

# Linear Scheduling 101

How to create your most-valuable  
project management tool on a single page.



GraphicSchedule

# The problem with Gantt charts on major projects:

*"Our schedule has 2,638 activities on 61 pages."*

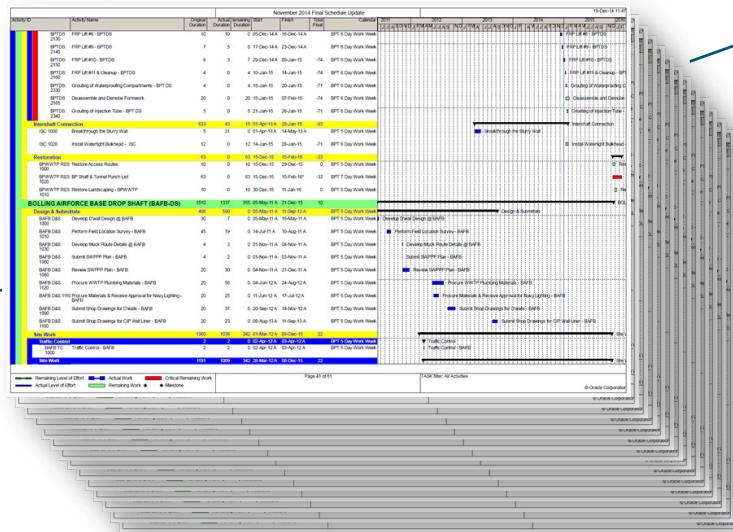
*"My boss doesn't want to see all of that detail."*

*"I can't tell where the work crews will be located. How can we spot conflicts before they happen?"*

*"This doesn't reflect how our linear activities actually work."*

*"Am I supposed to be able to read this?"*

*"Our schedule was supposed to be a planning tool, but it feels like it's mostly a payment tool."*



# We've been there. Major projects is what we do.

This guide was created by two construction managers who needed a better way to communicate complex schedules with their project teams. We live and breathe this stuff every day.



## James Wonneberg, PE, CCM

- Managing large-diameter tunnel projects for 9 years, including:
  - 2008-2011: Brightwater Conveyance Project (Woodinville, WA)
  - 2011-2016: DC Clean Rivers Project (District of Columbia)
  - 2016-Present: Alaskan Way Viaduct Replacement (Seattle, WA)
- Pioneered the use of dynamic Excel graphics that redraw themselves automatically with links to contractors' Primavera P6 schedules.



## Ron Drake, PE

- Leading complex infrastructure projects for 40 years, including:
  - 1990-1993: Metro Red Line (Los Angeles, CA)
  - 1993-1998: Tri-Met Westside Light Rail (Portland, OR)
  - 2005-2007: Brightwater Conveyance Project (Woodinville, WA)
  - 2014-Present: LA Metro Regional Connector (Los Angeles, CA)
- Has made linear scheduling a cornerstone of his project management approach for decades.

# What We Believe:

**We believe that the vast majority of people that work on these projects really do want to know what's in that huge schedule with thousands of activities.**

They want to know the master plan. They want to see the big picture and understand the relationships between activities. They want to know about the deadlines that their crew must meet. But our industry lacks the tools to communicate that information in a way that the entire team can understand.

**We believe that if you make your schedule beautiful, your team will use it!**

If you place a good-looking linear schedule on the table in any project office or jobsite trailer, people will go out of their way to look at it, pick it up, and study it. Then they will ask questions, and give you valuable feedback about how the work will *actually* be built.

(But if you don't make your schedule beautiful, it will be ignored and forgotten like all the rest.)

# What We Believe:

CONTINUED

## We believe that schedules should fit on one page.

The moment you have to flip the page to see the rest of your sequence of work, you've lost the relationships between activities. This is not to say that we don't create multiple sheets; in fact we do it all the time to "zoom in" and "zoom out" on our projects. But each sheet should tell the whole story of what you are trying to communicate.

## We believe that adding a simple graphic of what you're building makes your schedule information 10x more useful and effective.

Most people are visual learners, and schedule data doesn't sink in unless they can visualize the major work elements and the spatial relationships between them. A one-page illustration of scope of work and schedule becomes a very useful "talking paper" that helps you quickly explain your entire project to anyone, anywhere. And your team members will undoubtedly start sketching right on top of it for all sorts of problem solving, alternatives, and what-if-scenarios. This is when the magic happens – increasing the chances of your team delivering a winning project.

# What the Industry is Saying:



"As engineers and contractors, we are taught to break down complex projects into fundamental simpler pieces. Linear schedules are great tools that help us break down complex P6 schedules to help communicate to all team members our plan for success."

*-Fernando De Leon, Project Director at Shimmick Construction*

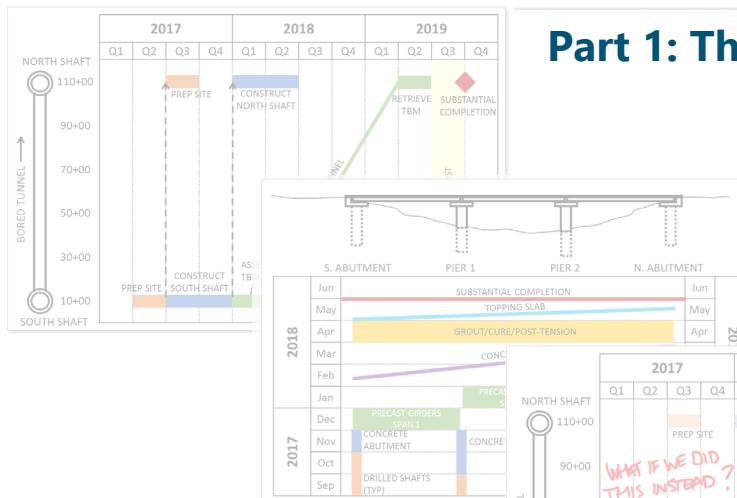


"The linear scheduling method really helps to visualize a project's schedule. It makes it possible to not only account for time but also space constraints."

*-Lisa Mori, Tunnel Engineer at Jay Dee Contractors*

# Coming Up:

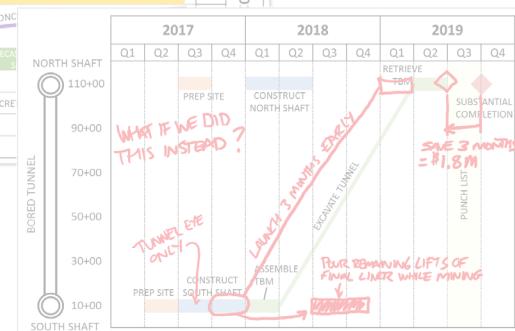
This guide will walk you through the fundamentals of a linear schedule, give you the vision for how it can be applied, and show you how to put it to work as your project evolves. Along the way you'll hear from more industry leaders about how they're using linear scheduling to execute their own challenging projects.



