

# Custom Civil 3D Subassemblies – Why Would I Need That??

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# About the speaker

Matthew Dalton





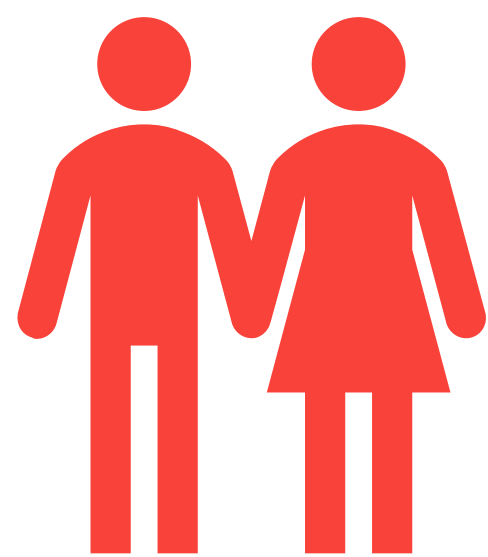
WSP





# WSP

in the UK



**+8,000 staff**





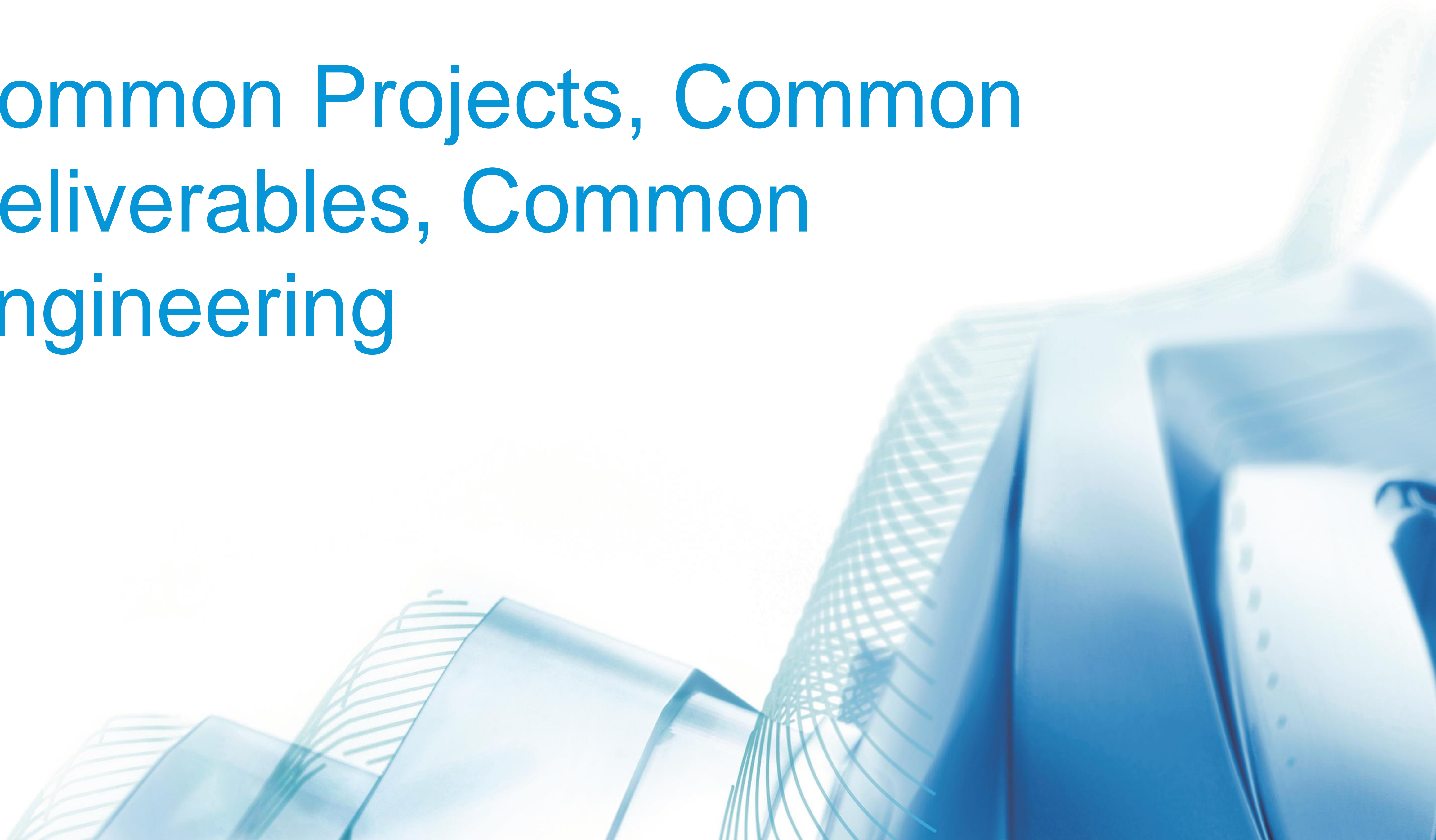
# Breakdown

- Common projects, Common Deliverables, Common Engineering
- Civil 3D 'out of the box' and Common project issues
- Custom Subassemblies
  - The Basics – Point, link and shape codes
  - Next Step – Keeping it simple!
  - Getting Clever – Linking it all up!
  - The Future





