



**12d<sup>®</sup> Solutions**

# **International Public Works Conference**

## **Vibrant Futures – Solid Foundations**

**Hobart  
25-28 August 2019**



**12d® Solutions**

# Utilising ADAC - The IPWEA BIM Standard

Hobart

26 August 2019

# Today's Presenter



**Dr Lee Gregory**

Managing Director

12d Solutions Pty Ltd



12d<sup>®</sup> Model



12d<sup>®</sup> Synergy



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# Resume

- Sydney University – Ph D Mathematics
- 1980 CEANET – Computer Engineering Applications
  - Offices around Australia
  - Timesharing Bureau (Cloud)
  - Introduced Moss (MX) on bureau in Australia
  - Software development - Father of SMIGS
- 1987 Founded 12d Solutions (formerly 4d) with Alan Gray
  - Consulting work in Civil Engineering
  - 1991 Released 12d Model
  - 2012 Released 12d Synergy.





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# Other Questions Often Asked About Lee Gregory

- Do you have any family?
- Do you have any other interests?
- Do you always do smart things?





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## Lee is

- Member Institute of Public Works Engineering Australasia
- Attends the IPWEA ADAC Technical meetings
- Member of buildingSMART
- Founding member of Open BIM Alliance
- Involved in bS International Conferences/Committees/Expert panels, especially with the ifc InfraRoom which is defining the ifc's for

ifc Model Setup Information Delivery Manual

ifc Alignment, ifc Roads and ifc Rail

ifc Tunnel, ifc Bridges

- Attends the buildingSMART International ifc Standards Summits, the next one being in Beijing in October 2019.



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# 12d Advertising

- **12d Model**

Largest Surveying, Civil Design and Water software in Australia and New Zealand. Celebrating 25 years



**12d® Model**

- **12d Synergy**

Product for collaboration and data management of all data including 12d Model projects.





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# Our Audience

- Who has heard of BIM ?
- Who has heard of IFCs ?
- Who has heard of Asset Design As Constructed (ADAC) ?
-





# Open Data Exchange Format

Such a format is:

- Documented and the documentation freely available to everyone
- Freely available for anyone to use
- Does not require any software from another party
- The Party owning/controlling the format makes it freely available and accessible
- An XML format is preferable for long term archiving.



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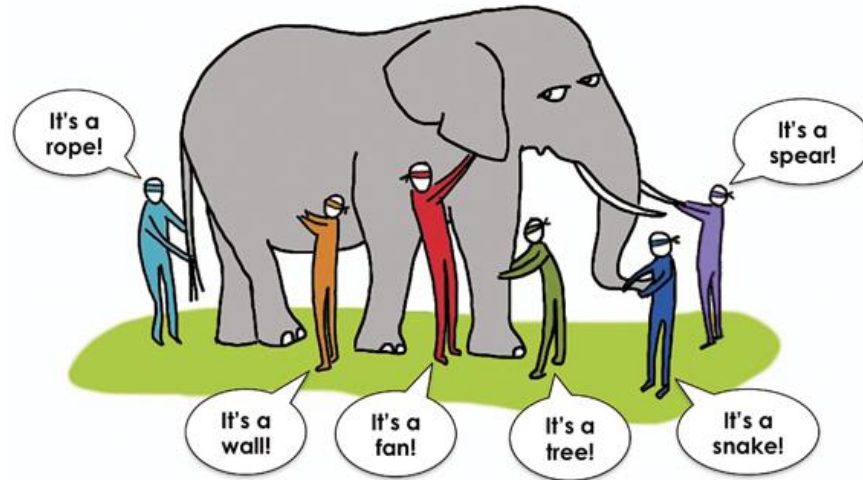
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# WARNING

Lee is a passionate believer in Open Data Exchange Formats.

# BIM and Digital Engineering

What BIM-Digital Engineering is depends on who you are talking to




And almost all the BIM discussions have been on buildings and structures.



# Background to BIM

If a wide search of the literature for BIM and ISO Standards is made, and all the marketing fluff is ignored, one quickly sees that almost universally the **BI** in BIM is **Building Information** (where Building is a **noun**) and although BIM is about the process, all the objects are for a Building on a site

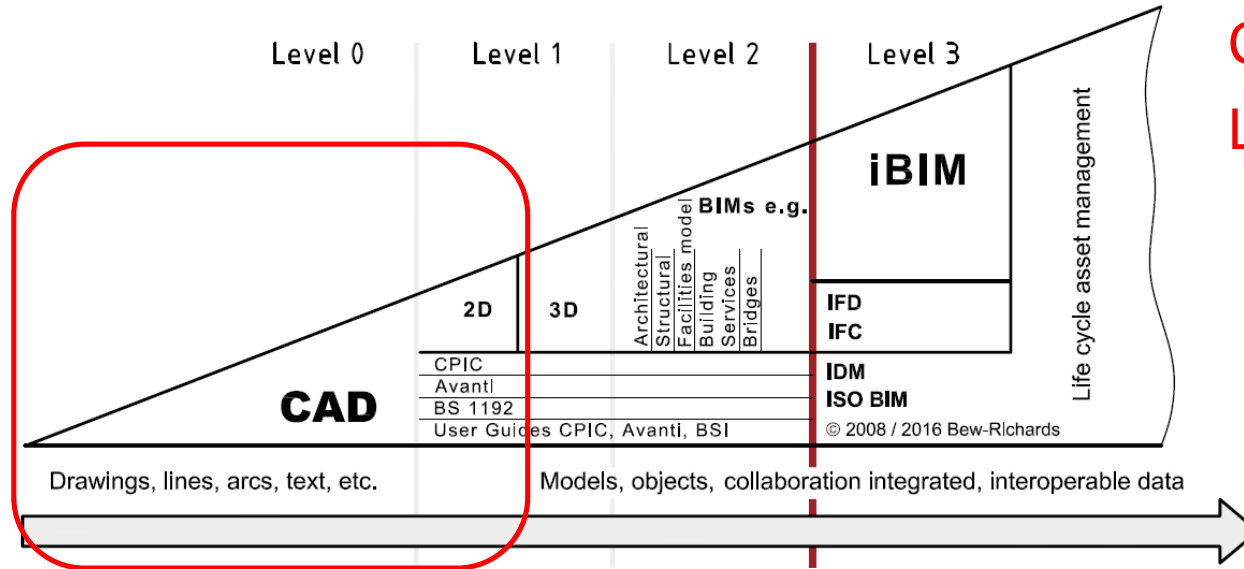
The other constant is that the International Standard for transferring BIM data is the vendor independent published format of IFCs.