## Part 1: The Basics

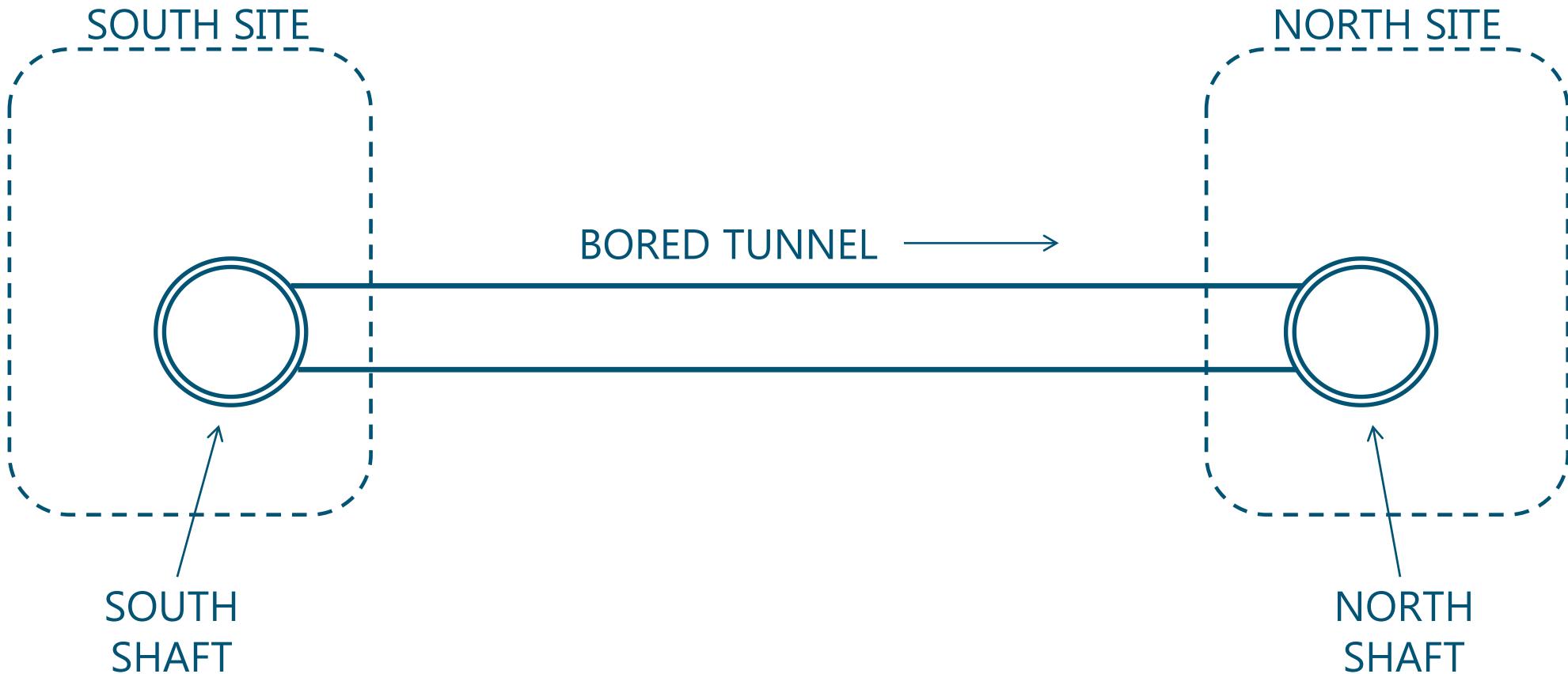
## Part 2: Example Projects

## Part 3: Adapting to Schedule Changes



# 1 The Basics

# Tunnel Project Example:



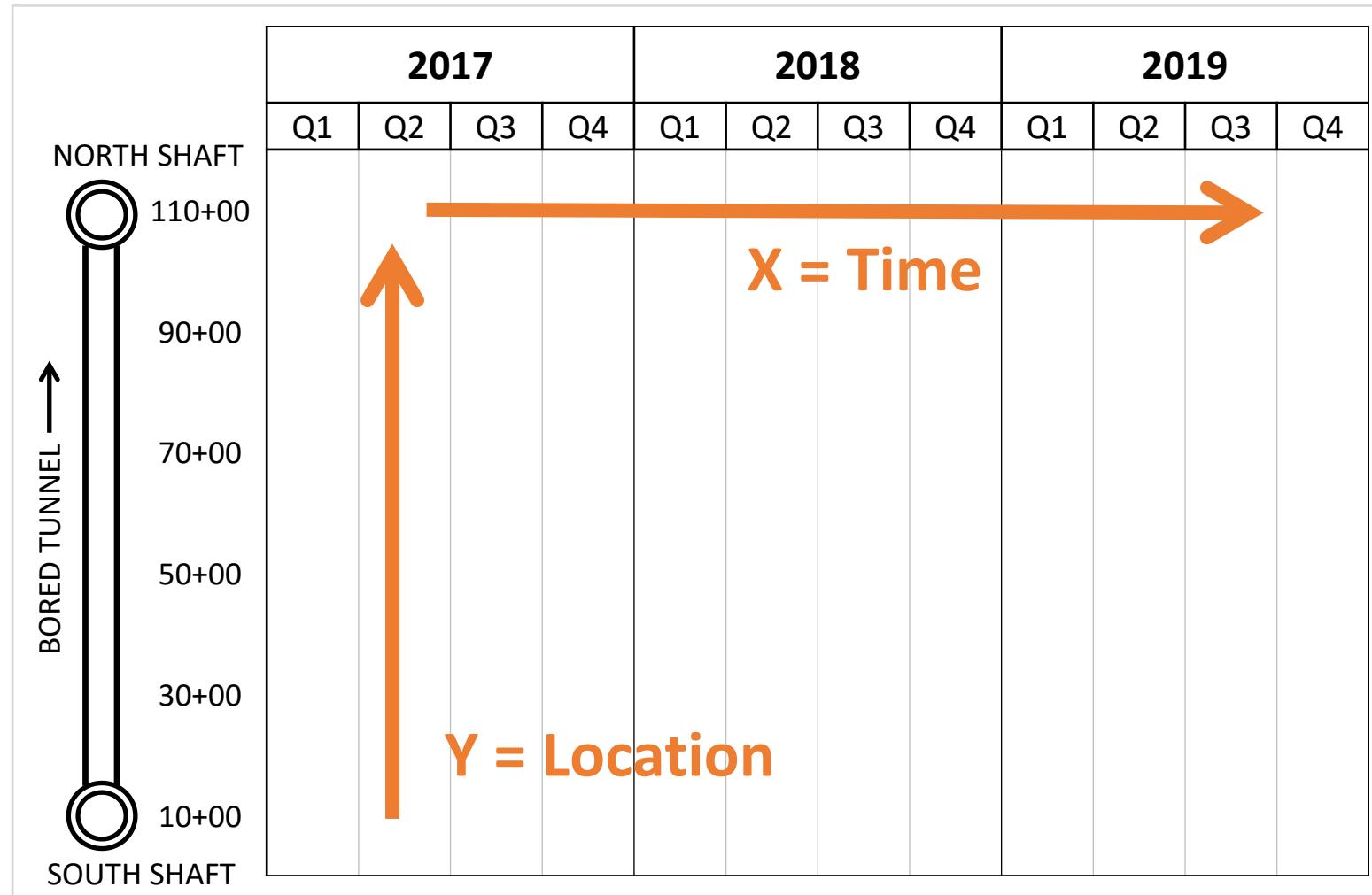
# Simplified Gantt Chart:

ACTIVITY	START DATE	FINISH DATE	2017				2018				2019			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
PREPARE SOUTH SITE	1-Apr-17	30-Jun-17												
CONSTRUCT SOUTH SHAFT	1-Jul-17	31-Dec-17												
PREPARE NORTH SITE	1-Jul-17	30-Sep-17												
CONSTRUCT NORTH SHAFT	1-Jan-18	30-Jun-18												
ASSEMBLE TBM	1-Jan-18	31-Mar-18												
EXCAVATE TUNNEL	1-Apr-18	31-Mar-19												
RETRIEVE TBM	1-Apr-19	30-Jun-19												
PUNCH LIST	1-Jul-19	30-Sep-19												
SUBSTANTIAL COMPLETION		30-Sep-19												

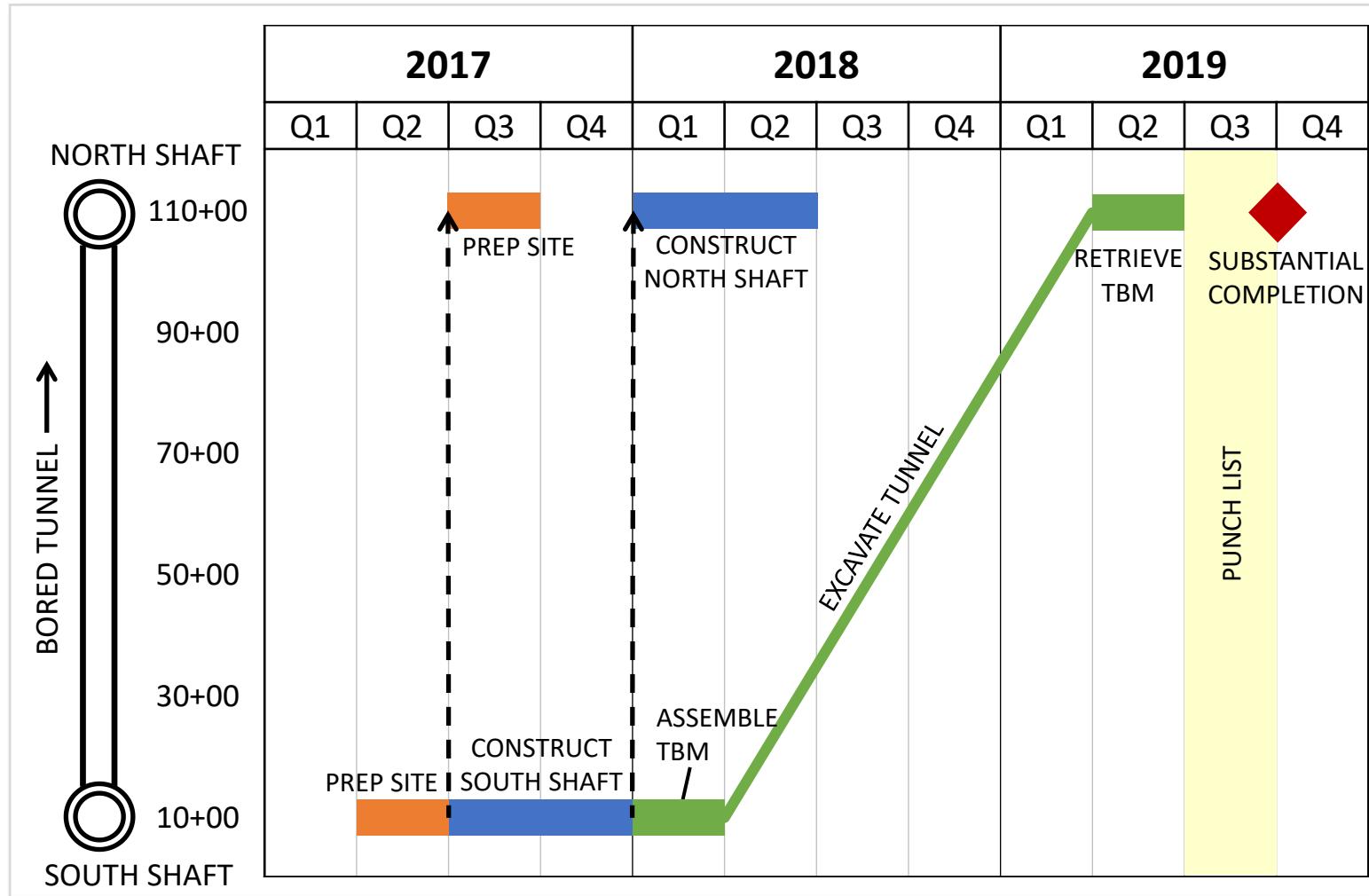
The chart illustrates the timeline for various project activities. Key features include:
 

- ACTIVITIES:** PREPARE SOUTH SITE, CONSTRUCT SOUTH SHAFT, PREPARE NORTH SITE, CONSTRUCT NORTH SHAFT, ASSEMBLE TBM, EXCAVATE TUNNEL, RETRIEVE TBM, PUNCH LIST, SUBSTANTIAL COMPLETION.
- DATES:** START dates range from 1-Apr-17 to 1-Apr-19; FINISH dates range from 30-Jun-17 to 30-Sep-19.
- DEPENDENCIES:** Arrows indicate dependencies between activities like CONSTRUCT SOUTH SHAFT leading to PREPARE NORTH SITE, and EXCAVATE TUNNEL leading to RETRIEVE TBM.
- NOTES:** A callout highlights 'EXCAVATE TUNNEL' as a **linear activity**.

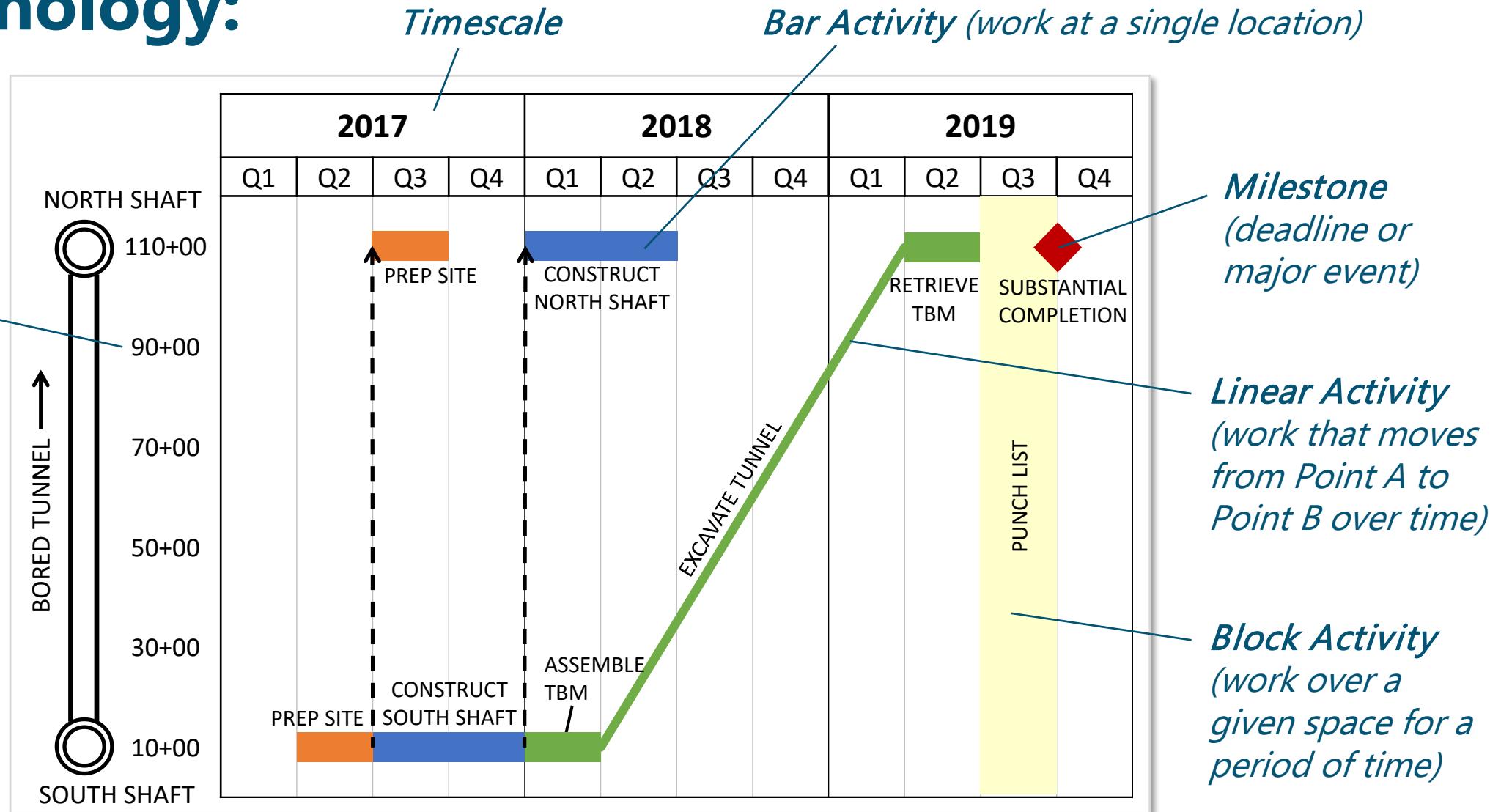
# Page Setup for Linear Schedule:



