Property Data Management Framework

for LINZ - Canterbury Spatial Data Infrastructure

FRAMEWORK AND DATA MODEL REPORT

29 March 2015
Executive summary

The response following the 2010 and 2011 Canterbury Earthquakes identified the need for a framework that provides well-defined, reliable, accurate property data relationships.

This report contains the initial work developed for a Property Data Management Framework, which was conducted on behalf of the LINZ Canterbury Spatial Data Infrastructure (SDI) office.

This report:

- summarises the work to date on the section of the PDMF project (Phase 2(a)) involved with developing and testing a PDMF model. This represents the first step toward the development of a Proof of Concept that can be tested with agencies in the Canterbury region.
- includes User Stories, a High-Level Concept Diagram, a Core Conceptual Model, Class Models, and an Information Model. For the models developed, a set of test cases were defined to test both the conceptual and information models, and the resulting instance diagrams (for the conceptual model), and test outputs (for the information model) are also included.
- highlights some key areas of need in terms of national datasets that are currently lacking or incomplete, and makes recommendations for moving the findings of this work forwards towards actual useful development of a national property data framework.

This documentation should provide the basis for ongoing development of the model, use of the key framework principles for other property-related developments (such as ASaTS), and future architecture and design activities for agencies looking to improve how their property data is currently managed.

It should be acknowledged that the modelling work presented here would be further informed by the implementation of the Proof of Concept, and that the model may need to be modified as a result. As such, this document should be treated as a ‘living document’, or as a foundation for further work and growth of the model as it is further explored through socialisation and implementation.
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## Overview

### Information Model Diagram

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## Overview

### Testing Output

#### Case 1 – Simple

<table>
<thead>
<tr>
<th>Scenario</th>
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#### Case 2 – Slightly More Complex

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#### Case 3 – Granny Flat

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#### Case 4 – Cross Lease

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<th>Scenario</th>
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#### Case 5 – Sausage Flats Unit Title

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#### Case 6 – Row of Shops

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#### Case 7 – Garage on Road Reserve

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#### Case 8 – Garages on Road Reserve

<table>
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<td>------</td>
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</tr>
<tr>
<td>9</td>
<td>Complex House</td>
<td>81</td>
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<td>10</td>
<td>Encroachment</td>
<td>82</td>
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<td>Corner Building</td>
<td>83</td>
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</tr>
<tr>
<td>12</td>
<td>Unit Title</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Somewhat Complex Site</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Sandhills Fire (two possible access addresses)</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Connected Cross Lease</td>
<td>87</td>
<td></td>
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<tr>
<td>16</td>
<td>A farm on both sides of the road</td>
<td>88</td>
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</table>
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1 Introduction

1.1 Background

At different times and in many different contexts, the notion of property and how it is defined, ranging from the physical fact to abstract notions of entitlement and responsibilities, has raised a number of tensions. The mismatch of sense and context, and the ultimately elusive quality of the essentially human institution of property, has resulted in complex, and often inefficient ways of trying to identify and manage property information. Different stakeholders in property have different areas of interest and focus - from the legal, to the physical, to the commercial and ‘people’ aspects – all of which creates a raft of different perspectives. The design, and eventual implementation, of an effective property data management framework (PDMF) which contains well-defined, reliable, accurate relationships, is crucial to unlocking process improvement, greater efficiencies, and innovation in NZ's property-related sectors.

For Canterbury, the need for such a framework has been demonstrated in the post-earthquake recovery process, with location-based information being a vital element of many activities including urban planning, communications, and consenting. The many agencies involved in the rebuild need ways to access, combine and share their information quickly and reliably, and an authoritative PDMF would provide a coordinated approach to this.

On a wider scale, a PDMF could provide the basis for some key national initiatives moving forwards, including LINZ’s Advanced Survey and Title System (ASaTS) and the National Online Consenting System (NOCS), and enable a variety of innovation within NZ. This includes the opportunity for improved services and support for industries such as emergency services, insurance, construction, transport, health, and many others.

1.2 The Canterbury PDMF Project

The Canterbury SDI PDMF project was initiated in order to ‘solve long-standing issues concerning inconsistencies between building footprints, addresses, land parcels, rating units, and ownership data, which are affecting the recovery’.

The PDMF project has been organised into a number of phases:

- **Phase 1:** Understand the problems faced in the Canterbury earthquake recovery relating to use and exchange of property data. This work was completed by Vicinity Solutions (“Property Data Management Framework – Problem Identification” Report - 4/2/2014).

- **Phase 2:** Develop and Test a property data management framework with Canterbury Agencies:
  a. Develop PDMF framework and model
  b. Develop a Proof of Concept (POC) Registry to test with Canterbury agencies

- **Phase 3:** Use the project outputs to inform relevant regional and national initiatives

The work in this report is for Phase 2(a) of the PDMF project.
1.2.1 Phase 1 Summary

The first phase of the PDMF project identified problems faced by organisations during the earthquake response and recovery, as they related to the use of property data. The Canterbury SDI programme office commissioned a study from Vicinity Solutions, which delivered its final report, “Property Data Management Framework – Problem Identification”, in February 2014.

The report highlighted that, in response to the 2010 and 2011 Canterbury Earthquakes, dealing with separate sources of data for address, property, ownership, and building information proved to be challenging. As a result, much duplication of effort and data occurred, and the lack of integration between related datasets led to significant re-work, reduced quality of decision-making, reduced quality of service to Canterbury citizens, loss of reputation among agencies and a significant cost burden.

The property data management issues identified in the report were classes into four key themes:

- Risk management: decisions made about data management and technology did not follow appropriate risk management procedures
- Location data: there were significant gaps in the availability and capture of certain types of location data
- Preparedness: a lack of preparation inhibited data sharing and integration
- Overuse of address: the lack of an integrated, reliable, and shareable means of connecting addresses to land parcels, titles, and buildings.

1.2.2 Phase 2(a) Summary

This report summarises the work to date on the section of the PDMF project involved with developing and testing a PDMF model. The development of this model is the first step toward the development of a Proof of Concept that can be tested with agencies in the Canterbury region.

It should be acknowledged that the modelling work presented here would be further informed by the implementation of the Proof of Concept, and that the model may need to be modified as a result. As such, this document should be treated as a ‘living document’, or as a foundation for further work and growth of the model as it is further explored through socialisation and implementation.

The PDMF model has the potential not only to inform the situation in Canterbury, but also to inform projects at a wider national level, such as LINZ’s Advanced Survey and Title System (ASaTS), Better Property Services, and Cadastre 2034, as well as projects by other agencies such as the National Online Consenting System (NOCS), and Canterbury’s 3D Enabled Cities project. The framework for property data management may also be of value to local councils and agencies such as EQC, who may be looking to improve how they manage their property data. As the model has been aligned with the LADM standards, there is also the potential to develop a LADM profile for New Zealand which will align us internationally.
1.3 **Methodology**

1.3.1 **Development of User Stories**

Based on the findings of the report produced by Vicinity Solutions, as well as discussions with the LINZ project team and stakeholders, a set of User Stories were developed to help define the scope of the problem that the PDMF model, and the Registry Proof of Concept, needed to address. For each User Story, there was discussion and identification of the key considerations and questions that the user story raised in relation to the PDMF.

These User Stories are documented in Section 2. For each User Story, there is also a brief description of how that story has been incorporated/demonstrated in the model and testing. In some cases, the User Stories relate to the Registry Proof of Concept, and so are not ‘demonstrated’ in this document, but will be addressed once the Registry Proof of Concept is developed.

1.3.2 **Conceptual Model**

The PDMF is an innovative, greenfield project, with thinking that incorporates a wide set of ideas, so the approach to the model development was relatively flexible, and involved a focus on the key drivers for the model.

The approach, initially, was to capture the scope of the PDMF through the less formal method of developing the High-level Concept Diagram (Section 3) which would capture the key entities and their relationships and form the basis for the discussions around key considerations (Section 4.3) for the Conceptual Model.

Once the key considerations were discussed and agreed on, a formal Core Conceptual Model (Section 4.3) was developed to capture the key domain relationships/entities.

To ensure that the PDMF model developed for Canterbury was not operating in isolation of international developments, and would be interoperable if required, the Core Conceptual Model was then integrated with relevant national and international standards. The ISO Land Administration Data Model (LADM) provides a conceptual model for land administration which can be extended and adapted to meet local requirements. A comparison of the Core Conceptual Model with the LADM showed a strong correlation of the key entities and concepts. The LADM was then integrated into the model to form the PDMF – LADM Conceptual Model (Section 4.5).

The model presented in this document should be treated as a first iteration, which can be expanded and developed further. The model at this point identifies the key entities and describes the relationships between them. As a model, it provides a reference from which agencies in NZ can implement frameworks and solutions to start addressing the issues identified in the initial PDMF report.

1.3.3 **Instance Level Cases**

The Instance Level Cases illustrate the flexibility and functionality of the PDMF model by showing its use in real world scenarios. The content of this section follows the pattern provided by the instance level cases presented in the LADM specification (Annex C of the LADM document). Each instance diagram is built around test case scenarios that demonstrate typical New Zealand property situations.
The diagrams present instances of the PDMF model classes and follow the same model colour coding as the PDMF Conceptual model diagram to enable easier reference back to the model.

The instance level diagrams do not include all possible class instances for any given test case. Instead, only relevant class instances are presented in order to reduce the complexity of the diagrams and to focus on the key classes related to the case.

1.3.4 Information Model

Development of the Information Model involved the documentation of an implementation of the PDMF Conceptual Model, and was undertaken for the purpose of testing and evaluating the PDMF in a physical relational database schema.

1.3.5 Model Testing

For testing of the Information Model, the conceptual model and the scenarios documented in the instance level cases were used to define a test physical database schema.

This schema was used to create a physical database using a PostgreSQL database server. For each test case scenario, a real world equivalent was found in the data provided by Christchurch City Council (CCC). This data was then scripted and loaded into the database server and the relevant relationships and other required data was entered to simulate a complete dataset which was able to be queried using SQL.

The test data was queried by different input parameters - for example, address and rating unit ID - and the output data served to confirm that the retrieved data matched the expected results.
1.4 Sources

1.4.1 Documents/References Used

<table>
<thead>
<tr>
<th>Document Name</th>
<th>Date</th>
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<tr>
<td>Request for Proposal- Canterbury SDI: Property Data Management Framework Project – Framework and Data Model</td>
<td>July 2014</td>
<td>Land Information NZ</td>
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<tr>
<td>Property Data Management Framework – Problem Identification</td>
<td>4/2/2014</td>
<td>Vicinity Solutions</td>
</tr>
<tr>
<td>Geographic Information – Land Administration Domain Model (LADM)</td>
<td>24/12/2012</td>
<td>ISO 19152:2012</td>
</tr>
<tr>
<td>Rating Valuations Rules 2008 – LINZS30300</td>
<td>1/10/2010</td>
<td>Land Information NZ</td>
</tr>
<tr>
<td><a href="http://www.ontologyengineering.org/">http://www.ontologyengineering.org/</a></td>
<td>Accessed: 10/12/2014</td>
<td>University of Brighton</td>
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<tr>
<td>Trimble Sketch-Up 3D Warehouse</td>
<td>Accesses: 1/12/2014</td>
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1.4.2 Contributors

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<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Peter Smith</td>
<td>e-Spatial</td>
<td>Solution Architect</td>
</tr>
<tr>
<td>Matti Seikkula</td>
<td>e-Spatial</td>
<td>Enterprise Architect</td>
</tr>
<tr>
<td>Shane Turk</td>
<td>e-Spatial</td>
<td>Data Architect</td>
</tr>
<tr>
<td>Kathryn Salm</td>
<td>e-Spatial</td>
<td>Consulting Team Lead</td>
</tr>
<tr>
<td>Andrew Chisholm</td>
<td>LINZ</td>
<td></td>
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<tr>
<td>Mike Judd</td>
<td>LINZ</td>
<td></td>
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<tr>
<td>Brendon Whiteman</td>
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<td>Byron Cochrane</td>
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<td>Steve Bensberg</td>
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<td>Hunter Colman</td>
<td>CCC</td>
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<tr>
<td>Mark O’Keeffe</td>
<td>EQC</td>
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1.4.3 Standards

The following standards were considered in the development of the model:

