

COMPARISON OF BRREO AGAINST THE PROJECT

As part of evidence presented to the Board of Inquiry, the Save the Basin Campaign Incorporated (STBC) and Richard Reid and Associates have presented an alternative option to the Basin Bridge Project (Project) namely the Basin Reserve Roundabout Enhanced Option (BRREO).

Summary

This compares BRREO with the Project and the existing situation. For simplicity the comparison has been based on the 2031 BRREO layout with a three lane approach to Paterson Street.

The comparison has focussed on a number of different elements, including:

- Walking; quantifying the number of crossings for key routes in and around the Basin Reserve as well as the number of lanes that would require crossing;
- Cycling; comparing the existing facilities to those proposed for both the BRREO and Project;
- Bus lanes / priority; comparing the BRREO (with and without bus lanes) to the existing situation;
- Parking;
- Accessibility;
- Cross sections; quantifying what changes are proposed under the BRREO;
- the alignment of the Project to the PTSS;
- A review of the implications for different vehicle journeys including lengths and the different geometry drivers need to follow for the BRREO and Project scenarios;
- Traffic flows;
- Transportation benefits; and
- Journey times.

Wherever possible, the comparison has sought to complete a quantitative assessment to provide direct comparisons between the proposed BRREO and the Project.

SUMMARY	1
1 WALKING	3
2 CYCLING	5
3 BUS LANES	7
4 PARKING	10
5 ACCESSIBILITY	12
6 CROSS SECTIONS	14
7 PT SPINE BRT / LRT	17
8 VEHICLE ROUTES	20
9 TRAFFIC FLOWS	21
10 BENEFITS	30
11 JOURNEY TIMES	32

1 Walking

Six journeys around the Basin Reserve have been identified representing key movement paths in this area. These routes are shown in Figure 1-1 below, and are as per the feasible options assessment¹.