# Common Projects, Common Deliverables, Common Engineering





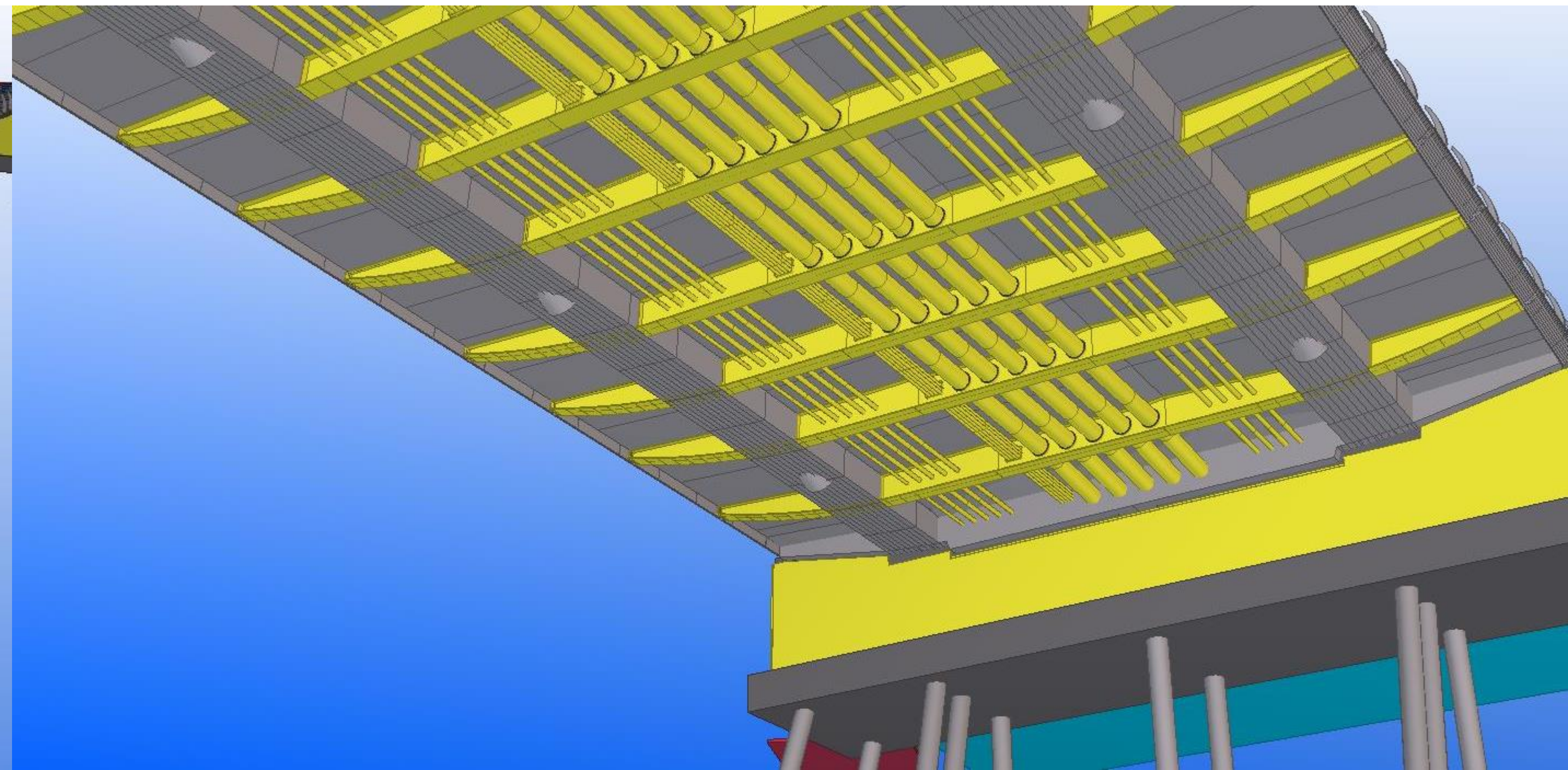
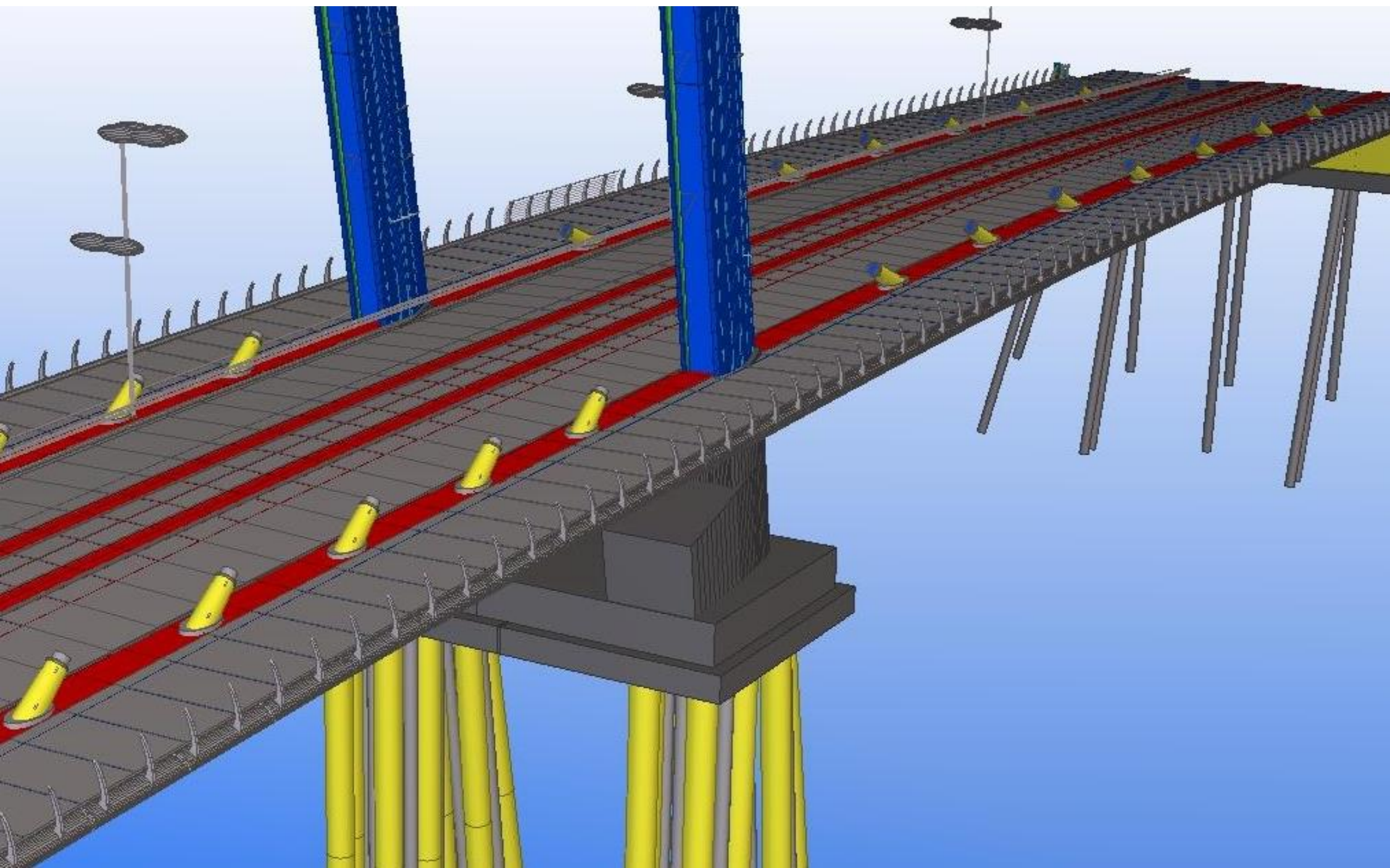
# Common Projects, Common Deliverables, Common Engineering

- Traditional CAD drawings
- Plan view 'string' output files (corridor feature lines, grading feature lines, alignments, drainage networks etc.)





# Common Projects, Common Deliverables, Common Engineering



- 3D Solids for use in clash detection and in a federated Project Information Model (PIM)

- Setting out information (feature lines, points)



# Common Projects, Common Deliverables, Common Engineering

- GIS outputs (to link to client Asset Information Models – Digital Twins)
- Asset Data





# Civil 3D 'out of the box' and Common Project Issues





# High Speed Rail 2 (HS2)





# High Speed Rail 2 (HS2)



## NETWORK

The total HS2 network will be around 330 miles connecting the North and South of the country.



