

Model development management on Highways England SMART motorways projects with CH2M

Paul Napier, Pete Burchill, Jonathan Dempsey

CH2M

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Agenda

- Client Requirements
 - Governing Documents
 - Resulting scope of information
- Solution Architecture
- Key features
- Live Demo
- Resulting Output
- Questions

Client Requirements

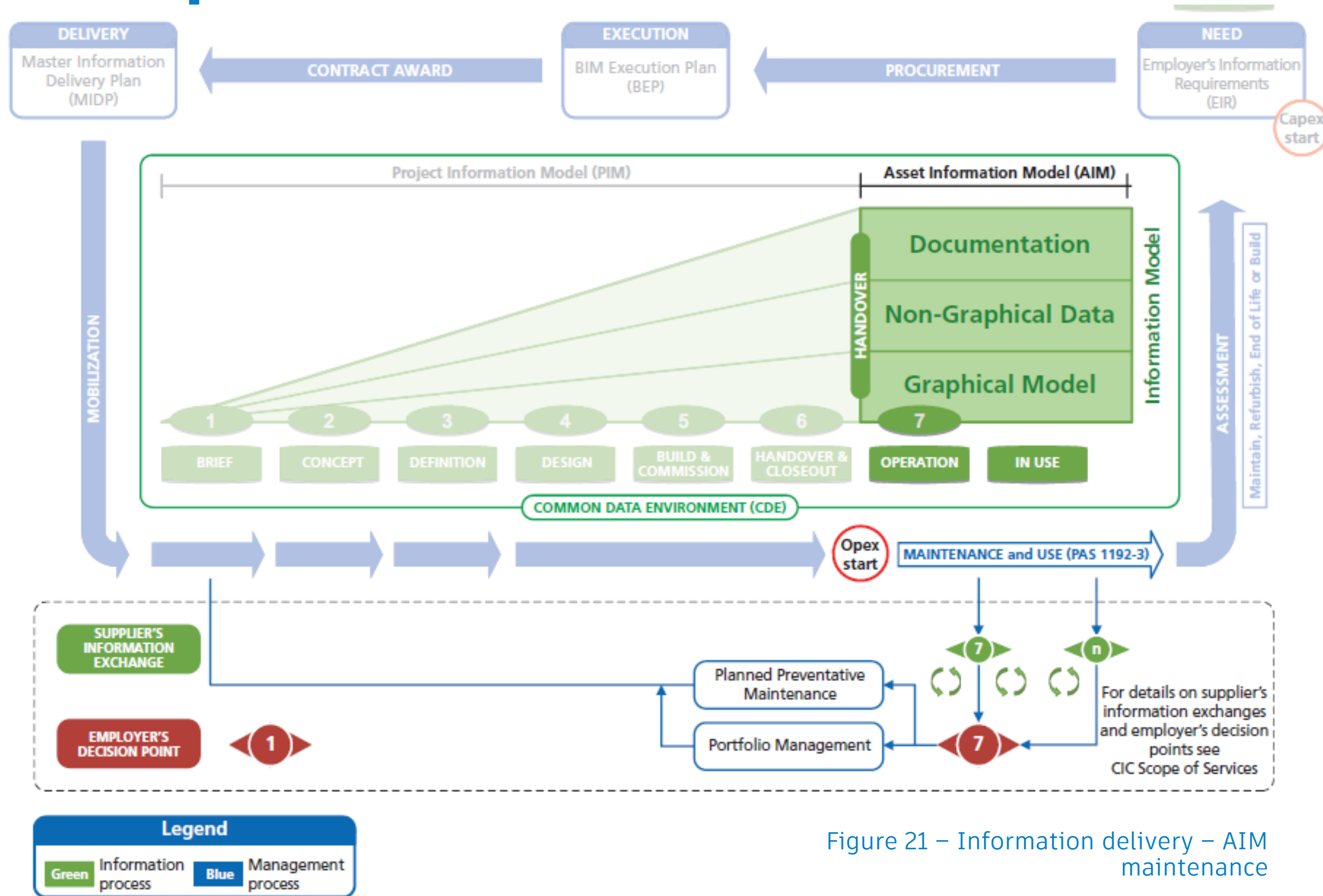


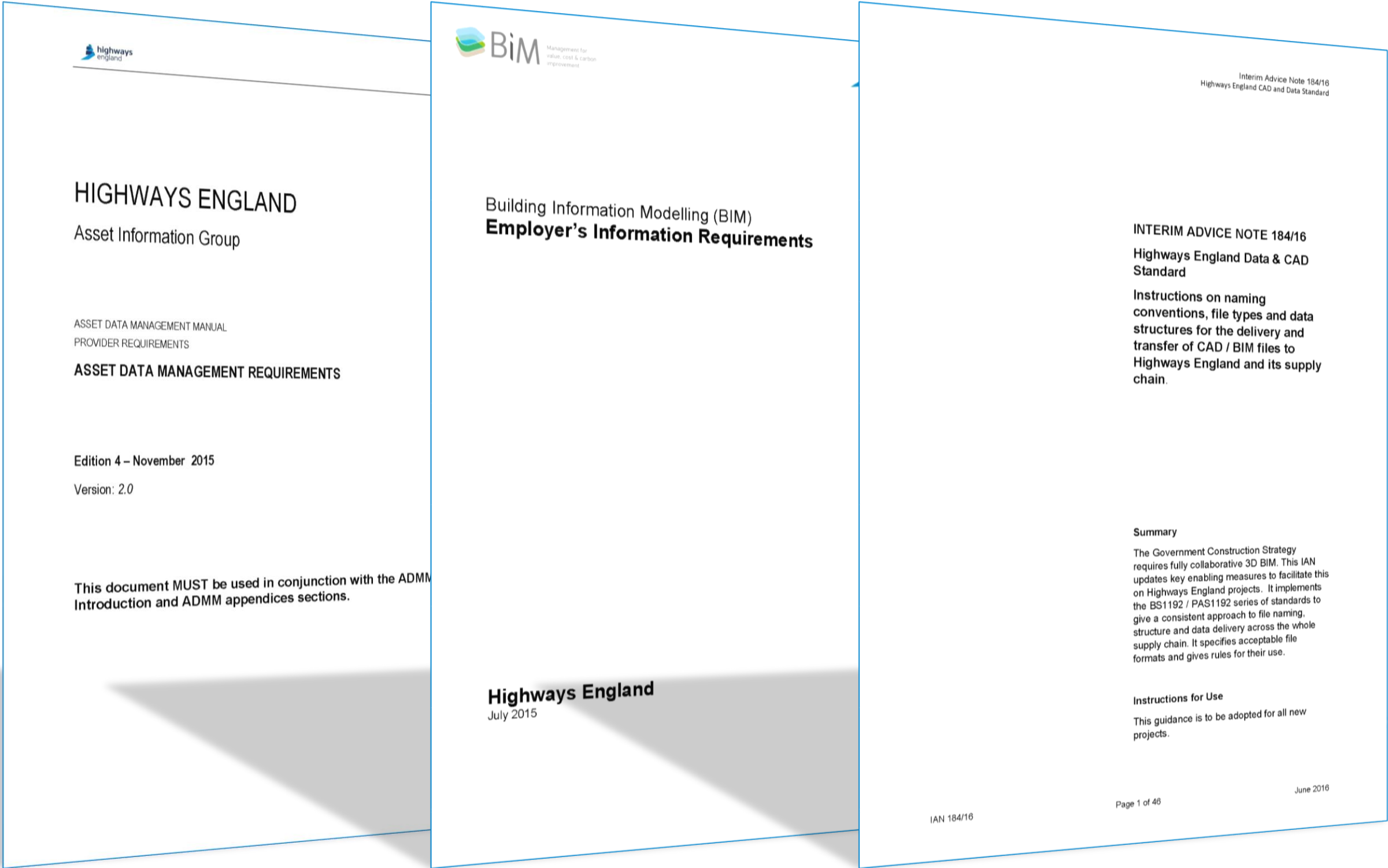
Figure 21 – Information delivery – AIM maintenance

