A Digital Built Environment

A coordinated vision for GIS, BIM and Digital Engineering

John Mitchell, Director, buildingSMART Australasia
What was the nature of the cities of the Fertile Crescent?

Source: MapMaster - Own work, GFDL, https://commons.wikimedia.org/w/index.php?curid=3578442
City of Babylon ca 1750 BC

City Plan

Etemenanki Ziggurat (Tower of Babylon)

Adad Gate
Where are we, with our digital built environment?

- after almost 4000 yrs we apparently have innovative technologies GIS, BIM or DE to design, build and manage cities, infrastructure & built assets
- why do these digital opportunities continue to be ignored in Australia?
Private house plan, Tello Late 3rd millennium BC

Obverse RTC 145 (AO 338), Musée du Louvre (Photo RMN-Grand Palais/Raphaël Chipault 15-646999)

Source: "Alternative Interpretations of The Early Mesopotamian Building Plan on RTC 145", Martin Gruber & Michael Roaf
Private house plan, Tello Late 3rd millennium BC

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Urban Modelling
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PIM - the Scale of Things

Source: UrbanIT, after Andreas Kohlhaas
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Precinct Information Modelling

- **Building**
  - Usage: Residential
  - Name: Altona Mansions
  - No of apartments: 64

- **Apartment**
  - Usage: Residential
  - Apartment type: 2 bed
  - Water consumption: 109k litres/pa
  - No of occupants: 3

- **Public Park**
  - Gross area: 1.4ha

- **Public Road**
  - Name: Marion Road
  - Vehicles/hr: 1140

- **Cadastre**
  - Lot type: strata
  - Area: 2200 m²
  - Zoning: 2b
Integration with existing information modelling standards

Integrated Digital Built Environment

Environment Modelling
- data capture
- regional analysis
- scenario modelling
- forecasting

Built Asset Modelling
- design modelling
- performance analysis
- simulation
- construction

Geospatial Modelling
(OGC: GML schema / W3C: RDF triples)
provides context
returns as-built data

Building Information Modelling
(bSI: IFC schema, MVD & bSDD)
Planning, Design, Construction & Operation of Built Assets

Digital Engineering & Asset Management
Top-Down approach
Bottom-Up approach
Integration with existing information modelling standards

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Planning, Design, Construction & Operation of Built Assets

PIM

Understanding & Managing the Natural & Built Environment

provides context

returns as-built data

Top-Down approach

Bottom-Up approach

Digital Engineering & Asset Management

Integrated Digital Built Environment
Precinct Model Scope
A Precinct is made up of sites that contain one or more built facilities
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Sites are linked to legal ownership through the cadastre: Need for a 3D cadastre
Precinct Model Scope

A Precinct is made up of sites that contain one or more built facilities

Sites are linked to legal ownership through the cadastre: Need for a 3D cadastre

Built facilities include a range of entities:

- Buildings
- Civil infrastructure (roads, railway, bridges, tunnels, etc.)
- Utility infrastructure (energy, water, waste, network, etc.)
- Open space (paved, parkland, water features, etc.)
- Structures (street furniture, shelters, public art, etc.)
A *Precinct* is made up of sites that contain one or more built facilities. Sites are linked to legal ownership through the cadastre: Need for a 3D cadastre

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- **Buildings**
- **Civil infrastructure** (roads, railway, bridges, tunnels, etc.)
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- **Open space** (paved, parkland, water features, etc.)
- **Structures** (street furniture, shelters, public art, etc.)

Precincts exist within an urban context:

- **Administrative zones** (local government, census, demographic, etc.)
- **Services** (transport, entertainment, education, health, etc.)
- **Ecological** (flora & fauna, protected habitats, fragile communities, etc.)
Tonsley Precinct - planning & development context

Planning Zones are modelled as *ifcSpatial Entities*, colour coded for *Permitted Use*, with State *cadastre* boundaries - *IFC format model*

City of Marion planning zones - *pdf*  
SA planning zones - *web page*
Tonsley LEP - defining Permissible Developments
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PIM Typologies

A precinct model at initial concept stage will designate geographic zones or simple volumes and spaces to represent the high level activities in the precinct. Each object has geometric properties (dimensions, volume, area), specified functional usage (residential, commercial, or other use types...)