# Background to BIM

Figure 1 – BIM Maturity Model



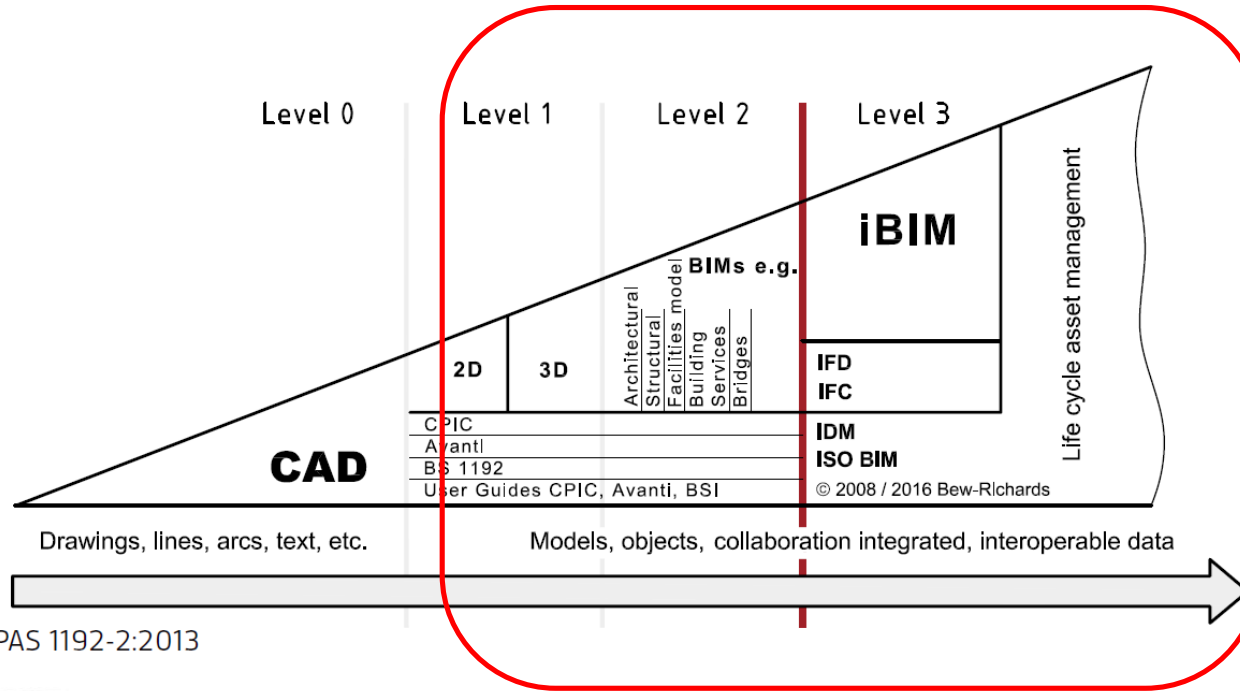
Current state:  
Level 0  
2D CAD drawings.





# Background to BIM

Figure 1 – BIM Maturity Model



Moving to:  
Models, objects,  
interoperable data



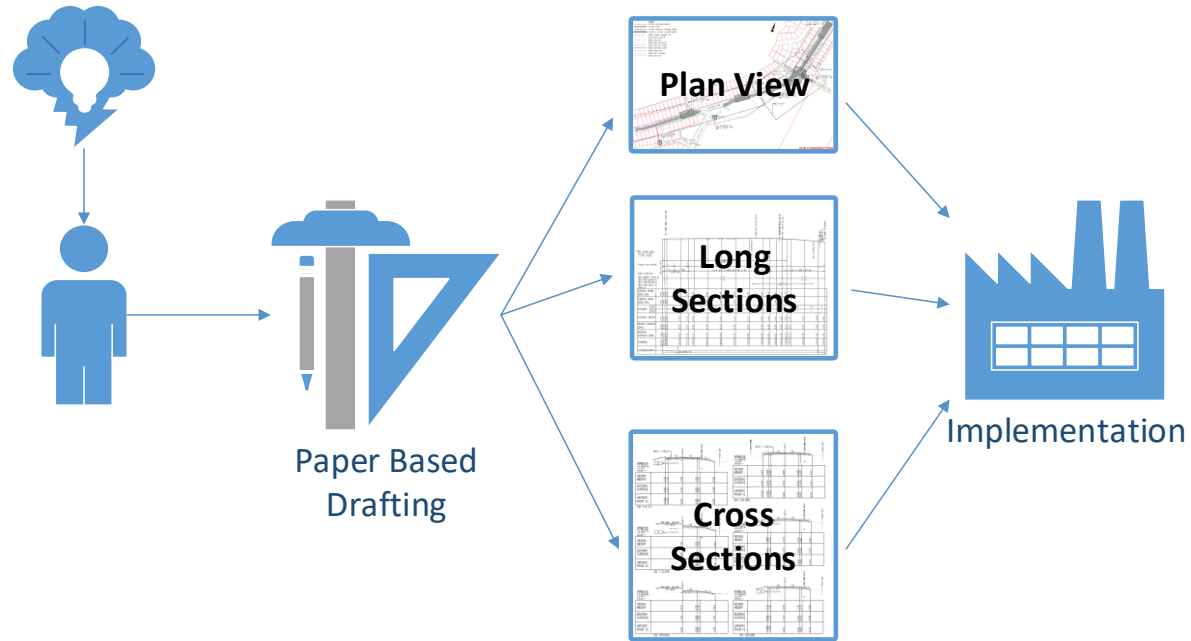
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**So a major process change is needed for BIM.**