PAS 1192-2:2013

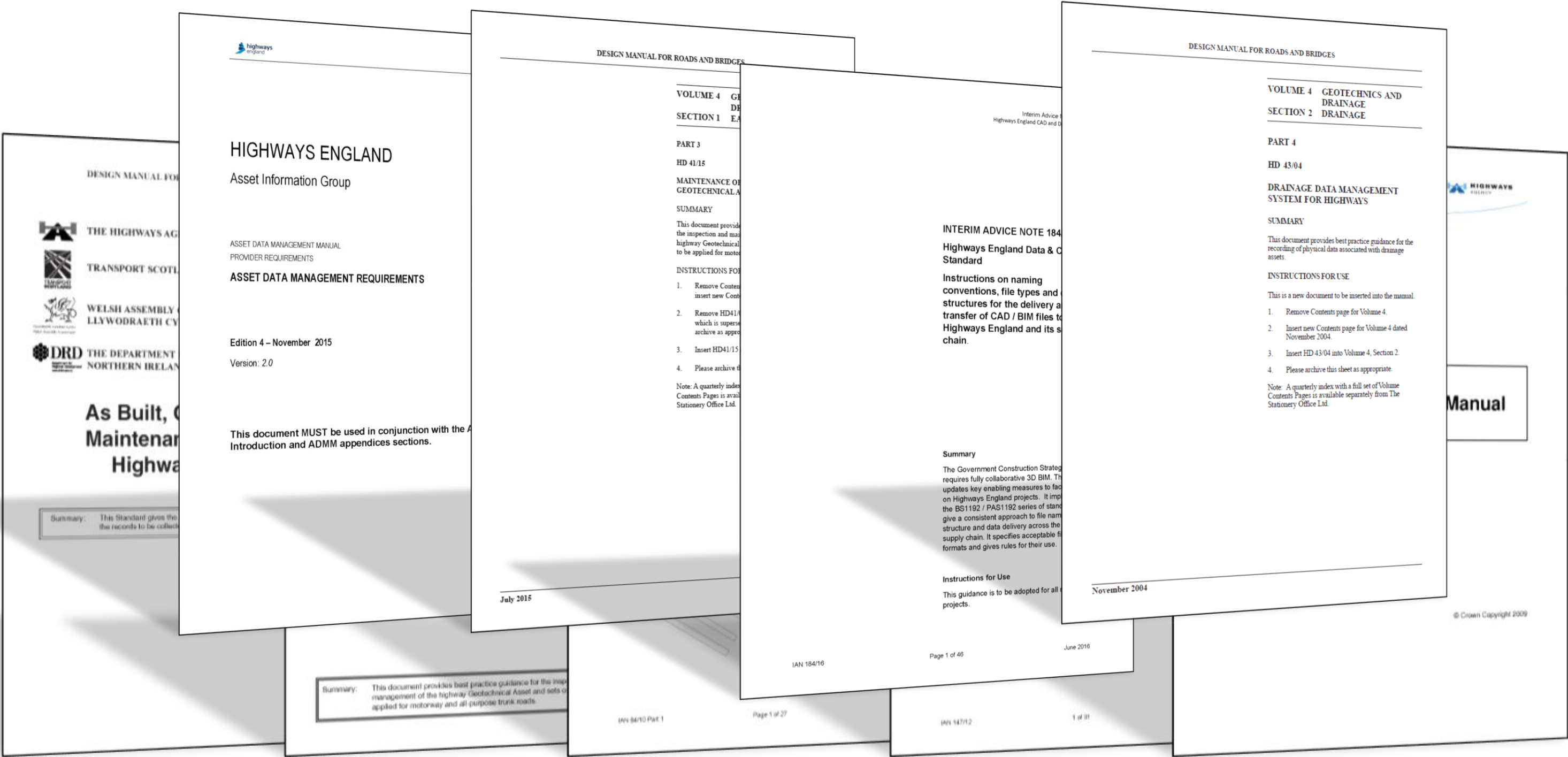


Client Requirements

Client Requirements



Client Requirements



Highways England Handover Requirements

Attributes										
Name	Type	Values	Requirement	Phase	Required By	D	C	M	Data Source	Comments
Status										
Object ID	VARCHAR			Design / Const / Ma	All	M	M			
Status	ENUM			Design / Const / Ma	All	M	M			See IAN 184 for Asset Status
3D Model Confidence	ENUM			Design / Const / Ma	All	M	M			Relevant to 3D model of existing
3D Model Revision	VARCHAR			Design / Const / Ma	All	M	M			Model version the design data came from
3D Model File	VARCHAR			Design / Const / Ma	All	M	M			Model file the design data came from
Location										
XSP	VARCHAR		ADMM	Design / Const / Ma	Maintainer	O	O	M		
Section Label	VARCHAR		ADMM	Main	Maintainer	O	O	M		
Start Chainage	NUMBER		ADMM	Design / Const / Ma	All	M	M	M		
End Chainage	NUMBER	NOT APPLICABLE	ADMM	Design / Const / Ma	All	N/A	N/A	N/A		
Start Date of Asset	DATE		ADMM	Const / Main	All	O	O	M		
Road Link	VARCHAR			Design / Const / Ma	All	M	M			The road link the chainage relates to
Start Easting (X) Local	NUMBER			Design / Const / Ma	All	O	O		AutoCAD	
Start Northing (Y) Local	NUMBER			Design / Const / Ma	All	O	O		AutoCAD	
Start Elevation (Z) Local	NUMBER			Design / Const / Ma	All	O	O		AutoCAD	
End Easting (X) Local	NUMBER	NOT APPLICABLE		Design / Const / Ma	All	N/A	N/A	N/A	AutoCAD	
End Northing (Y) Local	NUMBER	NOT APPLICABLE		Design / Const / Ma	All	N/A	N/A	N/A	AutoCAD	
End Elevation (Z) Local	NUMBER	NOT APPLICABLE		Design / Const / Ma	All	N/A	N/A	N/A	AutoCAD	
Start Easting (X) National	NUMBER			Design / Const / Ma	All	O	O			Calculate from Local Grid
Start Northing (Y) National	NUMBER			Design / Const / Ma	All	O	O			Calculate from Local Grid
Start Elevation (Z) National	NUMBER			Design / Const / Ma	All	O	O			Calculate from Local Grid
End Easting (X) National	NUMBER	NOT APPLICABLE		Design / Const / Ma	All	N/A	N/A	N/A		Calculate from Local Grid
End Northing (Y) National	NUMBER	NOT APPLICABLE		Design / Const / Ma	All	N/A	N/A	N/A		Calculate from Local Grid
End Elevation (Z) National	NUMBER	NOT APPLICABLE		Design / Const / Ma	All	N/A	N/A	N/A		Calculate from Local Grid
Security										
Security Classification	ENUM?					M	M			