# Linear Schedule:



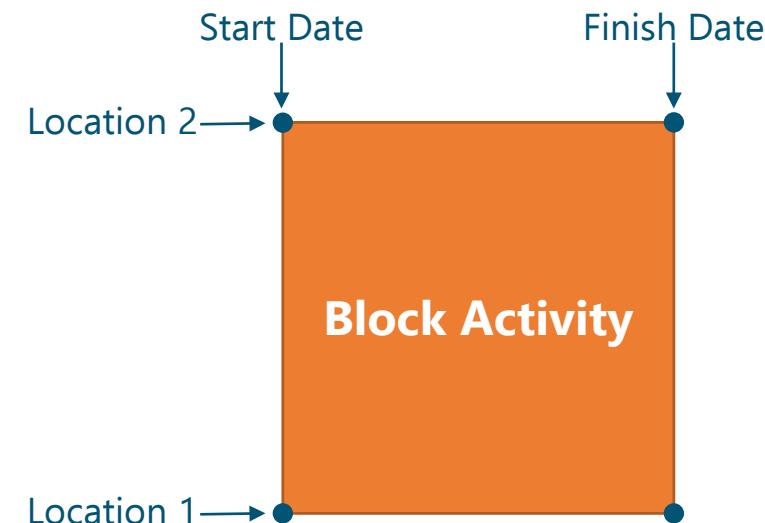
# Terminology:



# Primary Types of Activities:



*Work that moves from Point A  
to Point B over time*



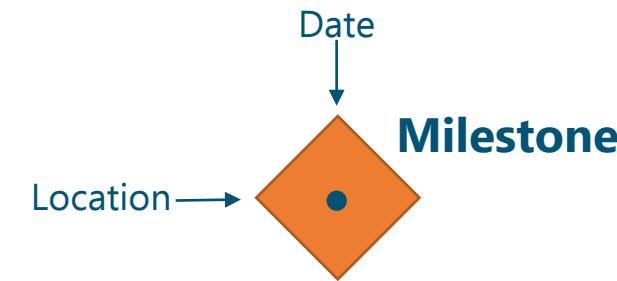
*Work over a given space  
for a period of time*

# Primary Types of Activities:

CONTINUED



*Work at a single location*



*Deadline or major event*

# What do the colors mean?

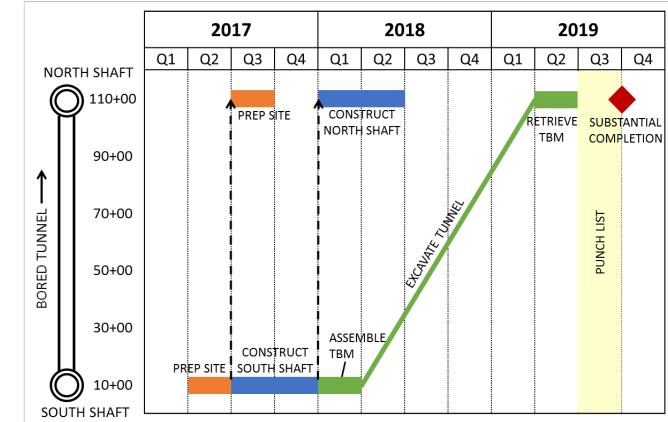
**Short Answer:** Whatever you like.

**Better Answer:**

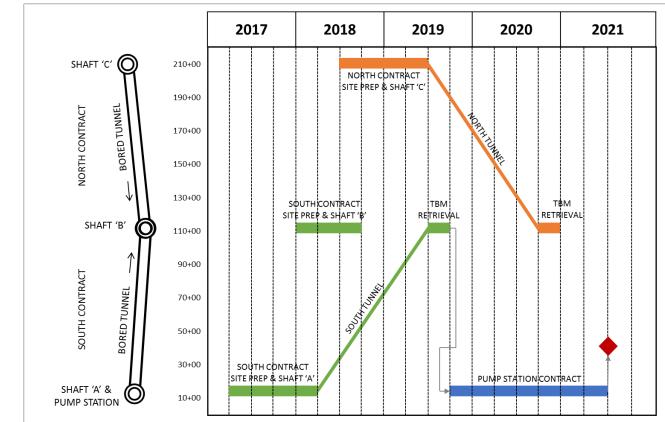
We usually assign one color to each major type of work (similar to layers in a CADD drawing). This makes it easy to see how your crews and equipment will move through the project over time.

Or, when illustrating a large program with multiple contracts, we often assign one color to each contract. This helps everyone see how all of the contracts work together to complete the program. It also highlights the interfaces (i.e. touch points) that will require coordination to make sure everything goes smoothly.

Color is a good thing. Be creative, and don't hold back!



or



# Advantages of a Linear Schedule:



"Are we OK with three cranes or do we need to add a fourth? I can just look down a specific month on the linear schedule and see right away how many crews or spreads we will have working and at what locations. All on one page. That is convenient compared to long P6 schedules."

*-Brett Zernich, Project Manager at Traylor Bros.*



"The linear schedule update is one email that I actually look forward to receiving each month. It provides a concise and useful snapshot of otherwise complex project and program schedules."

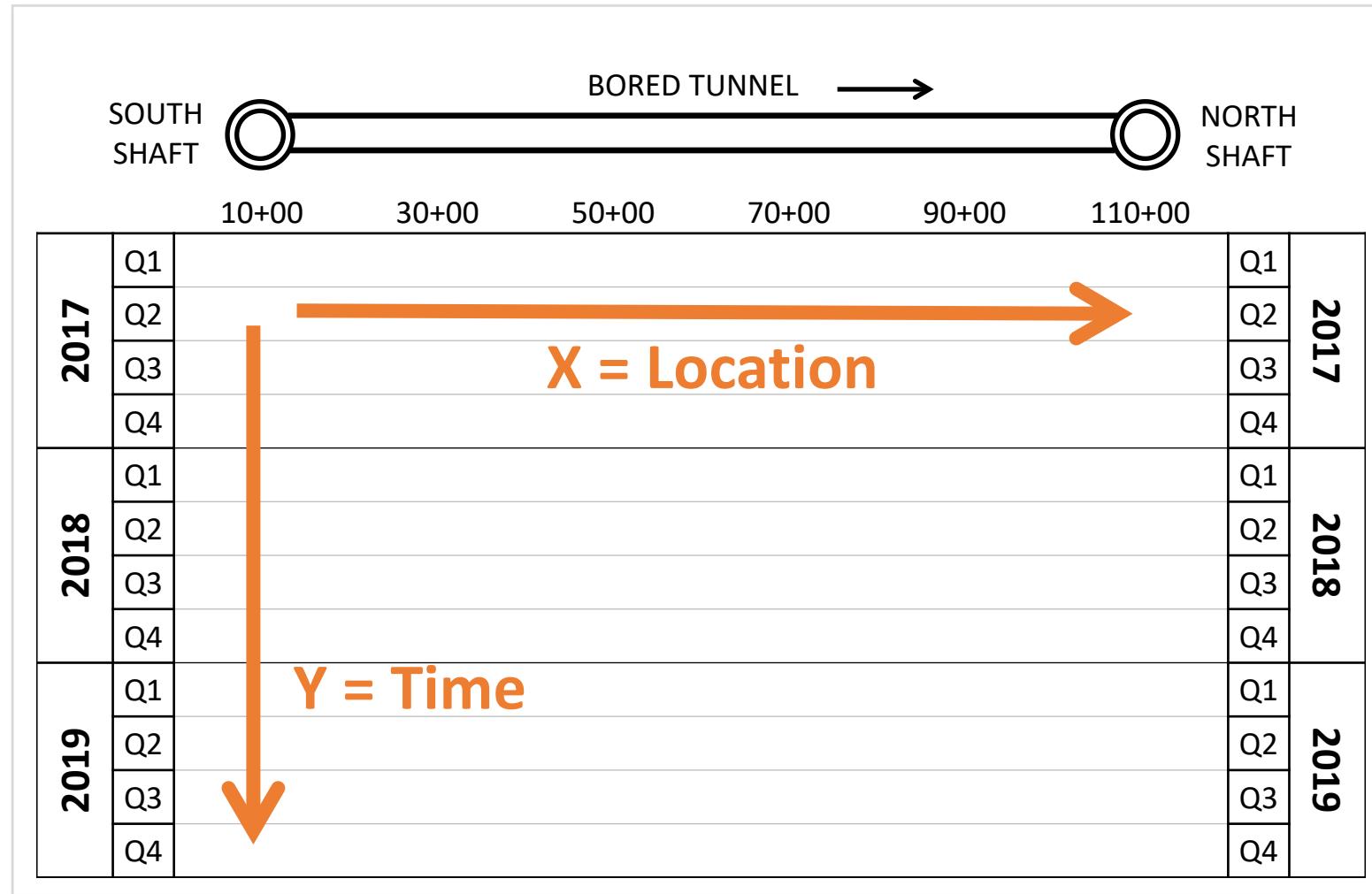
*-Rafael Castro, Principal at JCK Underground*



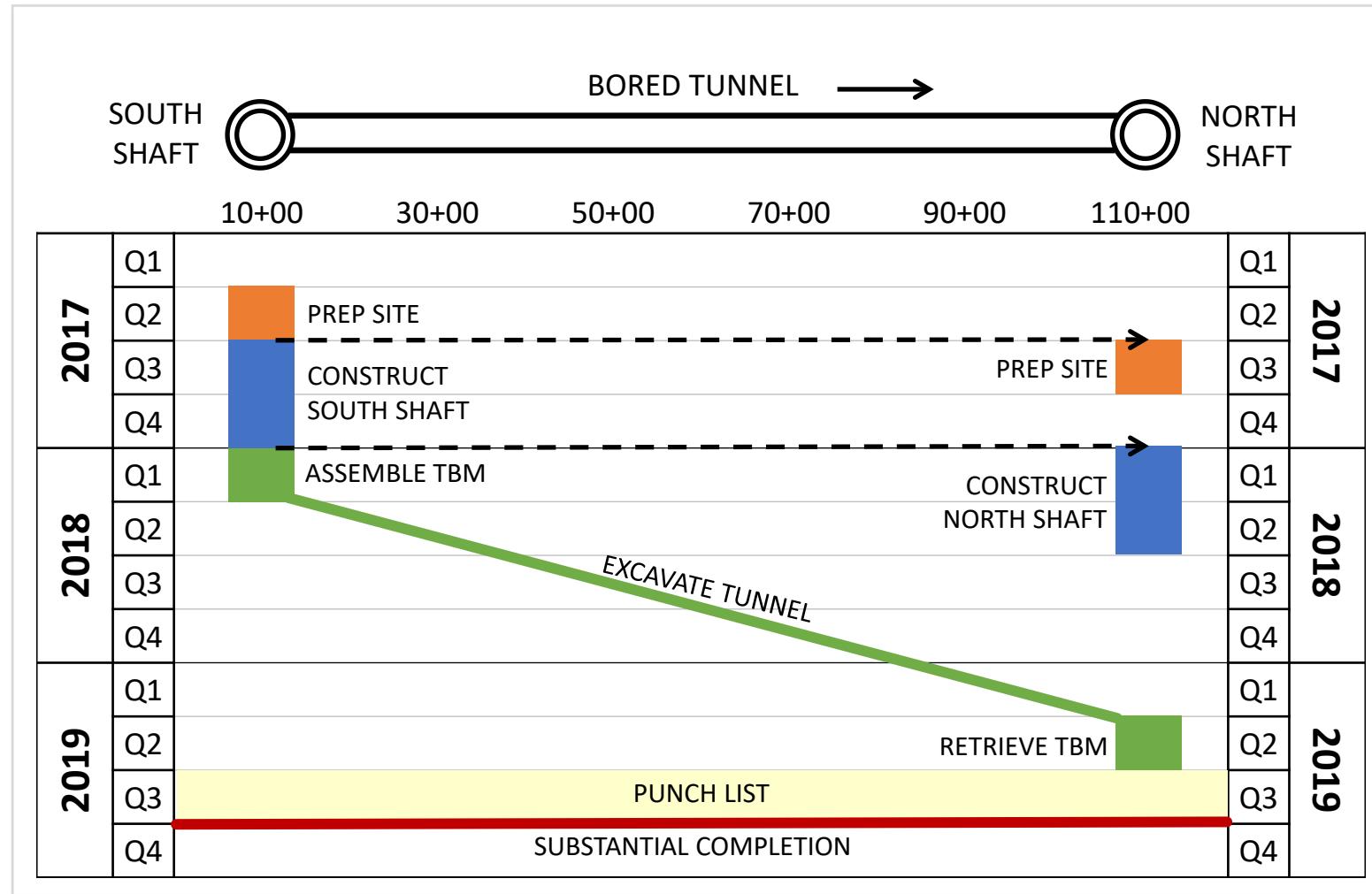
"Linear schedules have been essential to communicating inter-project and inter-agency construction relationships."