Functional
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Functional

At this level of detail PIM, activities are modelled as 3D forms that are approximations of the scale of development required, and with more attention to the relationships between the objects. Infrastructure elements representing transport and open space are also shown.

Built Facility
PIM Typologies

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Elemental

At the most detailed level all infrastructure and buildings are authored in BIM tools, with all elements described accurately and with detailed properties of the chosen types or products.

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Occupancy

Occupancy focusses on the functions carried out in a precinct by its users. It can address the requirements as a basis for a design (a brief), or it can model the operations of the facility for example in terms of energy consumption or patterns of energy usage by occupancy type.
Precincts - visualising models

PIMViewer is a software application developed by the PIM project team in order to show and interact with precinct models conforming to the PIM data schema (an extension of the international IFC ISO standard).

This is required because existing IFC viewers do not yet recognize the proposed PIM schema extensions.
Managing Precincts - using the City of Sydney FSES for Broadway
**Occupancy** - FSES classification of activities & business types

The FSES survey describes all the spaces (rooms) within a building, the type of business organisation and classifies both.

We have used the bsDD to host these ASNZ standard definitions and encourage its national adoption.

Associated with those functions are the consumption of energy or aggregated operational carbon impacts that are expended in the carrying out of the function.

*Many Precinct Assessment Indicators depend on occupancy data.*

The PIM framework includes the concepts described above, linking operational data with occupancy types.
Broadway partial model - working on parts of a PIM
Broadway partial model - working on parts of a PIM

Cadastral data is literally the foundation of a precinct model. If we need to edit, update this sub-model we must ensure we maintain dimensional accuracy converting from Map Grid (Easting & Northing format) to ground (cartesian) coordinates.
Model Setup project - an international geo-reference project

A Map projection enables points on the ellipsoid surface to be mathematically projected onto an imaginary developable surface

When the model extent is greater than 1km x 1km significant errors start to occur in conversions from GIS to ground coordinates, particularly in linear infrastructure and urban models
Map Coordinates

It is easy to see that the distance between the two points on the ellipsoid will not be the same as on the map projection by looking at the slice though the ellipse.

The distortion is called the **scale factor** and varies from point to point across the slice.
Establishing robust geo-reference - eg for large urban models

The buildingSmart International IDM (Information Delivery Manual) defines in the language and perspective of the professional participant what information must be contained in a “model exchange”, in this case **Model Setup**

Four key steps
- specify the problem
- document industry process and workflow
- specify technical solution
- implement & undertake case studies

PIM software implementers can then implement these *globally agreed* technical workflows and improve quality and efficiency
Survey Point Interface - explicit geo-referencing

A 2D Helmert transformation can be computed from the coordinates of the two (or more) reference points. The parameters of such a transformation are:

- X Shift = 333,780.622
- Y Shift = 6,246,775.891
- Z Rotation = -7°58'28"
- Scale = 0.999998

The corresponding IFC parameters are:

- Eastings = 333,780.622
- Northings = 6,246,775.891
- Orthogonal Height = 97.457
- XAxisAbscissa = 0.990330045
- XAxisOrdinate = -0.138731399
- Scale = 0.999998

New BIM authoring interface to store IFC4 geo-referencing data (beta ArchiCAD)

Cadastre in map grid coordinates

Cadastre in BIM model transformed to suit project specifics, local origin & documentation needs
An example of a Health Authority’s web accessible system where building information, plans etc are layered onto a local map.
Precinct Database - managing Asset Data
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Asset Data - linking maintenance & operational data
## Asset Data - linking maintenance & operational data