<table>
<thead>
<tr>
<th>Addressing Standard ISO 19160</th>
<th>The draft Addressing Standard ISO 19160 is used to inform the address related parts of the model.</th>
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<tbody>
<tr>
<td>LADM ISO 19152</td>
<td>Which comprises the following referenced standards:</td>
</tr>
<tr>
<td></td>
<td>- ISO 4217:2008, Currency names and code elements</td>
</tr>
<tr>
<td></td>
<td>- ISO 8601:2004, Information interchange — Representation of dates and times</td>
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<tr>
<td></td>
<td>- ISO 14825:2011, Intelligent transport systems — Geographic Data Files (GDF) — GDF5.0</td>
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<td>- ISO 19105:2000, Geographic Information — Conformance and testing</td>
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<td>- ISO 19107:2003, Geographic Information — Spatial schema</td>
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<tr>
<td></td>
<td>- ISO 19108:2002, Geographic Information — Temporal schema</td>
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<td></td>
<td>- ISO 19111:2007, Geographic Information — Spatial referencing by coordinates</td>
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<td>- ISO 19115:2003, Geographic information — Metadata</td>
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<td>- ISO 19125-2:2004, Geographic information — Simple feature access — Part 2: SQL option</td>
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<tr>
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<td>- ISO 19156:2011, Geographic information — Observations and measurements</td>
</tr>
<tr>
<td>UML 2.1</td>
<td>The model is documented using UML 2.1</td>
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<tr>
<td>Sparx Enterprise Architect</td>
<td>The model is documented as a Sparx Enterprise Architect file</td>
</tr>
<tr>
<td>ISO 19112:2003 Spatial referencing by geographic identifiers</td>
<td>This standard defines a general model for spatial referencing using geographic identifiers and the essential components of a gazetteer. It is useful for reference datasets such as ‘named places’.</td>
</tr>
<tr>
<td>ISO 19155:2012 Geographic information place identifier architecture</td>
<td>This standard defines a reference model with an encoding method for an identifier of a place. This standard is applicable to all location based services but significantly the emergency management services. Again, it is useful for reference datasets such as ‘named places’.</td>
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</table>

During the initial phases of the project, the ESA specifications and Fire ‘localities’ specifications were also examined, which informed the initial project start up work.
## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>CCC</td>
<td>Christchurch City Council</td>
</tr>
<tr>
<td>EQC</td>
<td>Earthquake Commission</td>
</tr>
<tr>
<td>OGC</td>
<td>Open Geospatial Consortium</td>
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</table>
| Address (as per RFP document)                  | A structured way of uniquely identifying and locating a property or part thereof  
*Note: The modelling work has revised this definition to say that an address is: “A way of unambiguously referencing a unique property or part thereof (that part being either a building or a connection)”*. |
| Buildings (as per RFP document)                | A built structure that is hollow and can be occupied for living, working or storage, which would need a building consent if it were to be replaced and that:  
- Is over 10m² in area or 2m in height  
- Has a roof and  
- Can be demolished without affecting another built structure |
| Land parcel (as per RFP document)              | An area of land defined by survey as portrayed on either a Survey office or Land Transfer Plan                                              |
| Title (as per RFP document)                    | A public record providing evidence of ownership and rights in a piece of real property. Includes private land, Crown land, and Maori land |
| Rating Unit (as per RFP document)              | As defined under the rating valuations Act 1998. In most cases there is one rating unit for a certificate of title (fee simple, stratum estate or cross lease). In a small number of cases a rating unit can be part of a title, or comprise two or more titles. |
| Property (as per RFP document)                 | For the purpose of the PDMF project, the term ‘property’ is the sum of all of the above data elements and the way they interact.  
*Note: The modelling work has revised this definition to say that a property is the combination of rights, land, and building. It does not include address.* |
| Tradable Unit                                  | For the purpose of the PDMF project, the term ‘Tradeable Unit’ is a concept developed to help think about ‘property’ in terms of something that can be bought, sold, leased, etc., and which may include (but is not limited to) a house, apartment, leased space (for example a shop or paddock), etc. |
2 User Stories

2.1 Overview

Based on the finding of the report produced by Vicinity Solutions, as well as discussion with the LINZ project team and stakeholders, a set of User Stories were developed to help define the scope of the problem that the PDMF model needed to address. For each user story, the key considerations and questions that the user story raised in relation to the PDMF were discussed and identified.

These User Stories are documented in Section 2. For each User Story, there is also included a brief description of how that story has been incorporated/demonstrated in the model and testing. In some cases, the User Stories relate to the Registry Proof of Concept, and so are not ‘demonstrated’ in this document, but will be addressed once the Registry Proof of Concept is developed.

2.2 User Stories

<table>
<thead>
<tr>
<th>User Story 1</th>
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<tbody>
<tr>
<td><strong>As:</strong> An Emergency Services Dispatcher</td>
</tr>
<tr>
<td><strong>I can:</strong> Accurately locate the situation of the emergency described by the caller</td>
</tr>
<tr>
<td><strong>So that:</strong> I can be certain that the address I am sending the responder to exists in the real world, and direct the responder to the correct location.</td>
</tr>
<tr>
<td><strong>Key considerations/questions:</strong></td>
</tr>
<tr>
<td>- A User should be able to search by a number of different variables that someone may use to identify a location, including but not limited to: physical address, building name, site name, tenancy name, alternative (alias) addresses.</td>
</tr>
<tr>
<td>- Allocated address as the ‘authoritative’ address dataset</td>
</tr>
<tr>
<td>- Do we need to consider emergency services requirements for access? Access ways linked to a site rather than an address.</td>
</tr>
<tr>
<td><strong>In this document</strong></td>
</tr>
<tr>
<td>Most of the instance level cases in Section 4 represent this User Story. In particular, Test Cases 21 and 22 highlight the need for a Connection network model to cover complex driveway access that would be critical for emergency services dispatch.</td>
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</table>
### User Story 2

**As:** An *Emergency Services Dispatcher*

**I can:** Accurately identify the location of an emergency by business name or building name (e.g. ‘The Cookie Time factory’, ‘The PWC Building’)

**So that:** I can quickly locate an incident and send a responder to the correct location

**Key considerations/questions:**
- Business tenancy
- Building name
- Building ID
- Site name (Including complex sites, e.g. Wellington Hospital)

**In this document** Building name is incorporated into the physical building unit entity in the PDMF model. The integration of business name data needs to be addressed in the next phase of the project (Registry Proof of Concept).

### User Story 3

**As:** An *Emergency Services Dispatcher*

**I can:** Accurately identify the location of an emergency by named place

**So that:** I can quickly locate the incident and send a responder to the correct location

**Key considerations/questions:**
- There needs to be acknowledgement of named places
- Potentially, there are multiple definitions of named places
- We don’t have named places as a data set but we need to take into consideration how such a dataset may connect to the registry in the future (there may be a separate system developed for these that needs to link it at a later stage)

**In this document** The integration of Named Place data needs to be addressed in the next phase of the project (Registry Proof of Concept).

### User Story 4

**As:** An *Emergency Services Responder*

**I can:** Identify the best access way for a building to which I have been called in an emergency

**So that:** I can ensure that I reach my destination as quickly as possible without wasting time trying to gain access

**Key considerations/questions:**
- There needs to be sufficient information in the attribute to make appropriate decisions.
- On occasion, there will need to be address used as a proxy for location
- There may be multiple access points for a property
- Access points need to be categorised by purpose (e.g. pedestrian class access, vehicle class access (or ‘drive on’ access).
- Need to have relationships within the Registry to searchable objects such as building, address, property, etc.

**In this document** Connections are addressed by most instance level cases in Section 4. The code list for Connections would provide support for this user story.
### User Story 5

<table>
<thead>
<tr>
<th>As:</th>
<th>A Territorial Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>Accurately identify a building</td>
</tr>
<tr>
<td>So that:</td>
<td>I can ensure that any data associated with that building for compliance, consent, or other purposes is connected to the correct building</td>
</tr>
</tbody>
</table>

**Key considerations/questions:**
- A unique building ID
- Authoritative building database
- Needs to include the notion of time attribution (including previous and proposed buildings)
- Building exists in three dimensions
- Consideration to how various attributes in different satellite systems link back to the unique building ID
- Consideration of the inherent spatial extents of objects
- PARKED: Discussion around defining building (and how alternative ‘non-building structures’ are handled)

**In this document**
A Building Identifier supports this user story. The links to property, ownership, connections and their spatial representations would help to further disambiguate the individual buildings.

### User Story 6

<table>
<thead>
<tr>
<th>As:</th>
<th>A Demolition Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>Accurately identify a building</td>
</tr>
<tr>
<td>So that:</td>
<td>So that I don’t demolish the wrong building</td>
</tr>
</tbody>
</table>

**Key considerations/questions:**
- a unique building ID
- Authoritative building database
- Building footprints and spatial extents
- There also needs to be consideration given to informal, ‘non-building’ structures and how (if) these are handled. They may just be attribute information about a property in, for example, MBIE, rather than core.
- The building to property relationship should be modelled. Consideration needs to be given to buildings not on a property, e.g. a garage tied to a property but physically on road reserve.

**In this document**
A Building Identifier supports this user story. The links to property, ownership, connections and their spatial representations would help to further disambiguate the individual buildings.
### User Story 7 (High Priority)

<table>
<thead>
<tr>
<th>As:</th>
<th>A USAR team leader</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>Accurately identify which buildings, and which units within those buildings, I have to check for survivors/corpses</td>
</tr>
<tr>
<td>So that:</td>
<td>I don’t miss any buildings, I don’t search buildings twice, and I don’t have to go back and repeat a search, and so that I can demonstrate that the process was carried out thoroughly and that every effort to locate survivors was made in a timely fashion.</td>
</tr>
</tbody>
</table>

**Key considerations/questions:**
- Unique building ID
- Authoritative building database
- Properties that exist within the building
- Residential and commercial tenancy and occupancy
- Unit titles
- 3D occupancy would be an aim of PDMF
- Specified search results
- Note: MBIE have Unique IDs for tenancy for every rented space
- Access

**In this document**
This user story is supported by the physical building unit and legal space building unit entities. Note that the model allows for any number of buildings to be associated to a property.

### User Story 8

<table>
<thead>
<tr>
<th>As:</th>
<th>An USAR coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>Identify all the property data (with a spatial extent) in a geographical area ('block') or around a GPS coordinate</td>
</tr>
<tr>
<td>So that:</td>
<td>So that I can undertake coarse planning and rapidly assign areas of work or responsibility.</td>
</tr>
</tbody>
</table>

**Key considerations/questions:**
- How do different property elements relate to one another?
- Does everything need a polygon to describe its spatial extent?
- Buffered around a point?

**In this document**
The spatial extents of property, buildings and connections can be spatially queried.

### User Story 9

<table>
<thead>
<tr>
<th>As:</th>
<th>A Building Consents Officer (TA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>See who owns a piece of land/property</td>
</tr>
<tr>
<td>So that:</td>
<td>I can see the ownership rights for this piece of land</td>
</tr>
</tbody>
</table>

**Key considerations/questions:**
- By owner name(s), appellation(s), address(es), parcels(s), parts of parcels
- Describing the relationship between entities
- Needs to include rating unit

**In this document**
Ownership details are covered by the party entity within the model and the links to property directly support this user story.
<table>
<thead>
<tr>
<th><strong>User Story 10</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>As:</strong></td>
</tr>
<tr>
<td><strong>I can:</strong></td>
</tr>
<tr>
<td><strong>So that:</strong></td>
</tr>
<tr>
<td><strong>Key considerations/questions:</strong></td>
</tr>
<tr>
<td><strong>In this document</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>User Story 11</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>As:</strong></td>
</tr>
<tr>
<td><strong>I can:</strong></td>
</tr>
<tr>
<td><strong>So that:</strong></td>
</tr>
</tbody>
</table>
| **Key considerations/questions:** | - For every piece of data in the registry, we can tell what satellite it came from and when. (Who the authoritative data holder is)  
- Need to preserve where the data came from |
| **In this document** | The use of a building identifier allows the integration of building datasets with buildings. |

<table>
<thead>
<tr>
<th><strong>User Story 12</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>As:</strong></td>
</tr>
<tr>
<td><strong>I can:</strong></td>
</tr>
<tr>
<td><strong>So that:</strong></td>
</tr>
</tbody>
</table>
| **Key considerations/questions:** | - Spatial extents  
- Links between parcel, rating units, and other features |
| **In this document** | Supported by the integration of rating unit into the PDMF. |

<table>
<thead>
<tr>
<th><strong>User Story 13</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>As:</strong></td>
</tr>
<tr>
<td><strong>I can:</strong></td>
</tr>
<tr>
<td><strong>So that:</strong></td>
</tr>
</tbody>
</table>
| **Key considerations/questions:** | - From the point the registry starts recording (with option of backfilling?)  
- Temporal relationships  
- Snapshot in time, rather than object lifecycle ‘chaining/versioning’. |
| **In this document** | Supported in the model by the versioned object entities from/to attributes within the LADM. |
**User Story 14**

<table>
<thead>
<tr>
<th>As:</th>
<th>An Insurer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>See who owns the title on a piece of land/property</td>
</tr>
<tr>
<td>So that:</td>
<td>I can sell the correct policy</td>
</tr>
</tbody>
</table>

**Key considerations/questions:**
- Spatial extent of elements
- Information on title ownership
- Each title should be linked to a single rating unit
- Insurer may know owner name, address, appellation
- Is it freehold, leasehold etc?
- An issue in Christchurch was that insurers knew the title but couldn’t identify what piece of land the title was for (cross-lease issues)
- Cross-lease needs to be considered

In this document: Ownership details are covered by the party entity within the model and the links to property directly support this user story.