23 Attributes are common to all asset types. Most are location based

Highways England Handover Requirements

Asset Code:										MH									
Document References:										HD 43									
Links:										Drawings, Spec App 500 Series, Drainage Schedules									
Attributes																			
Name		Type	Values	Requirement	Phase	Required By		Status		D	C	M	Data Source	Comments					
Object ID		VARCHAR			Design / Const / M All	Status				M	M								
Status		ENUM			Design / Const / M All														
3D Model Confidence		ENUM			Design / Const / M All					M	M								
3D Model Revision		VARCHAR			Design / Const / M All					M	M			See IAN 184 for					
3D Model File		VARCHAR			Design / Const / M All					M	M			Model version					
					Design / Const / M All					M	M			Model file the d					
Location																			
XSP		VARCHAR			Design / Const / M All					M	M								
Section Label		VARCHAR			Design / Const / M All					O	O								
Start Chainage		NUMBER			Main	Maintainer				O	O								
End Chainage		NUMBER	NOT APPLICABLE		Design / Const / M All					M	M								
Start Date of Asset		DATE			Design / Const / M All					N/A	N/A	N/A							
Road Link		VARCHAR			Const / Main	All				O	O								
Start Easting (X) Local		NUMBER			Design / Const / M All					M	M								

Category: Devices																			
Asset Code:		DEV_DRC																	
Document References:		MCH 1864																	
Links:		Drawings, Spec App 1500 Series, Result of Electrical Test																	
Attributes																			
Name		Type	Values	Requirement	Phase	Required By		Status		D	C	M	Data Source	Comments					
Object ID		VARCHAR			Design / Const / M All	Status				M	M								
Status		ENUM			Design / Const / M All														
3D Model Confidence		ENUM			Design / Const / M All					M	M								
3D Model Revision		VARCHAR			Design / Const / M All					M	M			See IAN 184 for					
3D Model File		VARCHAR			Design / Const / M All					M	M			Model version					
					Design / Const / M All					M	M			Model file the d					
Location																			
XSP		VARCHAR			Design / Const / M All					O	O								
Section Label		VARCHAR			Main	Maintainer				O	O								
Start Chainage		NUMBER			Design / Const / M All					O	O								
End Chainage		NUMBER	NOT APPLICABLE		Design / Const / M All					M	M								
Start Date of Asset		DATE			Design / Const / M All					N/A	N/A	N/A							

Category: Lighting Point																			
Asset Code:		LIPD																	
Document References:		ADMM																	
Links:		Drawings, Spec App 1300 Series																	
Attributes																			
Name		Type	Values	Requirement	Phase	Required By		Status		D	C	M	Data Source	Comments					
Object ID		VARCHAR			Design / Const / M All	Status				M	M								
Status		ENUM			Design / Const / M All														
3D Model Confidence		ENUM			Design / Const / M All					M	M			See IAN 184 for					
3D Model Revision		VARCHAR			Design / Const / M All					M	M			Model version					
3D Model File		VARCHAR			Design / Const / M All					M	M			Model file the design data name from					
Location																			
XSP		VARCHAR			Design / Const / M All					O	O								
Section Label		VARCHAR			Main	Maintainer				O	O								
Start Chainage		NUMBER			Design / Const / M All					M	M								
End Chainage		NUMBER	NOT APPLICABLE		Design / Const / M All					M	M								
Start Date of Asset		DATE			Design / Const / M All					N/A	N/A	N/A							
Road Link		VARCHAR			Const / Main	All				O	O								
Start Easting (X) Local		NUMBER			Design / Const / M All					M	M								
Start Easting (Y) Local		NUMBER			Design / Const / M All					M	M								
Start Easting (Z) Local		NUMBER			Design / Const / M All					O	O			The road link the chainage relates to					
End Chainage (X) Local		NUMBER	NOT APPLICABLE		Design / Const / M All					O	O			AutoCAD					
End Chainage (Y) Local		NUMBER	NOT APPLICABLE		Design / Const / M All					O	O			AutoCAD					
End Chainage (Z) Local		NUMBER	NOT APPLICABLE		Design / Const / M All					N/A	N/A	N/A		AutoCAD					
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Start Easting (Y) Local		NUMBER	NOT APPLICABLE		Design / Const / M All					N/A	N/A	N/A		AutoCAD					
Start Easting (Z) Local		NUMBER	NOT APPLICABLE		Design / Const / M All					N/A	N/A	N/A		AutoCAD					

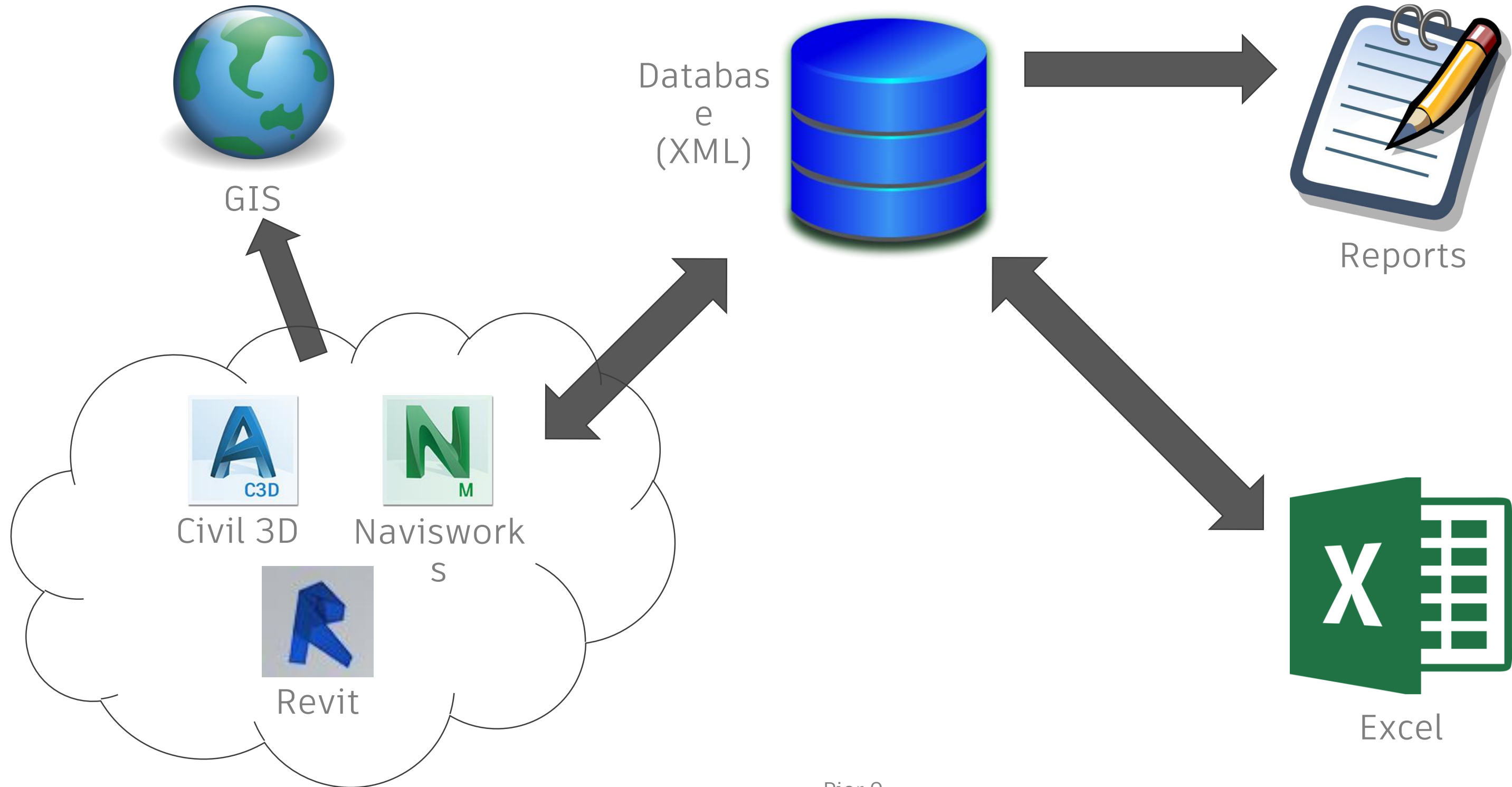
154 Asset Types with attributes ranging from 25 to 94 attributes per asset
One scheme has 520 signs resulting in 85,100 asset fields to be populated.
One scheme 50km length – 1,000,000+ attributes

