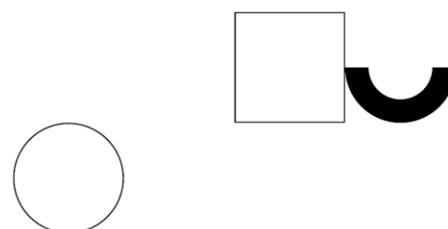
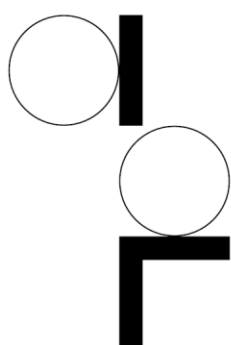
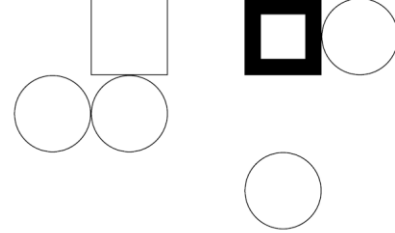


Buildings

Product Description
Version 2.0





Standard

This document is based on the AS/NZS ISO 19131:2008 Geographic information – Data product specifications standard. For more information, refer to www.saiglobal.com/online/.

Disclaimer

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Contents

1. Overview	5
1.1 Delivery Organisation - about PSMA	5
1.2 Data Product Specification Title	5
1.3 Data Scope	5
1.4 Reference Date	5
1.5 Responsible Party	5
1.6 Language	6
1.7 Topic Category	6
1.8 Informal Description of the Data Product	6
1.9 Distribution Format	6
1.10 Copyright and disclaimer	6
1.11 Privacy	6
1.12 Definitions, Acronyms and Abbreviations	7
2. Specification Scope	8
2.1 Scope Identification	8
2.2 Extent	8
3. Data Product Identification	9
3.1 Title	9
3.2 Alternate Titles	9
3.3 Abstract	9
3.4 Description	9
3.5 Purpose	10
3.6 Topic Category	10
3.7 Geographic Description	10
3.8 Geographic Extent Name	11
4. Data Content and Structure	12
4.1 Feature-Based Data	12
4.2 Feature-Based Application Schema (Data Model)	12
4.3 Data Dictionary	12
5. Reference System	13
5.1 Spatial Reference System	13
5.2 Temporal Reference System	13
5.3 Reference System Scope	13
6. Data Quality	14
6.1 Positional Accuracy	14
6.2 Thematic Quality	15
6.3 Logical Consistency	17
6.4 Topological Consistency	18



6.5	Temporal Accuracy	18
6.6	Completeness	18
6.7	Data Quality Scope	18
7.	Data Capture	19
7.1	Buildings Theme	21
8.	Data Updates and Maintenance	25
8.1	Update Frequency	25
8.2	Update Scope	25
8.3	Update Rules	26
8.4	Building Change Management	26
9.	Delivery Format	28
9.1	Components	28
10.	PSMA Partner Network.....	31
11.	PSMA Data Products	32
Appendix A – Buildings Data Model		33
Appendix B – Data Dictionary		34



1. Overview

1.1 Delivery Organisation - about PSMA

Geoscape data is created by PSMA Australia. It is consistently formatted spatial data that describes the buildings, addresses, land and transport networks across Australia's complex cities, regional centres and rural communities.

PSMA was formed by the governments of Australia in 1993 to collate, transform and deliver their geospatial data as national datasets. PSMA's establishment reflected the desire of Australian governments to work together to establish national, location information infrastructure to advance the emerging information economy. The organisation's first major initiative was to support the 1996 Census through the provision of Australia's first national digital basemap at street-level.

The value of Geoscape data is in its richness, which enables a broad range of innovations and applications. To support use of the data, it is available through online subscription services in business-ready formats, as well as customised enterprise plans. PSMA has a network of solution partners that integrate Geoscape data into other products and services. The partner network includes traditional geospatial specialists and data engineers, as well as software developers, marketing service providers, systems integrators and consultancies.

1.2 Data Product Specification Title

Buildings Product Description

1.3 Data Scope

Buildings is a digital dataset representing buildings across Australia.

Every release of Geoscape data will include a release report providing details of all enhancements, issues, and all other changes to the product. The release report will also provide statistics and information on the data updates included in the release.

1.4 Reference Date

June 2020

1.5 Responsible Party

PSMA Australia Limited

ABN: 23 089 912 710

Level 2, 113 Canberra Avenue, GRIFFITH ACT 2603 Australia

T: +61 2 6260 9000

E: info@geoscape.com.au

URL: www.geoscape.com.au

1.6 Language

English

1.7 Topic Category

Boundaries for buildings and related characteristics within Australia.

1.8 Informal Description of the Data Product

Buildings is a national digital dataset representing buildings for each State and Territory in Australia.

Additionally, licencing includes access to linkages of other PSMA products, including:

- G-NAF
- CadLite (Cadastre and Property)
- Administrative Boundaries (Mesh Blocks and Suburbs/Localities)

Users should note that the listed PSMA products above are not part of Buildings. G-NAF and Administrative Boundaries are available through PSMA's Partner Network or under an open licence from the Commonwealth of Australia at www.data.gov.au.

The Mesh Block data is sourced from the Australian Bureau of Statistics (ABS) and is part of their Australian Statistical Geography Standard (ASGS).

Data quality and potential capture timelines will vary across Australia based on two categories, each category has been developed based on a number of factors including the probability of the occurrence of natural events (e.g. flooding), population distribution and industrial/commercial activities. Areas with a population greater than 200, or with significant industrial/commercial activity in a visual assessment have been defined as 'Urban', and all other regions have been defined as 'Rural'.

PSMA welcomes your feedback on the Buildings Dataset. We also publish regular updates on the development of our products on the Geoscape website.

1.9 Distribution Format

This document is available in PDF format. For other formats and use of this document, contact PSMA Support (support@psma.com.au)

1.10 Copyright and disclaimer

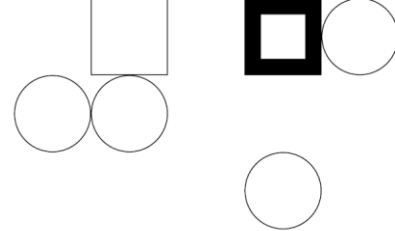
Please see geoscape.com.au/legal/data-copyright-and-disclaimer

1.11 Privacy

PSMA products and services should not contain any personal or business names or other sensitive information. PSMA undertakes reasonable data cleansing steps as part of its production processes to ensure that is the case. If you think that personal information may have inadvertently been included in PSMA products or services, please contact support@psma.com.au