## TOP SPEED

HS2 trains will run up to 400kph, faster than any other European high speed trains



## ECONOMY

The network is expected to generate benefits of £59 billion (including wider economic impacts)

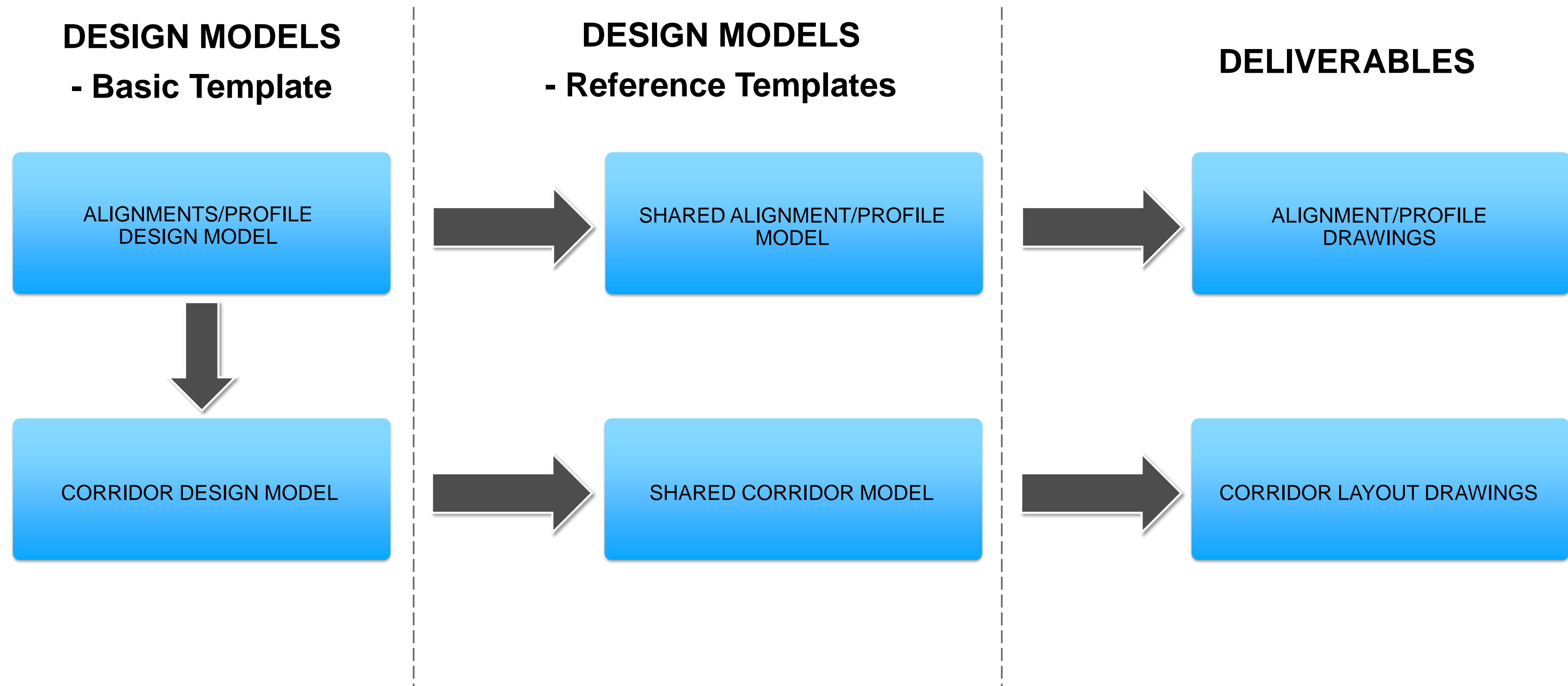


## EMPLOYMENT

The whole country will benefit from HS2, with Phase 1 predicted to support around 40,000 jobs.



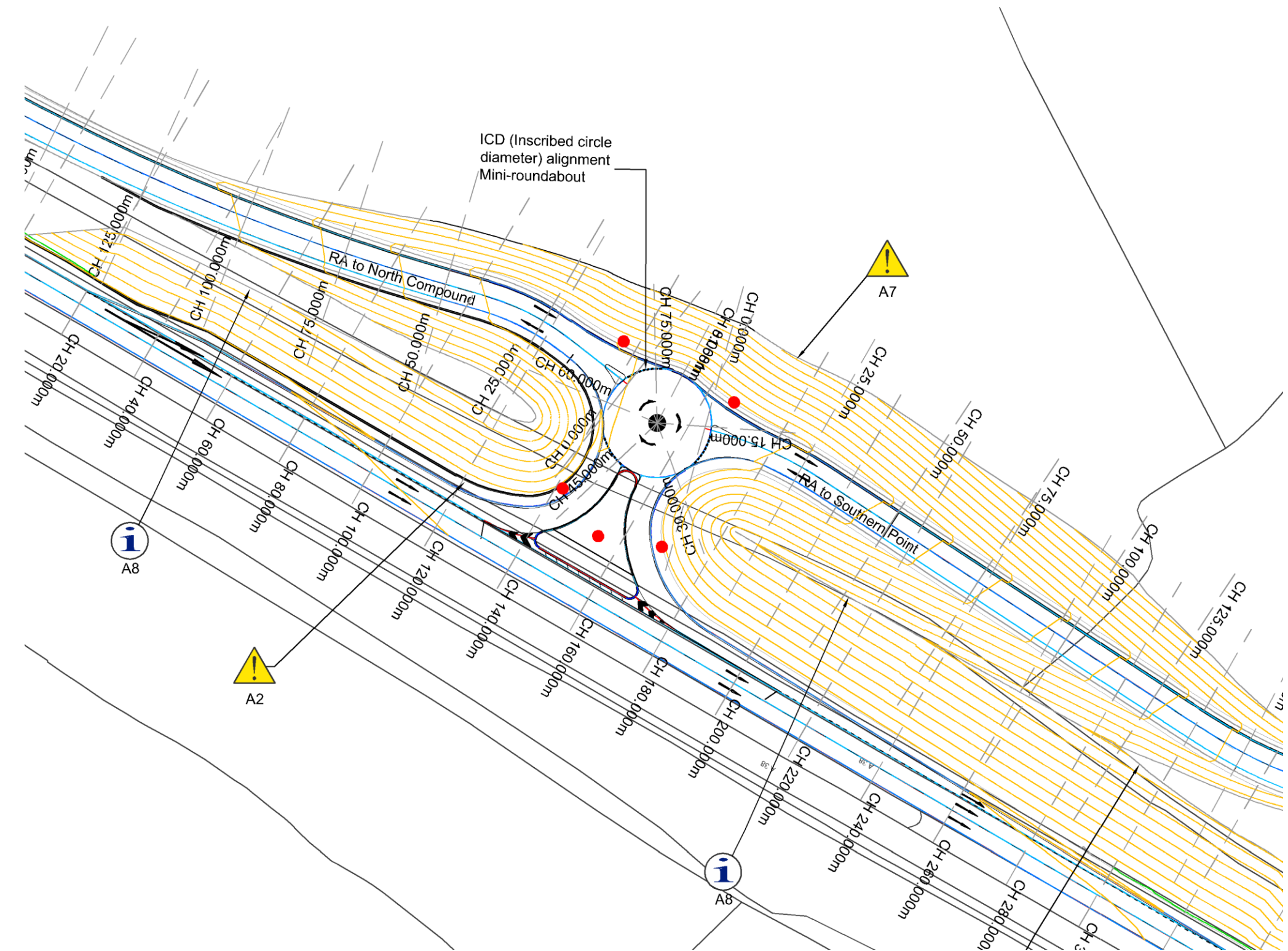
# Model breakdown - Example





# Civil 3D 'out of the box' and Common Project Issues

Checking, re-working, second run-throughs of check/review and post-processing all add up to a fairly significant cost, even for those of us with rigorous CAD standards and verification processes!