**User Story 15 (High Priority)**

<table>
<thead>
<tr>
<th>As:</th>
<th>An Insurer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>See the spatial relationship between features (e.g. ‘this unit is attached to this unit’)- including which part of a building footprint is related to a client’s policy</td>
</tr>
<tr>
<td>So that:</td>
<td>I can understand the context of the feature I am looking at.</td>
</tr>
</tbody>
</table>

**Key considerations/questions:**
(e.g. EQC can look at a unit and determine if it is standalone, or, if not, what it’s relationship is to other units on the title So that they can make decisions in context where they may affect other features)
- Relationship type between entities
- Predicate (in OWL model)
- Linkages can indicate a probability of party features
- Ownership information
- Extent of ownership definitions linked to building structures?
- Property as part of a building
- Adjacent buildings- as designed? In earthquake/fire scenarios?
- Satellite info- BIM level?
- The correct ID of building, to get right ID, so you can get the right info from the satellites.
- The job of the registry is to make sure you get the right ID.

In this document: Instance level cases 5, 6, 9, 12, 13 and 19 support this user story.
### User Story 16

<table>
<thead>
<tr>
<th>As:</th>
<th>An <strong>Insurer</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>Identify the location of tenants at risk (e.g. old/infirm)</td>
</tr>
<tr>
<td>So that:</td>
<td>I can ensure that they are assessed and dealt with quickly to prevent any harm (e.g. dying of cold)</td>
</tr>
</tbody>
</table>
| Key considerations/questions: | - Not to be solved directly now, but raises questions as to how personal occupancy data would be managed if it was made available in the future  
- The model needs to accommodate for it  
- Tenancy extent may have a tenancy ID in the future  
- This is not currently done, but the model could have a tenant ID placeholder that is not populated (to indicate how it may work in the future) |
| In this document | The use of a unique identifiers would allow information regarding tenants at risk to be recorded against the property or potentially the building within a property. |

### User Story 17

<table>
<thead>
<tr>
<th>As:</th>
<th>An <strong>Insurer</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>See who holds the land title and who leases it</td>
</tr>
<tr>
<td>So that:</td>
<td>I can determine who the correct person is to assign insurance outcomes to and that I can find the other owners who are affected by a claim</td>
</tr>
</tbody>
</table>
| Key considerations/questions: | - Lease  
- Information on title ownership  
- Cross-lease |
| In this document | Ownership details are covered by the party entity within the model and the links to property directly support this user story. |

### User Story 18

<table>
<thead>
<tr>
<th>As:</th>
<th>An <strong>Insurer</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>See all the buildings on a rating unit</td>
</tr>
<tr>
<td>So that:</td>
<td>I have a full picture of all the buildings on a property that a policy needs to cover</td>
</tr>
<tr>
<td>Key considerations/questions:</td>
<td>- Building footprints</td>
</tr>
<tr>
<td>In this document</td>
<td>The relationship between rating unit, building and property is supported by the PDMF model.</td>
</tr>
</tbody>
</table>
### User Story 19

**As:** An Insurer  
**I can:** See the relationship between owners and buildings, and when buildings overlap several parcels in common ownership  
**So that:** I can contact the appropriate building owners for a land claim  
**Key considerations/questions:**  
- Rating Units  
- Typing parcels together  
- Relationships between buildings and parcels  
**In this document** Instance level case 19 supports this user story.

### User Story 20

**As:** A Census Coordinator  
**I can:** See which buildings are dwellings  
**So that:** I can ensure that all the dwellings and the people who live in them can participate in the census  
**Key considerations/questions:**  
- Tenancy information (residential)  
- Linked to buildings  
- Whether buildings contain apartments/businesses  
- ‘Non-building’ structures such as sleepouts etc. Stats NZ has this info-how does the registry deal with it? (Or does it?).  
**In this document** We need to define dwelling - if it equals a property then the model supports it.

### User Story 21

**As:** A Statistician  
**I can:** See the where businesses are located  
**So that:** I can provide reliable analysis to the government for decision making.  
**Key considerations/questions:**  
- Residential vs Business tenancy  
**In this document** With integrated business information data this user story can be supported.
### User Story 22

**As:** A Surveyor  
**I can:** Access an authoritative 3D cadastre and add to that with surveyed areas of occupation  
**So that:** I can work with those land parcels that exist in three dimensions, to link associated ownership, rights and restrictions with their spatial location in the physical world  

**Key considerations/questions:**  
- Ensuring that there is the capability in the registry for links between building, title, and rating unit in a 3D cadastre scenario  
- Enable for 3D cadastre in the future  
- May, in the future, need to consider BIM as well.  
- Rating unit geometry can deal with height limits  
- Registry can reference 3D  

In this document The LADM supports 3D spatial units.

### User Story 23

**As:** Member of the Public  
**I can:** Determine whether a building I am going into has a good seismic rating  
**So that:** I can feel assured about my safety  

**Key considerations/questions:**  
- Unique building ID identifiable by address, building name, etc.  
- How do they then access further information (e.g. seismic rating info) from the ‘satellite’ systems?  

In this document With integrated building information data this user story can be supported.

### User Story 24

**As:** Utilities Company  
**I can:** Find out the best way to access a property with my truck  
**So that:** I can get as close to my work site as possible and save myself time  

**Key considerations/questions:**  
- Access Ways for specific purposes (drive on)  
- Linked to address, property, building ID, etc  

In this document Connections support this user story.

### User Story 25

**As:** Satellites of the registry  
**I can:** Maintain the data that I think is relevant to me  
**So that:**  

**Key considerations/questions:**  
- We could get duplicate data from multiple satellites that we need to resolve  

In this document The use of a unique identifiers for building, property, connection and address would allow information to be integrated into the PDMF.
### User Story 26

<table>
<thead>
<tr>
<th>As:</th>
<th><strong>Satellites of the registry</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>Synch my data with the registry</td>
</tr>
<tr>
<td>So that:</td>
<td>There is as little impact as possible on my processes and systems</td>
</tr>
<tr>
<td>Key considerations/questions:</td>
<td>Making changes as easy as possible for satellites</td>
</tr>
</tbody>
</table>

In this document: This is a PDMF implementation user story. However, the model supports the integration of data from various data sources.

### User Story 27

<table>
<thead>
<tr>
<th>As:</th>
<th><strong>A Satellite of the registry</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>Make sure that the data synched is valid and fit for purpose</td>
</tr>
<tr>
<td>So that:</td>
<td>The Registry can provide the most accurate and relevant results to the end users</td>
</tr>
<tr>
<td>Key considerations/questions:</td>
<td>-</td>
</tr>
</tbody>
</table>

In this document: This is a PDMF implementation user story.

### User Story 28

<table>
<thead>
<tr>
<th>As:</th>
<th><strong>A Satellite of the registry</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>Be notified of conflicts in datasets I maintain</td>
</tr>
<tr>
<td>So that:</td>
<td>I can proactively correct and cleanse my data where needed</td>
</tr>
<tr>
<td>Key considerations/questions:</td>
<td>- Identify if data supplied is not correct</td>
</tr>
</tbody>
</table>

In this document: This is a PDMF implementation user story.

### User Story 29

<table>
<thead>
<tr>
<th>As:</th>
<th><strong>New Satellite of the registry</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>I can:</td>
<td>Introduce my dataset into the registry</td>
</tr>
<tr>
<td>So that:</td>
<td>My data is added to the Registry, and becomes accessible to users</td>
</tr>
</tbody>
</table>
| Key considerations/questions: | - Could only be done by spatial extent possibly?  
- The registry is not about storing a whole raft of information, but about providing well-defined, reliable, accurate relationships between core/key defined entities/objects. |

In this document: This is a PDMF implementation user story. However, the use of a unique identifiers for building, property, connection and address would allow information to be integrated into the PDMF.
3 PDMF High-Level Concept Diagram

Figure 1. PDMF High-Level Concept Diagram (See Appendix 3 for A3 version)

The PDMF Concept Diagram presented in Figure 1 provides a high level overview of the key classes and relationships modelled in the PDMF.

‘Classes’ represent a set of objects and are shown with closed curves, labelled with the class name. ‘Properties’ represent binary relationships between objects which are shown with arrows that may be labelled. Classes can contain other classes to represent the cases where individuals of one class are also in another class.

The key PDMF classes of Building, Property, Rating Unit, Rights, Address, Access (alias ‘Connection’), Site and Party are shown in bold circles. Other classes - Parcel and Named Place - are shown in normal type. Classes that have a geospatial component are shown with a grey background. In this diagram, key class attributes are represented as classes e.g.: Building Name and Named Place Name.

Whilst the ‘Named Place’ class is outside the domain of interest and may only have a geospatial relationship to classes of the PDMF, it is shown in this diagram to illustrate that the PDMF can be used in conjunction with other datasets that have a geospatial component to them.
4 Conceptual Model

4.1 Overview

A key focus of this stage of the PDMF work was the development of a Property Data Conceptual Model.

The approach, initially, was to capture the scope of the PDMF through the less formal method of developing the High-level Concept Diagram (Section 3) which would capture the key entities and their relationships and form the basis for the discussions around key considerations (Section 4.2) for the Conceptual Model.

Once the key considerations were discussed and agreed on, a more formal Core Conceptual Model (Section 4.4) was developed to capture the key domain relationships and entities. This initial model was then combined with the relevant national and international standards (ISO, etc.) and existing international work that has already been done on the LADM (Land Administration Data Model) to ensure that the Canterbury PDMF model is not operating in isolation of international developments, and would be interoperable if required.

While work should still be done to further develop the model, for the purposes of this report the model is presented at the current point of its development. The model at this point identifies the key entities and describes the relationships between them. As a model, it provides a reference from which agencies in NZ can implement frameworks and solutions to start addressing the issues identified in the initial PDMF report.

4.2 Key Considerations

The initial discussions for the PDMF focussed on some key areas for consideration. This section attempts to capture some of those discussions and the decisions that were made, which then influenced the design of the PDMF model.

4.2.1 Address

Address was a key issue that was raised extensively in the Vicinity report. The report showed that addressing information in Christchurch is commonly used as a key identifier for properties, but there are multiple different representations of address, and often addresses are inconsistent across different addressing systems.

In discussions, it was agreed that address should never be used as a means to identify an addressable object- only to reference it. No matter what address (official or otherwise) is used, the address should only ever reference an addressable object - such as building, connection, or property.
In order to make addressing work effectively, there is a requirement to identify and publish the unique building, connection, and property identifiers so people can reference these with their addresses. It is important to consider what impact this approach will have on organisations. Many organisations currently use address as their primary key for identifying customers and assets, and if they were to change this approach, they would need to consider the impact on their systems and processes. This will be investigated in the Proof of Concept phase, when the actual interaction with stakeholder systems is introduced.

4.2.2 Addressable Objects

Property, Building, and Connection are ‘addressable objects’, and are represented and identified by unique IDs. Addressable Objects need to have a well-defined and managed relationship with address. The Property-Building-Connection-Address relationship is modelled in Section 4.6.