1.12 Definitions, Acronyms and Abbreviations

Term	Definition
Building	A structure generally permanent in nature which has been constructed to meet a specific objective (e.g. housing, storage, and workplace) and less permanent structures such as caravans and other portable housing may also be represented. All buildings are represented spatially as polygons.
Building Polygon	A Building Polygon is a digital representation of the roof outline of a building which has been classified from remotely sensed information that identifies every structure that is greater than 9m ² and falls within an area defined by PSMA for the capture of buildings.
CE90	Abbreviation for circular error at 90% confidence, which is the location error in the horizontal plane. It is the radial error distance centred at zero within which 90% of the data points fall.
Contours	A line connecting points of equal elevation/height used to display a 3D surface on a 2D map or image.
Digital Elevation Model (DEM) (Bare earth model on a regular grid)	The representation of continuous elevation values over a topographic surface by a regular array of sampled z-values, referenced to a common datum and expressed on a regular grid spacing or raster dataset. The DEM is a ground only representation and excludes vegetation such as trees and shrubs and human-constructed features such as sheds, houses and bridges. Note: Some organisations refer to a bare earth model in a regular grid as a DTM. In this context, refer to the alternate DTM definition in this document.
Digital Surface Model (DSM) - Irregular Grid (Surface model irregular grid)	A topographic model of the earth's surface in digital format represented by mass points of variable density and may include break lines. The DSM represents surfaces including ground, vegetation, buildings and other constructed features.
Digital Surface Model (DSM) - Regular Grid (Surface model on a regular grid)	The representation of continuous elevation or height values over a topographic surface by a regular array of sampled z-values, referenced to a known datum and expressed on a regular grid spacing or raster dataset. The DSM represents surfaces including ground, vegetation, buildings and other constructed features.
Digital Terrain Model (DTM) (Bare earth model on the irregular grid)	A topographic model of the earth's ground surface in digital format represented by mass points of variable density and may include break lines. The DTM representation of ground includes works such as levees, banks and roads, but excludes vegetation such as trees and shrubs and human-constructed features such as sheds, houses and bridges. Note: Some organisations refer to a bare earth model in a regular grid as a DEM. In this context, refer to the specific DEM definition in this document.
Elevation	This is a measure of vertical position relative to a known vertical datum.
Height	This is a measure of the relative vertical difference between two known points on the same vertical datum.
LE90	Abbreviation for linear error at 90% confidence, which is the location error in the vertical plane. It is the absolute value error distance from zero within which 90% of the vertical data points fall.
Minimum resolution	The lowest detail/most coarse representation of a building outline acceptable to PSMA.
Raster Resolution	This is a measure of image pixel/cell dimension, providing information on the level of detail of features it represents. The smaller the value the higher the level of detail represented.
Resolution	This is a measure of the geometric fidelity of each building represented. It is a combination of the minimum area of a polygon and minimum vertex separation.
Sensor	A device/machine that measures/records 1 or more physical properties.
Visible	Observable by someone with reasonable skill and expertise.



2. Specification Scope

2.1 Scope Identification

The Buildings dataset consists of one (1) theme and one (1) layer. The theme and layer have a defined extent and scope.

Identification of Buildings Dataset as Theme and Layer.

Dataset	Theme	Layer
Buildings	Buildings	Buildings

2.2 Extent

Spatial coverage of Buildings includes Australia's land mass. The dataset has areas classified that meet certain criteria based on the occurrence of natural events (e.g. flooding), population distribution and industrial/commercial activities. The classifications are "Urban" and "Rural" and data quality and attribute population varies based on this classification.

3. Data Product Identification

3.1 Title

Buildings

3.2 Alternate Titles

- Formerly known as 'Geoscape'.
- Buildings for Australia

3.3 Abstract

Buildings is a spatial dataset which represents Australia's built environment derived from remotely sensed imagery and aggregated data sources. The dataset comprises of one theme and one layer:

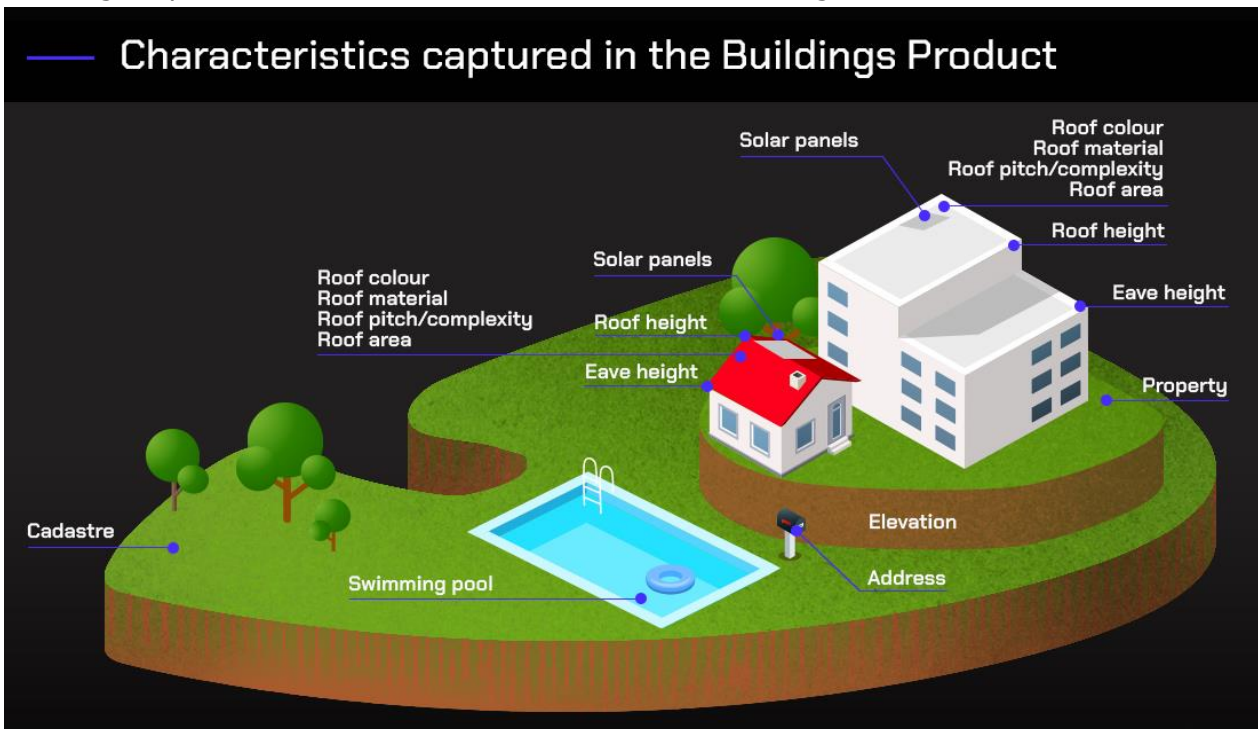
- Buildings Theme: Buildings Layer

Buildings has relationships with other PSMA products:

- G-NAF
- CadLite and
- Administrative Boundaries (Suburb/Locality and Mesh Blocks).

3.4 Description

Buildings represents Australia's built environment: Buildings





The buildings theme (buildings layer) consists of digital representations of the roof outline of a building which have been digitised from remotely sensed imagery using a combination of automated and manual processes to identify, extract and orthogonalise objects resembling a building structure greater than 9m². The process also determines building attributes including roof materials, presence of solar panels, and presence of swimming pools.

Data quality and potential capture timelines will vary across Australia based on two categories. Each category has been developed based on several factors defined by the population distribution, industrial/commercial activities, and the probability of natural events (e.g. flooding). Population distribution are categorised based on population size.

- **Urban** - areas with a population greater than 200, or with significant industrial/commercial activity in a visual assessment
- **Rural** - all other areas

3.5 Purpose

The purpose of Buildings is to spatially represent building related features for use by industry and government in geographic information systems, visualisations, engineering modelling, and for the derivation of analytics.

3.6 Topic Category

Vector spatial data defined by coordinates (latitude and longitude) with associated textual (aspatial) metadata.

3.7 Geographic Description

The spatial coverage of Buildings includes Australia's land mass. The dataset has classified areas within this coverage that meet certain criteria based on the occurrence of natural events (e.g. flooding), population distribution and industrial/commercial activities. The classifications are "Urban" and "Rural", and data captured varies based on these two classifications. The Bounding Box for this data is as follows:

- North bounding latitude: -9°
- South bounding latitude: -44°
- East bounding longitude: 160°
- West bounding longitude: 100°

The area covers the land mass of Australia, including offshore islands. Buildings does not currently include data for other territories of Christmas Island, Cocos (Keeling) Islands and Norfolk Island.



3.8 Geographic Extent Name

The States and Territories within Australia are represented by the following:

State or Territory Name	Abbreviation
New South Wales	NSW
Victoria	VIC
Queensland	QLD
South Australia	SA
Western Australia	WA
Tasmania	TAS
Northern Territory	NT
Australian Capital Territory	ACT
Other Territories	OT

Note: PSMA has adopted the Australian Bureau of Statistics (ABS) definition of 'Other Territories' (OT). It includes the Territory of Christmas Island, Territory of Cocos (Keeling) Islands, Jervis Bay Territory and more recently the inclusion of Norfolk Island. OT does not include any other external Territory.