### TAFE NSW Ultimo - Asset Database

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Asset ID</td>
<td>1321</td>
</tr>
<tr>
<td>Asset</td>
<td>AHU-07-03 Building J-Roof-JR.01</td>
</tr>
<tr>
<td>Equipment Type</td>
<td>Air handling Unit</td>
</tr>
<tr>
<td>Make Model</td>
<td>Fujitsu</td>
</tr>
<tr>
<td>Site Name</td>
<td>Ultimo</td>
</tr>
<tr>
<td>Building</td>
<td>Building J</td>
</tr>
<tr>
<td>Floor</td>
<td>Roof</td>
</tr>
<tr>
<td>Room</td>
<td>JR.01</td>
</tr>
<tr>
<td>Asset Location</td>
<td>Roof</td>
</tr>
<tr>
<td>Condition</td>
<td>3</td>
</tr>
<tr>
<td>Risk</td>
<td>3</td>
</tr>
<tr>
<td>Importance</td>
<td>3</td>
</tr>
<tr>
<td>Functionality</td>
<td>3</td>
</tr>
<tr>
<td>Overall Rating</td>
<td>60</td>
</tr>
<tr>
<td>Refrigerant Type</td>
<td>R22</td>
</tr>
<tr>
<td>Recommendation</td>
<td>Due to phase out of R22 it is recommended to replace this unit in 1 to 3 years time.</td>
</tr>
<tr>
<td>Budget Estimate</td>
<td>$9,000</td>
</tr>
<tr>
<td>Comment</td>
<td>Unit is aged and starting to deteriorate.</td>
</tr>
<tr>
<td>Date Added</td>
<td>16 10 2013</td>
</tr>
<tr>
<td>Date Updated</td>
<td>18 02 2014</td>
</tr>
</tbody>
</table>

---

**Asset 1321**
- **Equipment Type**: Air handling Unit
- **Make Model**: Fujitsu
- **Site Name**: Ultimo
- **Building**: Building J
- **Floor**: Roof
- **Room**: JR.01
- **Condition**: 3
- **Importance**: 3
- **Functionality**: 3
- **Overall Rating**: 60
- **Refrigerant Type**: R22
- **Budget Estimate**: $9,000
- **Comment**: Unit is aged and starting to deteriorate.
- **Date Added**: 16 10 2013
- **Date Updated**: 18 02 2014

**Asset 1628**
- **Equipment Type**: AC Split System
- **Make Model**: Fujitsu
- **Site Name**: Ultimo
- **Building**: Building J
- **Floor**: Level 1
- **Room**: J1.10A
- **Condition**: 3
- **Risk**: 3
- **Importance**: 3
- **Functionality**: 3
- **Overall Rating**: 60
- **Refrigerant Type**: R22
- **Budget Estimate**: $12,000
- **Comment**: Unit is aged and needs replacement.
- **Date Added**: 16 10 2013
- **Date Updated**: 18 02 2014

---

**Recommendation**
Due to phase out of R22, it is recommended to replace this unit in 1 to 3 years time.
Asset Data - linking maintenance & operational data

**TAFE NSW Ultimo - Asset Database**

| Asset ID | 1321  | 1628  | ...
|-----------|-------|-------|------
| Asset     | AHU-07-03 Building J-Roof-JR.01 | FCU-Building J-Rooftop-JR.01 | ...
| Equipment Type | Air handling Unit | AC Split System | ...
| Make/Model | Fujitsu | Fujitsu | ...
| Site Name | Ultimo | Ultimo | ...
| Building | Building J | Building J | ...
| Floor | Roof | Level 1 | ...
| Room | JR.01 | J1.10A | ...
| Asset Location | Roof | Room J1.10A | ...
| Condition | 3 | 3 | ...
| Risk | 3 | 3 | ...
| Importance | 3 | 3 | ...
| Functionality | 3 | 3 | ...
| Overall Rating | 60 | 60 | ...
| Refrigerant Type | R22 | R22 | ...
| Recommendation | Due to phase out of R22 it is recommended to replace this unit in 1 to 3 years. | Due to phase out of R22 it is recommended to replace this unit in 1 to 3 years. | ...
| Budget Estimate | $9,000 | $12,000 | ...
| Comment | Unit is aged and starting to deteriorate. | Unit is aged and starting to deteriorate. | ...
| Date Added | 16 10 2013 | 16 10 2013 | ...
| Date Updated | 18 02 2014 | 18 02 2014 | ...