System Type										Security Classification										Specific										Prevalence																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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The background of the image is a complex, abstract wireframe mesh. The mesh is composed of numerous interconnected lines forming a series of irregular, organic shapes that resemble a network or a topological structure. The lines are thin and grey. A solid blue horizontal bar spans the bottom portion of the image, providing a contrasting background for the text.

Solution Architecture

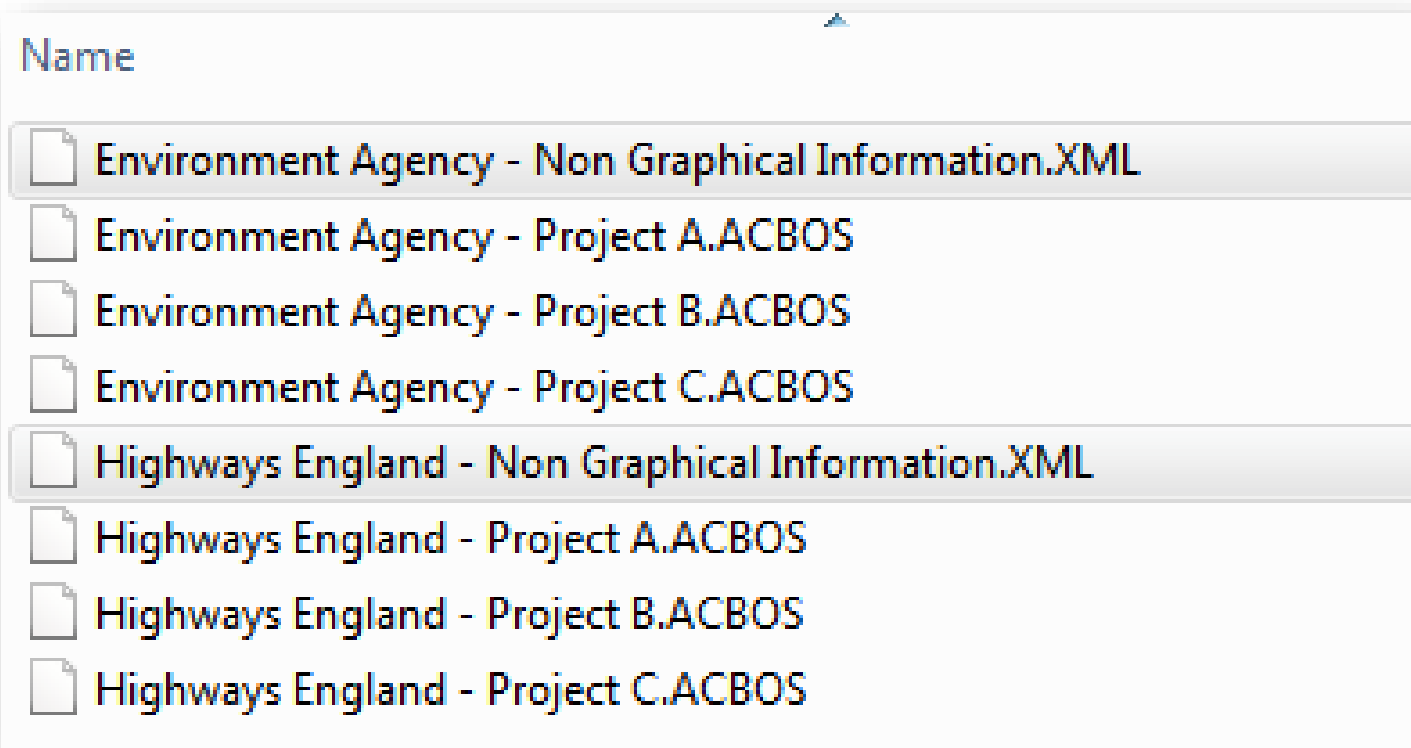
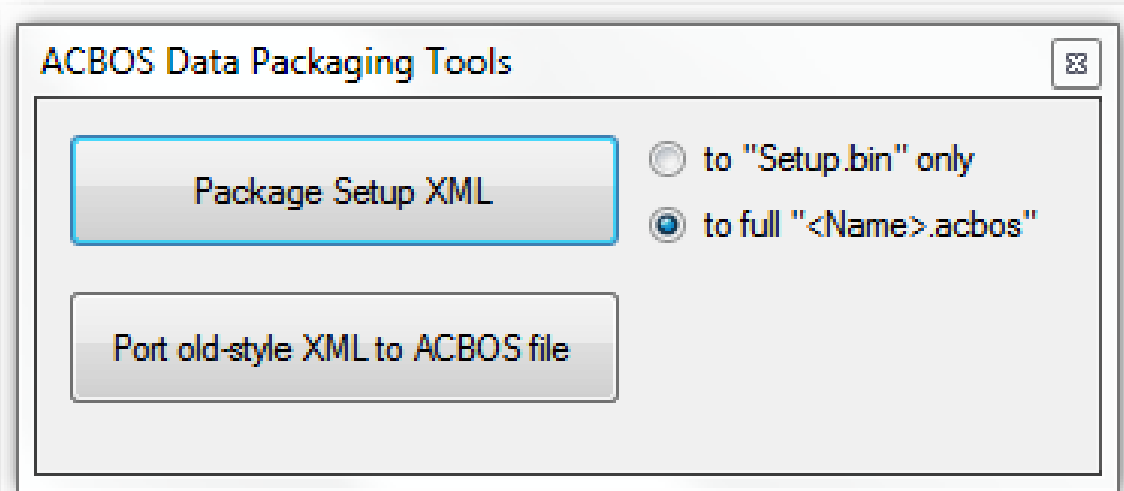
Solution Architecture