4. Data Content and Structure

4.1 Feature-Based Data

The feature type is a spatial polygon representation for the Buildings Dataset features. The table below outlines the features and their integration into related datasets.

Entity	Description	Integration
Building	A building is spatially represented by a single simple polygon of the outline of the building's roof line.	A building's representation has: 0 to many related addresses. Each address has 0 to one related G-NAF records. 0 to many CAD related records 0 to many Property related records 0 to one Suburb/Locality record 0 to one related Mesh Blocks 0 to one State/Territory record 0 to one related Zoning records

4.2 Feature-Based Application Schema (Data Model)

The Buildings dataset Data Model Diagram is set out in Appendix A.

4.3 Data Dictionary

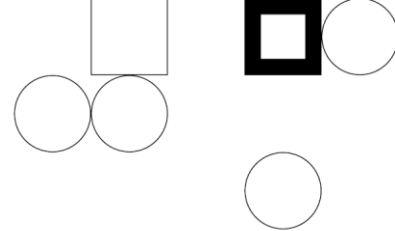
4.3.1 Feature-Based Feature Catalogue

Spatial attributes are added to the feature catalogue in the same manner as other attributes for completeness and conformance to the application schema.

Column	Description
Name	The name of the column in the Integrated Database.
Data Type	The data type of the column based on the types defined in ISO 19103:2015. Parentheses capture Scale, Precision and Maximum Length, where applicable.
Description of Field	A description of the column and what the expected contents are.
Primary Key	If 'Y' then this column must always have a unique value. (Has # entry in the data model tables).
Mandatory Field	Y = mandatory. If 'Y' (mandatory), this column is populated with data. That is, all ACTIVE records must have values in this column.
Foreign Key Table	Represents a column in the 'Foreign Key Table' that this column is referred to by another table. (Has * entry in the data model tables).
Foreign Key Column	Represents a table in the Integrated Database that this column is referred to.
10 Character Alias	An alias for this column name - up to 10 characters maximum. Used to define the name of the column when in ESRI Shapefile format.

4.3.2 Feature-Based Content Scope

All geometry and metadata for polygons within the Buildings Dataset.



5. Reference System

5.1 Spatial Reference System

The Buildings product includes vector data (Building Polygons).

5.1.1 Vector Data

GDA94

Vertical Datum: The Australian Height Datum (AHD) is the target vertical datum.

Horizontal Datum: The Geocentric Datum of Australia 1994 (GDA94) is the target horizontal datum.

Coordinate System: Geographic Coordinate System Geocentric Datum of Australia 1994 (GDA94).

GDA2020

Vertical Datum: The Australian Height Datum (AHD) is the target vertical datum.

Horizontal Datum: The Geocentric Datum of Australia 2020 (GDA2020) is the target horizontal datum.

Coordinate System: Geographic Coordinate System Geocentric Datum of Australia 2020 (GDA2020).

These coordinates are produced using a coordinate transformation from GDA94 using the following parameters:

```
shift_x = 0.06155,  
shift_y = -0.01087,  
shift_z = -0.04019,  
rotate_x = -0.0394924,  
rotate_y = -0.0327221,  
rotate_z = -0.0328979,  
scale_adjust = -0.009994
```

5.2 Temporal Reference System

Gregorian calendar

5.3 Reference System Scope

The spatial objects and temporal collection periods for the Buildings dataset.



6. Data Quality

The quality of Buildings data is assessed by averaging the results of measures applied to samples from the full dataset. Therefore, any figures set out below are only indicative of the quality of the Buildings data, which may be lower quality both in concentrated locations and isolated anomalies.

6.1 Positional Accuracy

Positional accuracy is an assessment of the closeness of the location of the spatial objects in relation to their true positions on the earth's surface. Positional accuracy consists of 2 assessments:

- Horizontal accuracy assessment, and
- Vertical accuracy assessment.

The horizontal and vertical positional accuracy is the assessed accuracy after all transformations have been carried out.

6.1.1 Horizontal Accuracy

The horizontal positional accuracy of Buildings data reflects the positional accuracy of source sensors utilised in data collection, and the reliability of feature classification and associated orthogonalisation processes.

The horizontal positional accuracy of source imagery varies across collected strips. The horizontal positional accuracy of imagery used for the extraction of urban buildings ranges from +/-0.2m (for buildings sourced from aerial imagery) to +/-2.5m Circular Error 90% (CE90) (for buildings sourced from satellite imagery).

The horizontal positional accuracy of rural buildings is known to be less than 10.9m CE90 and has been measured across various rural locations with CE90 accuracy between 1.8m and 7m.

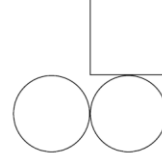
The positional accuracy of the vertices of unobstructed building features will reflect the accuracy of the source imagery from which it is extracted. Obstructed vertices will have their position estimated with building shapes orthogonalised using trained algorithms with some operator assistance. Users should note that anomalies from the building extraction algorithm may cause erroneous capture and further reduce the positional accuracy of the vertices of building features.

6.1.2 Vertical Accuracy

Source elevation accuracy is dependent on the reference data used for the assignment of height and elevation attributes. Heights are derived either from satellite derived DSM or aerial derived stereo digitisation.

Source elevation data used for the derivation of building height attributes have absolute spatial accuracies described below:

- **Absolute vertical (LE90) & horizontal accuracy (CE90):** ranging from 0.2m (aerial) to 2m (satellite).
- **Relative vertical (LE90) & horizontal (CE90) accuracy:** ranging from 0.1m (aerial) to 1m (satellite)



Multiple factors can impact the quality of the assigned elevation or height, these include but are not limited to:

- **Age of source imagery:** Where any imagery used within the production of the DSM is older than the date of construction of a building then the heights attributed to that building are likely to be erroneous.
- **Correct classification of the feature:** Where a building is not correctly defined (i.e. the highest point is not within the representation) then the height assigned to the feature has an increased likelihood of being erroneous.
- **The omission of the feature:** Where a building is not captured it cannot be assigned a height.
- **Obscured building:** Where a building is obscured by a tree or other feature then there is an increased likelihood of erroneous height values being assigned despite processes being run to limit this impact.
- **Tree coverage surrounding a building:** Where a building is surrounded by trees then the algorithm to calculate the roof height may struggle to obtain a representative ground elevation value. In these circumstances, there is an increased likelihood of an erroneous height assignment.
- **The off-nadir angle of source imagery:** Where imagery used for the classification of buildings is off-nadir the side of a building may be represented within the boundary of the footprint. Intersecting this part of the building against the DSM will return lower elevation values than those expected for the roof of the building. Where this occurs, there is an increased likelihood of an erroneous value being assigned to the eave height. The likelihood and impact of this issue are increased relative to the height of a building.

6.2 Thematic Quality

Thematic accuracy is defined as the accuracy of quantitative attributes, the correctness of non-quantitative attributes, and of the classification of features and their relationships.

6.2.1 Classification Correctness

Classification correctness is an assessment of the reliability of values assigned to features in the dataset in relation to their true 'real world' values.

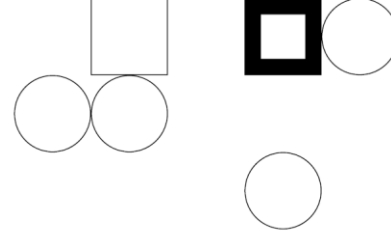
Building Solar Panel

The rate of classification correctness of the **solar_panel** attribute has been measured at above 85% where a photovoltaic solar panel is visible within the source imagery. Where a photovoltaic solar panel is not visible in the source imagery it is expected that the rate of classification correctness (in the negative) is greater than 90%. Other types of solar panels (e.g. solar hot water) may be captured and included in error.