# HISTORICAL

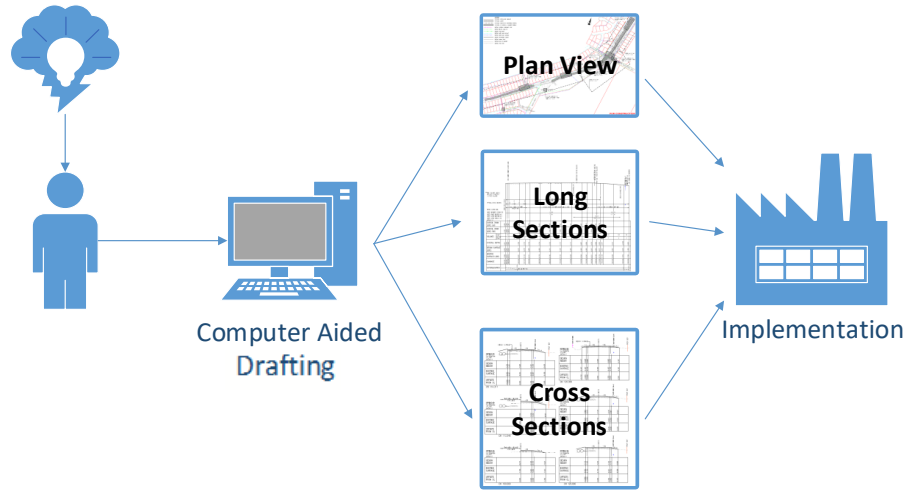


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# CURRENT



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**Not much has changed from the paper based system**

Computer Aided Drafting sped up the process slightly but it is still mainly manual and time consuming, and the biggest bottleneck and source of errors.



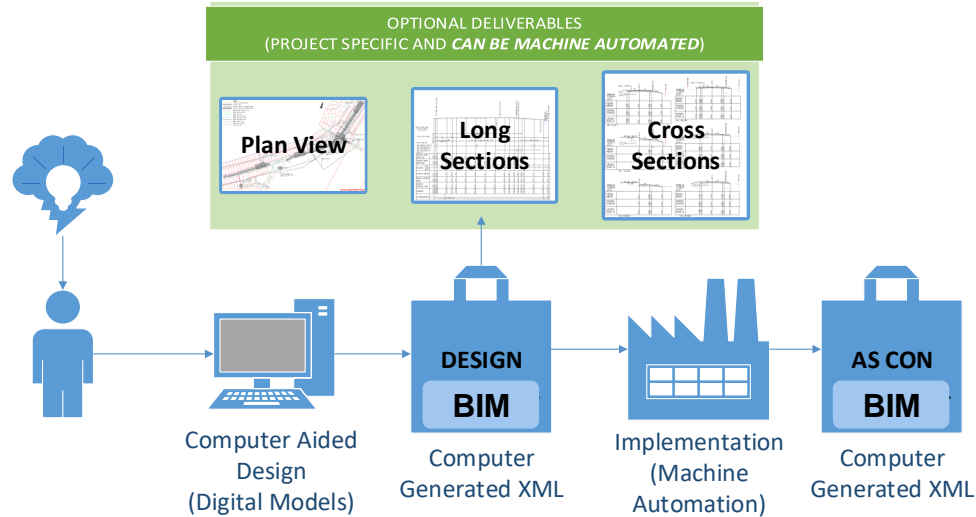
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# BIM – A Change in Thinking and Processes

FUTURE



The BIM model is the source of truth

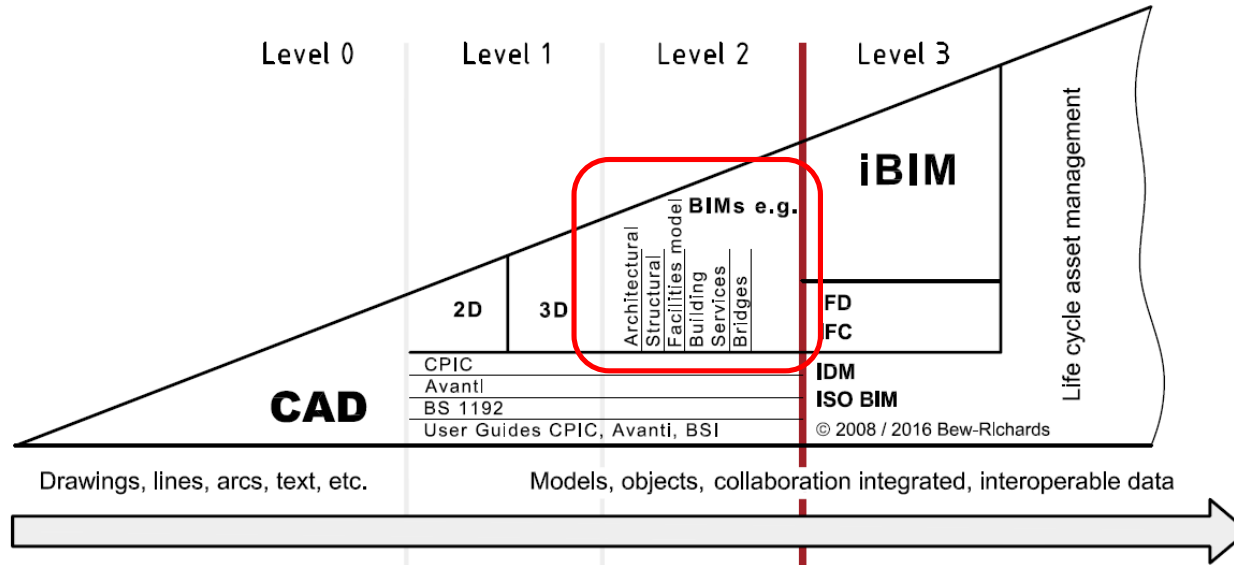
Drawings and reports are just ways at looking at the model.





