

# Data Management Plan

Team: TP33

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## 1. Datasets overview

To address the parking problem for Commuters in Melbourne's CBD, the open datasets “Motor Vehicle Census, Australia methodology 2021” , ”Australian Bureau of Statistics (ABS) Regional population 2021”, “On-street Parking Bay Sensors”, “On-street Parking Bays” and “Parking zones linked to street segments” will be utilised to gain insights, and analysis toward efficient parking.

Data sources					
Names	Physical access (e.g.API,CSV )	Frequency of source updates	Frequency of iteration system updates	Granularity	Copyright/ Licensing details
Motor Vehicle Census, Australia (2021 methodology)	CSV	Annually	Annually	State / territory-level	ABS, under Creative Commons or ABS terms; detailed via methodology page <a href="https://www.abs.gov.au/methodologies/motor-vehicle-census-australia-methodology/31-jan-2021">https://www.abs.gov.au/methodologies/motor-vehicle-census-australia-methodology/31-jan-2021</a>
Australian Bureau of Statistics (ABS) Regional population 2021	xlsx	Annually	Annually	State / territory-level	ABS — Open Licence (e.g. Creative Commons Attribution) <a href="https://www.abs.gov.au/statistics/people/population/regional-population/2021/3218">https://www.abs.gov.au/statistics/people/population/regional-population/2021/3218</a>

					<a href="#">0DS0001_2001-21.xlsx</a>
On-street Parking Bay Sensors	CSV/API	Real-time	Minutes	High	
On-street Parking Bays	CSV/API	Static	Occasionally	High	
Parking zones linked to street segments	CSV/API	Annually	Annually	High	

## 1.1 Open Data Sources

### 1.1.1 Motor Vehicle Census, Australia (2021 methodology)(CSV)

<https://www.abs.gov.au/methodologies/motor-vehicle-census-australia-methodology/31-jan-2021>

### 1.1.2 Australian Bureau of Statistics (ABS) Regional population 2021(xlsx)

[https://www.abs.gov.au/statistics/people/population/regional-population/2021/32180DS0001\\_2001-21.xlsx](https://www.abs.gov.au/statistics/people/population/regional-population/2021/32180DS0001_2001-21.xlsx)

### 1.1.3 On-street Parking Bay Sensors (CSV/API)

<https://data.melbourne.vic.gov.au/explore/dataset/on-street-parking-bay-sensors/information>

### 1.1.4 On-street Parking Bays (CSV/API)

<https://data.melbourne.vic.gov.au/explore/dataset/on-street-parking-bays/information/>

### 1.1.5 Parking zones linked to street segments (CSV/API)

<https://data.melbourne.vic.gov.au/explore/dataset/parking-zones-linked-to-street-segments/table/>

## 2. Iteration

### 2.1 Data usage

“Motor Vehicle Census, Australia methodology 2021” & “Australian Bureau of Statistics (ABS) Regional population 2021”: visualized data showing trends in car ownership and population growth in Melbourne.

“On-street Parking Bay Sensors” & “On-street Parking Bays” & “Parking zones linked to street segments”, combined to show optimal parking spot when entering street name, and predicting area parking availability.

### 2.2 Data Preparation (Cleaning & Wrangling)

#### Epic 1:

Vehicle data :

	Between 2016 and 2017		Between 2017 and 2018		Between 2018 and 2019	
	no.	%	no.	%	no.	%
NSW	262,872	4.6	287,998	4.9	314,416	5.2
Vic.	209,495	4.2	214,408	4.2	236,429	4.5
Qld	139,062	3.4	135,935	3.3	146,633	3.4
SA	50,434	3.5	49,470	3.4	52,949	3.6
WA	89,755	3.9	85,500	3.7	85,480	3.7
Tas.	7,927	1.7	8,433	1.7	7,716	1.5
NT	13,091	7.8	3,621	2.2	11,637	6.7
ACT	11,500	3.7	11,605	3.7	12,509	3.9
Aust.	784,136	4	796,970	4	867,769	4.3
a. These estimates exclude motorcycles. For more details on calculation of the attrition rate refer to the Glossary.						
Source: Australian Bureau of Statistics, Motor Vehicle Census, Australia methodology 31 Jan 2021						

Remove useless information such as footnotes and rename columns for graph drawing.

	X	2016	X.1	2017	X.2	2018	X.3	2019	X.4	2020	X.5
		no.	%	no.	%	no.	%	no.	%	no.	%
1	NSW	262,872	4.6	287,998	4.9	314,416	5.2	262,979	4.4	188,950	3.1
2	Vic.	209,495	4.2	214,408	4.2	236,429	4.5	215,728	4.0	188,855	3.5
3	Qld	139,062	3.4	135,935	3.3	146,633	3.4	144,070	3.3	97,156	2.2
4	SA	50,434	3.5	49,470	3.4	52,949	3.6	51,180	3.4	27,145	1.8
5	WA	89,755	3.9	85,500	3.7	85,480	3.7	58,113	2.5	53,481	2.3
6	Tas.	7,927	1.7	8,433	1.7	7,716	1.5	7,063	1.4	5,613	1.1
7	NT	13,091	7.8	3,621	2.2	11,637	6.7	9,770	5.7	5,564	3.3
8	ACT	11,500	3.7	11,605	3.7	12,509	3.9	13,874	4.3	12,593	3.8
9	Aust.	784,136	4.0	796,970	4.0	867,769	4.3	762,777	3.7	579,357	2.8