Building Roof Type and Roof Material

The **primary_roof_material** attribute is spectrally classified from imagery with pixel sizes greater than the imagery used to extract the building polygon feature. Pixels that intersect the boundary of a building polygon may return values from ground surfaces or neighbouring buildings impacting the results obtained. The primary material attributed to a building is represented by a minimum number of intersecting pixels which comprise at least 10% of the total roof area of the building polygon.

The rate of classification correctness of the **roof_material** attribute has been measured in excess of 70% across suburban residential areas. Commercial, industrial, and higher density residential areas are known to have lower classification correctness of the roof material.



Characteristics of a building that can impact the **roof_type** classification correctness of the roof shape include but are not limited to:

- Roof furniture e.g. plant rooms, steeples, aerials.
- Buildings that have a larger footprint than roof area.
- Multiple buildings represented as a single building due to proximity.
- The height of the building.
- Overhanging trees.

The rate of classification correctness of the **roof_type** has been measured at above 90% on unobstructed buildings.



Swimming Pool

The rate of classification correctness of a swimming pool has been measured at above 85% where a swimming pool is present.

Zoning

The **planning_zone** attribute is classified by mapping state, territory or local government planning zone scheme information against high-level, generalised national zoning codes developed by PSMA Australia. The mapping of the planning schemes to the national zoning codes is a generalised process and is not based on a detailed examination of each scheme. The classification does not take into consideration standard planning overlays, multi-zoned areas or amendments which may be made to planning schemes from time to time which may not be reflected in the base zoning datasets.

The generalised national zoning codes attempt to reflect the general intention of the individual planning schemes. However, they do not reflect differences in planning legislation or its interpretation by state, territory and local government planning authorities.

The **planning_zone** attribute provides only a general indication of the planning zone for a building and should not be treated as authoritative. It is therefore not suitable for purposes such as planning and development decision making. Users should contact the relevant state, territory or local government planning authority for authoritative planning scheme information.

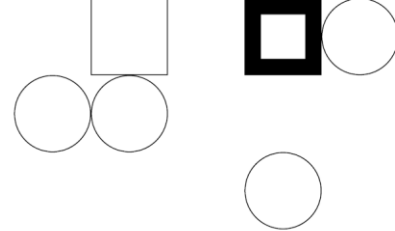
The source of data for the allocation of zones to buildings has large areas where no zoning information exists. This is in predominately rural areas for the state/territory of NT, WA and north-western NSW.

6.3 Logical Consistency

Logical consistency is a measure of the degree to which data complies to a technical specification. The test procedures are a mixture of software scripts and manual visual analysis. The data structure of Buildings has been tested for conformance to the data model.

The following have been tested and confirmed to conform:

- File names
- Attribute names
- Attribute lengths
- Attribute types
- Attribute domains
- Attribute order in the file
- Object type
- Compulsory attributes populated



6.4 Topological Consistency

Topological consistency is the measure of how features spatially relate to other features within and across the Buildings theme. Topological inconsistencies are identified using a combination of automated rules. Where topological inconsistencies are identified, they are notified back to the supplier for remediation. Some minor topological inconsistencies are corrected during product processing. The level of topological consistency is dependent on the data supplied to PSMA. Where topological inconsistencies continue to exist after supplier remediation they are identified within the product through the population of the **geometry_quality** attribute.

6.5 Temporal Accuracy

Temporal accuracy is an assessment of both temporal consistency (how well-ordered lifecycle events are) and temporal validity (validity of data with respect to time). Building polygons are attributed with the capture date of the imagery from which the outline has been captured.

6.6 Completeness

Completeness is an assessment of the extent and range of the dataset with regard to completeness of coverage, and completeness of attribution.

Attribute Completeness

The layer within the Buildings has a full population of attributes in accordance with the data model.

Feature Completeness

Building features are considered to have an omission rate below 5% in urban areas, with the majority of omission being smaller buildings such as garden sheds. In rural areas, buildings with an area of less than 100m² are considered to have an omission rate of less than 10% and buildings with an area of greater than 100m² are considered to have an omission rate below 5%.

6.7 Data Quality Scope

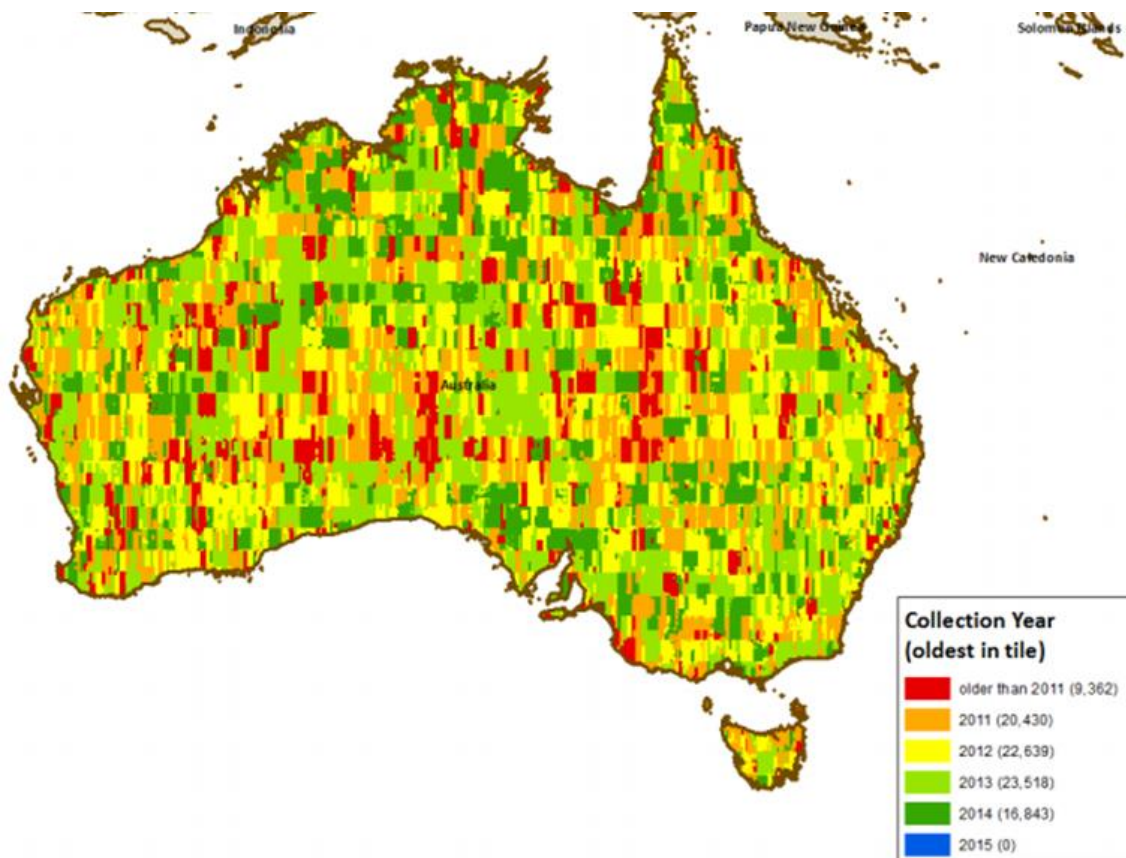
All spatial features including their attributes in the current time period for the Buildings Dataset.

7. Data Capture

Attribution, data quality and potential capture timelines will vary across Australia based on two categories. Each category has been developed based on several factors defined by the population distribution, industrial/commercial activities and the probability of natural events (e.g. flooding). Population distribution are categorised based on population size.

- **Urban** - areas with a population greater than 200, or with significant industrial/commercial activity in a visual assessment
- **Rural** - all other areas

The age of source imagery used for Buildings also varies across each of the categories to enable national coverage. 'Urban' areas have been captured with as recent as possible source imagery, where possible within 18 months of the building feature creation date. 'Rural' capture was undertaken across an image archive that spans a large timeframe and source imagery can be between 1-17 years old. The original age of imagery for Rural capture is shown below. Some limited update has been undertaken across Rural areas since original capture.