*-Brian Smith, Program Controls Manager at Mott MacDonald*

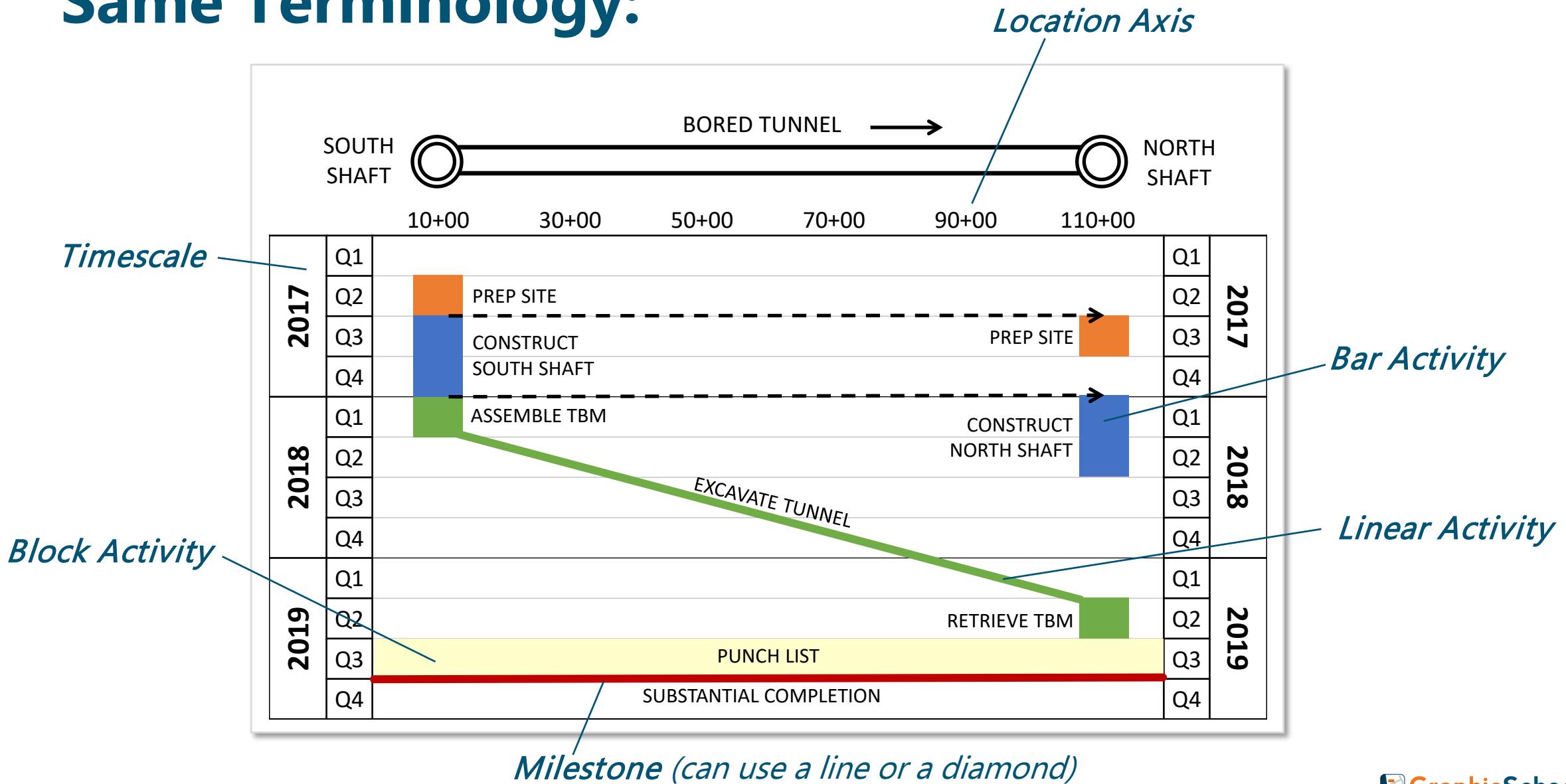
# Alternate Page Setup: Time on Vertical Axis

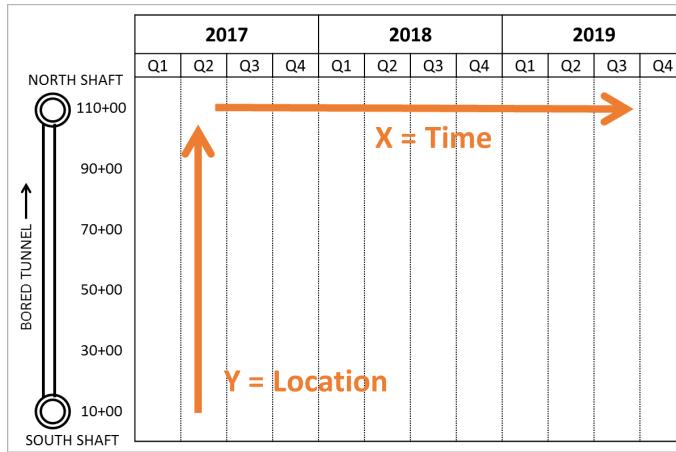


# Linear Schedule: Time on Vertical Axis

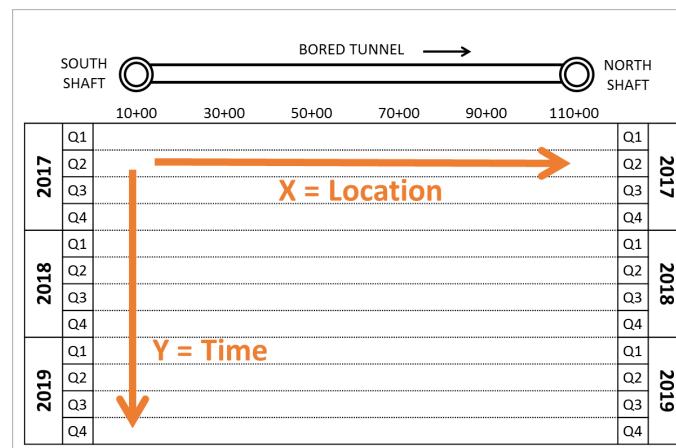


# Same Terminology:





VS.



## Time from Left to Right:

- ✓ Easiest to read for general audiences (the way we normally read schedules)
- ✓ Expanded timescale accommodates more-detailed schedule activities and labels
- ✓ Differences in linear production rates are more obvious

## Time on Vertical Axis:

*Also called a Time-Chainage Diagram*

- ✓ Keeps the drawing horizontal (the way we normally read plan & profile drawings)
- ✓ Can illustrate the sequence in the same direction that the work is constructed (i.e. top-down or bottom-up)

# Which format to choose? Here's our \$0.02:

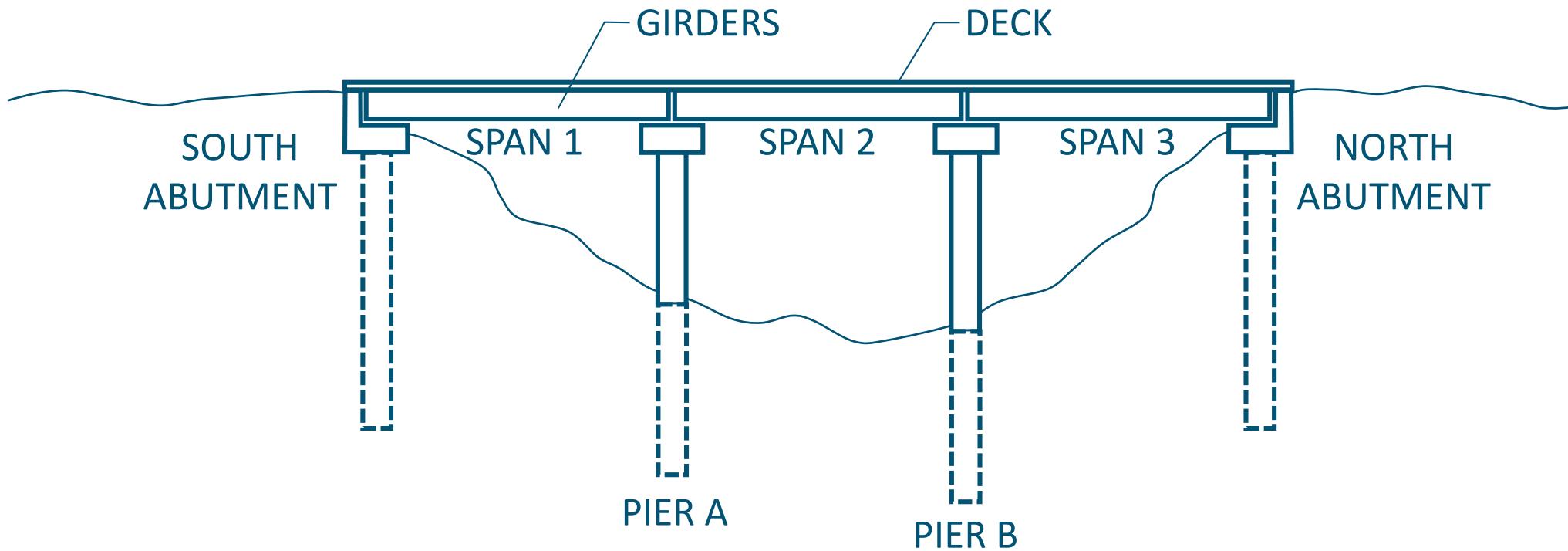
People that have never seen a linear schedule before usually find it easiest to read time from left to right. When meeting with executives, third party stakeholders or the Mayor, you need to bring them up to speed **quick**. So we plot time from left to right whenever possible.

However, certain industries and regions have been plotting time on the vertical axis for decades. In that case, stick with the format that your target audience wants to see.