Model Development Manager Capabilities

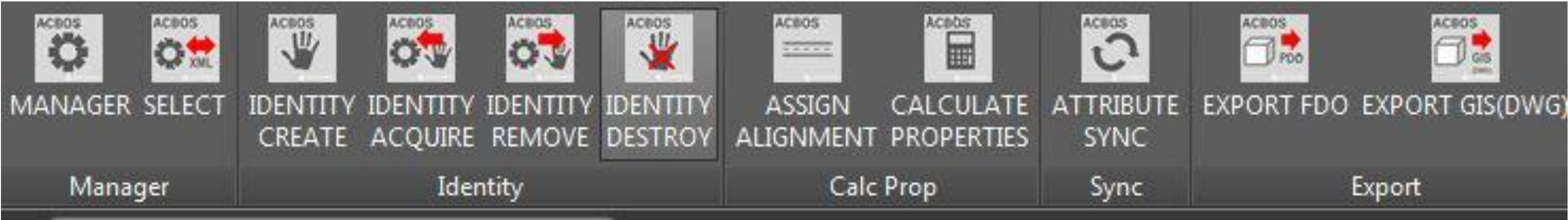
Project Setup



- Create XML schema template per client
- Easily create specific project database file from the template
- Assign project information such as Project ID and Name
- All generated asset ID numbers will contain the Project ID code

Model Development Manager

Civil 3D Ribbon



Manager

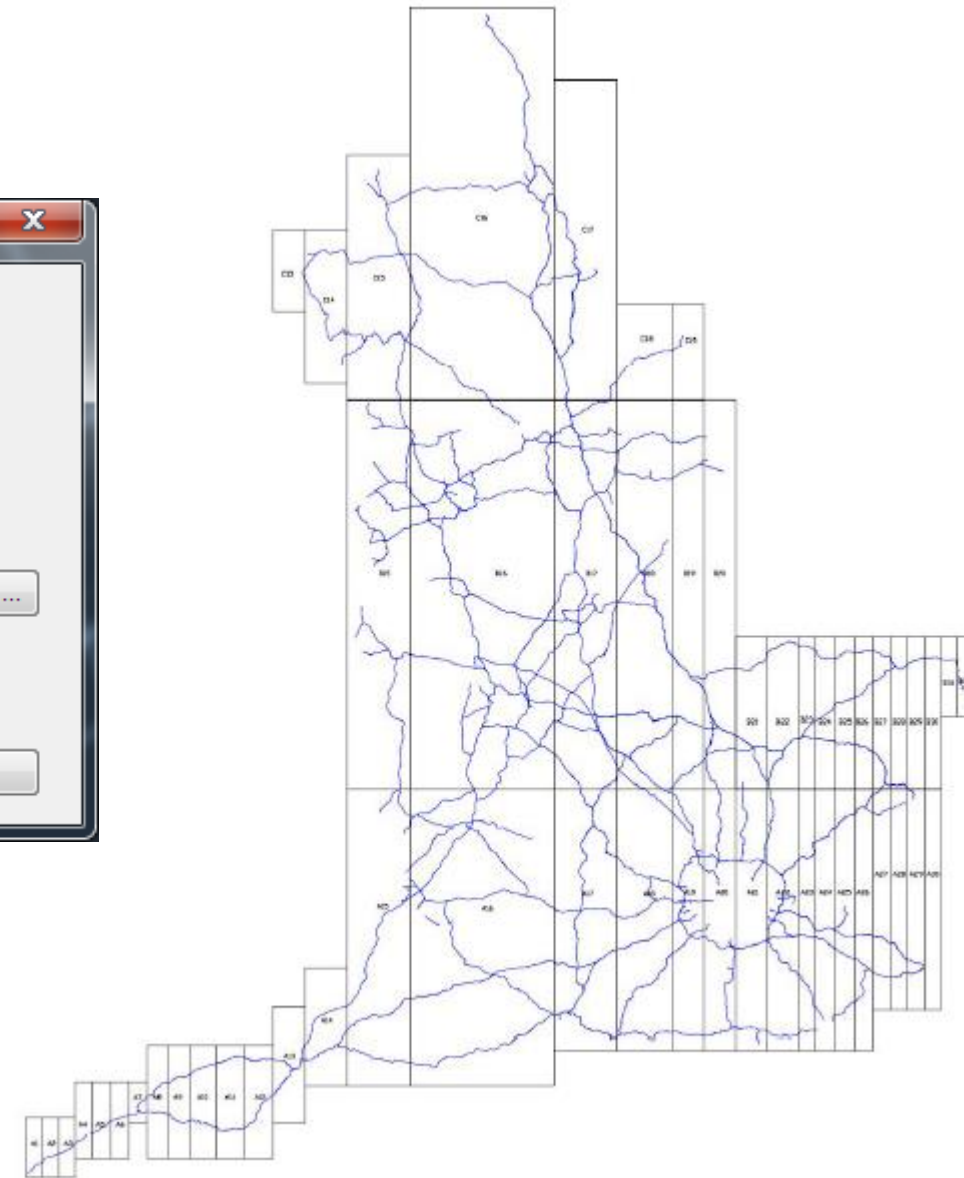
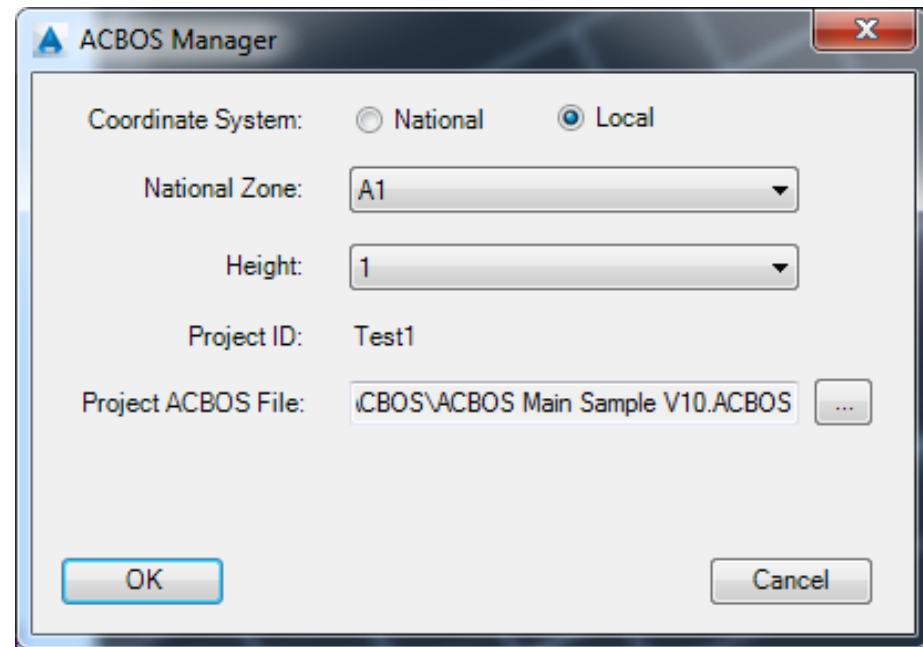


Figure 3: Highways Agency Local Grid Layout for England

- Set the database file to use with the model
- Specify if your model is in National or Local co-ordinate system.
- Specify details for Local Grid setup (Currently accepts IAN 99 zone bands)

Calculate Properties

- MDM can automatically calculate for each object:
 - Start / end chainage in relation to its assigned alignment
 - Bounding box X,Y,Z coordinates in both National and Local grids.
- Easily change which alignment objects are assigned to with “Assign Alignment” tool

XSP	
SectionLabel	
StartChainage	50920.61
EndChainage	52520
StartDateofAsset	
RoadLink	
StartEasting(X)Local	473755.86
StartNorthing(Y)Local	169260.12
StartElevation(Z)Local	41.52
EndEasting(X)Local	475272.87
EndNorthing(Y)Local	169595.85
EndElevation(Z)Local	60
StartEasting(X)National	611917.65
StartNorthing(Y)National	-1682.08
StartElevation(Z)National	41.52
EndEasting(X)National	613435.18
EndNorthing(Y)National	-1346.23
EndElevation(Z)National	60
SecurityClassification	To be Populated
InstallationDate	