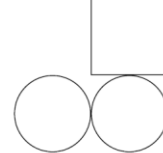
Age of Rural Source Imagery

Overarching data attributes available across the two classifications are provided in the table below:

Building layer and attribution for different Area Categories

Class / Attribute	Urban	Rural
Building Attributes		
Address count	Y	Y
Building centroid	Y	Y
Building outline (polygon)	Y	Y
Eave height	Y	N
Ground elevation	Y	N
Ground level Z value for vertices and centroid*	Y	Y
Maximum roof height	Y	N
Number vertices for a polygon	Y	Y
Polygon area	Y	Y
Roof colour	Y	N
Primary roof material	Y	N
Roof type	Y	N
Solar panel indicator	Y	N
Swimming pool adjacent indicator	Y	N
Building volume	Y	N
Planning zone	Y	Y
State/Territory	Y	Y
PSMA Data linkages		
Cadastre	Y	Y
G-NAF	Y	Y
Locality	Y	Y
Mesh Block	Y	Y
Property	Y	Y

***Not available in MapInfo TAB format**



7.1 Buildings Theme

The buildings theme (buildings layer) consists of digital representations of the roof outline of a building which have been digitised from remotely sensed imagery using a combination of automated and manual processes to identify, extract and orthogonalise objects resembling a building structure greater than 9m². Image quality factors including currency, capture geometry, and applicable weather conditions influence the specific image which can be utilised for further processing. A suitable high-quality Digital Surface Model is constructed to assist with feature extraction. Each type of feature extracted follows a distinct (but related) processing stream. Building footprints are classified on the WGS84 datum.

Further specific capture related information by feature is as follows:

7.1.1 Related Building Attributes

A number of additional building related attributes are included in the Buildings theme, specifically, these attributes are:

area

The area attribute value is a derived value calculated during processing. Area values are calculated with features projected in a Transverse Mercator coordinate system.

ground elevation

This value represents the building ground surface height in meters with respect to the Australian Height Datum (AHD) at the location of the building centroid. The centroid is calculated as the geometric centroid of the building polygon, for irregularly shaped features the centroid is ensured to lie within the bounds of the polygon. This centroid location is intersected with the best available data to assign ground elevation. Source of the data used for assignment of elevation for each building feature is contained within ground_elevation_source attribute.

eave height

This is the relative height in metres above the ground surface of the identified eave of a building. All efforts have been taken to identify an 'eave' for each building boundary. Multilevel buildings and irregular facades may impact the accuracy of this value.

roof height

This is the relative height in metres above ground surface of the identified maximum roof height within the building boundary and may include the height of plant rooms and building fixtures.

is residential

The linkage table between address and building features a separate attribute that has been included to indicate if the address has been identified as currently or having previously thought to be residential. The source of the residential indicator is currently derived from Commonwealth Government sources, which PSMA considers reliable.

number vertices

A total count of the number of vertices for all rings of the polygon feature representing a building. Users should note that a typical rectangular polygon feature has four vertices.



geometry quality

A quality flag has been included to identify buildings that have been modified during data correction processes, or that a quality issue was identified but an automatic correction could not be made.

roof colour

Provided as an attribute on each building, the roof colour is the mean hexadecimal value from all image pixels considered to be comprised of the primary roof material for that building.

roof material

Provided as an attribute on each building, the roof material is the classification of the primary roof material found across the building surface.

The roof material attribute is classified from image pixels that intersect the Building. The image signature of the intersecting pixels is matched to a spectral library of known material compositions to determine the best matching material for each pixel.

roof type

Provided as an attribute on each building feature is the classification of the shape type of a roof structure. For Buildings captured from satellite imagery the roof type is an approximation of the roof shape based off a statistical calculation of the elevation profile of the roof. For Buildings captured from aerial imagery the roof type is assessed manually and classified with the value that describes the overall roof type e.g. 'Gabled'.

solar panel

Provided as an attribute on each building feature, this is an indicator of the presence or absence of a photovoltaic solar panel on the roof surface. Other types of solar panels e.g. solar hot water can be captured as false positives and impact the classification correctness of this attribute.

swimming pool adjacent

Provided as an attribute on each building feature this is an indicator of the presence or absence of a swimming pool on the properties associated with the building feature.

volume

Provided as an attribute on each building feature, this is the volume in cubic metres of a building estimated using the roof height and building area for buildings derived from satellite imagery. Where a building has been manually digitised from aerial imagery as a complex polygon and generalised into the Buildings product as a single outline the volume is calculated from the complex building representation.

7.1.2 Linkages

Buildings uses the following PSMA products for inputs into the processing:

- G-NAF,
- CadLite (Property and Cadastre),
- Administrative Boundaries (Suburbs/Localities and ABS 2016 Mesh Blocks).

Planning zone boundaries that are not provided as a PSMA product are also linked to buildings. These planning zones have been aggregated into classifications such as "Residential", "Commercial/Business" and "Industrial/Utilities".



The linkages with buildings are explained in detail below.

Building_cad linkage and relationship confidence

A building will be linked to a cadastral parcel where the area of overlap is 7% or greater of the buildings area or 40% or greater of the cadastral parcels area. Cadastral parcels relating to roads and easements are not used in the creation of these relationships. If a building is related to multiple cadastral parcels and one of those parcels fully contains another of these parcels, a building linkage to the container cadastral parcel is not created.

Relationship confidence values are assigned to describe the confidence in these building_cad relationships. The relationship confidence values use the area of overlap to broadly describe the likelihood that a building is related to a cadastral parcel, with higher overlap inferring a greater confidence in the relationship.

Spatial Overlap	Relationship_confidence
>= 80% building area overlap or >= 40% parcel area overlap	90
60% - <80% building area overlap	80
40% - <60% building area overlap	50
20% - <40% building area overlap	30
7% - <20% building area overlap	20

Building_property linkage and relationship confidence

A building will be linked to a property parcel where the area of overlap is 7% or greater of the buildings area or 40% or greater of the property parcels area. If a building is related to multiple property parcels and one of those parcels fully contains another of these parcels, a building linkage to the container property parcel is not created.

Relationship confidence values are assigned to describe the confidence in these building_property relationships. The relationship confidence values use the area of overlap to broadly describe the likelihood that a building is related to a property parcel, with higher overlap inferring a greater confidence in the relationship.


Spatial Overlap	Relationship_confidence
>= 80% building area overlap or >= 40% parcel area overlap	90
60% - <80% building area overlap	80
40% - <60% building area overlap	50
20% - <40% building area overlap	30
7% - <20% building area overlap	20

Building_address linkage and relationship confidence

A building will be linked to a Geoscape Address where the address either intersects the building geometry or the address intersects a cadastral or property parcel that has been related to the building through the above building_cad or building_property linkage rules.

Linkage is limited to active principal addresses relating to the building centroid, property centroid, frontage centre setback or property access point setback.

Geoscape Addresses is an address dataset containing a standardised and quality assured national set of addresses that are linked to G-NAF and updated as frequently as addresses



are provided by each jurisdiction. This link to Geoscape Addresses assigns an address string to the building_address record and where the Geoscape Address is related to a G-NAF record the address_detail_pid is also assigned to the building_address.

The omission of non-jurisdictional addresses that are present in G-NAF has led to a reduction in unit numbered addresses being linked to in the product. This change will be most evident on sites with a large number of unit numbered addresses in G-NAF where the Geoscape Addresses do not include the unit numbered addresses, such as some major shopping centres, retirement villages and unit developments. This is expected to mostly affect address relationships in Queensland and New South Wales. Primary addresses for these types of development will still be allocated to the related building/s using the Geoscape Addresses.

Relationship confidence values are assigned to describe the confidence in these building_address relationships. The relationship confidence value for a building_address relationship will be 95% if the address intersects the building. If the building_address relationship has been created through cadastral or property relationships, the relationship confidence value for the building_address record will match that used for the building to parcel relationship.