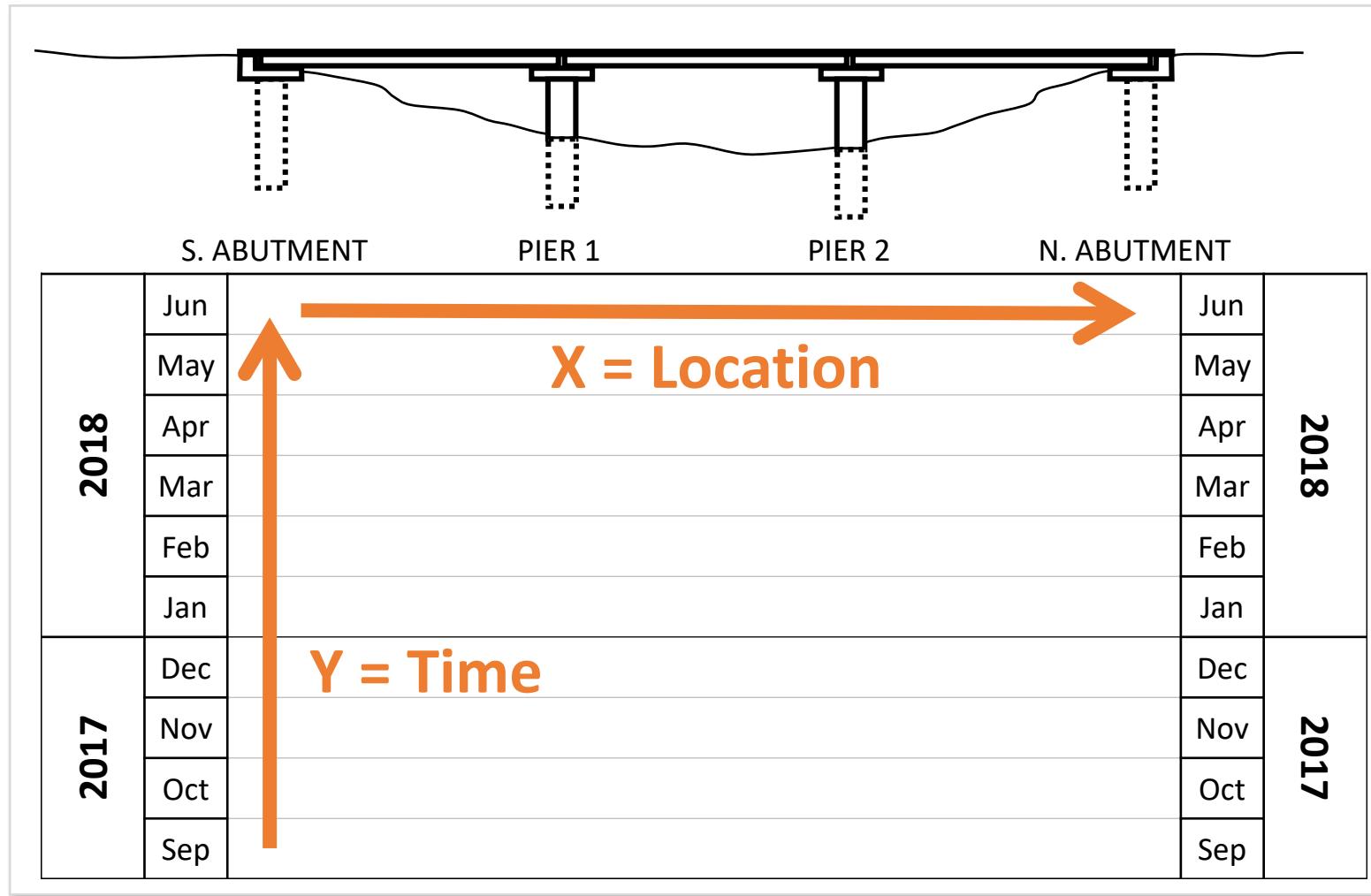
(Either way, your linear schedule is sure to communicate your plan far better than that stack of Gantt charts ever could.)

# 2 Example Projects

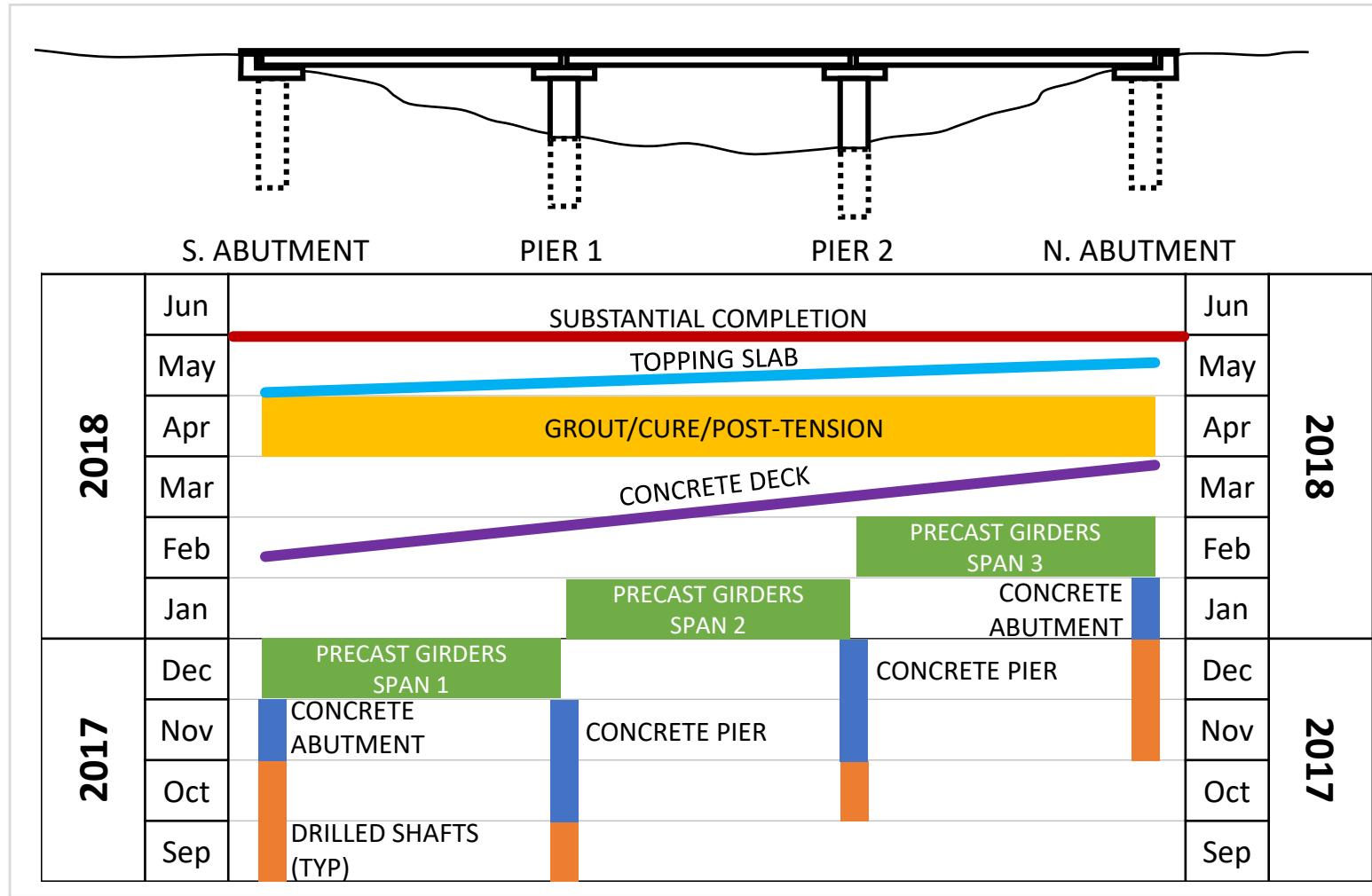
# Bridge Project Example:



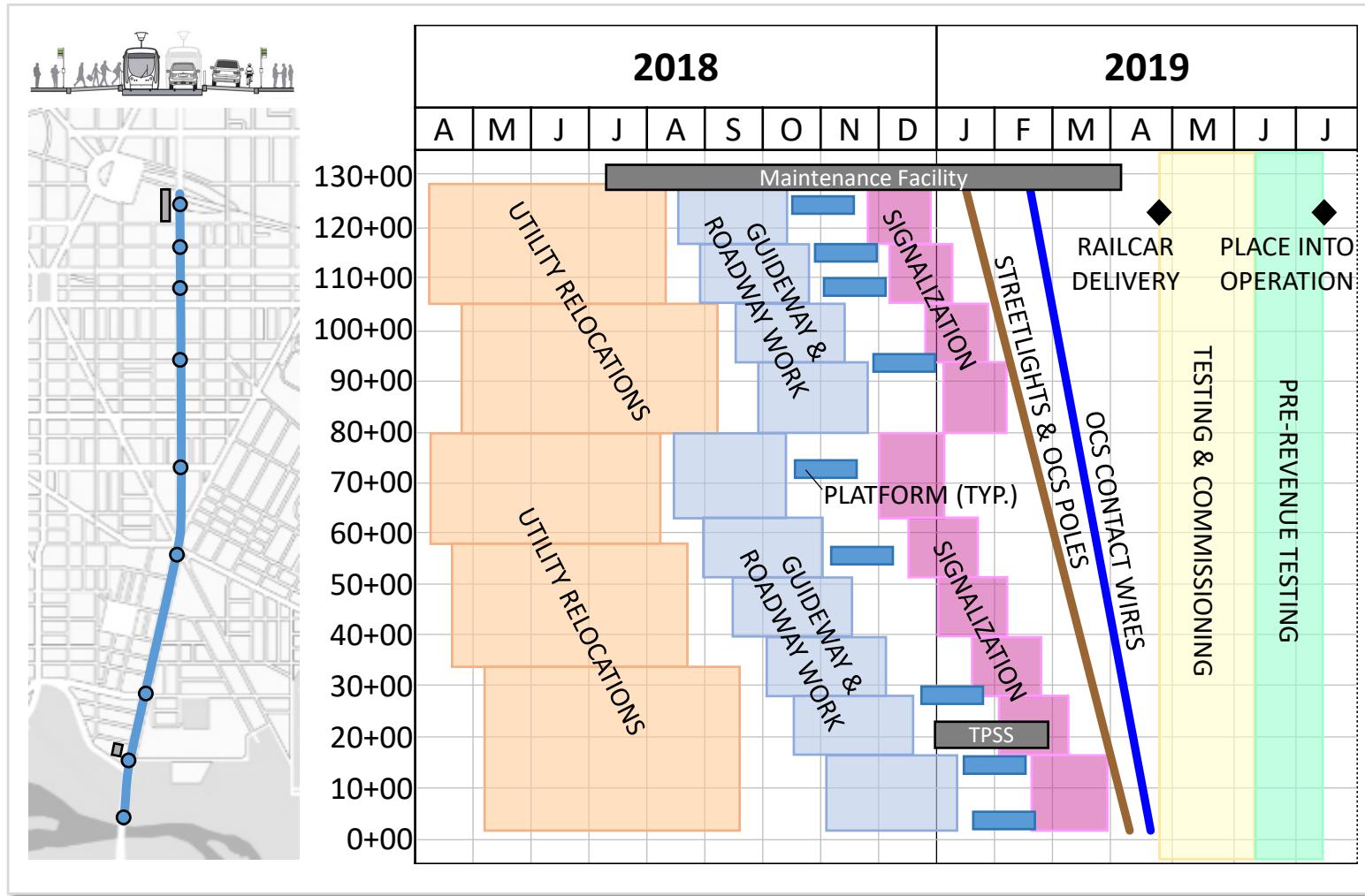
# Page Setup:



# Linear Schedule:



# Streetcar Project:



# Industry Perspectives:



"The intuitive format of a linear schedule helps us transform detailed CPM schedules from overwhelming to understanding."

*-Brian Ellingson, Schedule Engineering Supervisor at Sound Transit*



"Linear scheduling provides a graphic display of how crews and equipment move through the project over time. This 1) helps contractors depict their plan to construct the work and 2) allows for constructability analysis of the schedule that may be lost by Gantt Chart review only."

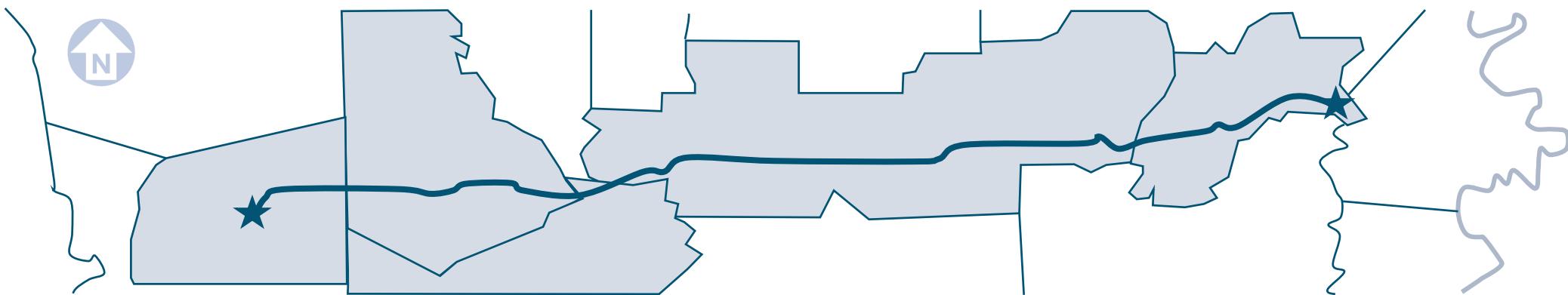
*-Amy Heine, Principal at Hirschmugl, Heine & Associates*



"Our linear schedule was extremely helpful on the floating bridge project. We used it to manage the job and communicate with the public."