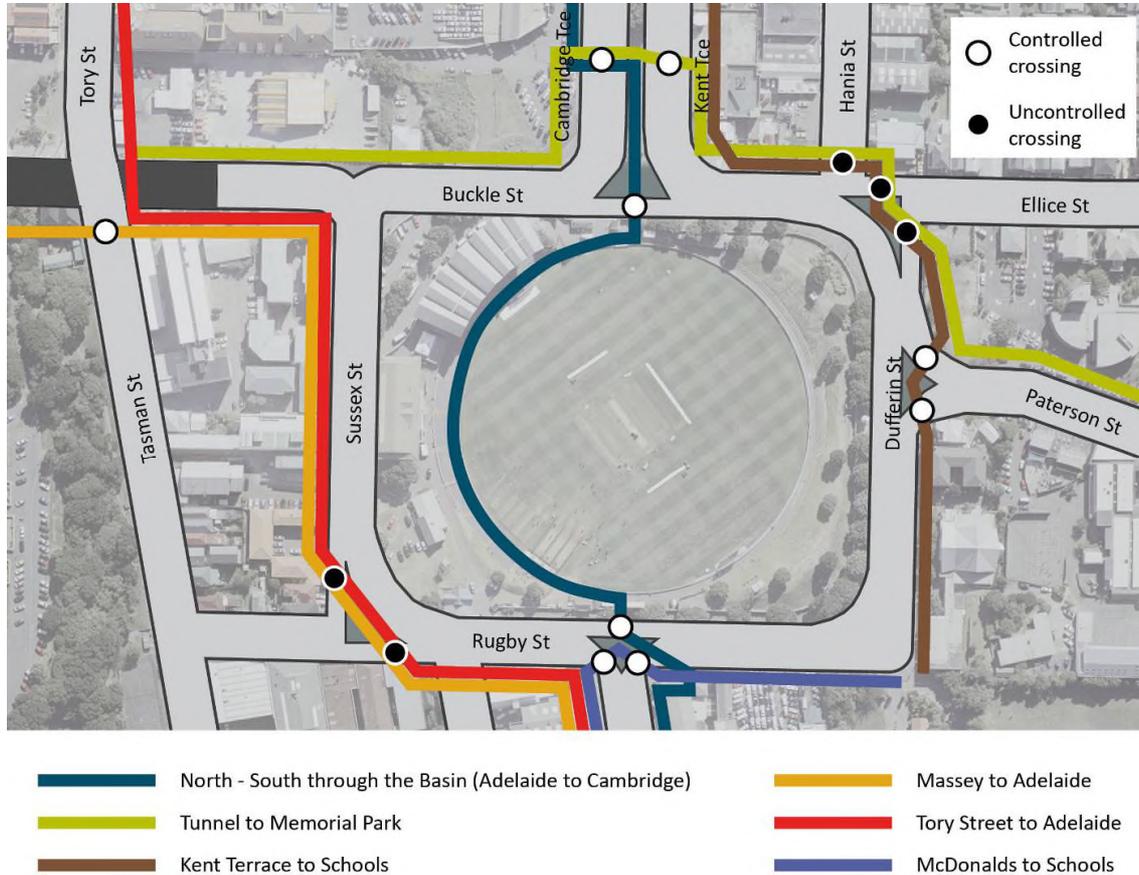


Figure 1-1: Typical Routes in and around the Basin Reserve

An assessment for each of these representative journeys has been made for the existing situation. The assessment looks at the number of controlled crossings, uncontrolled crossings and total crossings. It also quantifies the total number of traffic lanes that are crossed for each of the routes. Table 1 below summarises the assessment of the Existing situation.

Table 1: Assessment of Existing Situation

Crossing type		Controlled crossings	Uncontrolled crossings	Total Crossings	Lanes to cross
1	North - South through the Basin	4	0	4	8
2	Tunnel to Memorial Park	2	3	5	10
3	Kent Terrace to Schools	2	3	5	8
4	Massey to Adelaide	1	2	3	4
5	Tory Street to Adelaide	0	2	2	2
6	McDonalds to Schools	2	0	2	4
Total		11	10	21	36

¹ From the Feasible Options Report

An equivalent assessment of the BRREO (2021) has also been completed and is provided in Table 2. The BRREO layout replaces two uncontrolled crossings with one controlled crossing, which will result in a safer outcome for pedestrians. The total number of lanes to cross however increases by one (on Paterson Street) as compared with current.

Table 2: Assessment of BRREO

Crossing type		Controlled crossings	Uncontrolled crossings	Total Crossings	Lanes to cross
1	North - South through the Basin	4	0	4	8
2	Tunnel to Memorial Park	3	1	4	10
3	Kent Terrace to Schools	3	1	4	9
4	Massey to Adelaide	1	2	3	4
5	Tory Street to Adelaide	0	2	2	2
6	McDonalds to Schools	2	0	2	4
Total		13	6	19	37

The equivalent Project assessment is provided in Table 3 below. As is shown, the Project results in a significant improvement for travel between the Mt Victoria Tunnel and Memorial Park. The total number of lanes to cross is also reduced for three of the routes, with the total number of lanes being crossed reducing by 14 as compared with current.

Table 3: Assessment of the Project

Crossing type		Controlled crossings	Uncontrolled crossings	Total Crossings	Lanes to cross
1	North - South through the Basin	3	1	4	6
2	Tunnel to Memorial Park	0	0	0	0
3	Kent Terrace to Schools	3	1	4	7
4	Massey to Adelaide	1	2	3	4
5	Tory Street to Adelaide	0	2	2	2
6	McDonalds to Schools	2	0	2	4
Total		9	6	15	22

Other pedestrian improvements proposed as part of the Project that are not part of the BRREO include:

- Shifting the pedestrian crossings on Kent and Cambridge Terraces closer to desire lines.
- Replacing the Buckle Street to Ellice Street link road zebra crossing with shared space which is more direct.
- Having only one lane to cross at the turn lane from Sussex Street into Buckle Street (three in the BRREO).

In terms of severance, it is noted the BRREO increases the volume of traffic circulating around the perimeter of the Basin Reserve (refer to Section 9 below) which will further worsen the degree of severance that pedestrians currently encounter in this area. The current high traffic volume restricts access for pedestrians through the area, and also restricts access to the Basin Reserve itself. The BRREO will exacerbate these conditions.

2 Cycling

A similar comparative assessment has also been made for typical cycling journeys. The assessment reviewed the existing facilities and compared these to those within each of the BRREO and Project scenarios.

Within the BRREO layout, on-road cycling will be less safe around the Basin Reserve with the BRREO as its lane widths will generally be 3.2m (if there are no changes to the existing kerb lines). By contrast, the circulating lanes widths provided within the Project are a minimum of 3.5m wide except in the new slow-link connecting Ellice Street to Dufferin Street where a parallel shared walking and cycling facility is to be provided. Because of its function, this link road has been purposefully designed with a narrow width.