Population data:

xlsx only reads table5 (overall population data:

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Regional population, 2021													
Released at 11.30am (Canberra time) 26 July 2022													
Table 5. Estimated resident population, States and Territories (ASGS2021), Australia													
ERP at 30 June													
S/T code	S/T name	2001 no.	2002 no.	2003 no.	2004 no.	2005 no.	2006 no.	2007 no.	2008 no.	2009 no.	2010 no.	2011 no.	
1	New South Wales	6530349	6580807	6620715	6650735	6693206	6742690	6834156	6943461	7053755	7144292	7218529	
2	Victoria	4763615	4817774	4873809	4927149	4989246	5061266	5153522	5256375	5371934	5461101	5537817	
3	Queensland	3571469	3653123	3743121	3829970	3918494	4007992	4111018	4219505	4328771	4404744	4476778	
4	South Australia	1503461	1511567	1520399	1528189	1538804	1552529	1570619	1588665	1608902	1627322	1639614	
5	Western Australia	1906274	1928512	1952741	1979542	2011207	2050581	2106139	2171700	2240250	2290845	2353409	
6	Tasmania	473668	474152	478534	483178	486202	489302	493262	498568	504353	508847	511483	
7	Northern Territory	201743	202251	201725	202663	205905	209057	213748	219874	226027	229778	231292	
8	Australian Capital Territory	321538	324627	327357	328940	331399	335170	342644	348368	354785	361766	367985	
9	Other Territories	2584	2397	2336	2356	2381	2379	2514	2683	2876	3055	3117	
TOTAL AUSTRALIA		19274701	19495210	19720737	19932722	20176844	20450966	20827622	21249199	21691653	22031750	22340024	
Source: Regional population, 2021													
© Commonwealth of Australia 2022													

Clean up useless lines/columns such as comments, and rewrite state names to keep consistent:

State	...3	...4	...5	...6	...7	...8
1 NA	2001	2002	2003	2004	2005	2006
2 NSW	6530349	6580807	6620715	6650735	6693206	6742690
3 Vic.	4763615	4817774	4873809	4927149	4989246	5061266
4 Qld	3571469	3653123	3743121	3829970	3918494	4007992
5 SA	1503461	1511567	1520399	1528189	1538804	1552529
6 WA	1906274	1928512	1952741	1979542	2011207	2050581
7 Tas.	473668	474152	478534	483178	486202	489302
8 NT	201743	202251	201725	202663	205905	209057
9 ACT	321538	324627	327357	328940	331399	335170
10 Other Territories	2584	2397	2336	2356	2381	2379
11 Aust.	19274701	19495210	19720737	19932722	20176844	20450966

## Epic 2:

The sensor dataset's LastUpdated column was removed. (LastUpdated refers to the time the dataset was updated. Since we're more interested in changes in parking space status, we should use the status timestamp.)

The sensor time was processed and converted to:

Status_Timestamp	year	month	day	hour	timeminute	second	wday	is_weekend
1 2025-03-25T11:09:20+11:00	2025	8	6	21	46	52	Wed	FALSE
2 2025-03-25T10:56:53+11:00	2025	8	6	21	46	50	Wed	FALSE
3 2025-03-25T11:06:47+11:00	2025	8	6	21	46	43	Wed	FALSE
4 2025-03-25T10:16:22+11:00	2025	8	6	21	46	42	Wed	FALSE
5 2025-03-12T17:42:04+11:00	2025	8	6	21	46	40	Wed	FALSE
6 2025-03-25T11:40:57+11:00	2025	8	6	21	46	35	Wed	FALSE
7 2025-01-21T12:37:41+11:00	2025	8	6	21	46	35	Wed	FALSE
8 2025-01-20T21:25:07+11:00	2025	8	6	21	46	33	Wed	FALSE
9 2025-01-20T15:35:08+11:00	2025	8	6	21	46	32	Wed	FALSE
10 2024-08-17T14:23:15+10:00	2025	8	6	21	46	32	Wed	FALSE
11 2024-08-21T10:38:04+10:00	2025	8	6	21	46	29	Wed	FALSE
12 2025-01-15T09:21:10+11:00	2025	8	6	21	46	28	Wed	FALSE
13 2025-04-14T10:32:21+10:00	2025	8	6	21	46	24	Wed	FALSE
14 2025-03-25T15:51:04+11:00	2025	8	6	21	46	21	Wed	FALSE

Merge the sensor and bay datasets using the kerbside ID as the key. Then, further merge the resulting dataset with the street dataset to obtain information about which street and zone each sensor is located in.