*-Walter Tarr, Principal at Polaris Project Controls*

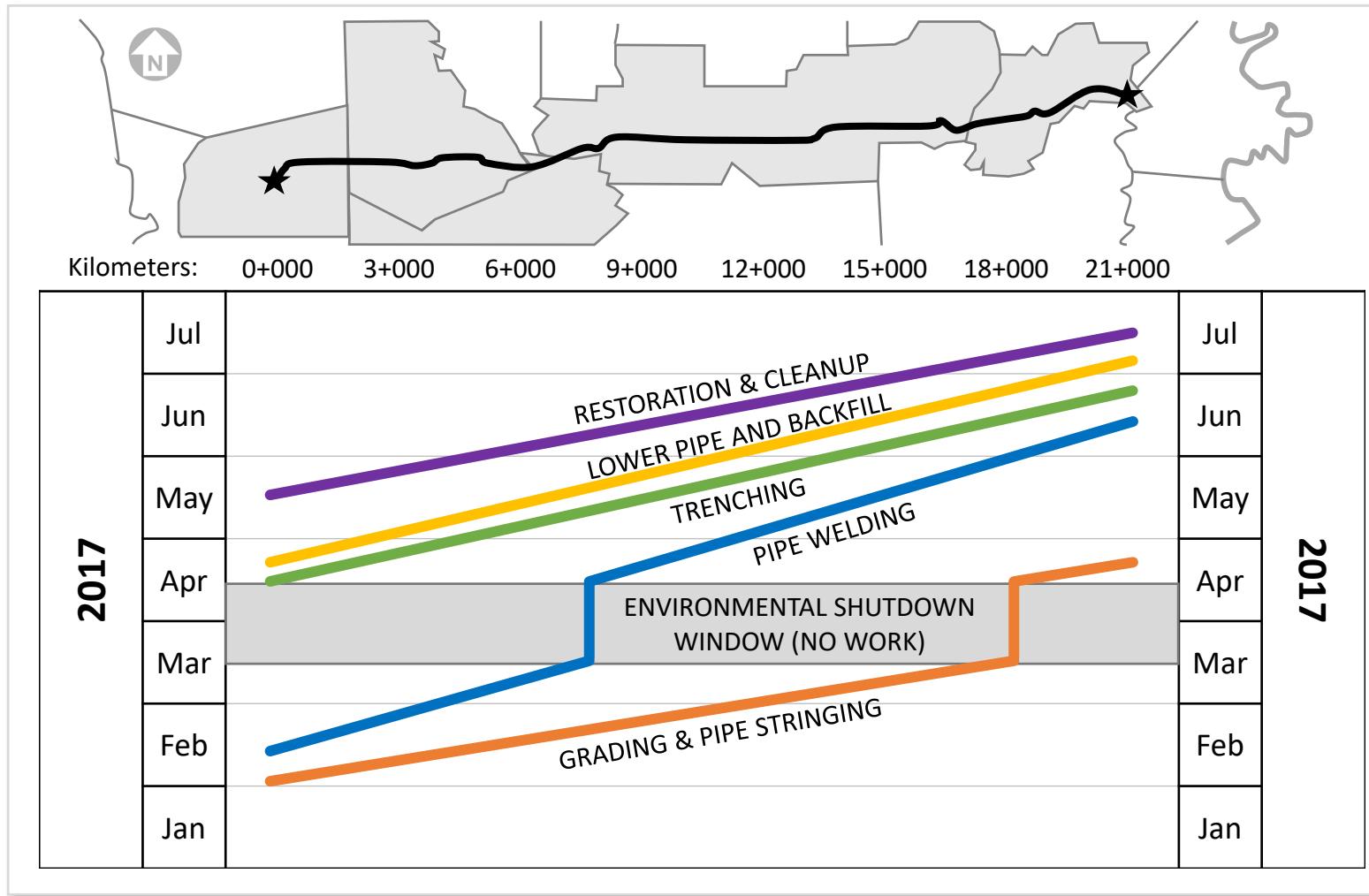
# Pipeline Project Example:



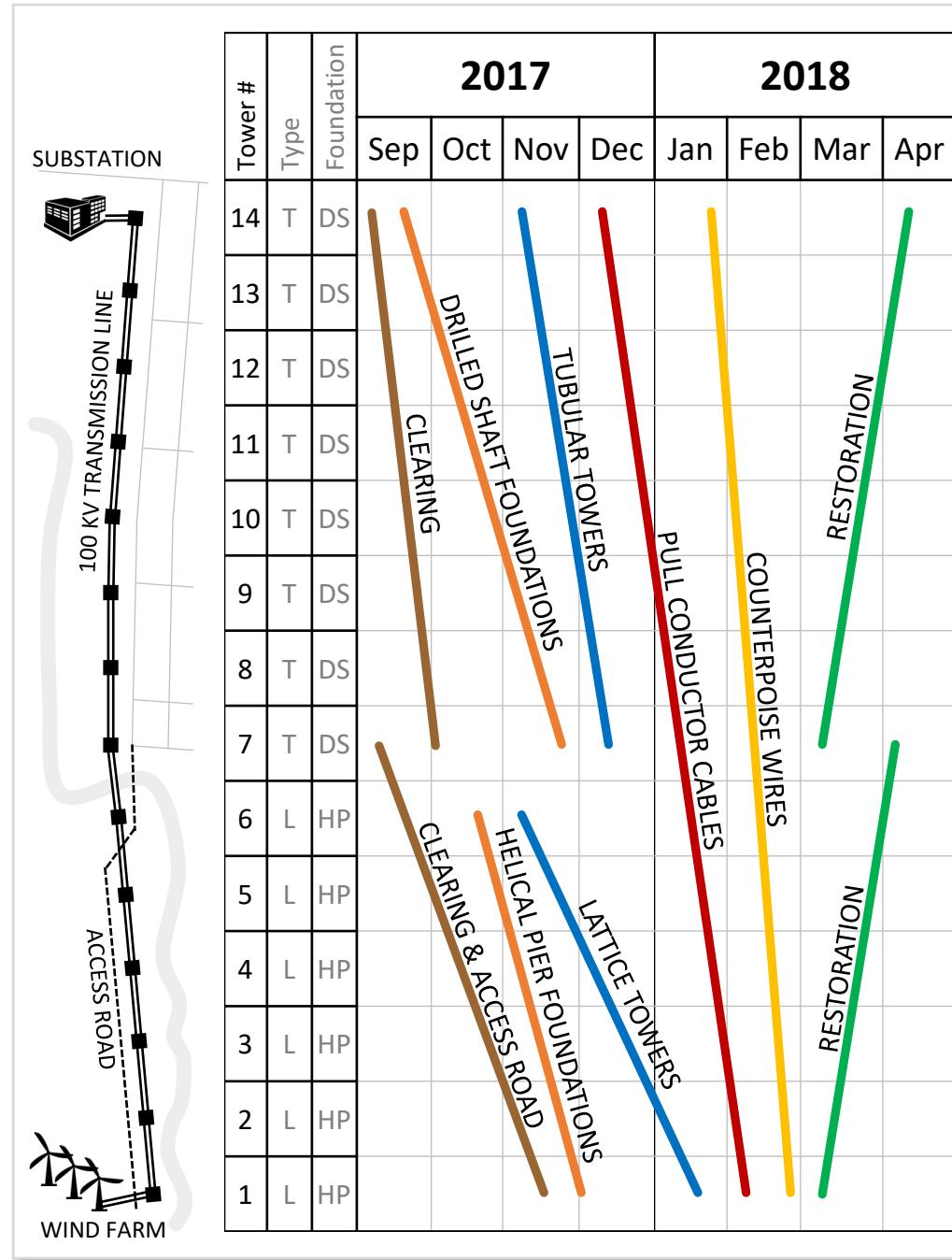
# Gantt Chart for Pipeline Project:

ACTIVITY	START DATE	FINISH DATE	2017						
			Jan	Feb	Mar	Apr	May	Jun	Jul
ENVIRONMENTAL SHUTDOWN WINDOW (NO WORK)	15-Mar-17	15-Apr-17			◆————◆				
GRADING & PIPE STRINGING	1-Feb-17	24-Apr-17		■————■	■————■				
PIPE WELDING	9-Feb-17	11-Jun-17		■————■	■————■	■————■	■————■	■————■	
TRENCHING	16-Apr-17	26-Jun-17			■————■	■————■	■————■	■————■	
LOWER PIPE & BACKFILL	23-Apr-17	3-Jul-17				■————■	■————■	■————■	
RESTORATION & CLEANUP	16-May-17	13-Jul-17					■————■		

# Linear Schedule for Pipeline Project:

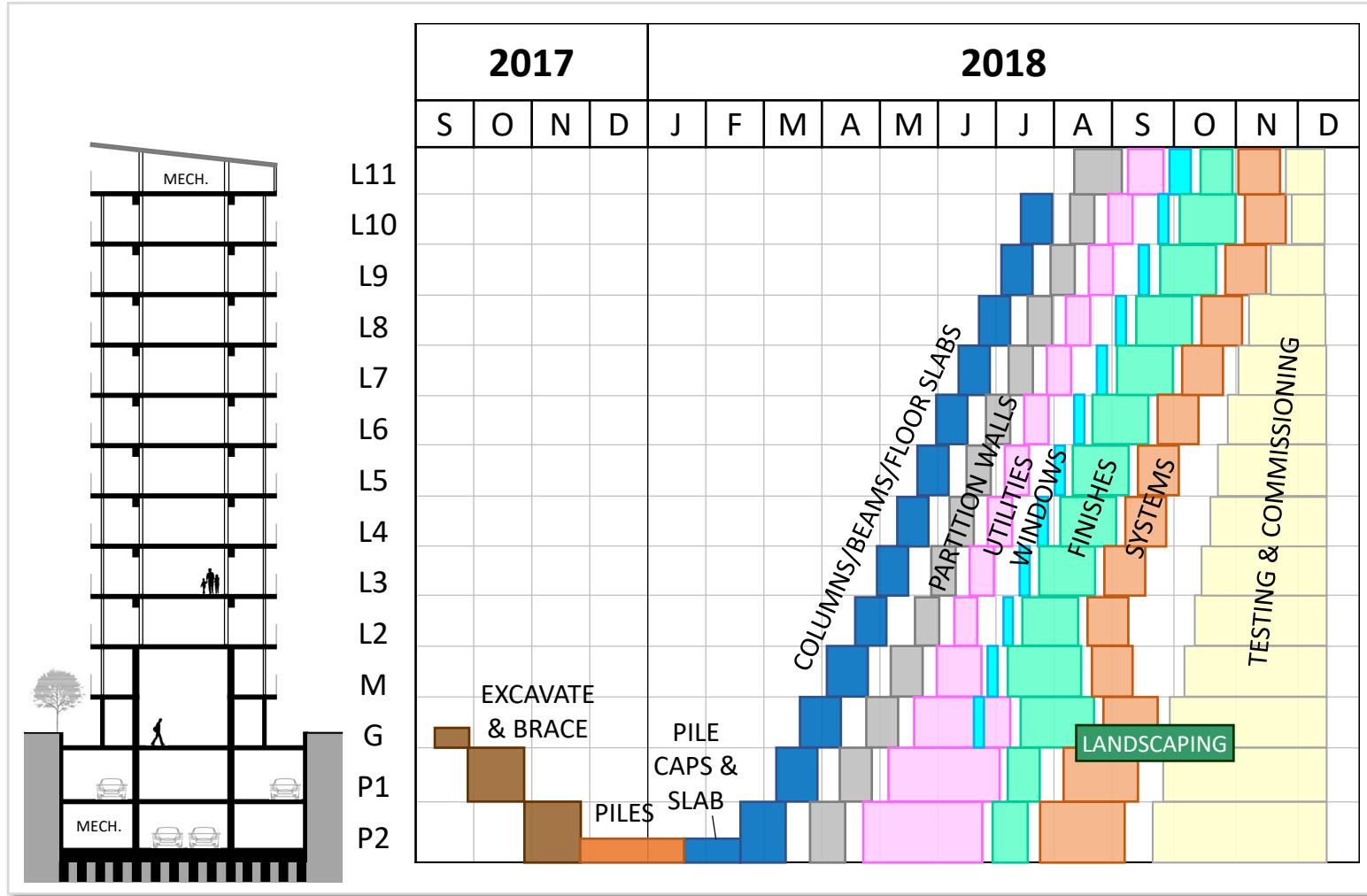


# Transmission Line Project:



So far these examples have all been infrastructure projects.  
**This method works for vertical construction too.**