With the BRREO layout (either with 3.2m or 3.5m wide lanes) on-road cycling will also be less safe around the Basin Reserve because of its greater volume of circulating traffic. The figures in Section 9 of this report show the differences between the flows. BRREO has more traffic than the do minimum on roads around the Basin Reserve.

Cycling facilities in and around the Basin Reserve are shown in Figure 2-1 below. The BRREO provides no obvious improvement for cyclists in terms of new or upgraded facilities (except for the cycle lanes replacing the median parking on Kent and Cambridge Terraces). In comparison, the Project enables significant improvements for cycle travel across the northern side of the Basin Reserve with two parallel routes being provided between Paterson Street and Buckle Street (one elevated and one at grade).

Existing cycle facilities are shown in pink with no intended change being made in the proposed BRREO layout. The improvements to be made as part of the Project are shown in red. It is noted the BRREO and Project layouts are each capable of providing a shared walking and cycling facility around the eastern side of the Basin Reserve.

Overall:

- the BRREO layout reduces number of road crossings by two but increases the total number of lanes to be crossed by one;
- by comparison, the Project reduces the number of road crossings by six, and reduces the total number of lanes to be crossed by 14.

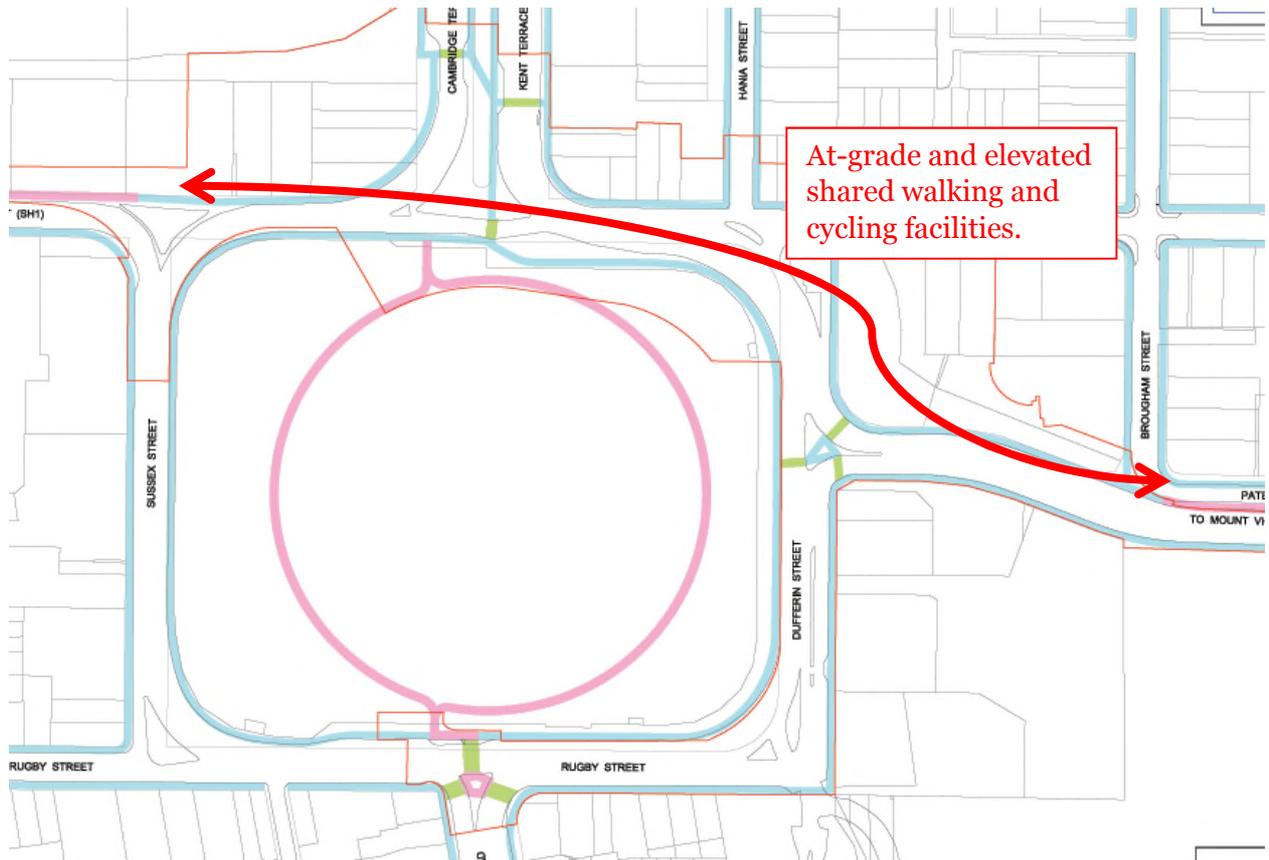


Figure 2-1: Comparison of Cycling Facilities

3 Bus Lanes

Given the Project Objectives and the importance of undertaking a balanced comparative assessment between the BBREO and Project this section shows how BRREO would need to be modified to accommodate Bus Priority. It also describes how BRREO will perform once these changes are made.