Highways England Handover Requirements

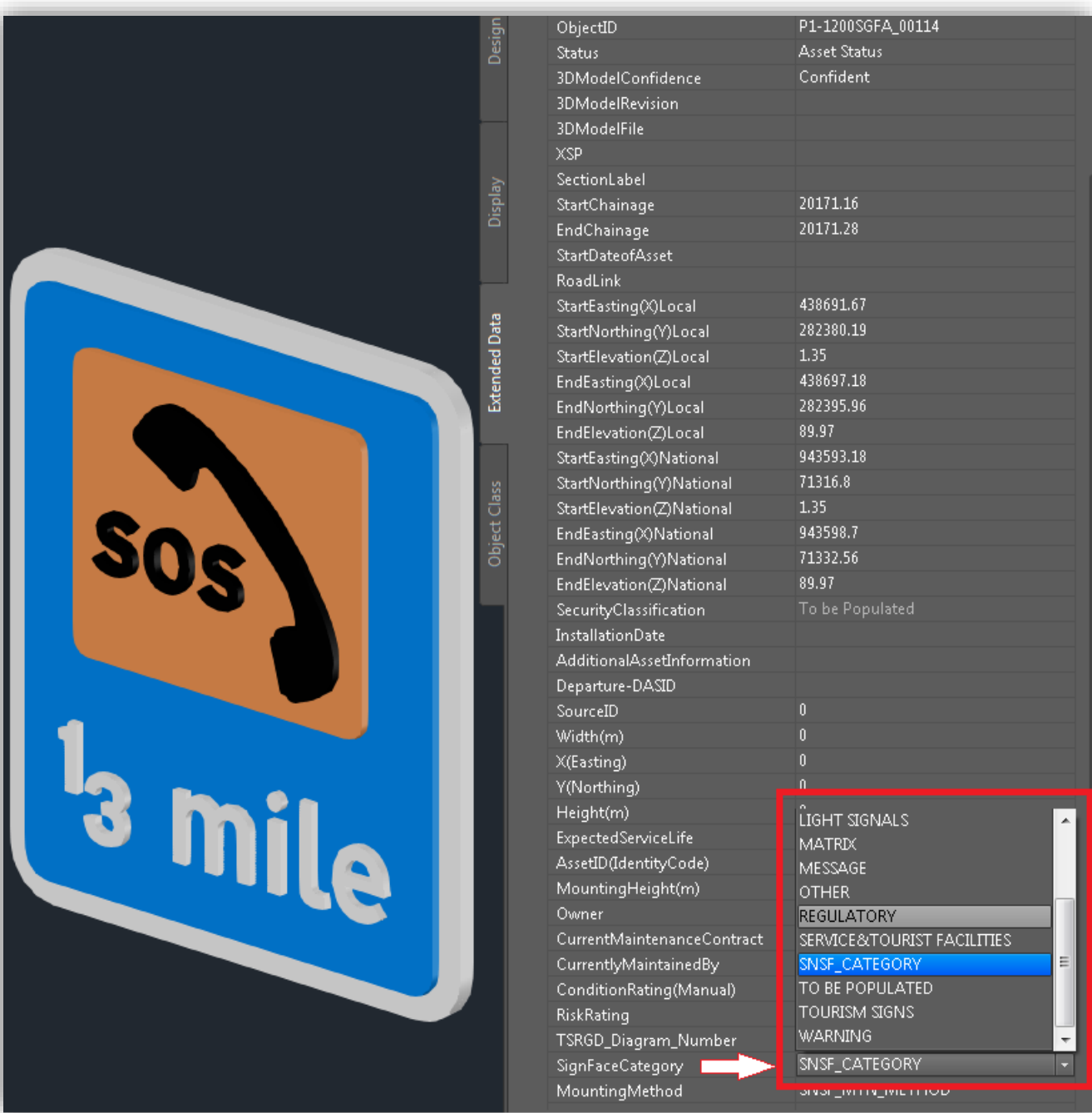
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Start Northing (Y) Local	NUMBER			Design / Const / Ma	All	O	O		AutoCAD	
Start Elevation (Z) Local	NUMBER			Design / Const / Ma	All	O	O		AutoCAD	
End Easting (X) Local	NUMBER	NOT APPLICABLE		Design / Const / Ma	All	N/A	N/A	N/A	AutoCAD	
End Northing (Y) Local	NUMBER	NOT APPLICABLE		Design / Const / Ma	All	N/A	N/A	N/A	AutoCAD	
End Elevation (Z) Local	NUMBER	NOT APPLICABLE		Design / Const / Ma	All	N/A	N/A	N/A	AutoCAD	
Start Easting (X) National	NUMBER			Design / Const / Ma	All	O	O			Calculate from Local Grid
Start Northing (Y) National	NUMBER			Design / Const / Ma	All	O	O			Calculate from Local Grid
Start Elevation (Z) National	NUMBER			Design / Const / Ma	All	O	O			Calculate from Local Grid
End Easting (X) National	NUMBER	NOT APPLICABLE		Design / Const / Ma	All	N/A	N/A	N/A		Calculate from Local Grid
End Northing (Y) National	NUMBER	NOT APPLICABLE		Design / Const / Ma	All	N/A	N/A	N/A		Calculate from Local Grid
End Elevation (Z) National	NUMBER	NOT APPLICABLE		Design / Const / Ma	All	N/A	N/A	N/A		Calculate from Local Grid
Security										
Security Classification	ENUM?					M	M			

23 Attributes are common to all asset types. Most are location based

The background of the slide features a complex, abstract wireframe pattern. This pattern consists of numerous interconnected lines forming a mesh of irregular polygons, which creates a three-dimensional, undulating effect. The lines are thin and light gray. A solid blue horizontal bar, with a gradient from a darker blue on the left to a lighter blue on the right, spans the bottom portion of the image. The text "Live Demo" is positioned on the left side of this blue bar.