Building to Locality linkage

A building will be assigned a locality_pid value relating to the gazetted locality boundary that the building is primarily within, based on maximum area of intersection. This linkage will not be made if the maximum area of intersection is less than 7% of the building area. If a gazetted locality does not intersect the building, the locality_pid of a hundred (SA) or district (ACT) may be assigned based on maximum area of intersection, if this intersection is 7% or greater based on the building area.

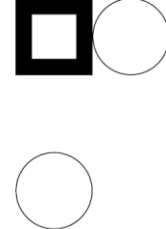
Building to Mesh Block linkage

A building will be assigned a mesh_block_code value relating to the 2016 Australian Bureau of Statistics (ABS) Mesh Block that the building is primarily within, based on maximum area of intersection. This linkage will not be made if the maximum area of intersection is less than 7% of the building area.

Building to planning zone linkage

A building will be assigned a planning_zone value relating to the planning zone that it is primarily within, based on maximum area of intersection. This linkage will not be made if the maximum area of intersection is less than 7% of the building area. If the building has over 80% overlap with two overlapping planning zones with different values, a hierarchy is used to assign the planning_zone value allocated. The hierarchy is as follows (with "Residential" as the highest priority):

Residential > Commercial/Business > Industrial/Utilities > Community Use > Mixed Use > Special Use > Transport/Infrastructure > Rural/Primary Production > Conservation/National Park > Recreational/Open Space > Water



8. Data Updates and Maintenance

PSMA completed delivery of the national Buildings product in October 2018 and has since commenced the update, maintenance and improvement program.

8.1 Update Frequency

Updates to Buildings are applied continuously and released on a quarterly schedule.

8.2 Update Scope

Buildings updates occurs for all existing objects with changed geometry, attributes and/or metadata, as well as data for new objects supplied prior to the release time period.

Updates to the product include:

1. Feature level building change management:
 - a. Addition of newly captured buildings,
 - b. Retiring of non-identified buildings,
 - c. Validation of existing building geometry,
 - d. Updates to building geometry to improve real-world representation, and
 - e. Updates to building attribution: height, roof material, roof type.
2. The inclusion of any new capture of Buildings received from third-party partners for inclusion within Buildings.
3. All Buildings relationships to other PSMA products (G-NAF, CadLite, and Administrative Boundaries) to account for any changes in either product.
4. Corrections and/or improvements to production processes in generating Buildings.

8.3 Update Rules

The update process describes rules that are applied to records to determine persistency. A record can be updated, retired or created.

The following table outlines the required attributes needed to be changed to cause a record to be retired.

Attributes Used for Persistency

Table Name	Attributes Used for Persistency
building	building_pid
building_address	building_pid, address_pid
building_property	building_pid, property_pid
building_cad	building_pid, cad_pid

8.4 Building Change Management

The update phase of Buildings focuses on areas with a high degree of change in primarily urban areas, including central business districts and new residential development areas. For each updated area, recently captured imagery is used to identify and extract all building features in line with the original specifications.

Newly captured buildings are compared against existing features in Buildings to determine if a footprint is new, an existing footprint no longer exists, or an existing footprint can be better represented with confidence to increase fidelity and accuracy. The logic for several change management scenarios is outlined in the sections below.

The following applies to all change management scenarios:

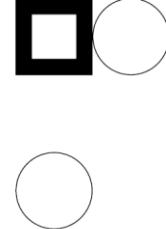
- Where a new buildings record is created, new related aspatial linkage records are also created if relationships to CAD, Property or Address exist.
- Where an existing buildings record is retired, all existing related aspatial linkage records are also retired.

Adds, Retires and Updates

The following rules describe the building change management process used for adding, retiring and updating records in the buildings table. Buildings from higher quality captures will be used in preference over other buildings where there is overlap between the two in this process.

For all buildings in the previous area of interest related to the new capture area, an overlap is performed between the previous buildings and the new capture of buildings. The rules for this are as follows:

- any buildings that have no overlap with the new capture of buildings are retired.
- any buildings that match against multiple buildings in the new capture are retired.
- any buildings that have an overlap of less than 20% with a new capture building are retired and the new capture building is added.



For all buildings in the new capture, an overlap is performed with the previous buildings related to the new capture area. The rules for this are as follows:

- any buildings that overlap multiple previous buildings will not result in any new or retired buildings.
- any buildings that overlap a previous building by less than 20% will be added.
- any buildings that overlap a previous building by between 90% and 99% will be treated as a minor update for that existing building. The previous building will be retired, and the new building polygon will be added with the same building_pid as the previous representation.
- any buildings that overlap a previous building by between 20% and 90% will be treated as a major update for that existing building. The previous building will be retired, and the new building polygon will be added with the same building_pid as the previous representation.
- any building that has 100% overlap with a previous building will be treated as an update. In this scenario the building polygon will remain the same as the previous representation, with the same building_pid.

9. Delivery Format

9.1 Components

The Buildings product will include vector components. The following table identifies what components will be delivered in vector formats as well as the file format options available for each component. The data is separated into each State and Territory, and a whole of Australia file is available for File Geodatabase and GeoJSON formats. OT includes all Jervis Bay Territory vector data

Vector and aspatial data will be made available using only the ESRI Shapefile, MapInfo TAB, File Geodatabase and GeoJSON formats described below.

Supplied formats

Theme	Vector Formats			
	ESRI Shapefile	MapInfo TAB	File Geodatabase	GeoJSON
Buildings	X	X*	X	X

***Z values not included in buildings data**

9.1.1 MapInfo TAB

Format Name

TAB – MapInfo Professional™

Specification

This format includes files with the following extensions: *.tab, *.dat, *.id, *.map

The MapInfo TAB format is a popular geospatial vector data format for geographic information systems software. It is developed and regulated by MapInfo as a proprietary format. TAB files support geospatial standards such as Open GIS, the OGC, ISO, W3C and others.

Language

English

9.1.2 ESRI Shapefile

Format name

Shape – ESRI™

Specification

This format includes files with the following extensions: *.shp, *.shx, *.dbf

ESRI Shapefile Technical Description, an ESRI White Paper, July 1998. Follow this link: www.esri.com/library/whitepapers/pdfs/shapefile.pdf

Language

English

9.1.3 File Geodatabase

Format name

File Geodatabase – ESRI™

Specification

This format includes files with the following extensions: *.gdb

ESRI File Geodatabase Technical Description. Follow this link:
<http://desktop.arcgis.com/en/desktop/latest/manage-data/administer-file-gdbs/file-geodatabases.htm>

Language

English

9.1.4 GeoJSON

Format name:

GeoJSON

Specification:

This format includes files with the following extensions: *.geojson

GeoJSON specification: <https://tools.ietf.org/html/rfc7946>

NOTE: The GeoJSON specification states that the coordinate reference system for all GeoJSON coordinates is:

"a geographic coordinate reference system, using the World Geodetic System 1984 (WGS 84) datum, with longitude and latitude units of decimal degrees"

Buildings will be provided with coordinates using the datum selected for download (GDA94/GDA2020) with longitude and latitude units of decimal degrees.

Language:

English

9.1.5 JSON

Format name:

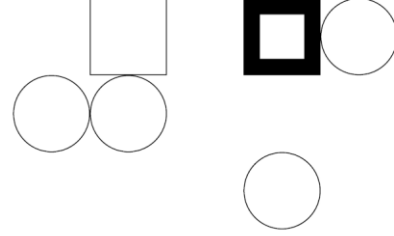
JSON

Specification:

This format includes files with the following extensions: *.json

JSON specification: <https://www.json.org/json-en.html>

Aspatial tables that are not valid within the GeoJSON file format will be provided in JSON format instead.



Language:
English



10. PSMA Partner Network

The value of PSMA's products is in the richness of the partner networks who have specialist skills and knowledge to provide business-ready solutions. Our network includes traditional geospatial specialists, data engineers, software developers, marketing service providers, system integrator, independent software vendors, research organisations and consultancies.