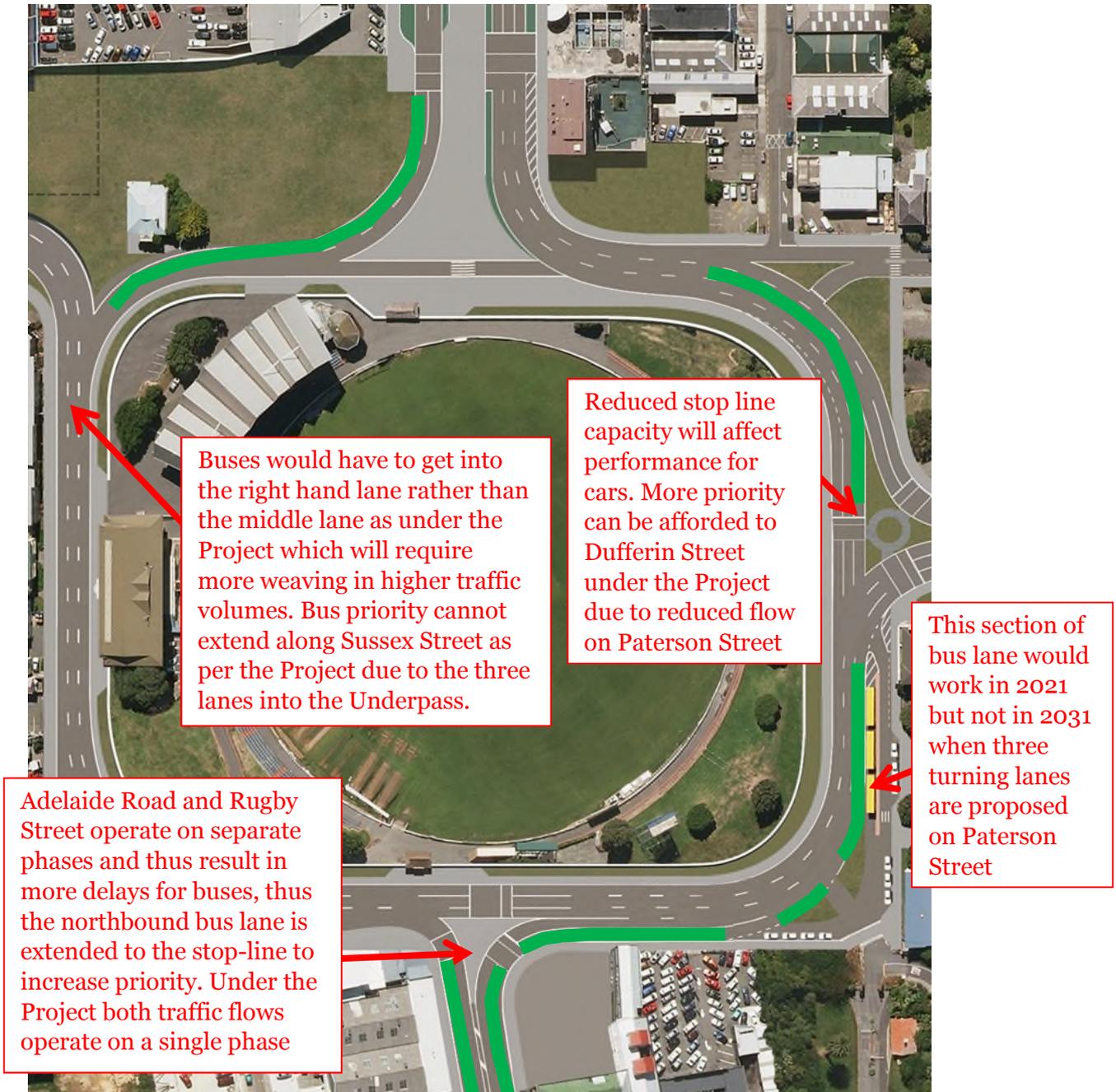


Figure 3-1: BRREO and Bus Priority

Figure 3-2 and Figure 3-3 compare the intersection layouts of the BRREO (with added bus lanes) to the existing layouts.