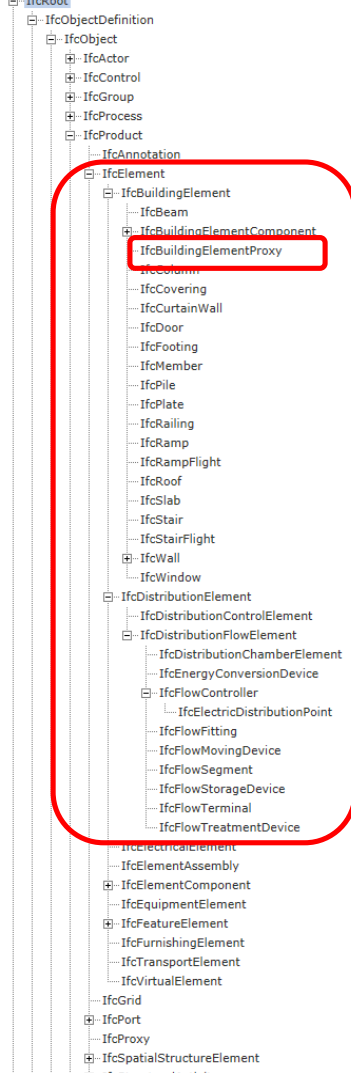
# Background to ifc BIM

Figure 1 – BIM Maturity Model



Source: PAS 1192-2:2013

However:  
as yet no ifc  
objects are  
defined for  
roads, rail,  
drainage,  
sewer etc.



## IfcRoot

**Definition from IAI:** The *IfcRoot* is the most abstract and root class for all IFC entity defined in subsequent layers of the IFC object model. It is therefore the common supertype for all IFC entities that are subtypes of *IfcRoot*. All entities that are subtypes of *IfcRoot* can be used independent of the IFC resource schema. All entities that are subtypes of *IfcRoot* are not supposed to be independent entities.

The *IfcRoot* assigns the globally unique ID, and the ownership and history information to all IFC entities. It provides a name and a description about the concepts.

**HISTORY** New entity in IFC Release 1.0

### EXPRESS specification:

```
ENTITY IfcRoot
  ABSTRACT SUPERTYPE OF (ONEOF(IfcPropertyDefinition, IfcRelationship, IfcObjectDefinition));
  GlobalId : IfcGloballyUniqueId;
  OwnerHistory : IfcOwnerHistory;
  Name : OPTIONAL IfcLabel;
  Description : OPTIONAL IfcText;
  UNIQUE
    URI : GlobalId;
END_ENTITY;
```

### Attribute definitions:

**GlobalId** : Assignment of a globally unique identifier within the entire software world.

**OwnerHistory** : Assignment of the information about the current ownership of that object, including owning actor, application, local identification and information captured about the recent changes of the object, NOTE: only the last modification is stored.

**Name** : Optional name for use by the participating software systems or users. For some subtypes of *IfcRoot* the insertion of the Name attribute may be required. This would be enforced by a where rule.

**Description** : Optional description, provided for exchanging informative comments.

### Inheritance graph

```
ENTITY IfcRoot;
ENTITY IfcRoot;
  GlobalId : IfcGloballyUniqueId;
  OwnerHistory : IfcOwnerHistory;
  Name : OPTIONAL IfcLabel;
  Description : OPTIONAL IfcText;
END_ENTITY;
```

# IFC's

For ifc 2x3, the defined Elements are mainly for vertical buildings

ifcBuildingElementProxy is a general Element often used for Civil elements.



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# So Can BIM and ifcs be Civil ?

- Can BIM be applied to Civil Infrastructure ?





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# Plans for More Civil Objects in IFC's

To address Civil BIM, buildingSMART (the International Group looking after IFCs) has working groups looking at how non-Building data should be transferred using IFCs

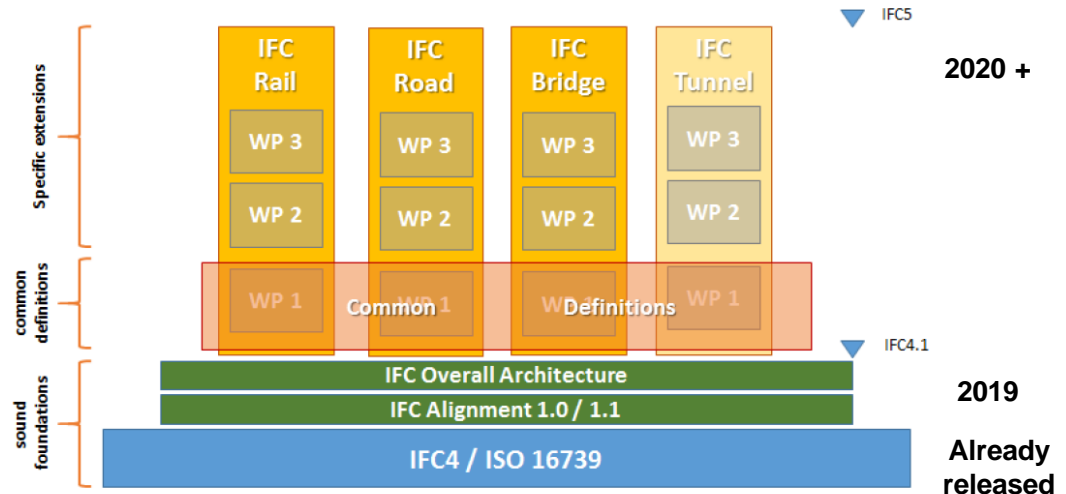


There are currently Working Groups on:

- Alignment
- Roads
- Rail
- Bridges
- Tunnels
- GIS

So not yet defined for Civil.