4.2.3 Definition of ‘Property’

This was a key discussion at the start of the project. All the elements of the PDMF represent property in some form, but the question was whether the model should contain a specific, defined entity for ‘property’. The ‘property’ entity has been included in the model, as a representation of the aggregation/completion of rights, land, and building. Within the PDMF, a group of closely related rights, responsibilities, restrictions, land, buildings and associated details, that are combined into a ‘tradable unit’, are considered to be property. In other words, a ‘property’ is a group of entities that are linked together in a ‘can’t dispose of separately’ scenario.

While property is really a combination of all the elements in the model, it is hard not to have an entity for property represented in the model. While in many cases a property is analogous to a rating unit (a 1:1 relationship) these are not the same thing. In particular, a rating unit can form part of a property, and a rating unit can be comprised of multiple properties.

4.2.4 Unique Property ID

To provide New Zealand with a reliable means to identify property, a unique Property ID needs to be introduced. The Property ID must unambiguously identify property. The Property ID is to be the primary and only means to identify property.

Secondary means to reference property include property associated details such as address or building name. The secondary means to reference property must not be used as the Property ID. The administration of the Property ID must be tightly regulated by the Government to ensure its integrity.

The establishment of a Property Register will enable a framework with which to store and manage the group of related rights, responsibilities, restrictions, land, buildings as associated details that constitute property.
4.2.5 Building

It was discussed and agreed prior to the model development that buildings are spatial in nature.

Building and property have a complex relationship. One or more buildings can be within a property, and one or more properties can be within a building.

In general, buildings should not cross the boundaries of properties (as per Figures 2 and 3). The exception is in cases such as terraced houses (as per Figure 4). This needs to be considered in conjunction with the NZ Building Act 2004, which states that buildings can only be constructed across parcel boundaries where titles are linked (Building Act 2004 (Section 75), and Building Amendment Act 2009 (Section 22)).

Local Councils have business rules and processes that reflect this relationship when associating building with rating unit.

Figure 2. Building within property

Figure 3. Property within Building (Unit title scenario)
4.2.6 How Valuation and Rating Unit are linked to Property

In the PDMF, rating unit is, in most cases, a good approximation of a property. In some cases other elements are required, for example in the case of a garage on road reserve or an easement on council land. Those elements need to be included in the concept of property.

One of the key considerations was around the Rights, Responsibilities and Restrictions (RRR). In the PDMF, we can clearly see that ownership forms part of the RRR in the area of Rights.

The PDMF doesn’t cover Restrictions in any depth- Restrictions include things like timeshares, easements, use constraints, etc.

In terms of Responsibilities, the LADM brought the rating unit idea into the area of a Responsibility. This is essentially about the responsibility to pay rates. As a rating unit represents a responsibility, it therefore becomes its own ‘administrative unit’ in LADM terms.

Valuation was on the edge of scope for the PDMF, so the model only reflects valuation as an association to a rating unit, as presented by the LADM. No further investigation has been undertaken at this point into how valuation would relate to non-rated land, leased land, etc.
4.2.7 Connections (Access)

While connections (or ‘access’) have been identified as a key entity and there is a description of how an address can reference a connection, the internal mechanisms of connections warrant further investigation and fall in a domain separate from the PDMF. The more complex cases of connection are more naturally related to road networks, or some sort of network-based models. Another consideration with connections is that they can go over people’s properties, which has implications for how features such as easements, etc. are modelled.

There was some discussion about the correct terminology to use for this entity. While many people would consider it to be an ‘access point’, or ‘access way’, the word ‘connection’ encompasses a variety of types of access in a more inclusive way.

4.2.8 Rights

Rights are separated into ‘Foundational’, ‘Additional’ and ‘Other’ rights. ‘Foundational’ rights are the most common and used type of rights and are the basis of the Land Transfer System. ‘Additional’ rights are slightly less common and relate to the unique things councils do, such as encroachments. ‘Other’ rights are generally uncommon and relate to things like customary rights, deeds, etc.

For a property to have additional rights, it has to have a foundational right to support it.

4.2.9 Party

Party was almost removed from scope in the early discussions. It was felt that, because of privacy concerns which would make it an area very difficult to implement, the amount of work required to include it in the model would be of minimal value.

However, based on some of the User Stories, it was ultimately decided that the PDMF has to include a component for ‘people’. Party is a natural person or an organisation or any other legally valid entity, such as family trusts, body corporates, the Surveyor General, Valuer General, etc. Parties play a key role in providing information to the PDMF, and in the rights expressed in the PDMF.

It was acknowledged that the scope of the PDMF does not include building a unique identifier for person, so that area of the modelling work requires further development to address how the notion of ‘person’ is included effectively.

Some issues arose in the use cases that discuss party, and there needs to be further work to address how these are resolved. Those issues were around the relationships between person, title, and parcel, as stored in the Land Transfer System.

Another concept which has yet to be modelled is ‘occupier’ as a party. The idea of recording which people are living in which spaces is valuable, but no such dataset currently exists in any authoritative way. It also presents some practical issues which need to be addressed, in order for it to be a viable set of information.
4.2.10 Tenancy/Occupation/Dwelling

Tenant space and dwelling can be considered, in essence, to be types of property.

Spatial data for tenancy units, unit titles, dwellings, and occupancies does not currently exist. For certain cases, digitised files of drawn plans are available from which spatial data could be derived. The PDMF model is capable of supporting a textual, 2D, or 3D representation of spatial features. Availability of accurate, managed spatial data for these entities would enable spatial querying capabilities.

4.2.11 Business Tenancy

To support some of the User Stories, a business tenancy/name dataset would need to be integrated with the PDMF model. Whilst the modelling of such a dataset is outside of the PDMF modelling exercise, the use of unique identifiers for property would allow business tenancy data to be integrated.

4.2.12 Named Place, Blocks, Localities

The concepts of named place, localities, and blocks, were discussed as a consideration for the PDMF. However, for the purposes of the model, it was agreed that these concepts were not in scope for the Conceptual Model. In essence, they are about ‘navigation’ but are not directly related to property. For the PDMF to work, it has to be supported by quality navigation elements such as these but, at the same time, they are coincidental to property entities rather than integral.

All of these elements are ‘spatial’ concepts that may relate to the entities within the PDMF in a spatial way, but are not core entities in their own right.

This does not preclude an external agency from creating or maintaining a dataset that contains these elements, with linkages to the ‘properties’ included in the PDMF. For example, LINZ has a ‘named place’ database, as well as responsibility for the gazetteer. There is an opportunity to build on that work.

The Named Place and Blocks concepts require more work, and for named places in particular there are a number of relevant standards that can be applied. Localities are looked after by the NZ Fire Service.

4.2.13 History

In the LADM, there is the concept of a ‘versioned’ entity. The LADM has a special class of versioned object to manage and maintain historical data (See LADM document: Annex N- History and Dynamic aspects). The LADM supports both event-based and state-based modelling of history and dynamic aspects.

Event-based aspects are modelled via the LA_Source class and state-based modelling is via the VersionedObject class. In addition, the more complex parent-child relationships (lineages) are included in the LADM via the LA_BAUnit and LA_SpatialUnit hierarchies. The modelling of lineage is highly complex and depends on lifecycles and triggers. Additional work is needed to thoroughly understand lineage for Property, Building, Connections, and Address. The lifecycle and lineage of the entities that fall under the Land Transfer System (such as parcels) are well defined and understood.
4.2.14 A New Zealand LADM Profile

Whilst this work demonstrates the suitability of adopting and using the LADM conceptual model as a reusable component of the PDMF, it does not attempt to provide an authoritative New Zealand profile of the LADM specification. The development and publication of such a New Zealand Profile of the Land Administration Domain Model would provide a framework with which land administration data, including those over water and land, and elements above and below the surface could be modelled, exchanged, and combined in a coherent manner.

4.2.15 Ontology Modelling of PDMF

The LADM community is actively working on academic papers associated with the development of the LADM specification. As part of this work, an OWL ontology for the LADM has been developed. As the PDMF conceptual model has been developed to align with the LADM it has the opportunity to leverage from this work and could be implemented using sematic technologies with the addition of an OWL ontology extension to represent the specific New Zealand specialisations and extension classes. This approach would allow the evaluation of an OWL PDMF model to be undertaken relatively quickly with the added benefit of being able to contribute back into the international LADM development effort.

4.3 The Core Conceptual Model

4.3.1 Overview

The Core Conceptual Model is the result of the modelling exercise undertaken to define the entities and the relationships between those entities that inform and help define the modelling domain required for the PDMF.

The Core Conceptual Model diagram shows:

1. **Foundational Rights** managed within the Land Transfer System.
2. **Additional Rights** that are essentially non-Land Transfer System managed rights.
3. **Other Rights** that are sourced from Maori customary rights or deeds systems.
4. The association of these rights to **Entitled Land** and **Entitled Space**.
5. The aggregation of Entitled Land and Entitled Space to form **Property**.
6. The association of Property to **Building, Connection, Site, Rating Unit, Valuation** and **Address**.
4.3.2 Model Diagram

![Core Conceptual Model Diagram](image)

Figure 5. The Core Conceptual Model (See Appendix 4 for A3 version)

4.3.3 Definitions

Entities that require further elaboration than the descriptions shown in the diagram are described as follows:

<table>
<thead>
<tr>
<th><strong>Site</strong></th>
<th>An aggregation of properties that act as a readily understood unit, such as university or hospital.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Property</strong></td>
<td>An area of land with any improvements that acts as a defined tradable space for the purposes of occupation. Real world (physical) land areas can be achieved through Foundational Rights for land from the owner plus council rights to some of their land associated with the owner. That combination can appear as a single real-world property though the aggregation of those two subsidiary spaces.</td>
</tr>
<tr>
<td><strong>Property Connection</strong></td>
<td>An interconnection point that can act as access to the property or, enabling the right connection to a property to be found given the purpose or type of connection needed. For example, allows interconnection with foot or vehicular access, each of which may have an address. Connection may be used to support a prime or default address associated to the property for a period.</td>
</tr>
<tr>
<td><strong>Land Area with “Foundational Rights” (Owned) and Managed as a Single Property</strong></td>
<td>The aggregation of all sets of Land Transfer entitlements. Includes all buildings and other improvements within the defined area. Can behave as a Property. Owner has &quot;Foundational Rights&quot; on this land. Owner may grant subsidiary rights on all or portions of the land through instances of &quot;Additional Rights on Subset of Land Area that acts as a Property&quot;.</td>
</tr>
<tr>
<td><strong>Physical Building</strong></td>
<td>The physical building that exists in the real world and that people interact with. Usually coincides with the LT Building which is the Land Transfer equivalent. People experience properties as Physical Buildings whose spatial extent may be different to the LT space. Physical buildings can be demolished and the legal rights still remain.</td>
</tr>
<tr>
<td><strong>Additional Rights on Subset of Land Area that act as or contribute to a Property</strong></td>
<td>A portion of the overall property ownership that behaves and has rights independent from the Owned Property. Must be within spatial extent of Land Area and Rights Owned and Managed as a Single Property.</td>
</tr>
<tr>
<td><strong>Entitled Space associated with a Building</strong></td>
<td>An extent of space within the building that has rights defined in the Land Transfer system.</td>
</tr>
<tr>
<td><strong>Entitled Space</strong></td>
<td>2D/3D spaces that define the portions of the Title with rights held by Unit holders, the Body Corporate or Cross Lease Holders. The aggregation of all these spaces for a property matches the extent of the Title.</td>
</tr>
<tr>
<td><strong>Body Corporate</strong></td>
<td>The party that manages the portion of the title's area outside the unit titles. May have important role for some needs. A body corporate only exists in association with unit titles.</td>
</tr>
<tr>
<td><strong>Unit Title</strong></td>
<td>Ownership rights of a portion of the land. Could be in 3 dimensions when associated with buildings. LandOnline has images that show each unit title's portion of the total area, but no structured definition.</td>
</tr>
<tr>
<td><strong>Land Transfer Entitlement (Ownership+Land Area) with Foundational Rights</strong></td>
<td>Includes Titles, non-title entities such as agreements for sale and purchase under Housing Act, interests of Body Corporate.</td>
</tr>
<tr>
<td><strong>Cross Lease</strong></td>
<td>A combination of shared ownership of land defined by the title and a lease of a portion of the land. There is no structured definition of the spatial extent held in LandOnline.</td>
</tr>
<tr>
<td><strong>LeaseHold</strong></td>
<td>Long-term right to occupy. Taken as ownership in council domain.</td>
</tr>
</tbody>
</table>
### 4.4 PDMF Entity Diagram

#### 4.4.1 Model Diagram

![PDMF Class Model](image)

**Figure 6. PDMF Class Model- Collated (See Appendix 5 for A3 version)**

#### 4.4.2 Collated Model- Package Definitions

The Collated Model brings in the classes of the Core Model, and allocates them to the various packages of the Land Administration Domain Model (LADM). The LADM provides an abstract, conceptual model with four packages related to:

- **Party** – a person or organisation (group) that plays a role in rights, responsibilities and restrictions
- **Administrative** - basic administrative units, rights, responsibilities and restrictions (ownership rights)
- **Spatial Unit** – single area (or multiple areas) of land and/or water, or a single volume (or multiple volumes) of space, including parcels, and the legal space of buildings and utility networks.
- **Surveying and Representation** - spatial sources (official or unofficial documentation of a survey) and spatial representations (including points, geometry, topology, and 2- and 3-D representations of spatial units)

To help make the diagrams more readily understandable, the ‘traditional’ LADM package colours as found in LADM related papers and documentation are used here. The Party package is green, the Administrative package is yellow, and the Spatial Unit/Surveying and Representation packages are blue. The External package is shown in brown.
For a detailed description of the LADM package structure please refer to the LADM specification document ISO/TC211 N 3344 FDIS reference 19152.