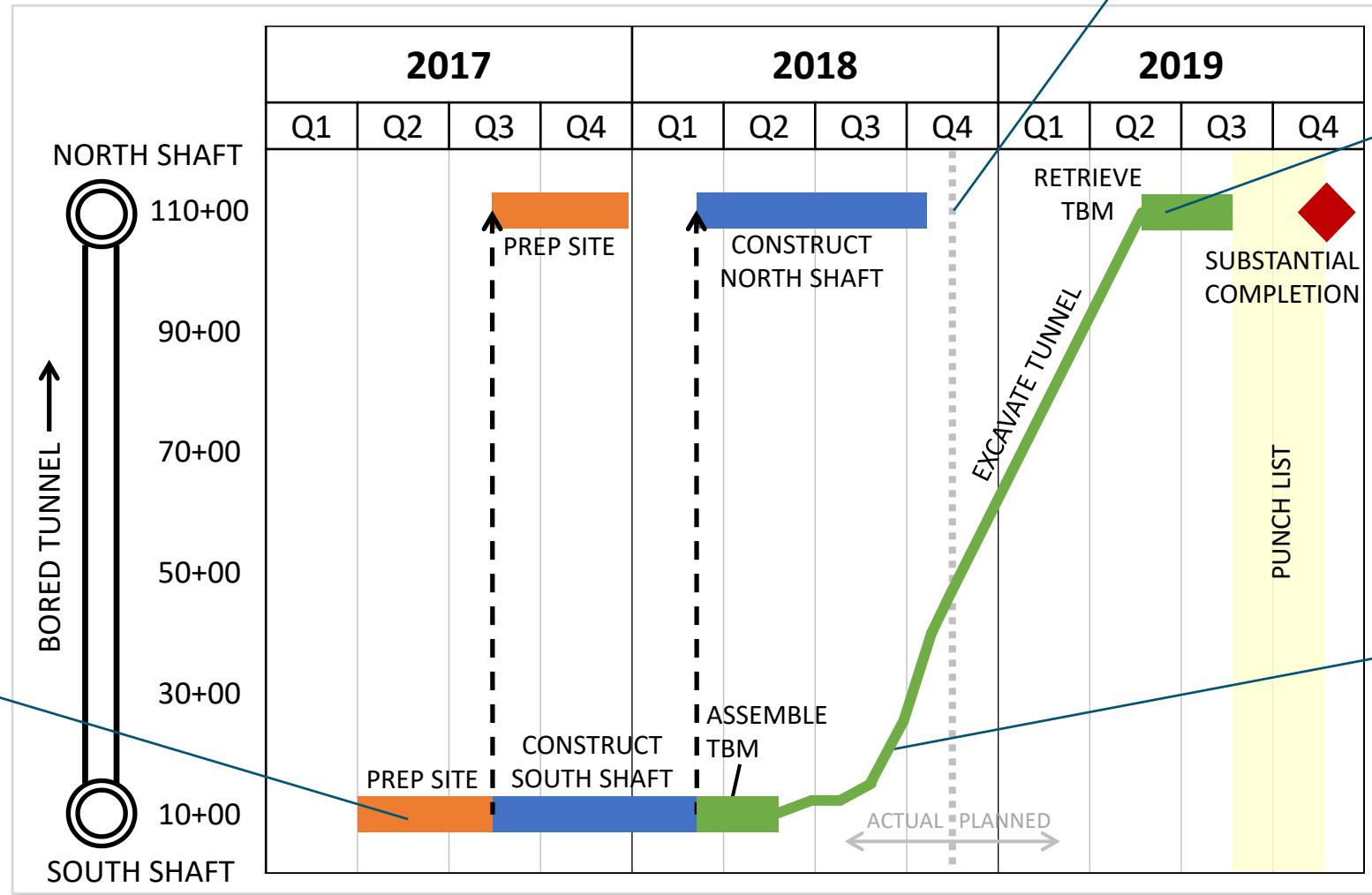
# High Rise Building Project:



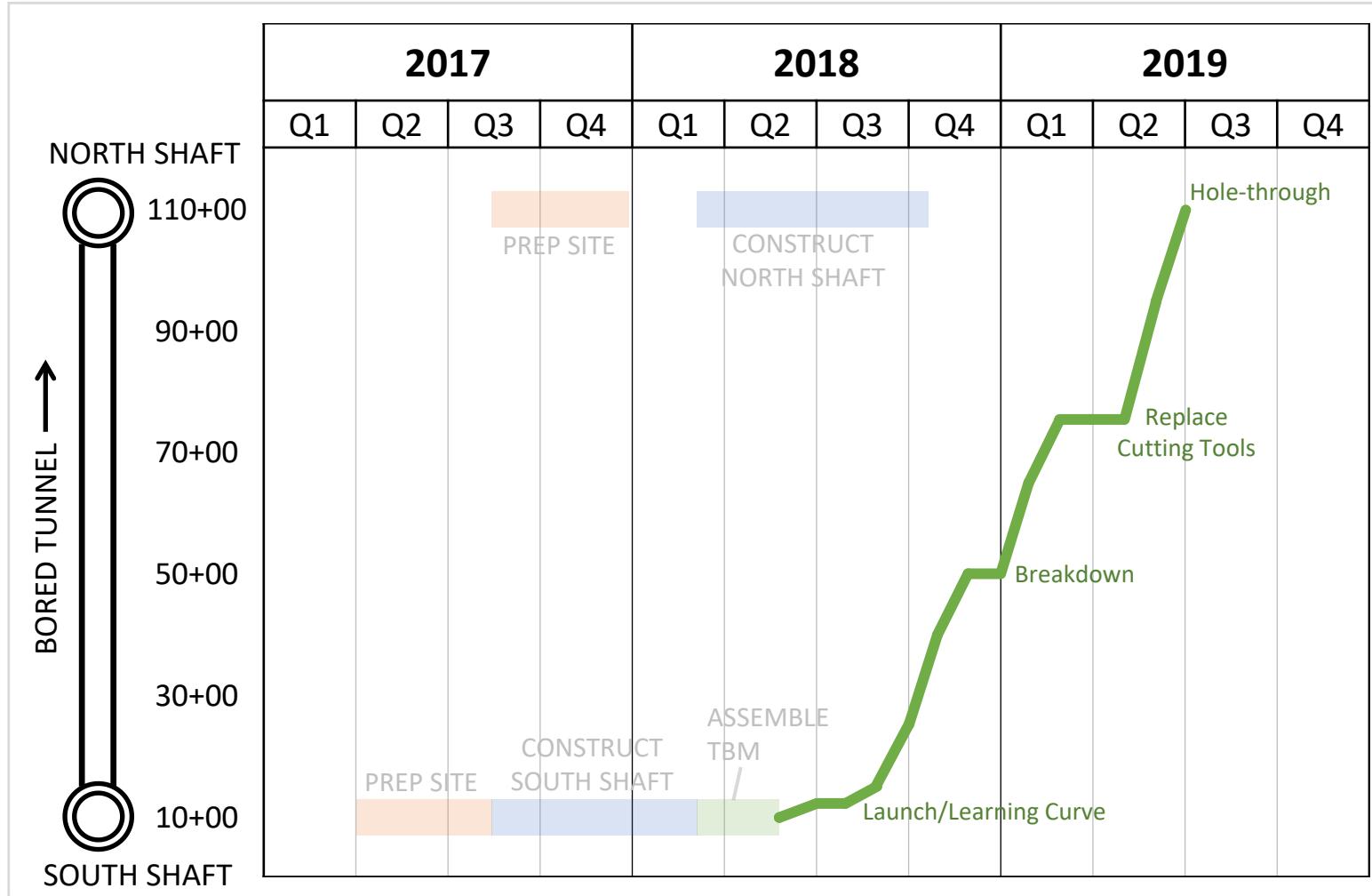
# 3 Adapting to Schedule Changes

“Everybody has a plan ‘till they  
get punched in the mouth.”  
- Mike Tyson

# Updating a Linear Schedule:



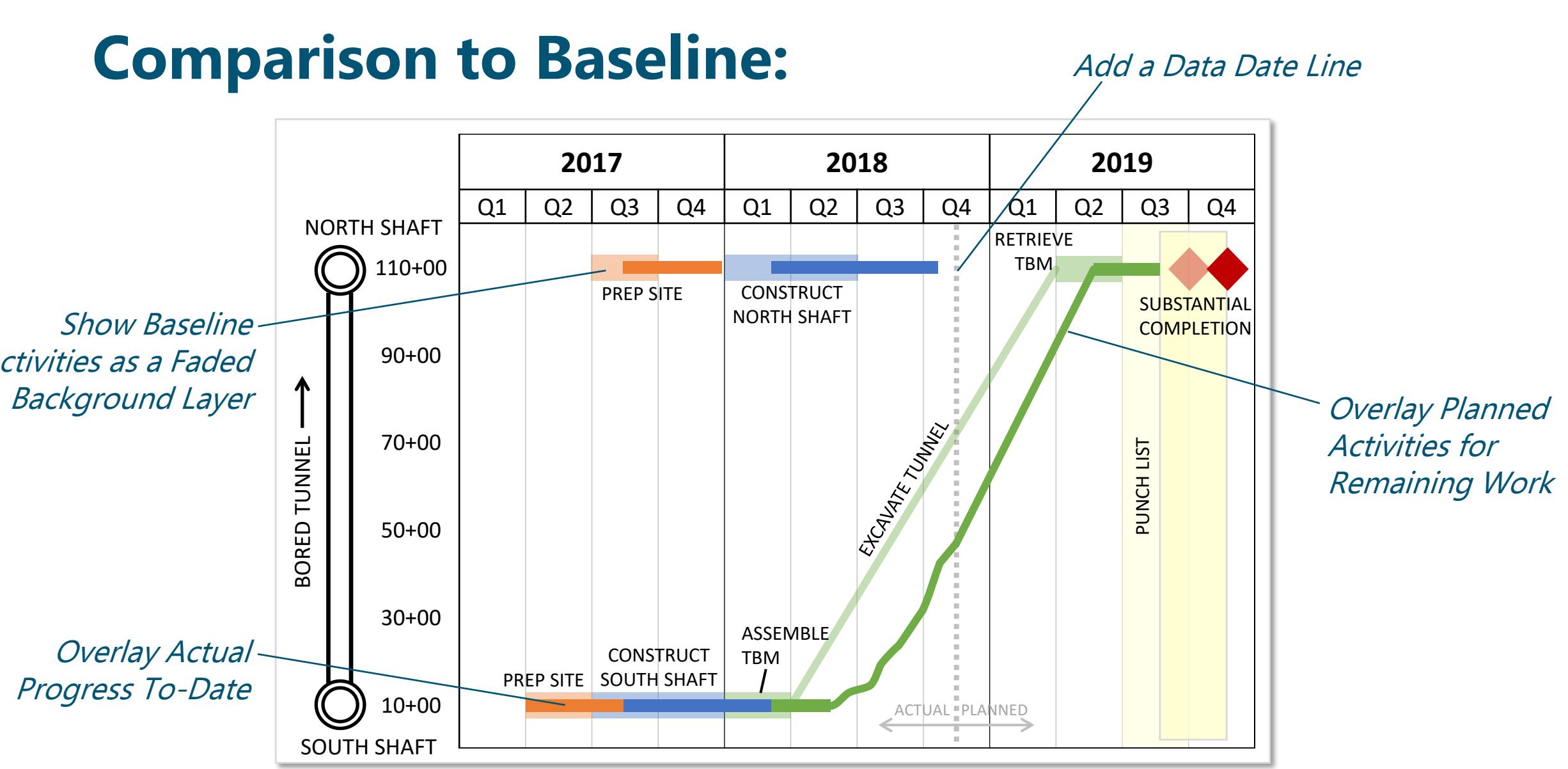
# Plotting Actual Progress for Linear Activities:



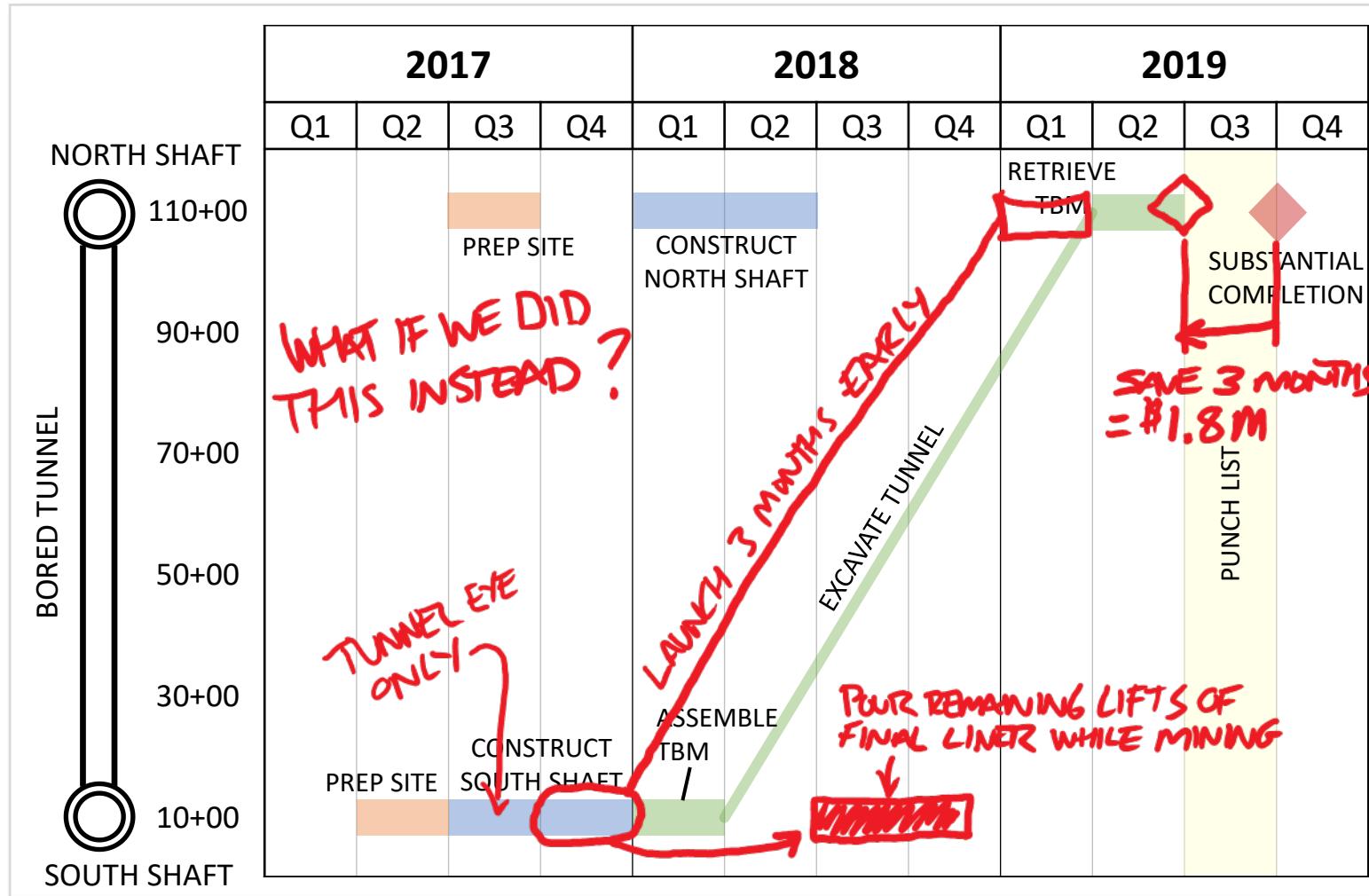
Date	Location
31-May-18	10+00
30-Jun-18	12+50
31-Jul-18	12+50
31-Aug-18	14+74
30-Sep-18	25+31
31-Oct-18	42+00
30-Nov-18	50+07
31-Dec-18	50+07
31-Jan-19	63+87
28-Feb-19	76+03
31-Mar-19	76+03
30-Apr-19	76+03
31-May-19	94+46
30-Jun-19	110+00

# Comparison to Baseline:

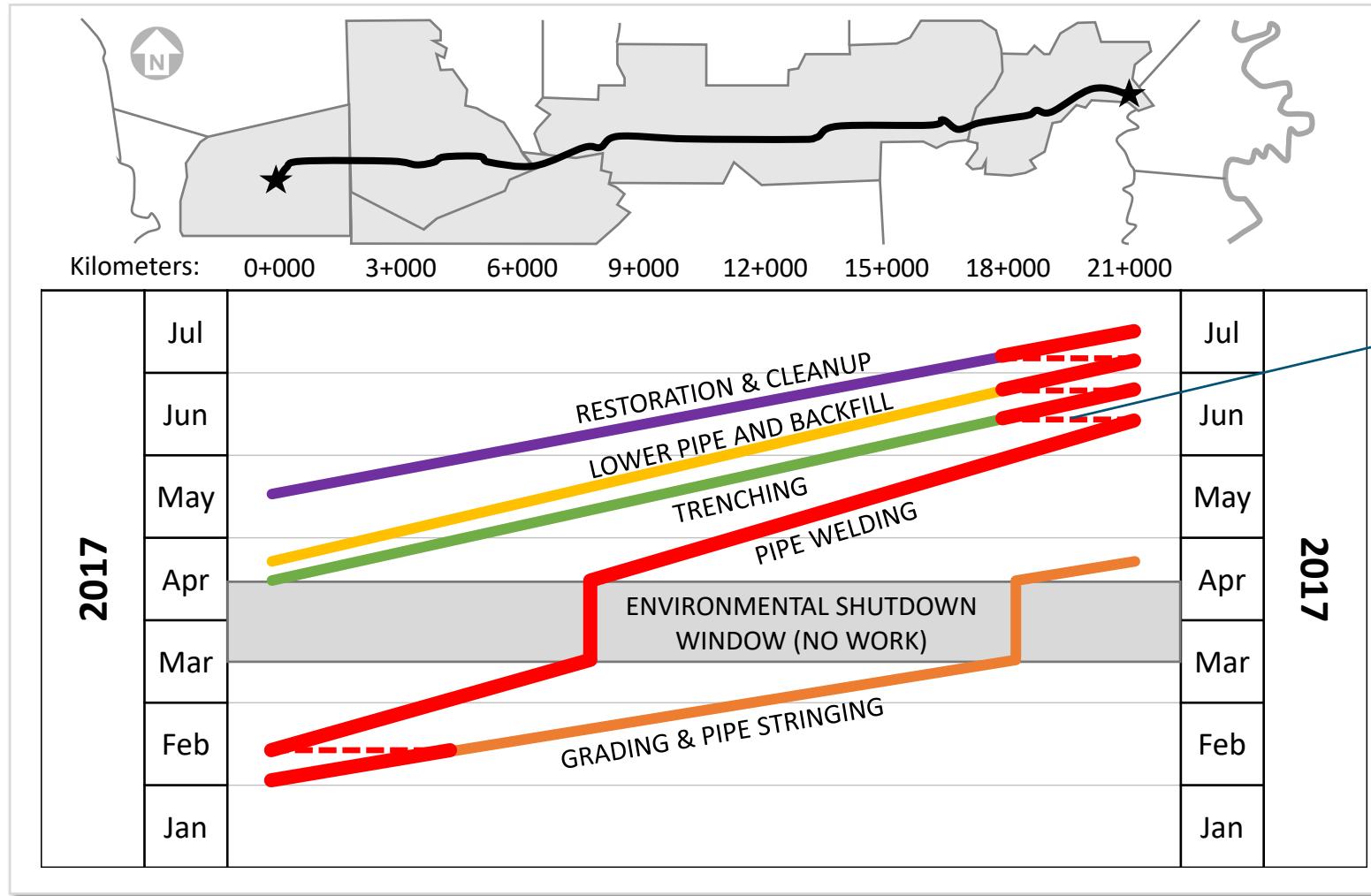
Show Baseline Activities as a Faded Background Layer



# Great for Markups & Alternatives:



# Highlighting the Critical Path:



# A Simple-Yet-Powerful Tool:



"From a risk management perspective, I find great value in using linear schedules to compare complex base (deterministic) schedules and risk-based (probabilistic) schedules. This helps identify the "trouble" activities where uncertainty is the highest. Overlaying the two schedules is a simple, quick, and effective way to help project managers focus their attention and manage their resources."

*-Norman Perez, Senior Engineer at Schnabel Engineering*



"One page, one clear pathway to completion, and infinite combinations of tasks for multi-faceted projects. Brilliant."

*-Allen Jansson, Mechanical Engineer at The Boring Company*



"This is what our Director wants to see."

*-Steve Wheeler, Construction Program Scheduler at Shrewsberry & Associates*

# Thanks for making it this far!

Here's where we've been together:

You've seen how a 1-page linear schedule can effectively communicate your plan to a wide variety of audiences.

You've seen how this method can be applied to all sorts of projects where location of the work is key.

And you've learned how to maintain your linear schedule during construction, when the rubber meets the road.

We hope you've enjoyed this guide.

But more importantly, we hope you'll do something with it.

# Is there an app that creates linear schedules?

We thought you'd never ask. 😊

There are a few products out there. Some are extremely powerful and sophisticated, and can practically cook you breakfast if you can get past the steep learning curve.

We're taking a different approach; developing an app that's easy to use by *non-schedulers* and runs right in Microsoft Excel, which most of you already use every day. If that sounds interesting to you, visit [GraphicSchedule.com](http://GraphicSchedule.com) to learn more.

# Want to help more people discover linear scheduling? ...and get an awesome PowerPoint deck in the process.

**Step 1:** email [james@graphicschedule.com](mailto:james@graphicschedule.com) and ask him to send you the animated PowerPoint version that brings these examples to life.

**Step 2:** share this guide with your project team, your network, and your boss. (Bosses love 1-page linear schedules because they can show it to their boss too...)

**Step 3:** start sketching up a linear schedule for your own project and let us know if you need any help along the way.

**Create something your entire team will love!**

## About GraphicSchedule:

We're a small startup with a big mission: empowering teams to see the big picture, communicate more effectively, and deliver winning projects.

We got tired of drawing schedules by hand so we developed an Excel app that makes it easy.

Visit our website: [GraphicSchedule.com](http://GraphicSchedule.com)

Read our [origin story](#)

Get in touch: [james@graphicschedule.com](mailto:james@graphicschedule.com)