# Custom Subassemblies –

So what can they do that's beyond conventional?



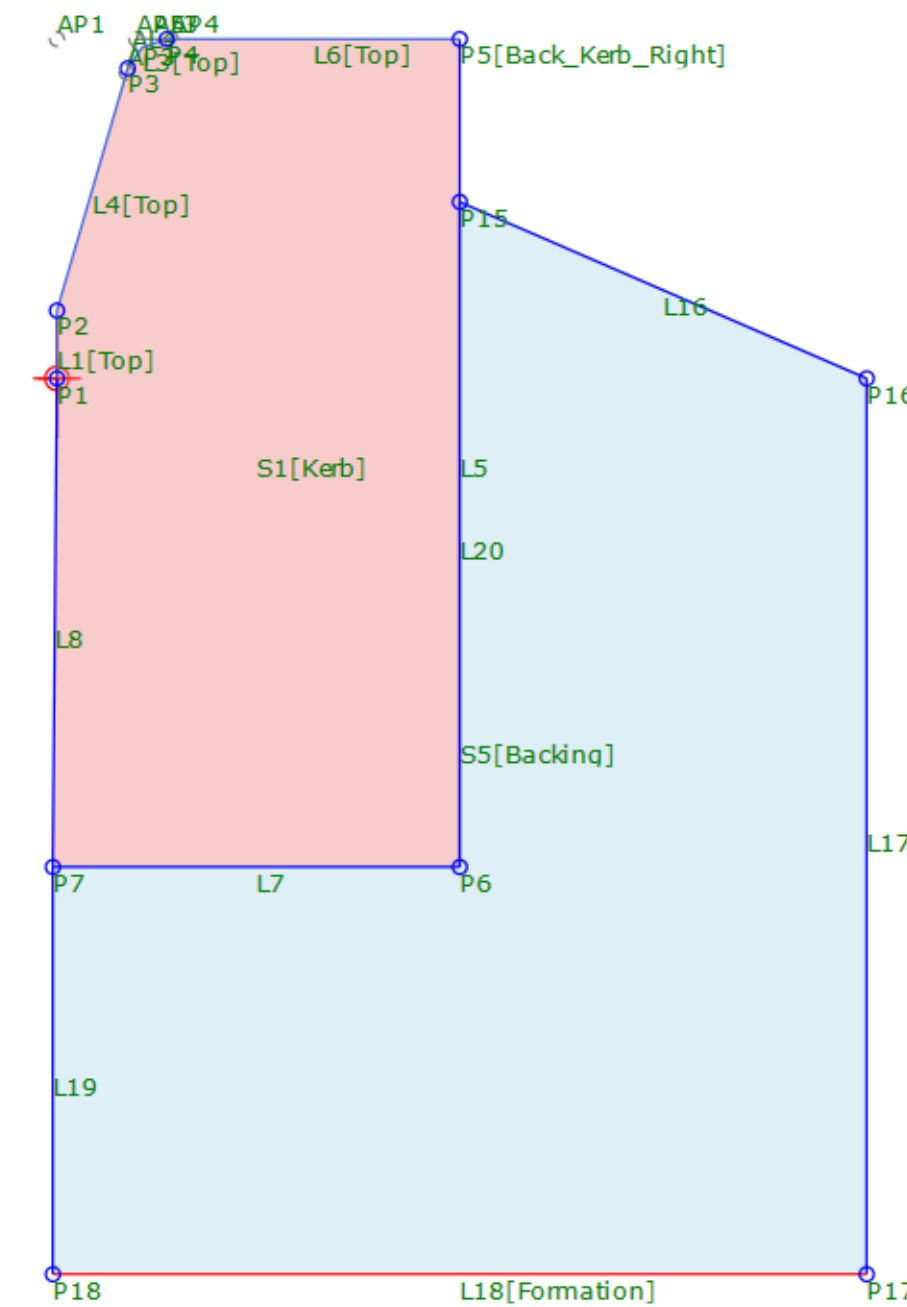


# THE BASICS – Point, Link and Shape Codes

Civil3D subassemblies use three key ‘codes’ in order to produce corridor models and can be varied in their behaviour using ‘Code Set Styles’ within a Civil 3D ‘.dwg’ file.

- Point codes
- Link Codes
- Shape Codes

In a traditional ‘out of the box’ subassembly such as those included with a country kit, these are all manual entry.





# Point Codes

How do we reduce Point  
code related errors?

- Typos
- Inside and Outside codes used
- Overlapping featurelines
- Etc!!