4.5 **PDMF Class Model - LADM Aligned**

4.5.1 **Overview**

The PDMF Class Model – LADM diagram presents the conceptual model for the PDMF at the time of writing this document. The diagram shows the LADM classes and the New Zealand extension classes that make up the PDMF. Only those classes from the LADM that are used in the PDMF have been shown. Where more specific use of a particular LADM class is required, a NZ Profile specialisation class is shown. Specialisations have been used to show the different categories of rights that are implemented within the NZ environment and are described as Foundational, Additional and Other.

It is important to note that the PDMF extends the LADM conceptual model with New Zealand specific classes used to represent Building, Property, Address and Connection. These classes are linked to the LADM via the LADM Spatial Unit package. To ensure that this linkage maintains the correct balance of flexibility and functionality the LADM LA_Level class is used to implement PDMF specific levels that separate property, title, and parcel spatial units. The use of the Property Level is to allow only instances of Property to be connected to property related spatial units. Levels enable the spatial units of different groups to be used and managed separately.

4.5.2 **Model Diagram**

![Figure 7. PDMF Class Model – LADM aligned (See Appendix 6 for A3 version)](image-url)
4.5.3 Legal Space vs Physical Space

A key discussion was around how spatial units and legal space building units (LADM terms) work with property, and how they all link together.

Essentially, occupiable space is one way of thinking about legal space. To manage the different types of legal spaces, the concept of levels has been introduced from the LADM—parcel level, title level, and property level. At the Parcel level, we have parcels (off the cadastre). The Title level comprises of all of the parcels that aggregate to form the title. The Property level is the level in which the spatial ‘occupiable space’ for property is represented.

All of those levels are considered ‘legal space’. ‘Physical space’ elements, including physical buildings and physical connections are represented by NZ specific extension classes. The legal space building units are the legal space within a building, whilst the physical building units are the physical space. The physical space relates to the legal space by direct association or spatial co-incidence.

4.5.4 Description of Entities

4.5.4.1 NZ_ExtPropertyUnit

An instance of NZ_ExtPropertyUnit is a property. A property should be associated with zero or more [0..*] spatial units (or specialisations of spatial units) that are associated to a property level. A property may be associated to zero or more [0..*] physical building units. A property may be associated to zero or more [0..*] physical connection units. A property may be referenced by zero or more [0..*] addresses. A property may be associated to zero or one [0..1] property groups. A property can form part of [0..1] other property. A property can include zero or more [0..*] other properties.

4.5.4.2 NZ_ExtPhysicalConnectionUnit

An instance of class NZ_ExtPhysicalConnectionUnit is a physical connection unit. A physical connection unit may be referenced by zero or more [0..*] addresses. A connection may be associated with one [1] property. A physical connection unit may be associated with one [1] physical building unit. A physical connection unit should be associated to one or more [1..*] physical spatial sources (i.e. the physical connection unit should be supported by at least one physical spatial source).

4.5.4.3 NZ_ExtPhysicalBuildingUnit

An instance of class NZ_ExtPhysicalBuildingUnit is a physical building unit. NZ_ExtPhysicalBuildingUnit is a class for the external (to the LADM) registration of mapping data of building units. A physical building unit can be associated to zero or many [0..*] legal space building units. A physical building unit should be associated to one or more [1..*] physical spatial sources (i.e. the physical building unit should be supported by at least one physical spatial source). A physical building unit may be referenced by zero or more [0..*] addresses. A physical building unit should be associated with zero or more [0..*] properties. A physical building unit may be associated with zero or more [0..*] physical connection units.

4.5.4.4 NZ_ExtPhysicalSpatialSource

An instance of NZ_ExtPhysicalSpatialSource is a physical spatial source. NZ_ExtPhysicalSpatialSource is a subclass of LA_Source. A physical spatial source may be associated to either LA_BoundaryFace or LA_BoundaryFaceString. A physical spatial source may be associated to external classes outside the scope of this model.
4.5.4.5  **NZ_ExtAddress**

An instance of **NZ_ExtAddress** is an address. An address can reference one [1] addressable object (either a property or a physical building unit or a physical connection unit). Addresses must unambiguously reference an addressable object.

The use of an address reference may be inherited between property, building and connection following these rules;

In the case that a physical building unit is not referenced by an address then the physical building unit may inherit an associated property address reference if only 1 property is associated with the building.

In the case that a physical connection unit is not referenced by an address then the physical connection unit may inherit the associated physical building unit address reference.

In the case that a physical connection unit and an associated physical building unit are not referenced by an address then the physical connection unit may inherit an associated property address reference.

In the case that a property in a puPropertyHierarchy is not referenced by an address then the property may inherit the parent property address reference.

4.5.4.6  **NZ_ExtPropertyGroup**

An instance of **NZ_ExtPropertyGroup** is a property group. A property group (alias Site) is made from one or more [1..*] parts/elements comprised of property.

4.5.4.7  **NZ_ExtValuation**

Class **NZ_ExtValuation** is a subclass of ExtValuation. A valuation reference is an attribute of **NZ_ExtValuation**.

4.5.4.8  **SpatialUnit:LA_Level**

A property level has a structure that is polygon based. A title level has a structure that is polygon based. A parcel level has a structure that is topological based. Mixed representations are also possible as a boundary face string can be defined either by a geometry or by a free text block.

4.5.4.9  **NZ Profile :: NZ_FoundationalRight**

An instance of the specialisation of LA_Right, **NZ_FoundationalRight** is a foundational right. A foundational right should be associated to exactly one [1] foundational basic administrative unit and exactly one [1] party (party being defined as a person or organisation (group) that plays a role in rights, responsibilities and restrictions).

4.5.4.10  **NZ Profile :: NZ_AdditionalRight**

An instance of the specialisation of LA_Right, **NZ_AdditionalRight** is an additional right. An additional right should be associated to exactly one [1] additional basic administrative unit and exactly one [1] party (party being defined as a person or organisation (group) that plays a role in rights, responsibilities and restrictions).
4.5.4.11 NZ Profile :: NZ_OtherRight

An instance of the specialisation of LA_Right, NZ_OtherRight is an ‘other’ right. An ‘other’ right should be associated to exactly one [1] other basic administrative unit and exactly one [1] party (party being defined as a person or organisation (group) that plays a role in rights, responsibilities and restrictions).

4.5.4.12 NZ Profile :: NZ_FoundationalBAUnit

An instance of the specialisation of LA_BAUnit, NZ_FoundationalBAUnit is a foundational basic administrative unit. A foundational basic administrative unit should be associated to one or more [1..*] foundational rights. A foundational basic administrative unit should be associated to zero or more [0..*] spatial units. A foundational basic administrative unit can be related through a required relationship to zero or more [0..*] other basic administrative units or specialisations of basic administrative units (i.e. create an explicit legal relationship between two basic administrative units when a business rule requires them to be dealt with together).

4.5.4.13 NZ Profile :: NZ_AdditionalBAUnit

An instance of the specialisation of LA_BAUnit, NZ_AdditionalBAUnit is an additional basic administrative unit. An additional basic administrative unit should be associated to one or more [1..*] additional rights. An additional basic administrative unit should be associated to zero or more [0..*] spatial units. An additional basic administrative unit can be related through a required relationship to zero or more [0..*] other basic administrative units or specialisations of basic administrative units (i.e. create an explicit legal relationship between two basic administrative units when a business rule requires them to be dealt with together). An additional basic administrative unit should be related to a foundational basic administrative unit.

4.5.4.14 NZ Profile :: NZ_OtherBAUnit

An instance of the specialisation of LA_BAUnit, NZ_OtherBAUnit is an ‘other’ basic administrative unit. A ‘other’ basic administrative unit should be associated to one or more [1..*] ‘other’ rights. An ‘other’ basic administrative unit should be associated to zero or more [0..*] spatial units. An ‘other’ basic administrative unit can be related through a required relationship to zero or more [0..*] other basic administrative units or specialisations of basic administrative units (i.e. create an explicit legal relationship between two basic administrative units when a business rule requires them to be dealt with together). An ‘other’ basic administrative unit should be related to a foundational basic administrative unit.
4.5.5 Code Lists

The PDMF model contains classes in the core LADM packages and the NZ extension package that have a type as one of their attributes. The code lists provided in the PDMF model are informative in that they provide an indication of the range of valid types that can be used. The LADM specification provides a template set of code lists which is shown in the diagram for reference.

Figure 8. PDMF Class Model- LADM Code Lists (See Appendix 7 for A3 version)
4.6 PDMF - Addressable Objects

4.6.1 Model Diagram

Figure 9. PDMF Class Model – Addressable Objects (See Appendix 8 for A3 version)

4.6.2 Overview

This is the Property-Building-Connection-Address relationship. Property, Building, and Connection are represented and identified by unique IDs, while address has a unique ID and references those other unique IDs. The address unique ID can’t be used as an ID for property, building or connection.
Unique identifiers for building, property, connection and address will enable the integration, sharing and exchange of information related to these entities to be unambiguous and precise. These benefits need to outweigh the effort required to implement and maintain a unique identifier regime. Practically, it is not enough to simply assign a unique identifier to an object. The identifier must be maintained through the objects lifecycle and clear, concise rules must be implemented to manage the creation, transition and retirement phases of objects assigned a unique identifier. The definition of the lifecycles and triggers (e.g. a demolished building) that cause changes in the state of the object lifecycle should be included in the development of the Proof of Concept (Phase 2(b)) and forms a critical implementation consideration for the PDMF.

The definition of the unique identifier encoding needs to be carefully and precisely defined to ensure that the identifiers are durable and consistent over time. For example, a composite identifier encoding that included a TA identification code component may break when TA boundaries changed or when amalgamation/devolution occurs. This definition is outside the scope of this modelling work but should also be addressed in Phase 2(b).

The conceptual modelling work for the PDMF has identified that Connection is an important part of a property framework and warrants further development. Essentially, the concept of Connection is about ‘access’ to property. The term ‘access’ in this context can include pedestrian, vehicle, utility, and social services access. A comprehensive model of Connection would be required to more fully understand the concept. For example, Connection data could provide crucial information to assist with the dispatch of emergency services to the correct property access location for the given mode of transport.

As the PDMF conceptual model is aligned to the LADM, the modelling made use of the LADM concept of SpatialUnit, which caters for text based, 2D, or 3D representations of geospatial objects. This allowed the concept of Connection to be included within the conceptual model as an extension class, similar to the concepts of building and address.

The Information Model developed as part of the initial PDMF project included a subclass of ‘spatialunit’ called ‘access’, which has an ‘accesscategory’ which showed how Connection could be integrated into the PDMF. Test Cases 21 and 22 were designed to incorporate the concept of Connection, but require further development.
5 Instance Diagrams

5.1 Overview

The instance level cases illustrate the flexibility and functionality of the PDMF model by showing its use in real world cases. The content of this section follows the pattern provided by the instance level cases presented in the LADM specification (Annex C of that document). Each instance diagram is built around a particular test case scenario that demonstrates a typical New Zealand property situation.