Contact us to provide feedback on the Buildings product or for further information on accessing PSMA Data:

PSMA Australia Limited

Unit 6, 113 Canberra Avenue, Griffith ACT 2603

T: 02 6260 9000

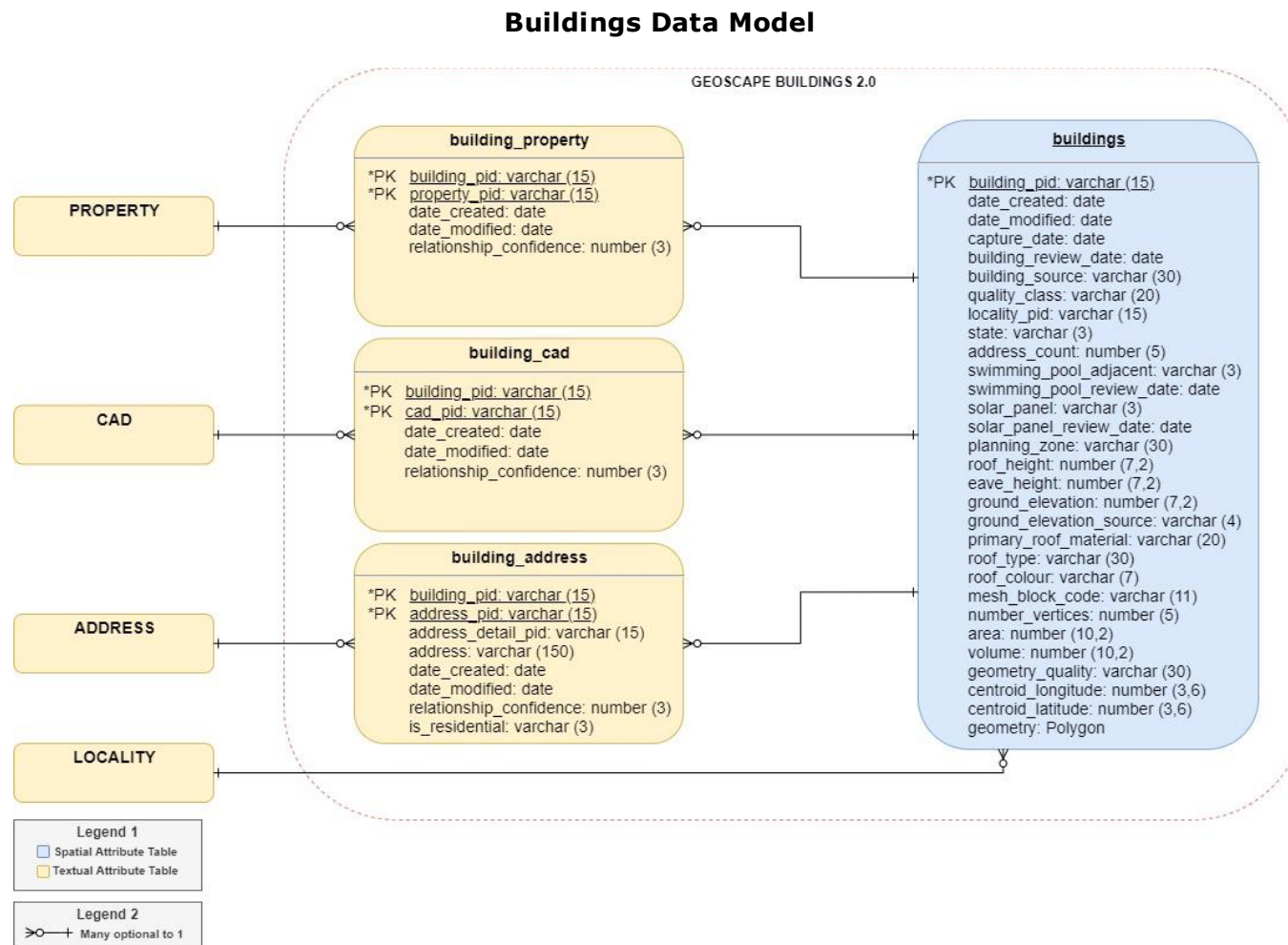
E: support@psma.com.au

W: www.psm.com.au

11. PSMA Data Products

DATASET	ACCESS	THEME	LAYER
Administrative Boundaries	Open Data (www.data.gov.au) PSMA Partner Network	ABS Boundaries 2011	2011 ABS Mesh Blocks
			Indigenous Location (ILOC)
			Indigenous Areas (IARE)
			Indigenous Region (IREG)
			Remoteness Areas (RA)
			Socio-Economic Indexes for Areas (SEIFA)
			Urban Centre Localities /Section of State
			Significant Urban Areas (SUA)
		ABS Boundaries 2016	2016 ABS Mesh Blocks and Statistical Areas
			2016 ABS Indigenous Regions, Areas and Locations
			2016 Urban Centre and Locality - Section of State - Significant Urban Area
			2016 Remoteness Areas (RA)
			2016 Socio-Economic Indexes for Areas (SEIFA)
Electoral Boundaries	Commonwealth Electoral Boundaries		
	State Electoral Boundaries		
	Local Government Areas (LGAs)		
	Suburbs/Localities		
	State Boundaries		
	Town Points		
	Wards		
CadLite	PSMA Partner Network	Cadastre	
		Property	
Buildings	PSMA Partner Network	Buildings	
Surface Cover	PSMA Partner Network	Urban Surface Cover (2m resolution)	
		National Surface Cover (30m resolution)	
Trees	PSMA Partner Network	Trees	
G-NAF	Open Data (www.data.gov.au)	Geocoded physical addresses	
	PSMA Partner Network		
Land Tenure	PSMA Partner Network	Land Tenure	
Postcodes	PSMA Partner Network	Postcode Boundaries	
Transport & Topography	PSMA Partner Network	Transport	Roads
			Rail
			Rail Stations
			Airports
			Hydrology
			Greenspace

Appendix A –Buildings Data Model



Appendix B – Data Dictionary

The following table refers to the columns used in all tables that form part of the data dictionary.

Column	Description
NAME	The name of the column in the Integrated Database (LOWERCASE).
DATE TYPE	The data type of the column based on the types defined in ISO 19103:2015. Parentheses capture Scale, Precision and Maximum Length, where applicable.
DESCRIPTION OF FIELD	A description of the column and what the expected contents are.
PRIMARY_KEY	If 'Yes' then this column must always have a unique value.
MANDATORY FIELD	Yes = mandatory. If 'Yes' (mandatory), this column is populated with data. That is, all ACTIVE records must have values in this column.
FOREIGN KEY TABLE	Represents a column in the 'Foreign Key Table' that this column is referred to by another table (has a * entry in the data model tables).
FOREIGN KEY COLUMN	Represents a table in the Integrated Database that this column is referred to.
10 CHARACTER ALIAS	An alias for this column name - up to 10 characters maximum. Used to define the name of the column when in ESRI Shapefile format. The name will be UPPERCASE.

buildings

NAME	DATA TYPE	DESCRIPTION OF FIELD	PRIMARY KEY	MANDATORY FIELD	FOREIGN KEY TABLE	FOREIGN KEY COLUMN	10 CHARACTER ALIAS
building_pid	character string (15)	Persistent identifier for the building.	Yes	Yes			BLD_PID
date_created	date (dd-mm-yyyy)	The date of record creation for the building	No	Yes			DT_CREATE
date_modified	date (dd-mm-yyyy)	The most recent date that an attribute (not including building_review_date, swimming_pool_review_date or solar_panel_review_date) has been modified for the building.	No	No			DT_MOD