It was found that the road segment ID is not unique. The same segment ID can correspond to different zones. Therefore, both the zone and segment ID need to be used together to merge the sensor\_bay dataset with the street dataset.

	ParkingZone	OnStreet	StreetFrom	StreetTo	Segment_ID
	<int>	<chr>	<chr>	<chr>	<int>
1	Z572	Lonsdale Street	Spring Street	Exhibition Street	20001
2	Z570	Lonsdale Street	Spring Street	Exhibition Street	20001
3	Z558	Lonsdale Street	Exhibition Street	Russell Street	20003
4	Z568	Lonsdale Street	Exhibition Street	Russell Street	20003
5	Z556	Lonsdale Street	Exhibition Street	Russell Street	20003
6	Z927	Lonsdale Street	Exhibition Street	Russell Street	20003
7	Z569	Lonsdale Street	Russell Street	Swanston Street	20005
8	Z557	Lonsdale Street	Russell Street	Swanston Street	20005
9	Z554	Lonsdale Street	Elizabeth Street	Queen Street	20009
10	Z553	Lonsdale Street	Elizabeth Street	Queen Street	20009

The parking bay status was converted to 0 or 1 to facilitate machine learning, where 0 represents no car on the sensor and 1 represents a car present.

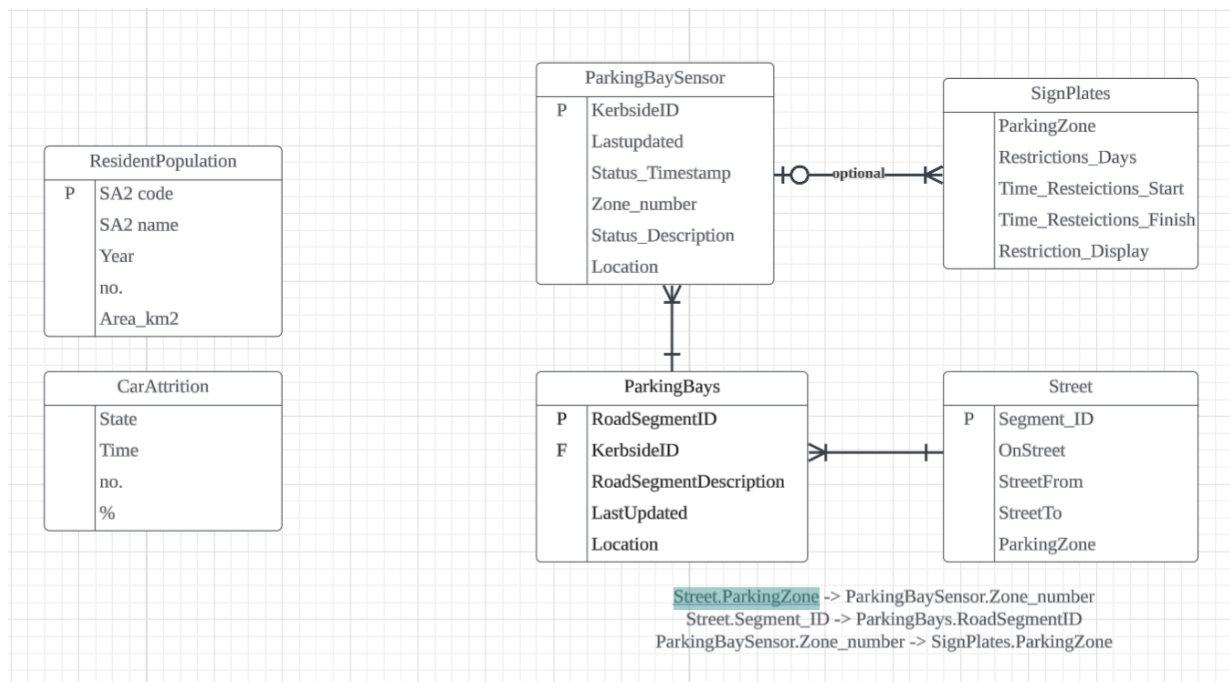
status
0
0
0
0
0
1
1
1
0

The dataset was found to be quite small. August 6 alone accounted for 2,817 records, while only 188 records remained for training. Therefore, data from August 7–9 was additionally downloaded for testing. All data up to and including August 6 was used as the training set. Three files were finally exported:

1. the training set (data up to August 6),
2. the test set for August 7–9 without the status column,
3. the comparison dataset for August 7–9 with the status column included.

## 2.3 Database design

### ERD model



## 2.4 Data Analytics

### 2.4.1 Insights:

- Using data structures of Parking Zone, Bay and Sensor, the available parking spaces and routes to the current street segment are displayed in real time, helping users quickly find the nearest vacant space.

### 2.4.2 Hindsight Insights:

- Vehical & population data: user can identify whether the parking demand for Melbourne cbd is likely to increase, and get a high-level view of infrastructure stress and congestion trends.

### 2.4.3 Foresight Insights:

- The prediction of parking availability for the selected area can help users determine parking locations, improving efficiency and the likelihood of finding a parking space.