The diagrams present instances of the PDMF model classes and follow the same model colour coding as the PDMF Conceptual model diagram. The instance level diagrams do not include all possible class instances for any given test case. Instead, only relevant class instances are presented in order to reduce the complexity of the diagrams.

The descriptions of the instance level diagrams assume an understanding UML notation and of the LADM specification and describes entities in these terms. In the diagrams, a boundary is shown to highlight the extent of base or specialised LADM classes with extension classes shown outside.
5.1.1 Test Case 1

This instance diagram shows the ownership rights and responsibilities expressed as titleUnit and ratingUnit LA_BAUunits. The parcel, title extent and rated property extent are shown associated to their individual levels. The building, connection, property and address are shown. The valuation is shown associated to the ratingUnit.
5.1.2 Test Case 2

This instance diagram extends Case 1 with an additional parcel which is shown in the aggregation of the titleSpatialUnit aggregation. Note that this creates a hierarchy with LA_SpatialUnits from more than one level. This may require a modification to the LADM rule that LA_SpatialUnits should only be associated to 1 level or use of additional BA_Units for the parcels and should be covered in future work.
5.1.3 Test Case 3

This instance diagram extends Case 1 with an additional building that is represented by an additional NZ_ExtPhysicalBuildingUnit associated to the NZ_ExtPropertyUnit.
5.1.4 Test Case 4

This case involves a cross lease which is represented within the LADM administration package classes and by using LA_RequiredRelationshipSpatialUnits to explicitly relate the spatial units together.
5.1.5 Test Case 5

This case introduces the use of LA_LegalSpaceBuildingUnit to represent the entitled spaces within the building. The body corporate entity is represented as a LA_GroupParty associated to the owners. The LA_LegalSpaceBuildingUnits are explicitly kept separate using a LA_RequiredRelationshipSpatialUnit that specifies they must be ST_Disjoint.
5.1.6 Test Case 6

This case introduces the concept of the Additional rights LA_BAUnit for the leasedUnits.
5.1.7 Test Case 7

This case represents the lease agreement as a separate LA_Right with an associated LA_SpatialUnit for the garage. The property is shown associated to both the ratedUnit and garage. The use of LA_RequiredRelationshipBAUnit represents a business rule that the garage cannot be sold or disposed of separately from the main property.
5.1.8 Test Case 8

This case is an extension of Case 7, that subtle difference is that the garages are all within the same building and therefore LA_LegalSpaceBuildingUnit is used as the spatial unit for the garages.
5.1.9 Test Case 9

This case shows two titles combined together into the one property. The LA_RequiredRelationshipBAUnit between the titleUnits represents that the garage spans two titles and is subject to a business rule constraint.
5.1.10 Test Case 10

This case shows the ratedUnit and encroachment LA_SpatialUnits being associated to the property. A LA_RequiredRelationshipBAUnit is shown to highlight that a Foundational right by the owner is required before an Additional right can exist.
5.1.11 Test Case 11

This case combines several patterns shown in previous cases.
This case explores the unit title scenario in a little more depth.
5.1.13 Test Case 13

This case shows a more complex use of building and connection entities.
5.1.14 Test Case 14

This case shows a property with multiple access ways represented by two NZ_ExtPhysicalConnectionUnits each referenced by an individual address.
5.1.15 Test Case 15

This case shows a connected cross lease that shares a common NZ_ExoPhysicalBuildingUnit.
5.1.16 Test Case 16

This case shows a single property with two rating units. In this diagram, the titleSpatialUnits are combined with LA_RequiredRelationshipSpatialUnits with a ST_Union relationship. Note that this will create a complex geometry in the ratedUnit LA_SpatialUnit. This may need to be modelled differently if the implementation environment needed to represent complex geometries differently.
5.1.17 Test Case 17

This case introduces the use of NZ_ExtPropertyGroup to represent a single farm made up of multiple properties.
5.1.18 Test Case 18

This case uses the spatial overlay provided by the LA_SpatialUnits that are associated to a property level (geometry, 2D).
5.1.19 Test Case 19

This case shows the scenario where separate properties are associated to a single LA_PhysicalBuildingUnit.
5.1.20 Test Case 20

This case shows two buildings referenced by two addresses.
5.1.21 Test Case 21

This case explores a more complex situation with connections. The diagram represents the connections to the properties as individual physical connection units with the connection on the road being a ‘joint’ physical connection unit. This highlights the potential for a more detailed connection model to be developed that would may include a network construct.
5.1.22 Test Case 22

This case extends Case 21 and introduces an easement restriction LA_BAUnit. The easement scenario can be modelled a number of different ways using the LADM classes. In this case, it is modelled as one easement spatial unit across No.10 and No.12. Easements can be modelled conceptually have a positive and negative effect\(^1\). In this case, a positive effect has been represented with the easement LA_Restrictions being associated to the LA_Parties they have a positive effect for. This case also introduces an easement LA_Level.

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6 Findings

As a result of the work in developing the PDMF Conceptual Model, a number of key findings were identified.

- **Relating Property Entities.** A Property Data Management Framework has to relate rights, responsibilities and restrictions to building, connection, and property.

- **Model Continuum.** It is important to recognise that that model contains a continuum of legal to physical entities that need to be understood in context.

- **Use of Address.** Address should only be used to reference property, not to identify it.

- **Property.** There is a need for a unique property identifier to enable the PDMF

- **Capacity for Additional Datasets.** In many areas of the PDMF, there is the capacity to cater for datasets such as unique building ID, occupancy, etc., but these datasets are yet to be developed. Until there is a national approach to developing and maintaining these datasets, they cannot be implemented in any real-world scenario.

- **Navigational Datasets.** Navigational datasets such as named place are important to the PDMF, but there is more work required to define how these datasets would be created and managed.

- **Lifecycles and triggers.** A thorough understanding of lifecycles and triggers are vital for the development of a system for unique IDs

- **Spatial Extents.** Spatial data for entities such as units need to be created, which can then also support actions such as 3D querying.

- **LADM Alignment.** The LADM alignment is effective, and should be further developed

**Additional Considerations:**

- **Flexibility.** The model is flexible and extensible, and can cater for text, 2D and 3D information formats.

- **Rating Unit Valuation.** The rating unit valuation can be integrated into the model

- **Componentised Structure.** The model is packaged in a way that allows multiple stakeholders to input data into it.

- **LADM Conformance.** The model developed in this document, or a NZ LADM profile developed from this model, can also be conformance tested to the LADM.
7 Next Steps

This document presents the modelling work completed to date, but the model presented may be further informed by the implementation of the Proof of Concept, and that the model may need to be modified as a result. As such, this document should be treated as a ‘living document’, or as a foundation for further work and growth of the model as it is further explored through socialisation and implementation.

In order to fully realise the value of this model, there are some activities that need to be undertaken to progress the model further:

Information Model. Further testing of the Information Model (Appendix 1) needs to occur. At present, the model needs further development and maturing to more fully cover the characteristics of the envisaged implementation. Additional work required may include descriptions of the class types, discussion of the class ‘relationships’, and operations.

Model Testing. Initial model testing was conducted (see Appendix 2), but further testing needs to occur as the model is still in development, and assumptions were made for the purposes of testing in the absence of ‘real’ data.

Registry Proof of Concept. The development of a Registry Proof of Concept would be invaluable in testing and proving the PDMF in a real-world scenario. In particular, there are a number of the User stories that can only be tested in a Registry Proof of Concept environment. This would also enable testing of a complex lifecycle build.

Semantic Modelling. An exercise on semantic modelling was proposed to support the conceptual modelling for the PDMF. This would be still be a valuable exercise to undertake. Modelling work using semantic (OWL) technologies would enable the evaluation of the ability for the PDMF to link data and knowledge together in a flexible and extensible environment.

Connection. There needs to be an exercise to model Connection. A model of Connection would be required to represent the concerns of access to property, and is an element of property that has emerged during the initial project and which should be included in the PDMF- including testing of the concept and its application.

Code lists. There is an exercise required to develop the code lists for the PDMF. While the code lists used in this document are informative, they are not complete. The code lists need further work so that they are normative.

Rules. A number of sets of rules needs to be developed for the PDMF including:

- Rules for relationships between entities, e.g. cardinality between entities, types of relationships between entities
- Rules for integrity of data, e.g. parent-child relationships
- Rules around business processes/legislation

which need to be considered when using the model.

Lifecycles. Further work needs to be done to describe the lifecycle of entities, for example, when entities are created, changed, retired, etc.
Engagement with Agencies/Stakeholders. Engagement with agencies that would make use of or contribute to the PDMF is vital. Whilst there has been some engagement to date with a limited number of stakeholders (such as LINZ, CCC and EQC), further engagement with a wider range of stakeholder will allow the model to be explored and tested, and may also highlight new datasets, issues, and areas for focus.

New datasets. There needs to be some further work to determine how the model might be extended to incorporate new datasets as they arise. This work may, for example, require investigation of things like OGC CityGML for integrating other datasets.

Navigation datasets. It is also important to engage with agencies such as the NZ Fire Service, to understand how navigational datasets such as localities can be integrated with the model.

There also needs to be further work into named place as a navigation dataset. In terms of Named Place, relevant standards that could be incorporated into defining a NZ Named Place standard are:

- ISO 19155:2012 Geographic information place identifier architecture – defines a reference model with an encoding method for an identifier of a place. This standard is applicable to all location based services but significantly the emergency management services.

This group of standards are being developed in conjunction with the OGC ‘Points of Interest’ Standards working group.

Unique IDs. There needs to be work done to determine who should own and manage unique ID registers for things like building and property, and how these might be implemented nationally. As part of this, it will be important to clearly define triggers and lifecycles that affect property to ensure that the definition of property is accurate and complete. This will involve the lifecycles and triggers of building, connection, address, rights, responsibilities, restrictions, and parties.

3D. Work needs to be done to determine how 3D spatial extents can be captured and managed nationally, and how these can be integrated into the model to support future directions in areas such as 3D cities, and 3D cadastre.

ASaTS alignment. It would be valuable to keep the PDMF model updated and in line with any work that the ASaTS team is doing on business requirements and modelling of the new land transfer system.
Appendix 1. Information Model

Overview

The work presented in this appendix documents an implementation of the PDMF conceptual model undertaken for the purpose of testing and evaluation of the model in a physical relational database schema. This testing has been carried out using the same test cases as used by the instance level cases which allows a degree of traceability and cross checking to be carried out. The data used for the testing is derived from data supplied by CCC and data created to suit the test case scenario.

The significant characteristics of this implementation are;

a. The choice of table structures to represent object specialisations – a single parent table holds common attributes with specialisations being represented in specific classes, see legalspacebuildingunit, building, access and address.

b. Address – the address and addresscomponent tables are facsimiles of a real address data schema and the use of addressableobjectguid proxies the concept that an address references an addressableobject by removing the need for an address foreign key from the addressable objects table.

c. Relationships – the relationshipspatialunit table is used to manage the relationships between spatial units.

d. History – the VersionedObject class from the conceptual model is implemented as begin and end lifespan attributes. The chaining of parent to child entities to record the changes through the entities life is not modelled as this pattern is well known and understood.

e. LA_Level – whilst this is a key concept defined in the conceptual model, the data integrity and management capabilities provided by this class are clearly understood and no additional value was perceived in implementing this part of the model.
Figure 10. (See Appendix 7 for A3 version)
Appendix 2. Model Testing Output

Overview

The work documented in this appendix provides test results and evaluation of using a physical database schema based on the PDMF conceptual model with datasets queried using a RDBMS. The methodology to perform the model testing was as follows:

- The conceptual model and the scenarios documented in the instance level cases were used to define a test physical database schema.
- This schema was used to create a physical database using a PostgreSQL database server.
- For each scenario provided by the instance level cases, a real world equivalent was found in the data provided by CCC.
- This data was then scripted and loaded into the database server and the relevant relationships and other required data entered to simulate a complete dataset which was the able to be queried using SQL.
- The test data was queried by different input parameters, for example, address and rating unit ID, and the output data checked that it represented the correct data that matched expected results.

The following assumptions were made in the use of the test data:

- As a starting point, for the purposes of testing in the absence of actual property data, the spatial boundaries of rating units were used as a proxy for property extents.
- That building footprint approximates the concept of building.
- That by using spatial queries, the relationship between address and building or property (via rating unit extent) could be derived.