BRREO Dufferin / Paterson



Existing Dufferin / Paterson



Figure 3-2: Comparison of BRREO (including bus lanes) to Existing at the Paterson Street / Dufferin Street Intersection

The BRREO (including bus lanes) would have much the same capacity for general traffic on the Dufferin Street approach compared with the existing situation. The 2031 layout would provide an additional lane on the Paterson Street approach, however this could not be utilised if a bus lane was provided downstream on Dufferin Street as per the previous page.

BRREO Adelaide / Rugby



Existing Adelaide / Rugby



Figure 3-3: Comparison of BRREO (including bus lanes) to Existing at the Adelaide Road / Rugby Street Intersection

The key differences as a result of the inclusion of these bus priority measures include:

- The fact that more bus lanes around the Basin would be required in order to meet the PT outcomes as a result of significantly higher circulating traffic volumes.
- The inclusion of a bus lane to the traffic signal stop line on the Dufferin Street approach to Paterson Street (noting that this bus lane would need to allow access for those vehicles turning into local access road for St Joseph’s School) and Adelaide Road to Rugby Street.

ANNEXURE B

- A bus lane consistent with that proposed by the Project on the northbound approach from Sussex Street to Cambridge Terrace. Note that bus lanes extending along Sussex Street were considered as part of the Project, however deemed unsafe due to the circulating and merging operation of the roundabout. This situation would be worse for the BRREO and is very unlikely to be acceptable with approximately 1400 more vehicles utilising the link in the AM peak period in 2021 for example.
- The BRREO would have less capacity for general traffic northbound and southbound on Adelaide Road (through the intersection) compared with the existing situation.

The comparison also found that there will be no improvements in traffic efficiency at the two key intersections (Dufferin Street / Paterson Street and Adelaide Road / Rugby Street) when compared to the existing situation. In fact there is likely be degradation at the Adelaide Road / Rugby Street intersection.

Further information on the economic benefits and journey times forecast with and without the bus lanes can be found in the later sections.

4 Parking

A comparison of the differences in parking provision has also been made. Changes to parking required by the BRREO layout are shown in Figure 4-1 below.