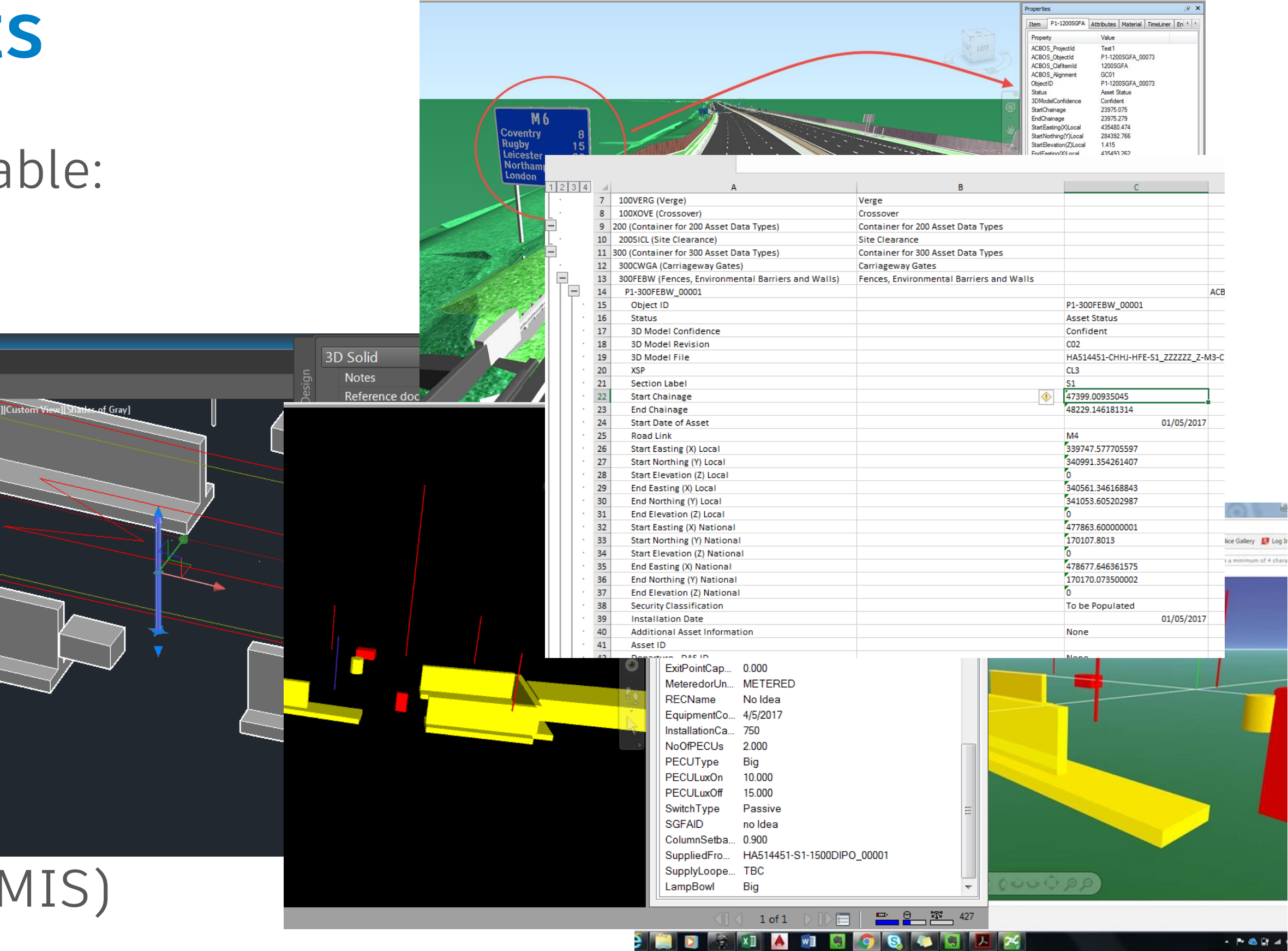
Live Demo

Graphical and Non-Graphical Information



MDM Outputs

- The data is available:
 - In the tools
 - In the federated
 - For use in sche
 - As Industry Fo
 - in HE CDE
 - As GIS in a num
 - Tab (CONFIR
 - SHP (HE-IAMIS)



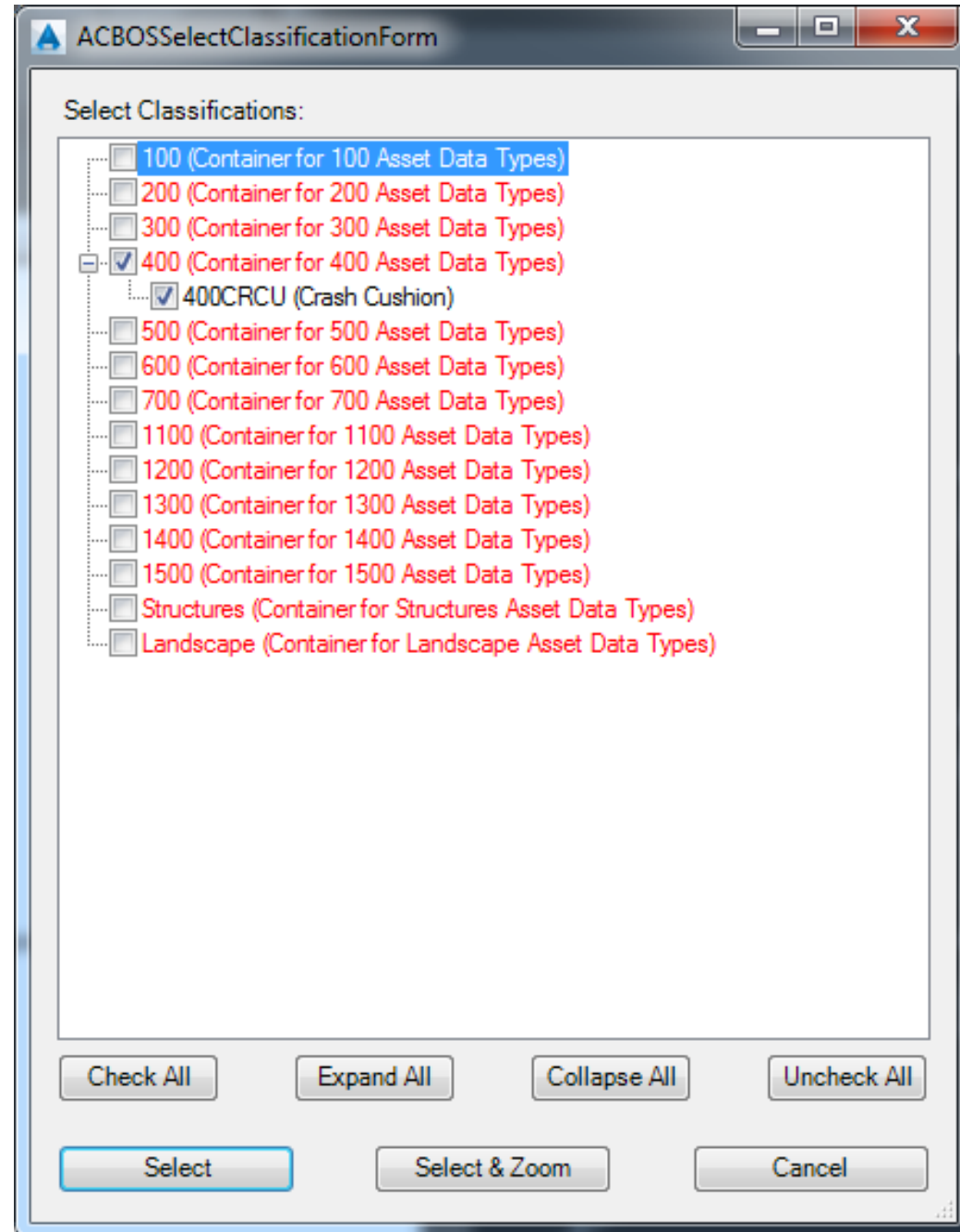
Development Team

- Pete Burchill
- Paul Napier
- Jon Dempsey
- Rich McCabe
- Miroslav Schonauer (Autodesk)
- Emyr Isaac (Autodesk)
- Lynn Palko (Autodesk)