The concept of connection was not included in these tests as the building to property and building to address relationships obtained from the test data approximated the relationships for connection well enough that extra time was not spent in this area. This means that test cases that focus solely on connection scenarios (21 & 22) have not been included in this section of the report. Note that these cases are covered in the instance level cases.
**Case 1 – Simple**

**Description**

The simplest case for a property scenario is one which has a straightforward relationship of one building, in one parcel, in one rating unit, with one title, and one address.

**Scenario**

![Diagram of a simple property scenario]

**Test Input/Output**

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [35 London Street], Search by: Rating Unit [50910]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22350 23600], Building [system id] referenced by Address [35 London Street], Parcel [Lot 1 DP 8751], Title [CB15/130], Ownership [Fee Simple], Parties [x2], Rating Unit [22350 23600]</td>
</tr>
</tbody>
</table>

**Comments**

- This is the simplest form of a property.
- Duplicate parcel records are returned as each individual title and owner combination is linked to a survey parcel.
Case 2 – Slightly More Complex

Description

A slightly more complex scenario is one where you have a single building that spans two parcels and has two owners, but still sits on one rating unit, has one address, and one title.

Scenario

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [193 Peterborough Street], Search by: Rating Unit [78779]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22690 30600], Building [system id] referenced by Address [193 Peterborough Street], Parcels [Sec 26 TN OF Christchurch] and [Sec 28 TN OF Christchurch], Title [CB10K/744], Ownership [Fee Simple], Parties [x2], Rating Unit [22690 30600].</td>
</tr>
</tbody>
</table>

Comments

- Very similar to Test Case 1 with the exception of an extra parcel.
- Duplicate parcel records are returned as there are two owners for each parcel.
- The LINZ 'Title Estate' table lists the ownership details for all titles. This information is linked to a ‘survey parcel’ as in the LINZ BDE there is no concept of a property. If the ownership details were linked to property the number of duplicated records would be significantly reduced.
- Building is used as the ‘addressableobject’.
Case 3 – Granny Flat

Description

In this scenario - such as may be the case for a property with a granny flat - there may be multiple buildings on one parcel, with one rating unit, one address, and one title.

Scenario

![Diagram of Granny Flat]

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [8 Aspen Place], Search by: Rating Unit [3649]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [21851 43200], Building [system id] referenced by Address [8 Aspen Place], Building [system id], Parcel [Lot 73 DP 29845], Title [CB12A/477], Ownership [Fee Simple], Parties [x2], Rating Unit [21851 43200].</td>
</tr>
</tbody>
</table>

Comments

- This scenario is similar to Test Case 1 with the exception of an extra building.
- Two parcel rows are returned as there is only one parcel with two owners.
- Building is used as the ‘addressable object’.
- The second building ‘granny flat’ is linked to the property/rating unit and returned with the data.
Case 4 – Cross Lease

Description

In the cross lease scenario, there may be multiple buildings on one parcel, with two separate rating units, two addresses, and two cross leases/unit titles.

Scenario

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [1/34 and 2/34 Colenso Street], Search by: Rating Unit [95937, 95938]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22920 23900], Building [system id] referenced by Address [1/34 Colenso Street], Building [system id], Parcel [Lot 1 DP 12367], Titles [CB31A/339] and [CB31A/800], Ownership [Cross Lease], Parties [x2], Rating Unit [22920 23900].</td>
</tr>
<tr>
<td></td>
<td>Property [22920 24000], Building [system id] referenced by Address [2/34 Colenso Street], Building [system id], Parcel [Lot 1 DP 12367], Titles [CB31A/339] and [CB31A/800], Ownership [Cross Lease], Parties [x2], Rating Unit [22920 24000].</td>
</tr>
</tbody>
</table>

Comments

- The individual building on each cross lease is used as the ‘addressableobject’.
- The ‘shared’ garage is linked to each property and is therefore returned with each property
- The title information for both cross leases is returned for each property as the LINZ parcel information is linked to the single survey parcel rather than the property.
- The parcel to owner issue keeps reoccurring due to the linkage of title\owner information to parcels rather than property.
**Case 5 – Sausage Flats Unit Title**

**Description**

In the ‘Sausage Flats Unit Title’ scenario, there is one building on one parcel, but the building is ‘split’ into, for example, three unit titles with three rating units and three addresses, managed by one body corporate.

**Scenario**

![Diagram of Sausage Flats Unit Title]

**Test Input/Output**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22350 15700 A] referenced by Address [1/52 North Avon Road], Building [system id], Parcel [Lot 1 DP 30609], Unit Titles [CB12B/1293] [CB12B/1294] [CB12B/1295] [CB12B/1296] [CB12B/1297] [CB12B/1298], Ownership [Unit Title], Parties [multiple and body corp], Rating Unit [22350 15700 A].</td>
</tr>
</tbody>
</table>

*NB: Output repeated for each individual property.*

**Comments**

- A single building spans six separate Unit title properties. Each of these properties has the ‘common areas’ looked after by a body corporate.
- As the building can be linked to six different addresses (1/52 – 6/52) the property (rating unit) is used as the addressable object.
- The relationship for each property\rating unit to the ‘body corporate’ is via the ‘title’. As there is six titles (unit titles) each with a relationship to the corporate body, six records are returned as all title information is linked to the parcel.
Case 6 – Row of Shops

Description

In this scenario, there is a single building, on one parcel and in one rating unit with one title. However, within that building are multiple leases, each with their own address, as would be the case for a row of shops.

Scenario

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [9 – 11 Balfour Terrace], Search by: Rating Unit [77278]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22670 77800], Building [system id], Parcel [Pt Lot 1 DP 37267], Tenant Space [system id] referenced by Address [9 Balfour Terrace], Tenant Space [system id] referenced by Address [11 Balfour Terrace], Ownership [Fee Simple] [Commercial Lease 6a] [Commercial Lease 6b], Parties [Two companies and HRH], Rating Unit [22670 77800].</td>
</tr>
<tr>
<td></td>
<td>• Repeated for each unit</td>
</tr>
</tbody>
</table>

Comments

- Commercial property has a single owner and one parcel hence a single row for the ownership details.
- Two Commercial Leases have been captured but are still linked to the single property\rating unit, hence are both returned when the property is queried.
- The commercial lease Properties were used as the addressable objects.
- As buildings are related to the leases that they contain\intersect, the addresses related to that building can be acquired.
Case 7 – Garage on Road Reserve

Description

In this scenario, where a property has a garage on a road reserve, there are two buildings (the house and the garage), with one parcel, one rating unit, one address and one title. There is also one lease agreement.

Scenario

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [68 Clyde Road], Search by: Rating Unit [153472]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22070 41804] referenced by Address [1/34 Colenso Street], Building [system id], Building (garage) [system id], Parcel [Lot 1 DP 427140], Titles [506883] and [Encroachment 7], Ownership [Fee Simple], Parties [x2], Rating Unit [22070 41804].</td>
</tr>
</tbody>
</table>

Comments

- Very similar to Test Case 1 with the exception of a garage that is located on road reserve
- There are two owners for the property\rating unit and a single parcel hence, two rows returned
- The encroachment is linked to the property not the title as the property owners don’t own the garage, the Council does.
- The address was linked to the property\rating unit rather than the building on the property as this was calculated using a spatial point in polygon query. The address point is not located inside the building footprint like a majority of the other addresses.
**Case 8 – Garages on Road Reserve**

**Description**

In this scenario, there are multiple buildings (multiple houses with a single building comprising a garage for each rating unit), on multiple parcels, with multiple titles, over multiple rating units with multiple addresses and multiple lease agreements.

**Scenario**

![Diagram of Garages on Road Reserve](image)

**Test Input/Output**

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [64, 66, 66A, 68B Clyde Road], Search by: Rating Unit [29749 - 29752]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22025 53200] referenced by Address [64 Clyde Road], Building [system id], Building (garage) [system id], Parcel [Lot 1 DP 17798], Titles [CB643/68] and [Encroachment 8], Ownership [Fee Simple], Parties [x1], Rating Unit [22025 53200]. Output repeated for each Property with relevant linked data.</td>
</tr>
</tbody>
</table>

**Comments**

- Similar to Test Case 7 with the exception that multiple properties share the garage that encroaches on road reserve
- Property data is returned as per the description in Test Case 1 and Test Case 7 with the exception that the ‘garage 2’ encroachment is returned with each property\rating unit it is related to.
Case 9 – Complex House

Description

In the Complex House scenario, there are two buildings over multiple parcels, but with one rating unit, one address, and two titles.

Scenario

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [72 Clyde Road], Search by: Rating Unit [29745]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22025 53800] referenced by Address [72 Clyde Road], Building [system id], Building (garage) [system id], Parcel [Lot 1 DP 8749] [Part XX Lot 1 DP 8749], Titles [CB999/999] and [CB444/273], Ownership [Fee Simple], Parties [x3], Rating Unit [22025 53800].</td>
</tr>
</tbody>
</table>

Comments

- There are two titles each comprising a single parcel but with three owners. Hence six rows returned.
- Both of these titles comprise the single property\rating unit
- Both buildings are linked to the rating unit
- One of the buildings has been used as the addressable object
Case 10 – Encroachment

Description

In the Encroachment scenario, there is a single building on one parcel with one rating unit, one address and one title. However, there is also an encroachment onto a road reserve.

Scenario

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [20 Lochee Road], Search by: Rating Unit [30276]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22060 7200], Building [system id] referenced by Address [20 Lochee Road], Building [system id], Parcel [Lot 17 DP 21809], Titles [CBA1/1053] and [Encroachment 10], Ownership [Fee Simple] and [Licence], Parties [x2], Rating Unit [22060 7200].</td>
</tr>
</tbody>
</table>

Comments

- Very similar to Test Case 1 with the exception of extra land use that is located on road reserve
- There are two owners for the property\rating unit and a single parcel hence, two rows returned
- The encroachment is linked to the property not the title as the property owners don’t own the garage, the Council does.
- The main building (house) acts as the addressable object.
Case 11 – Corner Building

Description

In this scenario, there is one building on one parcel with one rating unit and one title. The building contains two commercial leases and three addresses.

Scenario

![Diagram of the Corner Building with labels: 10 South Street, 11 South Street, 18 North Park.]

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search by: Address [76 Manchester Street], Search by: Rating Unit [77047]</td>
<td>Property [22670 26200] referenced by Address [76 Manchester Street], Building (Case 11 Tower) [system id], Parcel [Lot 1 DP 25756], Title [CB78/949], Tenant Space [Comm10b] referenced by Address [230 St Asaph Street] and [Comm11a] referenced by Address [70 Manchester Street], Ownership [Fee Simple], Parties (owner and 2 companies) [x3], Rating Unit [22670 26200].</td>
</tr>
</tbody>
</table>

Comments

- Test Case is a bit more complex due to the property hierarchy.
- A single building is linked to the rating unit/property
- The building has two leases on it that only cover two thirds of the building
- The address was linked to the Property (rating unit) rather than the building on the property as there were three addresses that could have been linked to the building.
- The two commercial lease extents have been used as the addressable object for two of the addresses
- There is only one parcel and one owner hence a single ownership row returned
Case 12 – Unit Title

Description

In the scenario for Unit Title, there are three buildings on one parcel, with three rating units, and three addresses, and with one body corporate.

Scenario

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [70, 70A, 70B Clyde Road], Search by: Rating Unit [29749 – 29748]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22025 52900 A], Building [system id] referenced by Address [70 Clyde Road], Parcel [Lot 2 DP 8749], Title [CB34A/1138] [CB34A/1139] [CB34C/822], Ownership [Fee Simple], Parties (multiple and body corp), Rating Unit [22025 52900 A]. Output repeated for Properties eg: [22025 52900 C], Building [system id] referenced by Address [70C Clyde Road], etc.</td>
</tr>
</tbody>
</table>

Comments

- Very similar to Test Case 5 with the exception that there are three buildings rather than the solitary building
- The building on each property is used as the addressableobject
- The relationship for each property to the ‘body corporate’ is via the ‘title’. As there is three titles each with a relationship to the corporate body, three records are returned as all title information is linked to the parcel.
- All of the owner rows are returned with each address as the title information is linked to the parcel.
Case 13 – Somewhat Complex Site

Description

A somewhat complex site scenario is applicable to sites such as universities, hospitals or sports complexes. As an example, you may have four buildings over three parcels, in one rating unit with one address.