## Road map





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# History of ADAC

## The Problem for Local Government in 2000's:

Local Government Authorities needed Asset data and wanted to ask industry to provide it for most construction being done for the Authority.





# History of ADAC

## The Industry Nightmare:

- Each Authority wanted different information, different meta data (attributes) and different formats and some even required proprietary binary formats such as DWG or DGN
- Even within the same Authority, different staff asked for different things
- Interchanging data between Authorities was almost impossible.



# History of ADAC

## The Local Government Solution

A group of Councils & Water Authorities met and decided that they would

- All use common definitions of assets, and metadata and attributes for these assets
- Define and use the **one** XML data transfer format for these assets
- Cover both As Constructed and Design of asset
- Make the definitions and XML format freely available to Industry (Open Data)
- Did this in 2005.



# History of ADAC

## The Local Government Solution

The Authorities created ADAC (Asset Design and As Constructed) and stated:

1. First, it's a non-proprietary data specification and transport format (XML) for the description and transmission of asset design and as constructed data
2. Second, it's a national association of asset management practitioners drawn from government and private enterprise that maintain and enhance the ADAC data specification and share tools, experience and knowledge
3. Third, it's a governance and management entity that provides strategic planning and technical development training through the Institute of Public Works Engineering Australasia (IPWEA).



# History of ADAC

## The Local Government Solution

The ADAC Consortium provides

1. ADAC XML Schema Definition (as ADAC XSD)
2. General ADAC Guidelines for the Assets  
and
3. Each Authority requesting ADAC provides Local Guidelines (based on the General ADAC Asset Guidelines) that specify which ADAC Assets, metadata and asset attributes are required/not required for that Authority.



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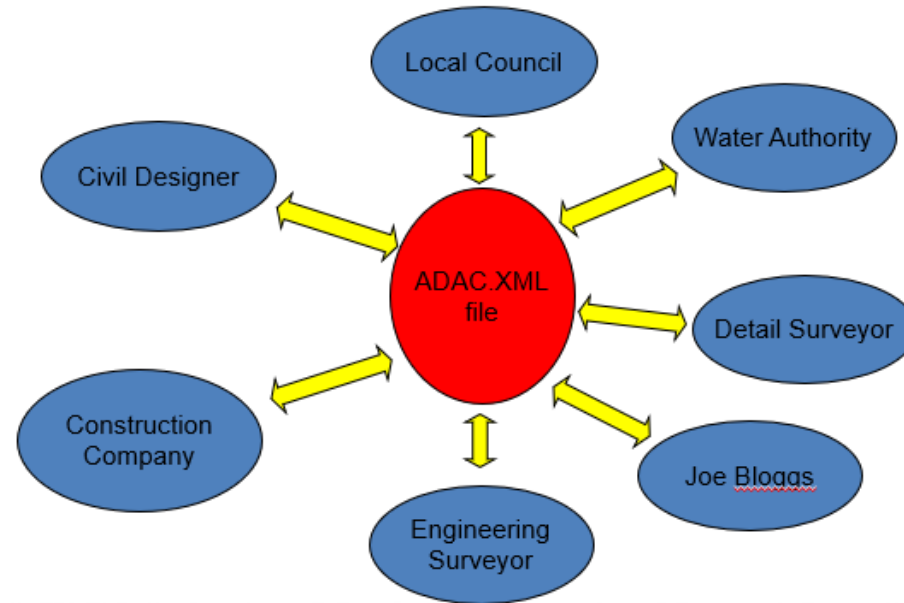
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# History of ADAC

## The Local Government Solution





# ADAC

## ADAC Schema Simplified Snapshot

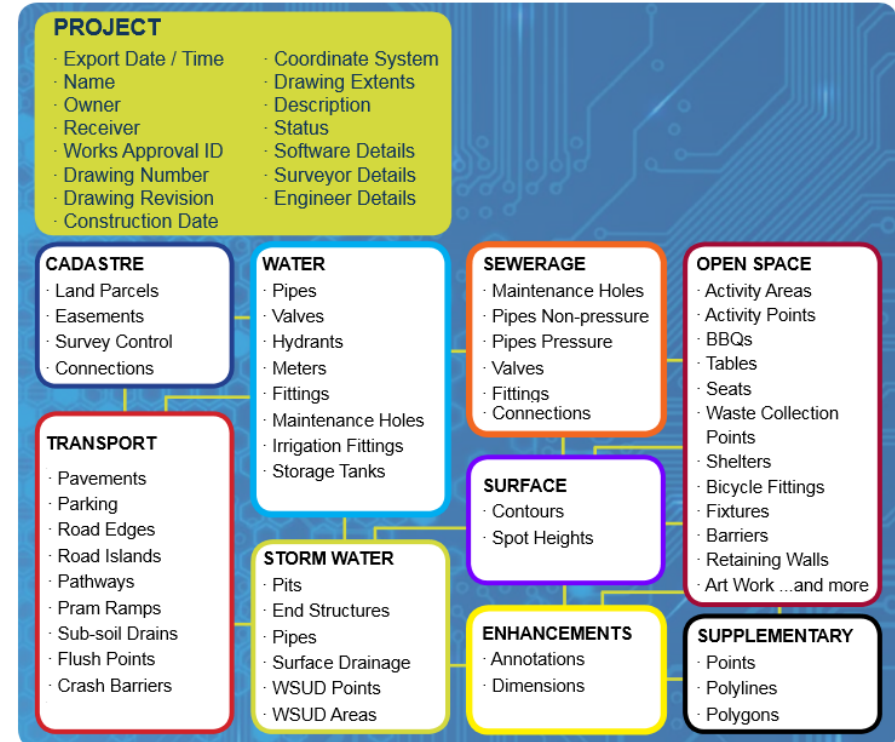
## INITIAL ADAC ASSETS

Sixty eight (68) assets were already included in 2010

And these were the assets of major interest to Councils

For example, Water, Sewerage, Stormwater, Transport, Open Space

More assets are being added with each ADAC version.