Due to phase out of R22 it is recommended to replace this unit in 1 to 3 years.
Planning Agencies - ensuring Compliance

• **BASIX Assessment** chosen as “proof of concept” pilot
  – Used the NSW Basix Web site (see http://www.basix.nsw.gov.au)
  – Mapping specification prepared to identify any gaps in IFC support

• Trial implementation of 5 steps
  – Project address, Plan type, Building type & “bedroom” count, Thermal comfort - wall types
### Basix - Web Assessment Steps

<table>
<thead>
<tr>
<th>Project Details</th>
<th>Water</th>
<th>Thermal Comfort</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Address</td>
<td>Landscape</td>
<td>Construction Type</td>
<td>Hot Water</td>
</tr>
<tr>
<td>Project Type</td>
<td>Fixtures</td>
<td>Construction Details</td>
<td>Heating &amp; Cooling</td>
</tr>
<tr>
<td>Site Details</td>
<td>Alternative Water</td>
<td>Insulation</td>
<td>Ventilation</td>
</tr>
<tr>
<td>Alternative Water Details</td>
<td>Windows &amp; Skylights</td>
<td></td>
<td>Lighting</td>
</tr>
<tr>
<td>Pool &amp; Spa</td>
<td>Windows &amp; Skylights details</td>
<td>Pool &amp; Spa</td>
<td>Alternative Energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other</td>
</tr>
</tbody>
</table>

For each step in the BASIX submission process each data item has been mapped to the appropriate entity in the IFC Specification. In this analysis we have not investigated all details in the system, but we consider that we have been able to interpret everything in principle to support the use of a BIM in IFC format as the means of submitting for BASIX assessment.
Basix IFC Mapping Example

**ifcExternalReference** Definition from IAI: An *ifcExternalReference* is the identification of information that is not explicitly represented in the current model or in the project database (as an implementation of the current model). Such information may be contained in classifications, documents or libraries.

**ifcSpace** Definition from IAI: A space represents an area or volume bounded actually or theoretically. Spaces are areas or volumes that provide for certain functions within a building.

<table>
<thead>
<tr>
<th>Step</th>
<th>Subject</th>
<th>Value</th>
<th>ifcEntity</th>
<th>Notes</th>
</tr>
</thead>
</table>
| 2    | Separate dwelling house | y,n | *ifcBuilding*  
*ifcBuilding.Name* = "Smith Residence"  
*ifcExternalReference*  
*ifcExternalReference.Name* = "Separate Dwelling" | check Types |
|      | Attached dwelling house | y,n | *ifcPropertySet.Name* = "BasixBasixBuilding"  
*ifcProperty.Name* = "BasixBuildingType"  
*ifcProperty.Value* = "Attached Dwelling" | alternative method |
|      | Unit | y,n | see above  
*ifcProperty.Value* = "Unit" | |
|      | No_of_bedrooms number | r | *ifcSpace*  
*ifcSpace.Name* = "R02"  
*ifcSpace.Description* = "Bedroom 2"  
*ifcSpace.ObjectType* = "Sleeping" | Count by the analysis tool |

**Note 1:** “Project type” would map to *ifcBuilding* type

**Note 2:** Identify definitive source of building types (BCA?) and room naming (NCRB?)
Project: Address details
Project: Address details

urbanIT Project - 33 Botany Road, Waterloo, NSW, 2012, Australia
Project - building type

Name: AU_Precinct_Modelling
Name: SA LEP Permitted Land Uses
Name: AU English

Context

has context

Language

has language

Subject

Full Name: dwelling house
Description: A building containing only one dwelling
Thermal Comfort: wall types
There is no single solution today for providing embodied carbon data to support sustainability analysis and modeling in a PIM or a BIM environment. The Accurate developments represent the best interim solution, while the industry waits for either the NOL or international BIM and EPD vendors to establish a robust service. However, global online libraries are becoming a powerful provider of object data and likely to influence developments here in Australasia.
A significant development has been the publishing of the CSIRO Implementation of Embodied CO2 Module in Accurate. This has a much larger range of approximately 150 product material definitions (see extract opposite).