# Point Codes

## THE SOLUTION

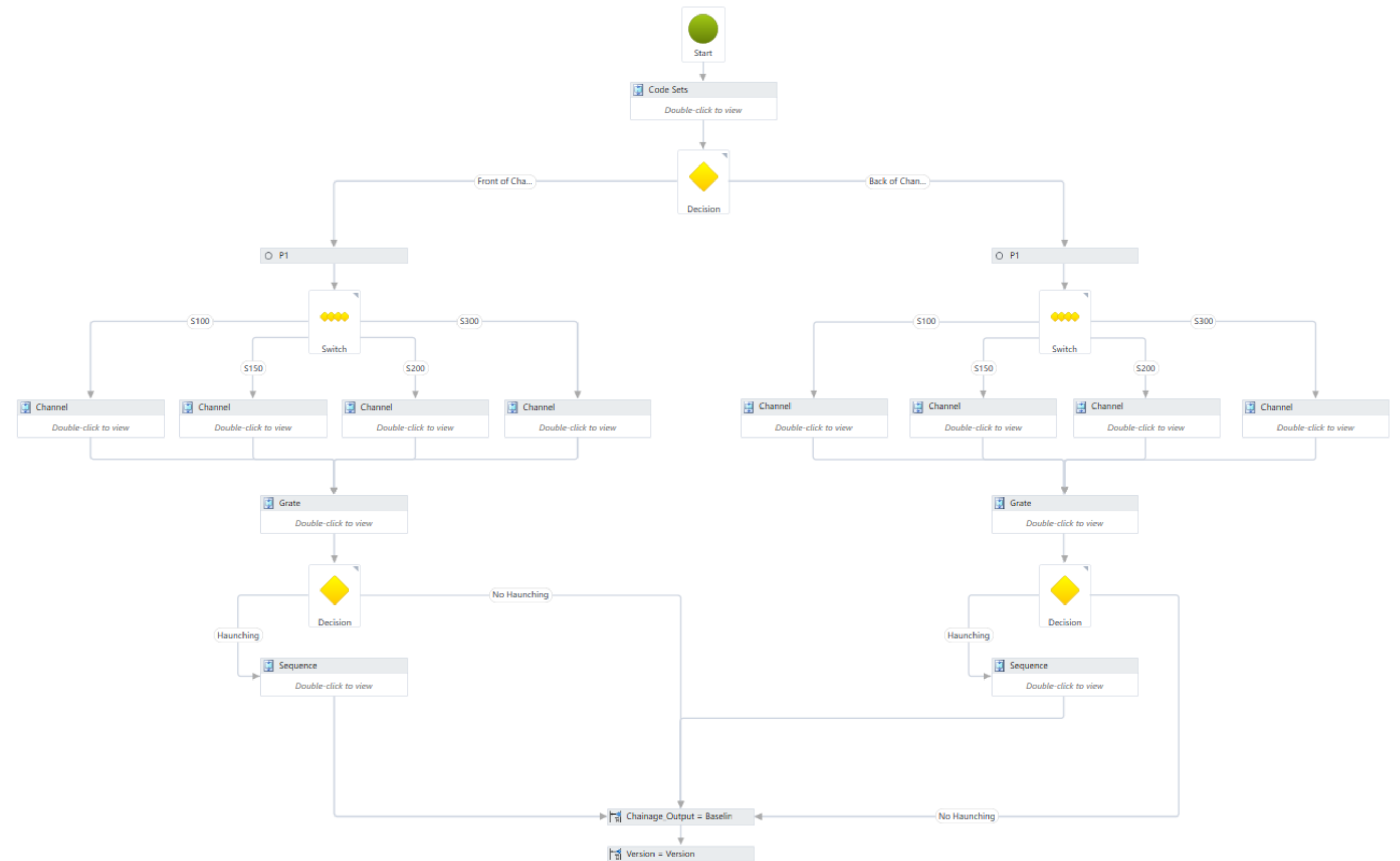
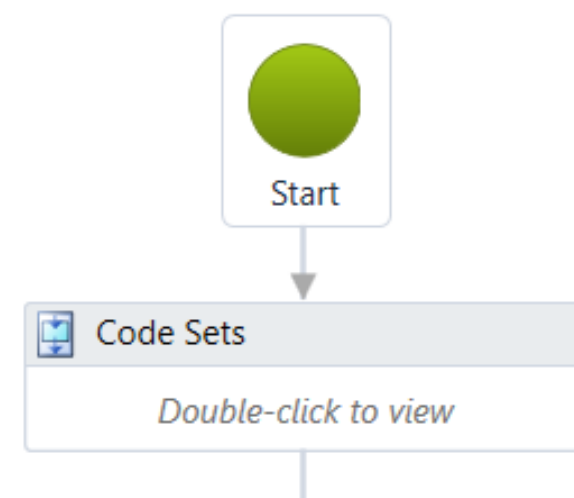
- Hard-code where possible
- Include 'side' information
- Pre-define point codes that can be used in the subassembly
- Choose which of those codes was applicable
- No manual entry = No typos!
- Be common across all subassemblies





# The Layout:

- Keep it tidy
- Make it readable
- Leave it so others can understand
- Organised, locked elements!





# Selectable Point Code Values

- How do we have selectable values for our point codes?...

## Enumeration Lists!!

Enum Group	Enum Item	Display Name (Shows in Civil3D)
Inside_Codes	Crown	Crown
Outside_Codes	Hardstrip	Hardstrip
Target	InsideShoulder	Inside Shoulder
MySuper	EdgeOfCarriageway	Edge Of Carriageway
Surface_Course	CreateEnumItem	
Binder_Course		
Base_Course		
SubBase_Course		
Capping_Course		

Create a parameter for your enumeration list.

Input/Output Parameters					
Name	Type	Direction	Default Value	DisplayName	Description
Side	Side	Input	Left		
Insides	Inside_Codes	Input	Crown	Inside Point Code	Sets inside point code
Outsides	Outside_Codes	Input	EdgeOfCarriagewa	Outside Point Code	Sets outside point code



Then create a string variable and set that to read the parameter name and use the ‘.value’ function.

Variable	
Name	Inside_Pt
Variable Type	String
Default	Insides.value
Miscellaneous	
Comment	



We can then use a second variable to link the side and name together and this is our code variable.

Code Sets	
▽	
Side_Code <String>	▽
Inside_Pt <String>	▽
Inside_Pt_Code <String>	▽
Outside_Pt <String>	▽
Outside_Pt_Code <String>	



# Selectable Point Code Values

And the code we use?

Bring it all together to make it work with a simple 'Yes/No Parameter...

Variable	
Name	Inside_Pt_Code
Variable Type	String
Default	IF(Use_Inside=No,"",Inside_Pt+Side_Code)

The Result?

- Easy to use
- Locked Values determined by enumeration lists
- Side information included automatically
- If it's wrong, the code set misses it and no line appears – Easily checkable!



# GETTING CLEVER – Linking it all up!

- What else can we do if that works??
- Link Codes?
- Shape Codes??

A photograph of a piece of light gray paper with a rectangular section torn out of its center. The edges of the torn paper are irregular and frayed. The text "what else?" is printed in a bold, dark blue, sans-serif font on the white background of the torn section.