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# ADAC

## PUBLISHED ADAC XSD for ADAC XML

# ADAC



### Asset Design and As Constructed

### Version: 4.1.0

### Schema Help File

**Abstract:**

This schema provides for the description of objects representing as constructed public works.  
The schema is maintained and approved by the ADAC Strategic Reference Group, under the governance of IPWEAQ.  
The ADAC Version 4.1.0 Schema constrains all data within an ADAC Version 4.1.0 XML instance document.  
Release: 4 Jan 2013. Prepared by Ian Read, Redland City Council on behalf of IPWEAQ. Supersedes the 6 Aug 2012 release by the inclusion of edit feedback from ADAC Member organisations.

ADAC 4.1.0 XML Schema Documentation

Hide Back Print Options

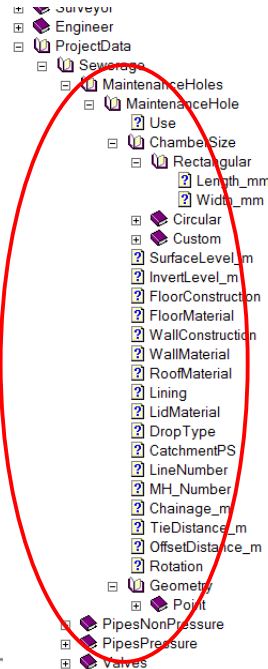
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        - Name
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        - DrawingExtents
        - Description
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        - Engineer
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          - WaterSupply
          - StormWater
          - OpenSpace
          - Cadastral
          - Surface
          - Enhancements
          - Supplementary
      - version (Attribute)
    - Element Groups
    - Complex Types
    - Simple Types



# ADAC

## ADAC XSD– Attributes



Independent Complex Data Type: <b>rectangular_struct_mm</b> <a href="#">Back to Root Element</a>	
<a href="#">Constrains: Feature Sewerage MaintenanceHole.ChamberSize.Rectangular</a>	
<a href="#">Constrains: Feature Water MaintenanceHole.ChamberSize.Rectangular</a>	
<a href="#">Constrains: Feature StormWater Pit.ChamberSize.Rectangular</a>	
<a href="#">Constrains: Feature StormWater GPTComplex.Construction.Commercial.Size.Rectangular</a>	
<a href="#">Constrains: Feature StormWater GPTComplex.Construction.Custom.Size.Rectangular</a>	
<i>Used for the expression of rectangular dimensions in millimetres. Whether the dimensions are internal or external are defined by the element referencing this type.</i>	
Sequence Occurrences: Minimum = 1 (Required) Maximum = 1	
Sequence	<div><div>Element: <b>Length_mm</b> { Data Type: positiveInteger }</div><div>Occurrences: Minimum = 1 (Required) Maximum = 1</div><div>Length in millimetres</div></div>
	<div><div>Element: <b>Width_mm</b> { Data Type: positiveInteger }</div><div>Occurrences: Minimum = 1 (Required) Maximum = 1</div><div>Width in millimetres</div></div>

Independent Complex Data Type: <b>circular_struct_mm</b> <a href="#">Back to Root Element</a>	
<a href="#">Constrains: Feature Sewerage MaintenanceHole.ChamberSize.Circular</a>	
<a href="#">Constrains: Feature Water MaintenanceHole.ChamberSize.Circular</a>	
<a href="#">Constrains: Feature StormWater Pit.ChamberSize.Circular</a>	
<a href="#">Constrains: Feature StormWater GPTComplex.Construction.Commercial.Size.Circular</a>	
<a href="#">Constrains: Feature StormWater GPTComplex.Construction.Custom.Size.Circular</a>	
<i>Used for the expression of circular dimensions in millimetres. Whether the dimensions are internal or external are defined by the element referencing this type.</i>	
Sequence Occurrences: Minimum = 1 (Required) Maximum = 1	



# ADAC

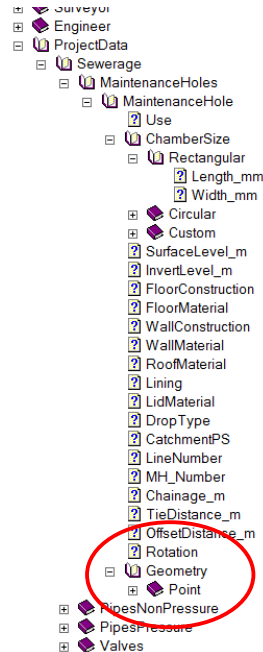
## ADAC XSD– Attributes and Geometry

Geometry  
restricted to  
GIS objects:

Points

Poly Lines

Polygons.



Independent Complex Data Type: **rectangular\_struct\_mm** [Back to Root Element](#)

Constrains: [Feature Sewerage MaintenanceHole ChamberSize Rectangular](#)

Constrains: [Feature Water MaintenanceHole ChamberSize Rectangular](#)

Constrains: [Feature StormWater Pit ChamberSize Rectangular](#)

Constrains: [Feature StormWater GPTComplex.Construction.Commercial.Size Rectangular](#)

Constrains: [Feature StormWater GPTComplex.Construction.Custom.Size Rectangular](#)

Used for the expression of rectangular dimensions in millimetres. Whether the dimensions are internal or external are defined by the element referencing this type.