This data currently, as far as we can ascertain, is the best dataset for embodied carbon at an elemental and materials scale. Use of this data requires sufficient detail to be identified in a precinct information model in order to apply the metrics at that level, then aggregate.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Unit</th>
<th>Embodied CO2 (kg CO2 eq/unit)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerated autoclaved concrete block</td>
<td>m³</td>
<td>196.9</td>
<td>Adopt European data from Ecoinvent (2004, autoclaved aerated concrete block, at plant/kg/CH). Assumed raw material are transported within 100km Density is 550 kg/m³ (Hebel, 2009)</td>
</tr>
<tr>
<td>Aluminum</td>
<td>m³</td>
<td>35804.8</td>
<td>Employ closed-loop method for recycling allocation (EAA, 2005; ISO 14044, 2006). Assumed 70% recovery rate Assumed mixing as virgin (70%) and scrap aluminum (30%) (Koltun and Tharumarajah, 2006)</td>
</tr>
<tr>
<td>Bituminous roof membrane</td>
<td>m³</td>
<td>1012.5</td>
<td>Adopt European data from Ecoinvent (2007, bitumen sealing, polymer EP4 flame retardant, at plant/kg/RER)</td>
</tr>
<tr>
<td>Brickwork with extruded clay brick</td>
<td>m³</td>
<td>290.8</td>
<td>Density 1580kg/m³ Standard brick size (110 (W)×230 (L)×76 (H)) 3.3kg of clay brick (extruded)</td>
</tr>
<tr>
<td>BST lightweight concrete</td>
<td>m³</td>
<td>1332.0</td>
<td>Density 2000kg/m³ (25-30MPa) sourced from Kirkside Products (2009)</td>
</tr>
<tr>
<td>Carpet (Nylon)</td>
<td>m³</td>
<td>2337.9</td>
<td>Assumed 50% for cut pile (0.175 g/cm³) and 3 50% for loop pile (0.150 g/cm³) * surface pile mass for Nylon BCF carpet (25.2/100mm gauge) is 580g/m² cut pile and 475 g/m² loop pile (CIAL, 2009)</td>
</tr>
<tr>
<td>Carpet underlay (rubber)</td>
<td>m³</td>
<td>739.5</td>
<td>Rubber underlay Thickness 7.5mm (1.830±55 kg/m²) Sourced from NFA (2009)</td>
</tr>
<tr>
<td>Ceramic tile</td>
<td>m³</td>
<td>1920</td>
<td>Adopt European data from Ecoinvent (2003, ceramic tiles, at regional storage/kg/CH) Assumed raw material are transported within 100km</td>
</tr>
<tr>
<td>Concrete block 190 dense- weight (not core-filled)</td>
<td>m³</td>
<td>153.9</td>
<td>Adopt Boustead data (UK dense concrete block) Thickness 190mm Density 1101kg/m³</td>
</tr>
</tbody>
</table>
### Reference data - linking C02e metrics to models