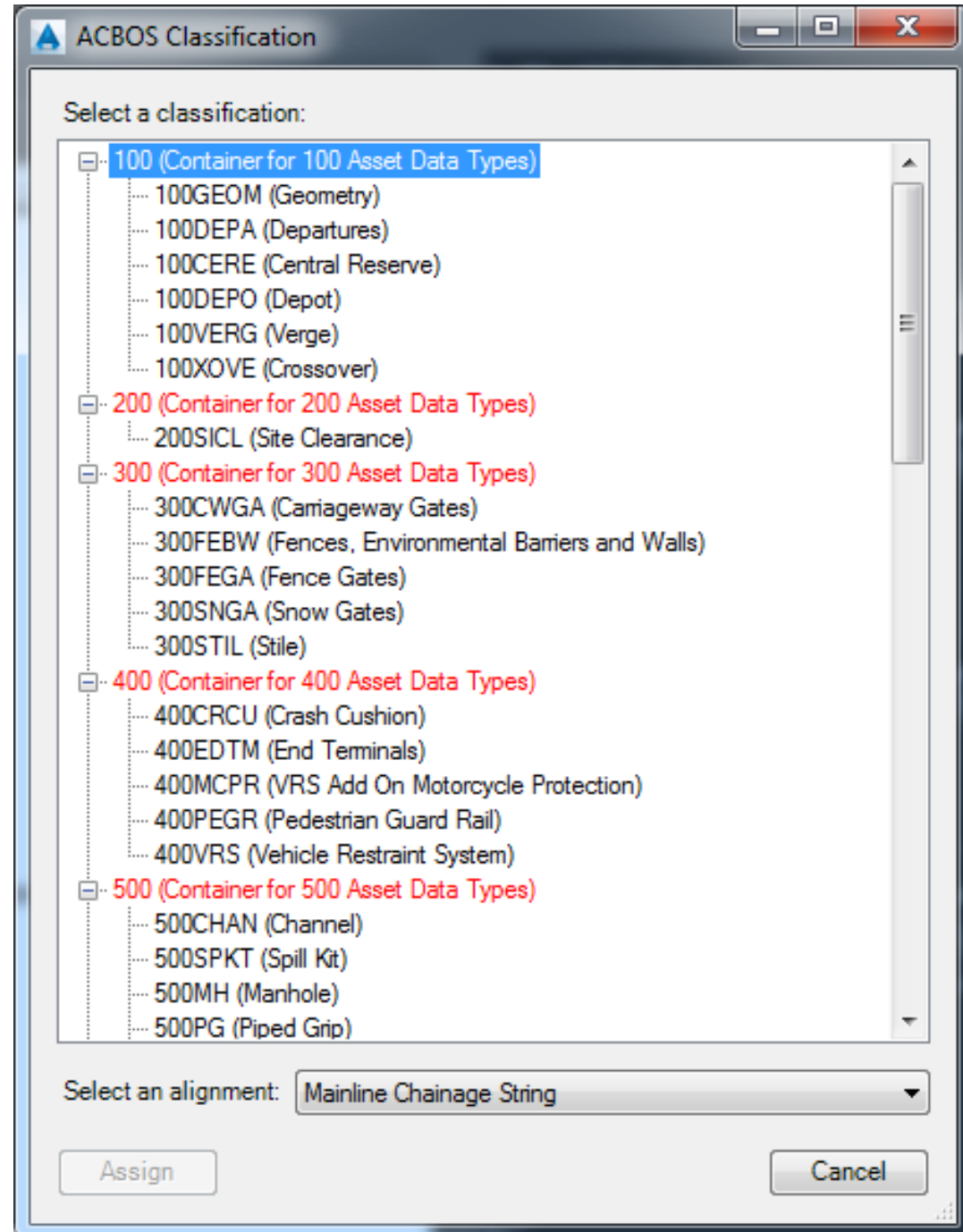
Questions & Answers

Select



- Select objects within model which have been “tagged” as an asset
- Able to refine selection by asset type, and by individual assets.
- Automatically zoom to selected asset(s)

Identity Create / Acquire / Remove / Destroy



- Assign an object as a specified asset.
- Assign with new asset record (Identity Create)
- Assign with existing asset record (Identity Acquire)
- Remove object assignment with asset record, but leave asset record in database to be re-assigned later (Identity Remove)
- Remove object assignment with asset record, and delete asset record from database (Identity Destroy)

XML ↔ XLS

- Write to/from the database via Excel spreadsheets

The image displays three windows related to ACBOS data exchange:

- XML Editor:** Shows an XML document structure for an ACBOS project. The root is `<ACBOSProject>`, containing `<ProjectSetup>` and `<Classification>` sections. The `<ProjectSetup>` section includes a `<Header>` with fields like `<UniqueId>`, `<Name>`, `<Description>`, `<TokenForObjectIds>`, and `<NumPaddedZerosForObjectIds>`. It also includes a `<Clients>` section with client details and a `<Classification>` section with multiple `<ClassificationItem>` entries.
- ACBOS XLS Write:** A dialog box for writing data to an Excel file. It features fields for "Project ACBOS File" and "Output XLS File", both pointing to a test data file. A "Classification Items" list contains five items: 400CRCU, 400VRS, 500GU, 500MH, and 500PW, all of which are checked. Buttons for "Check All", "Uncheck All", "Write", and "Close" are present.
- ACBOS XLS Read:** A dialog box for reading data from an Excel file. It features fields for "Input XLS File" and "Project ACBOS File", both pointing to a main data file. A "Worksheets" list contains one item: 300FEBW, which is checked. Buttons for "Check All", "Uncheck All", "Read", and "Close" are present.

Asset Reports

- Query the database with Regular Expressions or C# LINQ queries on any asset type and attribute
- Export results to Excel or XML formats

ACBOS Report

Add Files... Remove Refresh Displaying 16 / 16 objects

☒ ACBOS Main Sample V10

☐ Selected Classifications Select...

☐ Object Id (RegEx) [help...](#)

☐ C# LINQ [help...](#)

```
1 t =>
2 t.IsObject &&
3 t.DisplayName != null &&
4 t.DisplayName.StartsWith("P1-100CERE")
```

DisplayName	Description	AttributeValue
1500TSSIG (Traffic Signal Signal)	Traffic Sig...	
1500TX (Transmission)	Transmissi...	
200 (Container for 200 Asset Data Types)	Container ...	
200SICL (Site Clearance)	Site Clear...	
300 (Container for 300 Asset Data Types)	Container ...	
300CWGA (Carriageway Gates)	Carriagew...	
300FEBW (Fences, Environmental Barriers ...)	Fences, E...	
P1-300FEBW_00001		
3D Model Confidence		Confident
3D Model File		
3D Model Revision		
Additional Asset Information		
Asset ID		
Boundary Fence YesOrNo		False
Condition Rating (Manual)		TO BE POPULATED
Current Maintenance Contract		TO BE POPULATED
Currently Maintained By		TO BE POPULATED
Departure - DAS ID		
End Chainage		48229.146181314
End Easting (X) Local		340561.346168843
End Easting (X) National		478677.646361575
End Elevation (Z) Local		0
End Elevation (Z) National		0
End Northing (Y) Local		341053.605202987
End Northing (Y) National		170170.073500002
Expd EOL Sound Absorp Perf		
Expd EOL Sound Insulation Perf		555555555
Expected Service Life		0
Height (m)		0
Initial Sound Absorp Perf		

Show All Attributes Expand All Collapse All Expand to Classifications Expand to Objects

Export to GIS

- MDM can automatically export a model to GIS formats
 - Export to DWG creates a GIS compatible drawing. Then able to export to any GIS file format Civil 3D is capable of
 - Export via FDO exports directly to .shp for all assets in a model file.
- GIS config file specifies if an asset should be converted to a point, line, or polygon