NAME	DATA TYPE	DESCRIPTION OF FIELD	PRIMARY KEY	MANDATORY FIELD	FOREIGN TABLE	KEY	FOREIGN COLUMN	KEY	10 CHARACTER ALIAS
capture_date	date (dd-mm-yyyy)	The capture date of the source imagery used to derive the geometry of the building.	No	No					CAPT_DATE
building_review_date	date (dd-mm-yyyy)	The most recent date of source imagery from which the building was reviewed for update or removal.	No	No					BLD_RV_DT
building_source	character string (30)	The methodology of capture for the Building attributes.	No	Yes					BLD_SRC
quality_class	character string (20)	Represents whether the building has been classed as either Urban or Rural. The quality class of urban denotes buildings with high population of attributes and high horizontal positional accuracy. The quality class of Rural denotes buildings with generally lower population of attributes and lower horizontal positional accuracy than the Urban records.	No	Yes					QUAL_CLASS
*locality_pid	character string (15)	The Locality that the building is primarily within, based on maximum area of intersection.	No	No	LOCALITY		LOCALITY_PID		LOC_PID
state	character string (3)	The abbreviated name of the State or Territory that the building is primarily within, based on maximum area of intersection.	No	No					STATE
address_count	number (5)	Total number of addresses related to a building.	No	Yes					ADD_COUNT
swimming_pool_adjacent	character string (3)	Indicates whether a swimming pool is on a property related to the building.	No	No					SP_ADJ
swimming_pool_review_date	date (dd-mm-yyyy)	The most recent review date for the swimming_pool_adjacent field.	No	No					SP_RV_DT
solar_panel	character string (3)	Describes whether a visible photovoltaic solar panel is identified for the building.	No	No					SOLAR_P
solar_panel_review_date	date (dd-mm-yyyy)	The most recent review date for the solar_panel field.	No	No					SOLP_RV_DT
planning_zone	character string (30)	The planning zone type assigned to a building, based on the planning zone with the highest area of intersection.	No	No					PLAN_ZONE

NAME	DATA TYPE	DESCRIPTION OF FIELD	PRIMARY KEY	MANDATORY FIELD	FOREIGN TABLE	KEY	FOREIGN COLUMN	KEY	10 CHARACTER ALIAS
roof_height	number (7,2)	The height of the building from the lowest elevation where the constructed walls intersect the ground to the highest point on the constructed Building that is not on a spire, antenna or similar.	No	No					ROOF_HGT
eave_height	number (7,2)	The height of the building from the lowest elevation where the constructed walls intersect the ground to the average height of the part of the roof that meets or overhangs the walls (eave).	No	No					EAVE_HGT
ground_elevation	number (7,2)	The elevation of the ground at the centroid of the building.	No	No					GRD_ELEV
ground_elevation_source	character string (4)	The grid separated distance (GSD) of the source elevation model used to extract ground elevation.	No	No					GRD_EL_SRC
primary_roof_material	character string (20)	The material that the roof is primarily made from.	No	No					PR_RF_MAT
roof_type	character string (30)	Indicative shape of the roof of the building.	No	No					ROOF_TYPE
roof_colour	character string (7)	The measured Red/Green/Blue (RGB) colour value in hexadecimal format (#rrggbb) for the primary_roof_material of the building.	No	No					ROOF_CLR
*mesh_block_code	character string (11)	The 2016 Australian Bureau of Statistics (ABS) Mesh Block that the building is primarily within, based on maximum area of intersection.	No	No	MB_2016		MB_2016_CODE		MB_CODE
number_vertices	number (5)	The number of vertices for the building geometry.	No	Yes					NUM_VERT
area	number (10,2)	The area in square metres of the Building geometry.	No	Yes					AREA
volume	number (10,2)	The volume of the polygon in cubic metres. For geometries captured with greater detail than represented in the building product,	No	No					VOLUME

NAME	DATA TYPE	DESCRIPTION OF FIELD	PRIMARY KEY	MANDATORY FIELD	FOREIGN TABLE	KEY	FOREIGN COLUMN	KEY	10 CHARACTER ALIAS
		the volume value from this source will be used.							
geometry_quality	character string (30)	Describes quality issues with the geometry of the building.	No	No					BLD_GM_QLT
centroid_longitude	number (3,6)	The longitude of the building centroid.	No	Yes					CNTRD_LONG
centroid_latitude	number (3,6)	The latitude of the building centroid.	No	Yes					CNTRD_LAT
geometry	Polygon	The geometry field for the buildings table, which represents the building polygon (including ground level elevation values for all vertices).	No	Yes					GEOMETRY

***LOCALITY and MESH BLOCK tables are NOT in the Buildings product; they are located in PSMA's Administrative Boundaries product.**

building_cad

NAME	DATA TYPE	DESCRIPTION OF FIELD	PRIMARY KEY	MANDATORY FIELD	FOREIGN TABLE	KEY	FOREIGN KEY COLUMN	KEY	10 CHARACTER ALIAS
building_pid	character string (15)	The persistent identifier of the building related to a cadastral record.	Yes	Yes	buildings		building_pid		BLD_PID
cad_pid	character string (15)	The unique persistent identifier for each CAD record associated with the building record by spatial intersection.	Yes	Yes		CAD	CAD_PID		CAD_PID
date_created	date (dd-mm-yyyy)	The date of record creation for the building_cad relationship.	No	Yes					DT_CREATE
date_modified	date (dd-mm-yyyy)	The most recent date that an attribute has been modified for the building_cad relationship.	No	No					DT_MOD
relationship_confidence	number (3)	The percentage confidence that a building has a relationship with a CAD parcel.	No	Yes					REL_CONF

**CAD table is not included in this product. It is available in the CadLite product.*

building_property

NAME	DATA TYPE	DESCRIPTION OF FIELD	PRIMARY KEY	MANDATORY FIELD	FOREIGN KEY TABLE	FOREIGN KEY COLUMN	10 CHARACTER ALIAS
building_pid	character string (15)	The persistent identifier of the building related to a property record.	Yes	Yes	buildings	building_pid	BLD_PID
property_pid	character string (15)	The unique persistent identifier for each property record associated with the building record by spatial intersection.	Yes	Yes	PROPERTY	PROPERTY_PID	PR_PID
date_created	date (dd-mm-yyyy)	The date of record creation for the building_property relationship.	No	Yes			DT_CREATE
date_modified	date (dd-mm-yyyy)	The most recent date that an attribute has been modified for the building_property relationship.	No	No			DT_MOD
relationship_confidence	number (3)	The percentage confidence that a building has a relationship with a property parcel.	No	Yes			REL_CONF

*PROPERTY table is not included in this product. It is available in the CadLite product.

building_address

NAME	DATA TYPE	DESCRIPTION OF FIELD	PRIMARY KEY	MANDATORY FIELD	FOREIGN KEY TABLE	FOREIGN KEY COLUMN	10 CHARACTER ALIAS
building_pid	character string (15)	The persistent identifier of the building related to an address record.	Yes	Yes	buildings	building_pid	BLD_PID
address_pid	character string (15)	The address pid that is related to the building feature. The persistent identifier is unique to the address feature this record relates to.	Yes	Yes			ADD_PID
address_detail_pid	character string (15)	The unique persistent identifier for each address_detail record associated with the address record.	No	No	ADDRESS_DETAIL	address_detail_pid	ADD_DT_PID
address	character string (150)	The address string from the related address record.	No	Yes			ADDRESS
date_created	date (dd-mm-yyyy)	The date of record creation for the building_address relationship.	No	Yes			DT_CREATE
date_modified	date (dd-mm-yyyy)	The most recent date that an attribute has been modified for the building_address relationship.	No	No			DT_MOD



NAME	DATA TYPE	DESCRIPTION OF FIELD	PRIMARY KEY	MANDATORY FIELD	FOREIGN KEY TABLE	FOREIGN KEY COLUMN	10 CHARACTER ALIAS
relationship_confidence	number (3)	The percentage confidence that a building has a relationship with an address record.	No	Yes			REL_CONF
is_residential	character string (3)	Value of "Yes" allocated where address information has identified the land use as residential.	No	No			IS_RESI

**ADDRESS_DETAIL table is not included in this product; it is available in PSMA's G-NAF product.*