**what else?**



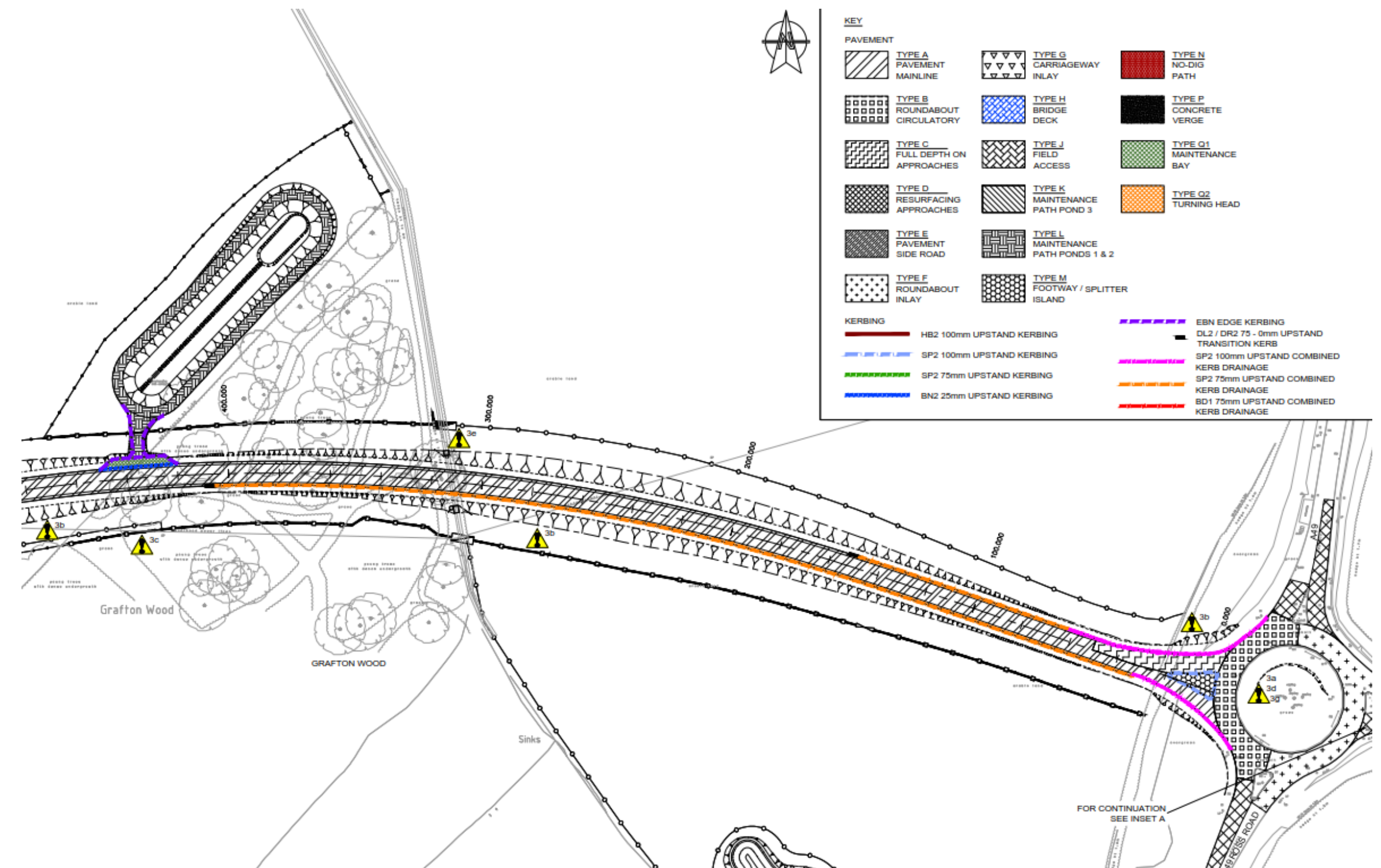
# Link Codes

## Links

- Simple Option: Set Variable — “Top”

OR...

- Use the exact same process of an enumeration list as for point codes..





# Pavement Types...

Lets say we want to automate creation of paving layout drawings...

- Enumeration Lists (again!)
- Create a List which reflects your local layering system (the UK uses Uniclass2015)
- Map to link code using string variables (‘.value’ function)

Enum Group	Enum Item	Display Name (Shows in Civil3D)
Inside_Codes	Pr_35_31_05_05	Asphalt concrete (AC) surface courses
Outside_Codes	Pr_35_31_05_40	Hot-rolled asphalt (HRA) surface courses and slurries
Target	Pr_35_31_05_50	Mastic asphalt (MA) surface courses
MySuper	Pr_35_31_05_65	Porous asphalt concrete (PAC) surface courses
Surface_Course	Pr_35_31_05_85	Stone mastic asphalt (SMA) surface courses
Binder_Course		
Base_Course		
SubBase_Course		
Capping_Course		

CreateEnumItem

CreateEnumGroup

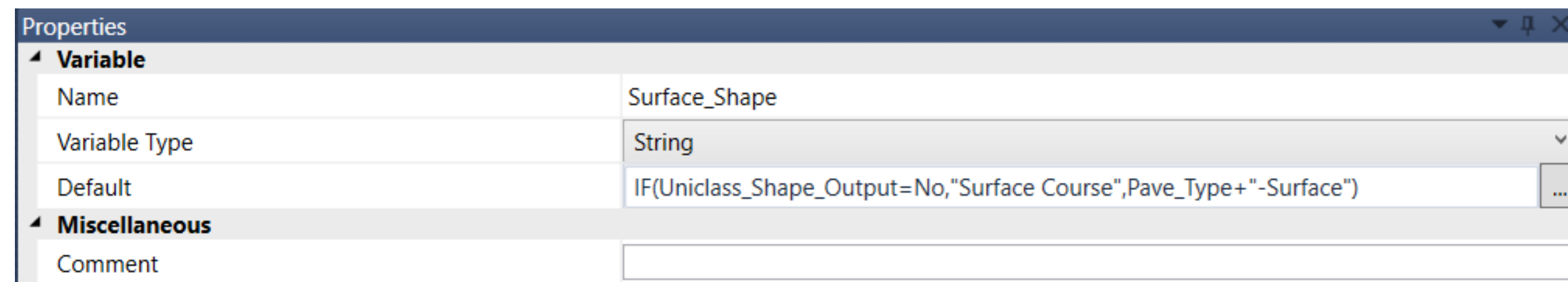
OK Cancel Help



# Going Further – Shape Codes

This also all applies to Shape Codes, but we can do more!

- Shape codes may have multiple uses, not just for solid creation
- Use needs to be flexible
- Create Yes/No Parameter – Uniclass\_Shape\_Output
- Set Shape Code string variable. Needs to reference yes/no parameter and add “-Surface” text (I’ll explain shortly...)



The screenshot shows a 'Properties' window with a dark blue title bar. It contains two expandable sections: 'Variable' and 'Miscellaneous'. The 'Variable' section is expanded, showing three rows: 'Name' with the value 'Surface\_Shape', 'Variable Type' with a dropdown menu set to 'String', and 'Default' with a text field containing the formula 'IF(Uniclass\_Shape\_Output=No,"Surface Course",Pave\_Type+"-Surface")'. A small '...' button is to the right of the 'Default' field. The 'Miscellaneous' section is also expanded, showing a 'Comment' field which is currently empty.

Properties	
<b>Variable</b>	
Name	Surface_Shape
Variable Type	String
Default	IF(Uniclass_Shape_Output=No,"Surface Course",Pave_Type+"-Surface")
<b>Miscellaneous</b>	
Comment	



# Shape Codes & Parameters – Why the effort?

Now if you're sat reading this and scratching your head, why would you want to drive layer information to a shape code?

The answer lies in Civil 3D and how it creates 3D solids.