Scenario

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [25 Edward Avenue], Search by: Rating Unit [123948]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [2230 6600], Building [system id] referenced by Address [25 Edward Avenue], Parcel [Lot 13 DP 81199] [Lot 1 DP 2498] [Pt RES 4794], Title [CB246/253], Ownership [Fee Simple], Parties (CCC) [x1], Rating Unit [2230 6600].</td>
</tr>
</tbody>
</table>

Comments

- Similar to Test Case 2 with the exception of more buildings and parcels
- Only one of the three parcels on the property are linked to title information. As there is only one owner, one a single record is returned for the parcel linked to the ownership details.
- One of the buildings is the addressable object. The other building is linked to the property\rating unit.
**Case 14 – Sandhills Fire (two possible access addresses)**

**Description**

This scenario relates to a property which may have two possible access addresses. In this scenario, there is one building, on one parcel, in one rating unit, with one title but with two addresses.

**Scenario**

![Property diagram](image)

**Test Input/Output**

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search by: Address [372 Moorhouse Avenue], Search by: Rating Unit [124033]</td>
<td>Property [22580 45200], Building [system id] referenced by Address [372 Moorhouse Avenue], Parcel [Lot 3 DP 66673], Title [CB39A/794], Ownership [Fee Simple], Parties [x2], Rating Unit [22580 45200].</td>
</tr>
</tbody>
</table>

**Comments**

- Similar to Test Case 1 with the addition of an extra address on the property\rating unit
- There are two owners and a single parcel hence, two rows returned.
- The single building is the addressable object.
- The second address is linked to the property. If there were access locations stored then the secondary address would probably be linked to the access point rather than the property\rating unit.
**Case 15 – Connected Cross Lease**

**Description**

In the Connected Cross Lease scenario, there is one building on one parcel, with two rating units and two addresses, with one title and two cross lease agreements.

**Scenario**

![Diagram of Connected Cross Lease scenario]

**Test Input/Output**

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search by: Address [41A, 41B Kotare Street], Search by: Rating Unit [135263, 135264]</td>
<td>Property [22312 28505] referenced by Address [41A Kotare Street], Building [system id], Parcel [Lot 1 DP 21455], Title [236747] [case 15], Ownership [Fee Simple] [Cross Lease], Parties [x3], Rating Unit [22312 28505].</td>
</tr>
<tr>
<td></td>
<td>• Repeated for both properties</td>
</tr>
</tbody>
</table>

**Comments**

- Very similar to Test Case 4 with the exception that there is a single building spanning properties rather than two individual buildings.
- The property\rating unit is used as the addressable object as there are two addresses associated to the building.
- There is a single owner for the property\rating unit, hence a single row.
- The two cross lease agreements are returned for each property\rating unit as title information is linked to the parcel rather than the property.
Case 16 – A farm on both sides of the road

Description
In this scenario there is a farm with a road through it. The farm has one building, two parcels, one rating unit (separated by road), one address, and two titles.

Scenario

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [2 Signal Hill Road], Search by: Rating Unit [122471]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [23651 53706], Building [system id] referenced by Address [2 Signal Hill Road], Parcel [Lot 2 DP 83474] [Lot 10 DP 304773], Title [18958], Ownership [Fee Simple], Parties [x3], Rating Unit [23651 53706].</td>
</tr>
</tbody>
</table>

Comments
- Similar in principle to Test Case 9 with the exception that one of the titles is separated by a feature such as a road.
Case 17 – A single farm with two areas of land

Description

In this scenario, there is a farm with areas of land separated by more than one feature. There is one building, two parcels, two rating units, one address and two titles.

Scenario

![Diagram of farm with two areas of land]

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [99 Shalamar Drive], Search by: Entity Group [Farm1 ID 1234567]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [Farm1], Building [system id] referenced by Address [99 Shalamar Drive], Parcel [Lot 1 DP 40701] [Lot 1 DP67692], Title [CB18B/865] [CB39C/666], Ownership [Fee Simple], Parties [x3], Rating Unit [23451 12200] [23652 38000].</td>
</tr>
</tbody>
</table>

Comments

- Relationships getting a bit more complex. Essentially, this is the grouping of a number of properties into a single entity. The single entity in this case is a farm. The farm has been created by grouping together two rating units and therefore two titles.

- The standard relationships between objects such as building to rating unit, building to parcel, parcel to rating unit and parcel to title information are stored. The exception is a new relationship is stored between the two rating units\properties and the farm. This means that when the farm is queried the information is returned for two rating units\properties.

- NOTE: The rating unit\property information can still be queried for the individual components that make up the farm

- The relationship between the two sections of the farm was actually stored in the spatial relationship table which is a good enough approximation to the use of the property group table for this case.
**Case 18 – Garage Half on Road Reserve and half on the Owned Land**

**Description**

In this scenario there are two buildings (a house and garage) on one parcel with one rating unit, one title and one address. However, there is also an encroachment agreement/licence for the garage which is half on owned land and half on road reserve.

**Scenario**

![Scenario Diagram]

**Test Input/Output**

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [322 Hoon Hay Road], Search by: Rating Unit [98221]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22960 13900 B], Building [system id] referenced by Address [322 Hoon Hay Road], Building (garage 18) [system id], Parcel [Lot 1 DP 18877], Title [CB719/13], Ownership [Fee Simple] [Licence], Parties [x1], Rating Unit [22960 13900 B].</td>
</tr>
</tbody>
</table>

**Comments**

- Similar to Test Case 1 with the exception of the garage residing on private property and public property (road reserve)
- The garage is linked to the rating unit\property but as there is an encroachment there is encroachment information linked to the building spatialunit
**Case 19 – Terraced Housing**

**Description**

In the scenario of terraced housing, there is one building over three parcels, with three titles, three rating units, and three addresses.

**Scenario**

![Diagram of terraced housing](image)

**Test Input/Output**

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [1/83 – 5/83 Ruskin Street], Search by: Rating Unit [76652 – 76656]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22660 64500 B] referenced by Address [1/83 Ruskin Street], Building [system id], Parcel [Lot 1E DP 38286], Title [CB17A/93], Ownership [Fee Simple], Parties [x1], Rating Unit [22660 64500 B].</td>
</tr>
<tr>
<td></td>
<td>• Repeated for each property</td>
</tr>
</tbody>
</table>

**Comments**

- Similar in concept to Test Case 1 with regards to the property hierarchy relationships. The exception is the building the spans all properties.
- Due to multiple addresses being related to a single building the relationship has been created to the rating unit\property
- All other relationships are stored as per Test case 1.
Case 20 – Two addressed buildings

Description

In the ‘Two addressed buildings’ scenario, there are two buildings on one parcel in one rating unit, with one title, but with two addresses.

Scenario

Test Input/Output

<table>
<thead>
<tr>
<th>Input</th>
<th>Search by: Address [45, 45A Dickens Street], Search by: Rating Unit [73684]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Property [22631 61900], Building [system id] referenced by Address [45 Dickens Street], Building [system id] referenced by Address [45A Dickens Street], Parcel [Lot 11 DP 2181], Title [CB254/106], Ownership [Fee Simple], Parties [x1], Rating Unit [22631 61900].</td>
</tr>
</tbody>
</table>

Comments

- Behaviour is similar to Test Case 1 with the exception of a second address on the property.
- As there are two disjoint buildings, each can act as an addressable object.
Case 21 – Shared access on road reserve

Description

In this scenario, there are three separate properties on three parcels, with three titles, three rating units and three addresses, but they have one shared access on the road reserve.

Scenario

There is no scenario diagram for this case, as the case focusses on connections.

Comments

- Typically the councils does hold information once it crosses the property boundary. The exception to this is generally building outline.
- It is envisaged that the access point would be stored in the spatial unit table and related to the various property objects.
- The access spatialobject could be linked to other spatial objects such as road centrelines and road parcels thus allowing information retrieval by road name or locating spatial objects related to a particular segment of road.

Case 22 – Shared access across property

Description

In this scenario, there are three properties on three parcels with three titles, three rating units, and three addresses. However, they have one shared access which crosses two properties, and possibly require three access agreements.

Scenario

There is no scenario diagram for this case, as the case focusses on connections.

Comments

- Typically when someone\somebody requires access across property not owned by them, an easement is recorded against their title. This will include a diagram (generally surveyed) on the certificate of title detailing what the easement is for. For example, the most common easements created are for utilities such as drainage and gas.
- The easement would be stored in the spatial unit table and recorded in a manner similar to encroachments.
- The basic administrative unit would then have a type of ‘Easement’ and restrictions that would include ‘use for access, ‘use for drainage’ or ‘use for supply of gas’.
- If the actual object that the easement was created for is captured, this too, would be stored in the spatial unit table and related to the easement then to the property.
**EQC Case References**

EQC provided some exceptional cases that caused issues for them following the earthquakes. These were mapped to the Test Cases above, to demonstrate how the model can successfully handle these real world scenarios for EQC, as a sample stakeholder.

<table>
<thead>
<tr>
<th>EQC Case</th>
<th>PDMF Test Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EQC Case 1</strong></td>
<td></td>
</tr>
<tr>
<td>- All of the baches have a licence that allows them to occupy the road reserve (owned by Council)</td>
<td>14, 20</td>
</tr>
<tr>
<td>- There are multiple access points to all baches as they are spread along the beach</td>
<td></td>
</tr>
<tr>
<td>- Multiple addressable objects on a single property</td>
<td></td>
</tr>
</tbody>
</table>

**EQC Case 2**

- Significant number of unit titles managed by a body corporate
- Lots of single buildings inside their own rating unit
- Village complex is accessed off two roads

<table>
<thead>
<tr>
<th><strong>EQC Case 3</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Simple case of two titles (one property) with a building that spans the boundary</td>
<td>9</td>
</tr>
</tbody>
</table>

**EQC Case 4**

- Standard connected cross lease with single buildings crossing multiple rating units within a single parcel
- Exception is that the two buildings can be accessed off two roads

<table>
<thead>
<tr>
<th><strong>EQC Case 5</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Similar to EQC Case 2</td>
<td></td>
</tr>
<tr>
<td>- However, most buildings span rating units in a manner similar to EQC Case 4</td>
<td>5, 14, 15, 19</td>
</tr>
</tbody>
</table>

**EQC Case 6**

- Very complex site due to rating unit within rating unit and a number of body corporates
- The addressable objects are very clear
- Accessed off multiple roads

<table>
<thead>
<tr>
<th><strong>EQC Case 7</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- A combination of EQC Case 2 and EQC Case 5</td>
<td>5, 14</td>
</tr>
</tbody>
</table>

**EQC Case 8**

- Simple case of two addressable objects (buildings) on a single parcel

<table>
<thead>
<tr>
<th><strong>EQC Case 9</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Simple case of two addressable objects (buildings) on a single parcel</td>
<td>20</td>
</tr>
<tr>
<td>- May appear as two properties but there is only one parcel and one rating unit</td>
<td>20</td>
</tr>
<tr>
<td>EQC Case 10</td>
<td>1</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>• Seems like a simple Test Case 1 example with the exception that two of the rating units have a building that spans them</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EQC Case 11</th>
<th>4, 5, 9, 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Similar to EQC Case 4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EQC Case 12</th>
<th>4, 5, 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Similar to EQC Case 8, with the exception that the buildings have multiple tenanted spaces</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EQC Case 13</th>
<th>4, 5, 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Similar to EQC Case 8 with the exception that the complex spans two roads that allow access</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EQC Case 14</th>
<th>4, 5, 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Similar to EQC Case 12</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EQC Case 15</th>
<th>4, 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Complex example of EQC Cases 4 and 5</td>
<td></td>
</tr>
<tr>
<td>• Single owner (CCC) with multiple rating units</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EQC Case 16</th>
<th>4, 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The same as EQC Case 15</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 3. PDMF High-Level Concept Diagram
Appendix 4. Core Conceptual Model
Appendix 5. PDMF Class Model – Collated
Appendix 6. PDMF Class Model - LADM
Appendix 7. PDMF Class Model - LADM Code Lists
Appendix 8. PDMF Class Model - Addressable Objects

Name: PDMF Class Model - Addressable Objects
Author: Pete Smith
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Created: 28/11/2014 7:05:30 a.m.
Updated: 6/12/2014 12:49:28 p.m.
Appendix 9. Information Model