Sequence Occurrences: Minimum = 1 (Required) Maximum = 1

Sequence	Element	Data Type	Occurrences
	<b>Length_mm</b>	positiveInteger	Minimum = 1 (Required) Maximum = 1
	Length in millimetres		
	<b>Width_mm</b>	positiveInteger	Minimum = 1 (Required) Maximum = 1
	Width in millimetres		

Independent Complex Data Type: **circular\_struct\_mm** [Back to Root Element](#)

Constrains: [Feature Sewerage MaintenanceHole ChamberSize Circular](#)

Constrains: [Feature Water MaintenanceHole ChamberSize Circular](#)

Constrains: [Feature StormWater Pit ChamberSize Circular](#)

Constrains: [Feature StormWater GPTComplex.Construction.Commercial.Size Circular](#)

Constrains: [Feature StormWater GPTComplex.Construction.Custom.Size Circular](#)

Used for the expression of circular dimensions in millimetres. Whether the dimensions are internal or external are defined by the element referencing this type.

Sequence Occurrences: Minimum = 1 (Required) Maximum = 1



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# LOCAL AUTHORITIES ADAC GUIDELINES



## GUIDELINES FOR CREATION AND SUBMISSION OF ADAC XML FILES





# LOCAL AUTHORITIES ADAC GUIDELINES

## StormWater

### EndStructure

Asset Capture: Simple point feature representing the top of the headwall.

Spatial Relationship: Headwall “floats” adjacent to the end of a StormWater pipe feature.



Figure 5

## Stormwater Object Model

### EndStructure

Element Name	Mandatory (Y/N)
StructureID	Y
StructureLevel_m	Y
EndWallType	Y (if EndWall exists)
EndWallConstruction	Y (if EndWall exists)
WingWallType	Y (if WingWall exists)
WingWallConstruction	Y (if WingWall exists)
ApronType	Y (if Apron exists)
ApronConstruction	Y (if Apron exists)
GrateType	N
TideGate	N
PredominantMaterial	Y
OutletProtectionType	Y
Rotation	N

### Fitting

Element Name	Mandatory (Y/N)
FittingType	Y
Rotation	N





# ADAC is a Best Practise Solution

ADAC is a Civil BIM system controlled by IPWEA and has a vendor independent transfer file format ADAC XML

The ADAC standardisation solved the Industry problems of

- Each Authority wanting something different
- Different people, and departments within an Authority, wanting something different
- Each Authority wanting different formats (some even proprietary)
- Not being able to easily interchange asset data between different Authorities
- Long term archiving - XML is a 1000 year archiving solution.



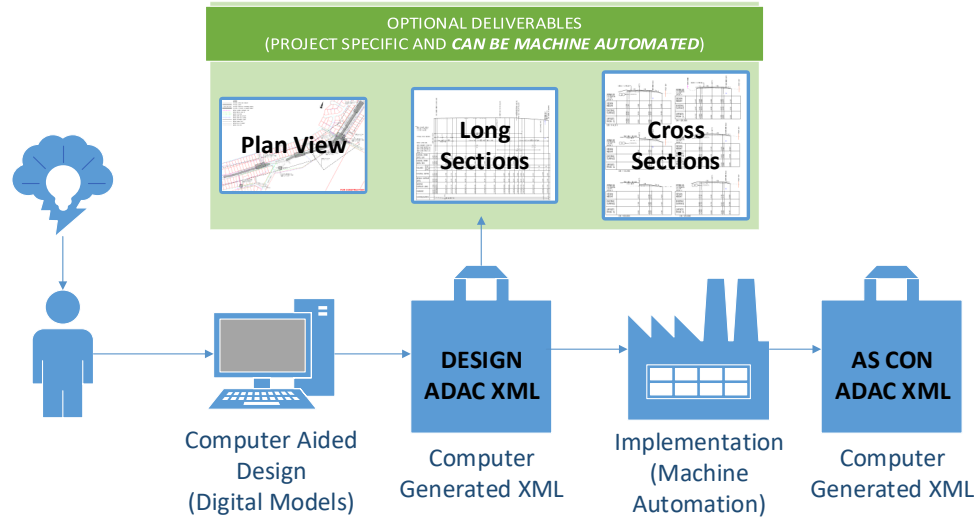
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# ADAC – Has Changed Thinking and Processes

NOW



The ADAC model is the source of truth

Drawings and reports are just ways at looking at the model.



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# Wide Software Support for ADAC by 2014

- 12d Model
- FME
- ESRI
- MapInfo
- BricsCAD
- Keays Software
- BlackBox 22 on AutoCAD





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# Spreading ADAC Usage

- Legislated for the Water Authorities in South East Queensland
- Councils from large to small:
  - Gold Coast
  - Logan
  - Bundaberg
  - Gladstone
  - Rockhampton.