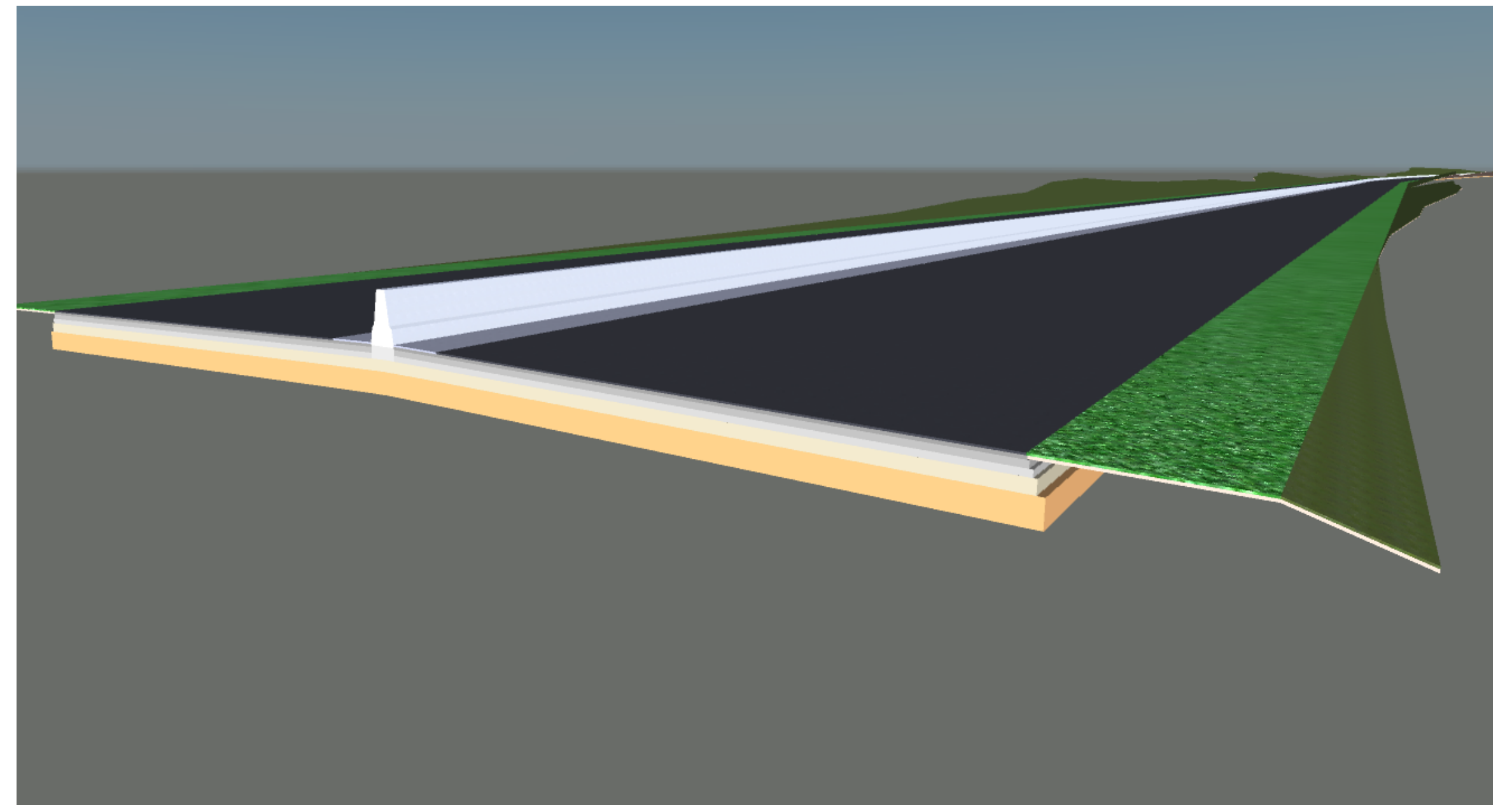
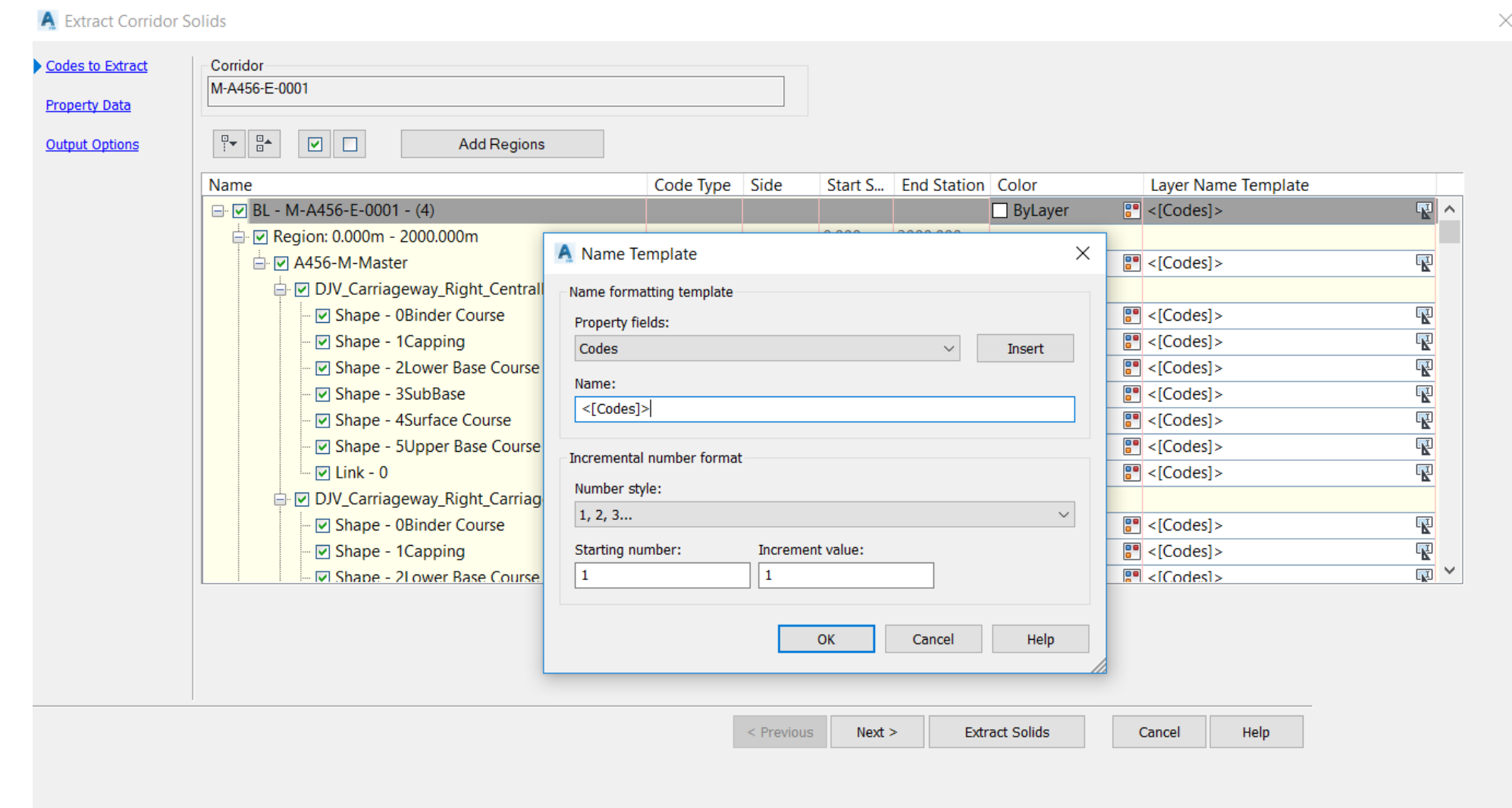


# Civil 3D Solid Output

Use your enumerations to drive your outputs!