<table>
<thead>
<tr>
<th>Ifc Pset_EnvironmentalImpactIndicators</th>
<th>Data type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>IfcPropertySingleValue / IfcIdentifier</td>
<td>Reference ID for this specified type in this project</td>
</tr>
<tr>
<td>FunctionalUnitReference</td>
<td>IfcPropertySingleValue / IfcLabel</td>
<td>Reference to a database or a classification</td>
</tr>
<tr>
<td>Unit</td>
<td>IfcPropertySingleValue / IfcText</td>
<td>the unit of the quantity the environmental indicators values are related with.</td>
</tr>
<tr>
<td>LifeCyclePhase</td>
<td>IfcPropertyEnumeratedValue / IfcLabel / PEnum_LifeCyclePhase: Production, Transportation, Installation, Usage, Disposal, WholeLifeCycle, UserDefined, NotDefined</td>
<td>the whole life cycle or only a given phase from which environmental data are valid.</td>
</tr>
<tr>
<td>ExpectedServiceLife</td>
<td>IfcPropertySingleValue / IfcTimeMeasure</td>
<td>Expected service life in years.</td>
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<tr>
<td>TotalPrimaryEnergyConsumptionPerUnit</td>
<td>IfcPropertySingleValue / IfcEnergyMeasure</td>
<td>Quantity of energy used as defined in ISO21930:2007.</td>
</tr>
<tr>
<td>WaterConsumptionPerUnit</td>
<td>IfcPropertySingleValue / IfcVolumeMeasure</td>
<td>Quantity of water used.</td>
</tr>
<tr>
<td>HazardousWastePerUnit</td>
<td>IfcPropertySingleValue / IfcMassMeasure</td>
<td>Quantity of hazardous waste generated.</td>
</tr>
<tr>
<td>NonHazardousWastePerUnit</td>
<td>IfcPropertySingleValue / IfcMassMeasure</td>
<td>Quantity of non hazardous waste generated.</td>
</tr>
<tr>
<td>ClimateChangePerUnit</td>
<td>IfcPropertySingleValue / IfcMassMeasure</td>
<td>Quantity of greenhouse gases emitted calculated in equivalent CO2</td>
</tr>
<tr>
<td>AtmosphericAcidificationPerUnit</td>
<td>IfcPropertySingleValue / IfcMassMeasure</td>
<td>Quantity of gases responsible for the atmospheric acidification calculated in equivalent SO2</td>
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<tr>
<td>RenewableEnergyConsumptionPerUnit</td>
<td>IfcPropertySingleValue / IfcEnergyMeasure</td>
<td>Quantity of renewable energy used as defined in ISO21930:2007</td>
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<tr>
<td>NonRenewableEnergyConsumptionPerUnit</td>
<td>IfcPropertySingleValue / IfcEnergyMeasure</td>
<td>Quantity of non renewable energy used as defined in ISO21930:2007</td>
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<tr>
<td>ResourceDepletionPerUnit</td>
<td>IfcPropertySingleValue / IfcMassMeasure</td>
<td>Quantity of resources used calculated in equivalent antimony</td>
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<tr>
<td>InertWastePerUnit</td>
<td>IfcPropertySingleValue / IfcMassMeasure</td>
<td>Quantity of inert waste generated</td>
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<tr>
<td>RadioactiveWastePerUnit</td>
<td>IfcPropertySingleValue / IfcMassMeasure</td>
<td>Quantity of radioactive waste generated.</td>
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<tr>
<td>StratosphericOzoneLayerDestructionPerUnit</td>
<td>IfcPropertySingleValue / IfcMassMeasure</td>
<td>Quantity of gases destroying the stratospheric ozone layer calculated in equivalent CFC J11</td>
</tr>
<tr>
<td>PhotochemicalOzoneFormationPerUnit</td>
<td>IfcPropertySingleValue / IfcMassMeasure</td>
<td>Quantity of gases creating the photochemical ozone calculated in equivalent ethylene</td>
</tr>
<tr>
<td>EutrophicationPerUnit</td>
<td>IfcPropertySingleValue / IfcMassMeasure</td>
<td>Quantity of eutrophicating compounds calculated in equivalent PO4</td>
</tr>
</tbody>
</table>
### Reference data - linking C02e metrics to models

A European project led by the industry group **SBAlliance** has been to “... bring together operators of rating and certification tools for sustainable buildings, standard setting organisations, national building research centres as well as key property industry stakeholders and manufacturers of construction products.”

<table>
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Reference data - linking C02e metrics to models

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Accessing structured C02e data - bsDD terminology

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PIM - empowering Local Government
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State & Local Government
Planning & Compliance

Development Planner
PIM, BIM, DE based planning tools
PIM - empowering Local Government

Designers & Builders
PIM supports smarter planning & urban management, but asset development processes are not exploiting this!

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Planners & Mayors
How can we manage our urban centres and infrastructure more effectively?