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# Thank You



**Dr Lee Gregory**

Managing Director  
12d Solutions Pty Ltd



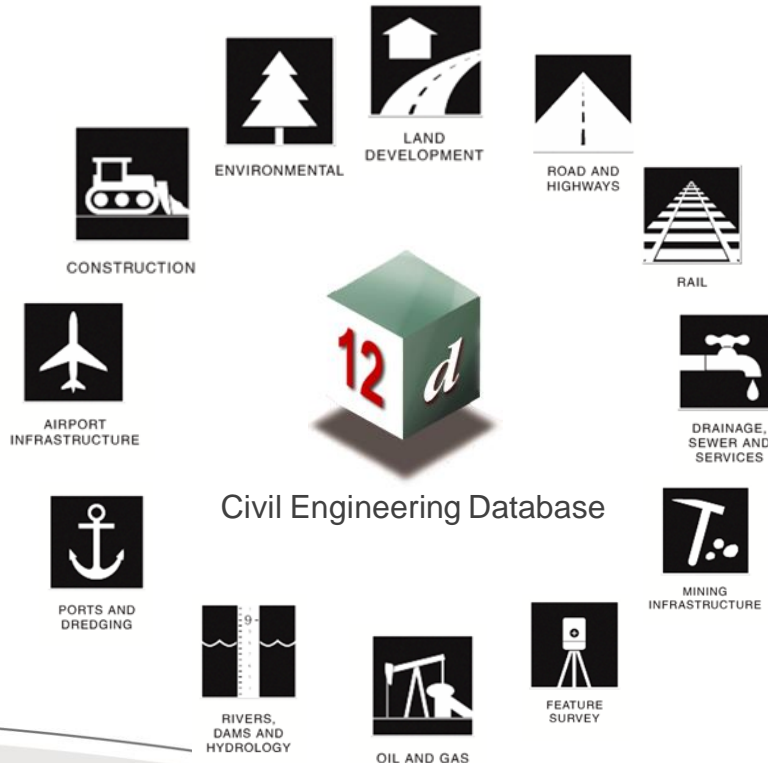


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# 12d Model 14 – the Ultimate Civil BIM Solution





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# Utilising ADAC - The IPWEA BIM Standard

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26 August 2019



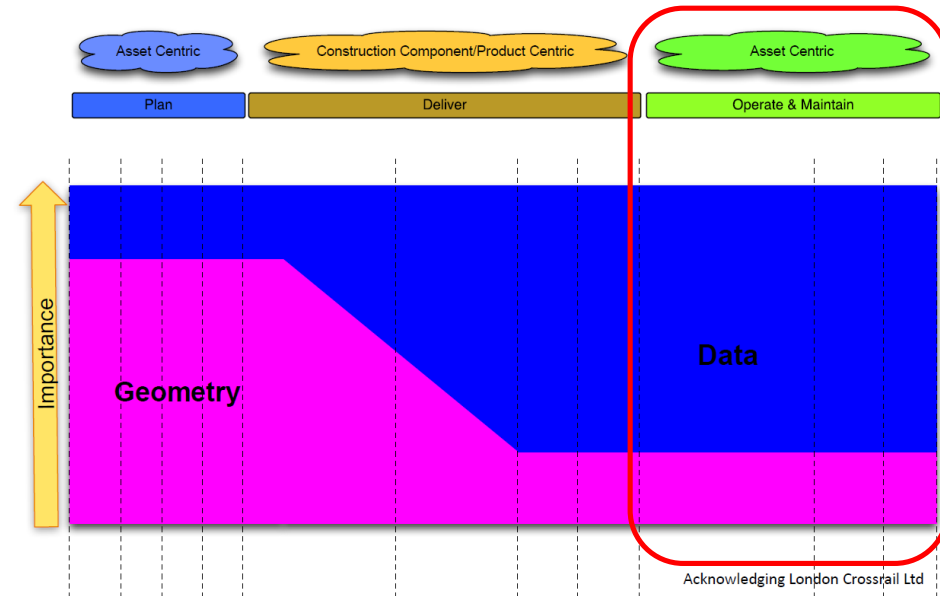


# “Fit For Purpose”

BIM statements are often too broad to be meaningful

So it is important to know exactly what part of the asset life cycle you are wanting BIM data for

When you are interested in asset maintenance, the full 3D Geometry may be of no interest





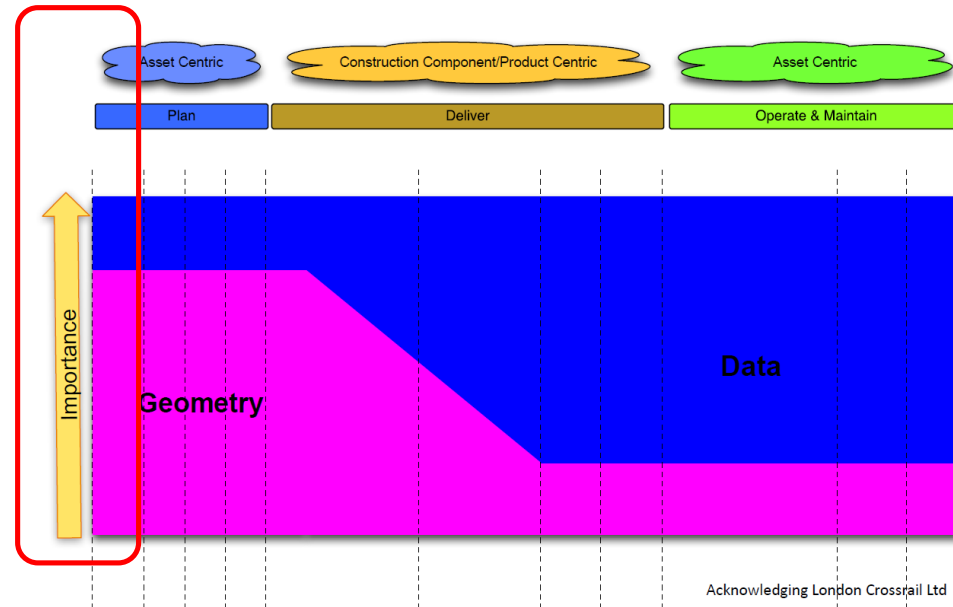
# “Fit For Purpose”

BIM statements are often too broad to be meaningful

So it is important to know exactly what part of the asset life cycle you are wanting BIM data for

When you are interested in asset maintenance, the full 3D Geometry may be of no interest

But if you talking about reusing the as-built data as the starting data for future construction then the full 3D data is critical.





# “Fit For Purpose”

So when I refer to Civil (horizontal) BIM and ifc's, I am meaning the planning, design, construction and quality assurance phases (infrastructure delivery) where geometry is all important.