- Set your name template to 'Codes' (or ShapeCodes in older C3D versions)
- Create a reference template for a single featureline only (EdgeofCarriageway)
- Dref your corridor model
- Create solids in that 'solids only' model
- Dynamically link the solids to the corridor
- Append to Navisworks

You now have a dynamically updating 3D solid model file, which will maintain its link to your single source of truth!

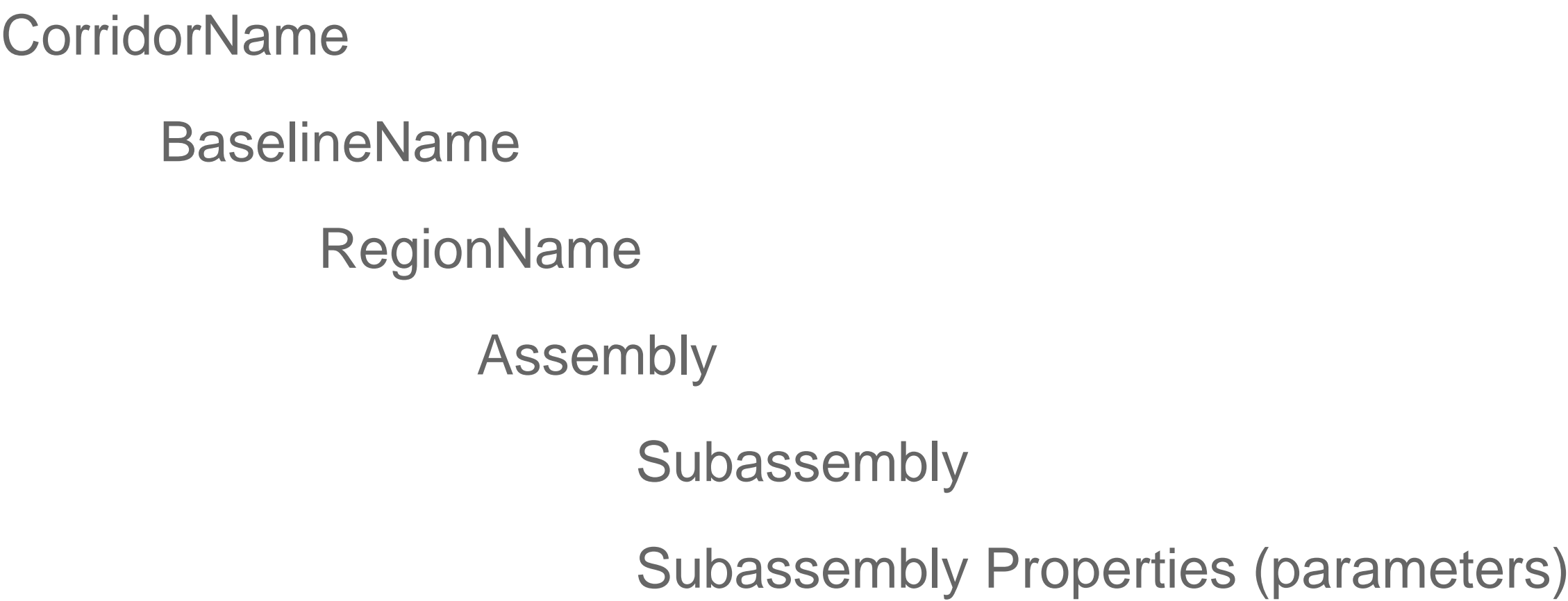




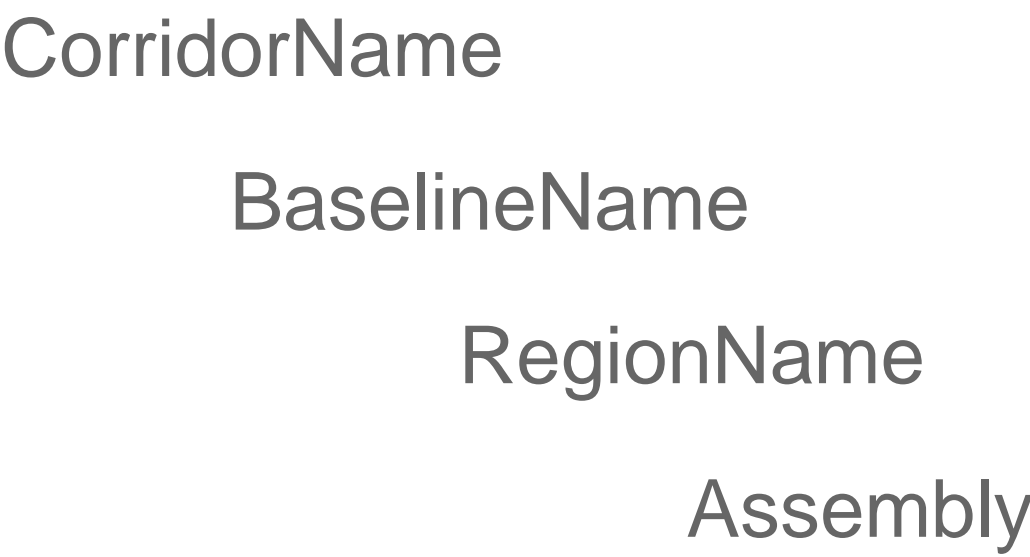
# The Future – Leveraging Your Subassemblies For More!

Time to really stretch things out....

How is a corridor structured in the .net API?



And in the 3D Solids File??



Unique, Non-repeatable, extractable!!!!

```
- Corridor: TestCorridor - (1) (2319600249968)

- Solid3d: (2319600253072)
  *A1:
    CorridorName: TestCorridor - (1)
    CorridorDesc:
    BaselineName: BL - M-Mainline Dual Carriageway-1 - (2)
    HorizontalBaseline: M-Mainline Dual Carriageway-1
    VerticalBaseline: M-Mainline Dual Carriageway-1 - Training_Topo - SP 2
    RegionName: RG - TestAssembly - (1) - (2)
  *A3:
    CodeName: Topsoil_Shape, Grass
    Side: Left
    RateItem:
    ClassificationCode:
    AssemblyName: TestAssembly - (1)
    AssemblyStartStation: 0.000m
    AssemblyEndStation: 6711.992m

- Assembly: TestAssembly - (1) (2319600249824)

- Subassembly: Subassembly3 (2319600249952)
  Subassembly Properties:
    Verge Grade: -0.025
    Sub-Surface Depth: 0.3
    Topsoil Depth: 0.15
    Verge Width: 2.5
    Formation Link Code: Formation
    Inside Point Code: Verge_In
    Outside Point Code: Verge_Out
    Subsoil Shape Code: Subsoil_Shape
    Subsoil Top Link Code: Subsoil_Top_Link
    Topsoil Base Link Codes: Topsoil_Base_Code
    Top Link Codes: Top, Verge
    Topsoil Shape Code: Topsoil_Shape
    Verge Sub Material: Sub-Soil
    Side: Left
    Verge Top Material: Grass
```



Have at me!!







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