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Accessing & Sharing PIM Data

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Designer: I'm planning an Office Building
Accessing & Sharing PIM Data

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Platforms:
- State & Local Government: Planning & Compliance
- Development Planner: BIM based planning tools

bDD terminology
## Accessing & Sharing PIM Data

### bsDD terminology

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### Designer:
I'm planning on an Office Building

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State & Local Government
Planning & Compliance

Development Planner
BIM based planning tools
Accessing & Sharing PIM Data

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**State & Local Government** Planning & Compliance

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bsDD terminology

National C02e database

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State & Local Government  
Planning & Compliance

Development Planner  
BIM based planning tools

Accessing & Sharing PIM Data

Designer: What are the C02e factors
Accessing & Sharing PIM Data

Proponent uploads Development Proposal

State & Local Government
Planning & Compliance

Proposal Model

Development Planner
BIM based planning tools

bsDD terminology

National CO2e database

PIM Project repository

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Development Planner
BIM based planning tools
**Accessing & Sharing PIM Data**

- **State & Local Government**
  - Planning & Compliance
  - DA Manager: Get the next project for assessment

- **DA Checker downloads**
  - Development Proposal

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**Notes:**

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Accessing & Sharing PIM Data

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Development Planner
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Assessor: What are permissible uses for this site in our LGA?
Accessing & Sharing PIM Data

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CoS Zoning Plan

National LEP Database

National C02e database

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Low Carbon Living CRC

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Zoning Plan

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Approved Model meets sustainability targets...

State & Local Government Planning & Compliance

Development Planner BIM based planning tools

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Building Compliance in Mesopotamia 1800 BC

The Laws of Hammurabi
The collection of rules was compiled toward the end of the forty-two year reign of Hammurabi (r. 1792-1750 S.C.E.), sixth ruler of the First Dynasty of Babylon,
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$§229$ If a builder constructs a house for a man but does not make his work sound, and the house that he constructs collapses and causes the death of the householder, that builder shall be killed.

$§230$ If it should cause the death of a son of the householder, they shall kill a son of that builder.

$§231$ If it should cause the death of a slave of the householder, he shall give to the householder a slave of comparable value for the slave.

...
Are we an innovative industry?

Are we an innovative industry?

Jared Diamond* provides an insight into the adoption and mastery of technology

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Opportunities for Australian leadership and innovation
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• Adopt *PIM as a backend technology for activities* such as the following:
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• Identify and *implement a national CO2e library* (for PIM granularities)
  - extend AccuRate across broader range of building types
  - support a national approach to product information as the basis for certification, compliance and product data
Opportunities for Australian leadership and innovation

• Adopt *PIM as a backend technology for activities* such as the following:
  - the use of BIM models to assess DA/BAs
  - implement openBIM for BASIX assessments
  - integrate PIM into the 3D Cadastre initiative in Queensland
  - collaborate with other initiatives e.g. ACT Climate Change Strategy office – precinct-scale initiatives

• Adopt *PIM as a data framework* for the development of the NCOS

• Identify and *implement a national CO2e library* (for PIM granularities)
  - extend AccuRate across broader range of building types
  - support a national approach to product information as the basis for certification, compliance and product data

• Require *EPDs for all building products*
Opportunities for Australian leadership and innovation
Opportunities for Australian leadership and innovation

• Implement *PIM in Australian precinct projects*, such as:
  - for new or existing urban centres
  - defence, health care or university facilities
  - precinct developments (greenfield, brownfield or greyfield)
  - major civic/infrastructure developments - eg Darling Harbour, Badgery’s Creek Airport, Brisbane River Rail crossing...
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• Undertake *pilots focussed on a targeted outcomes* providing owners and clients practical experience in the new technology, quick feedback under 1-2 years, and strong learning of the benefits for senior management and practitioners involved
  - small suburban centres...
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- Develop a Local Government *asset management data specification* to support operations and management of Council owned built assets in a BIM, PIM or Digital Engineering context
The challenge to Government & Industry

• There is a well developed body of examples to start **today** on the digital transformation

• We need national consensus, not state based initiatives

• The Australasian BIM Advisory Board (ABAB) is starting to set leadership for Governments in the BIM & DE domains

• Considering the current focus on Infrastructure we need explicit technology adoption to service their needs and to steward the changes and impact on projects and services

• Local Governments are a key to leading the industry in the transformation
# Thank to our collaborators

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
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Thank you

To find out more about the CRC for Low Carbon Living, see http://www.lowcarbonlivingcrc.com.au

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