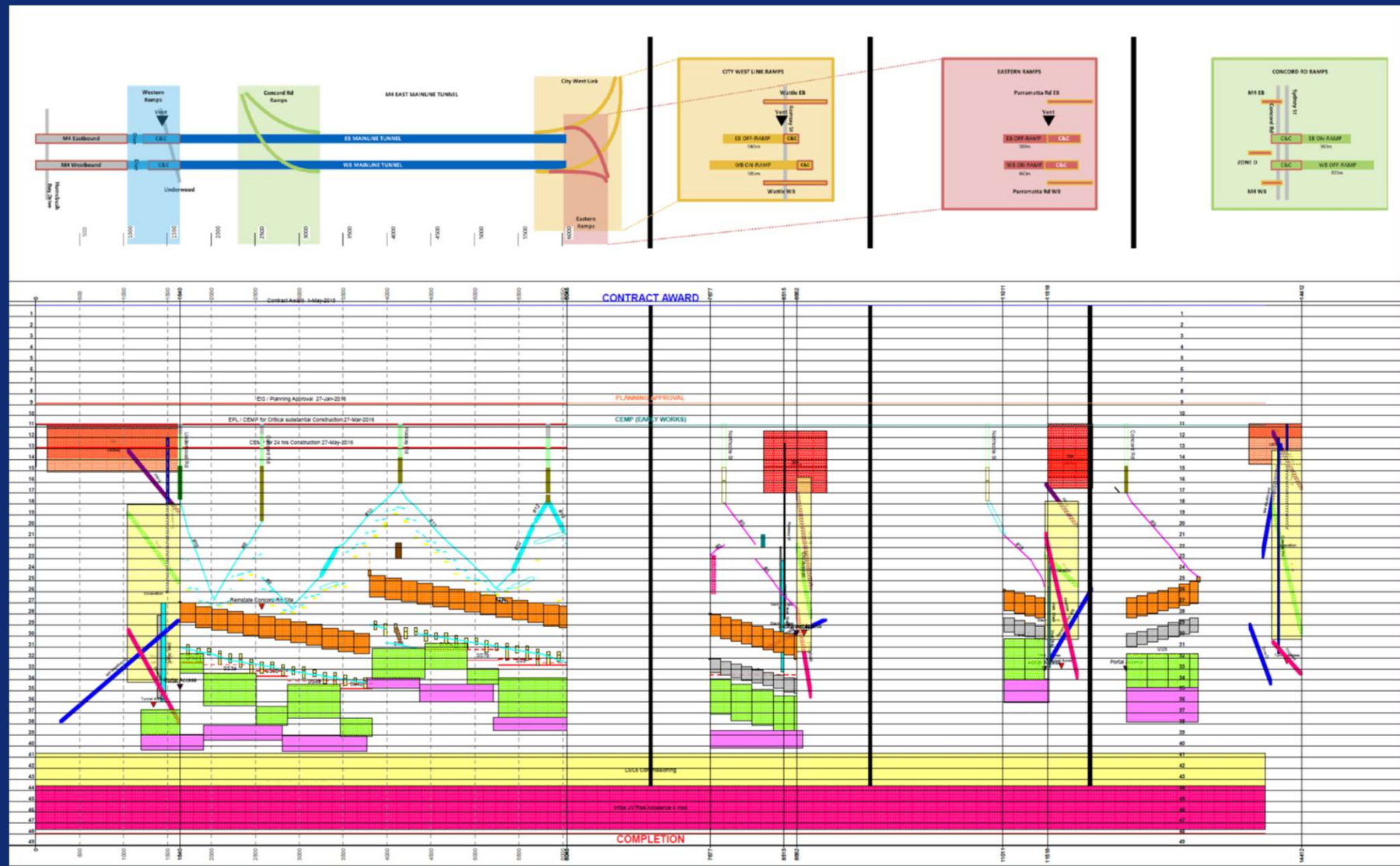
# Multiple Control Lines



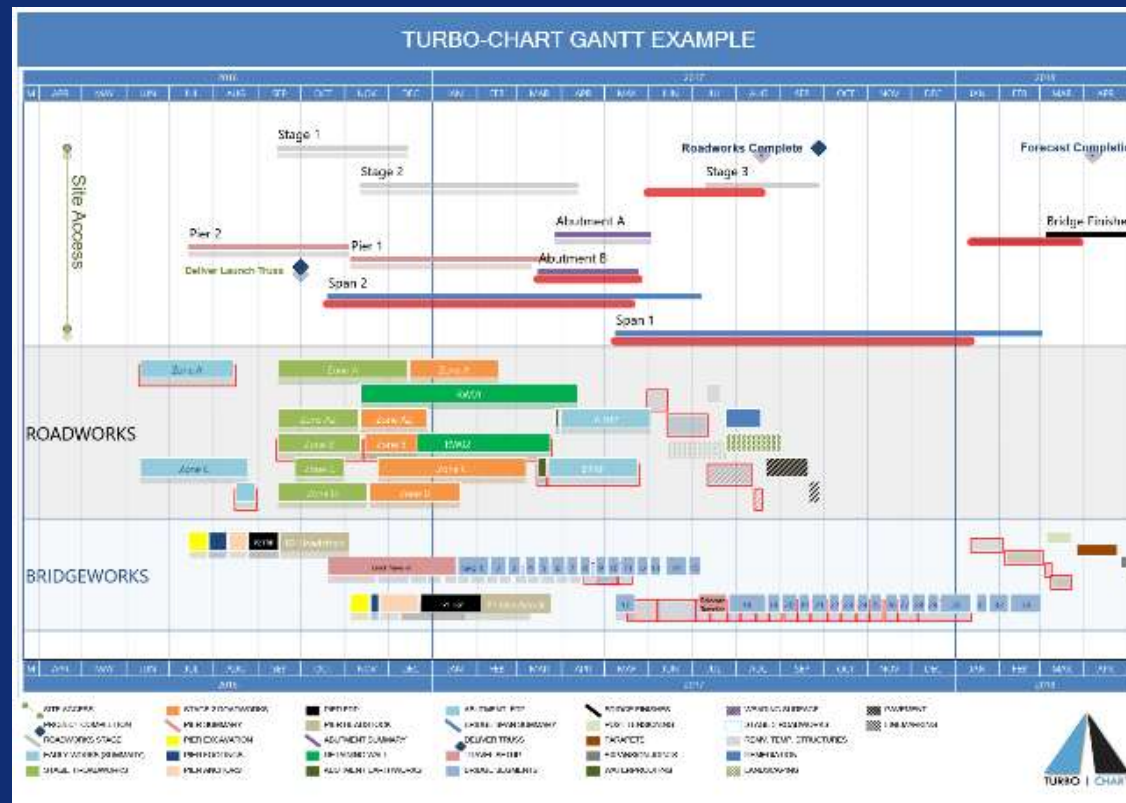


# Multiple Control Lines





# Other uses



# Thank you!

Download Trial

<http://www.turbo-chart.com>



Questions

[support@linearprojectsoftware.com](mailto:support@linearprojectsoftware.com)