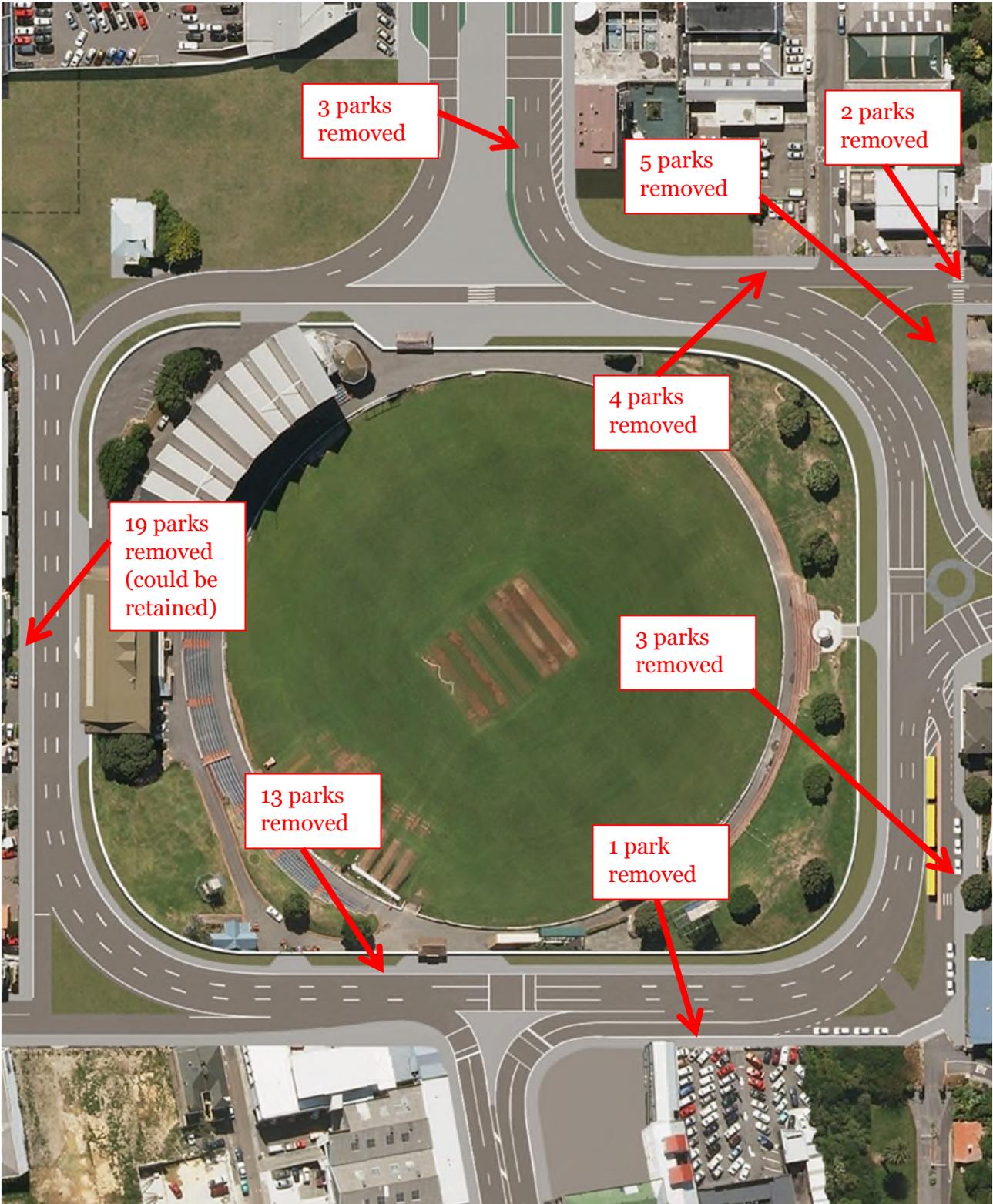


Figure 4-1: Assumed Parking Changes under the BRREO

Note: there has been no consideration of the changes to parking on Kent / Cambridge Terraces due to cycle facilities as these could be implemented by WCC in both the BRREO and Project scenarios.

A comparison of parking provision is summarised in Table 4.

Table 4: Comparison in Parking Changes between the BRREO and the Project

Location	BRREO	Project
Vivian Street	-21	-21
Pirie Street	-5	-5
Cambridge Terrace East	0	+2
Cambridge Terrace West	0	+2
Ellice – Dufferin Corner	-5	-5
Ellice Street West	-4	-4
Ellice Street East	-2	-2
Kent Terrace West	-3	0
Sussex Street West	-19	0
Rugby Street North	-13	0
Rugby Street South	-1	0
TOTAL	-52	-12
TOTAL + Peak Hour Loss	-73	-33

The comparison shows that the BRREO requires the removal of 52 car parks compared with 12 under the Project. Some of these could potentially be retained.

5 Accessibility

The key changes to accessibility are associated with changes to the Ellice Street / Dufferin Street / Hania Street intersections. This location is shown in Figure 5-1. Comparison of the associated changes to accessibility are summarised in Table 5.

This comparison shows the BRREO layout to be more restrictive than the Project, with all southbound traffic on Hania Street only being able to access Ellice Street.

Table 5: Comparison of Accessibility between the BRREO and the Project

Movement	Existing	BRREO	Project
Hania to Dufferin	Yes	No	Yes
Hania to SH1	Yes	No	Yes
Hania to Ellice	Yes	Yes	Yes
Ellice to Dufferin	Yes	Yes	Yes
Ellice to SH1	Yes	Yes	Yes
Ellice to Hania	Yes	No	No
Regional Wines & Spirits to Hania	Yes	Yes	Yes
Regional Wines & Spirits to Ellice	Yes	Yes	Yes
Regional Wines & Spirits to Dufferin	Yes	Yes	Yes
Regional Wines & Spirits to SH1	Yes	Yes	Yes



Figure 5-1: Proposed Layout of Hania and Ellice Street under the BRREO

In addition, the greater volume of traffic circulating around the southern side of the Basin Reserve required by the BRREO layout compared to that with the Project, will reduce accessibility to

ANNEXURE B

businesses around the perimeter of the Basin Reserve (refer to the Section 9 which shows the volume differences).

6 Cross Sections

The changes to cross-sections and lane widths required by the BRREO layout compared to the existing situation are summarised in Figure 6-1.

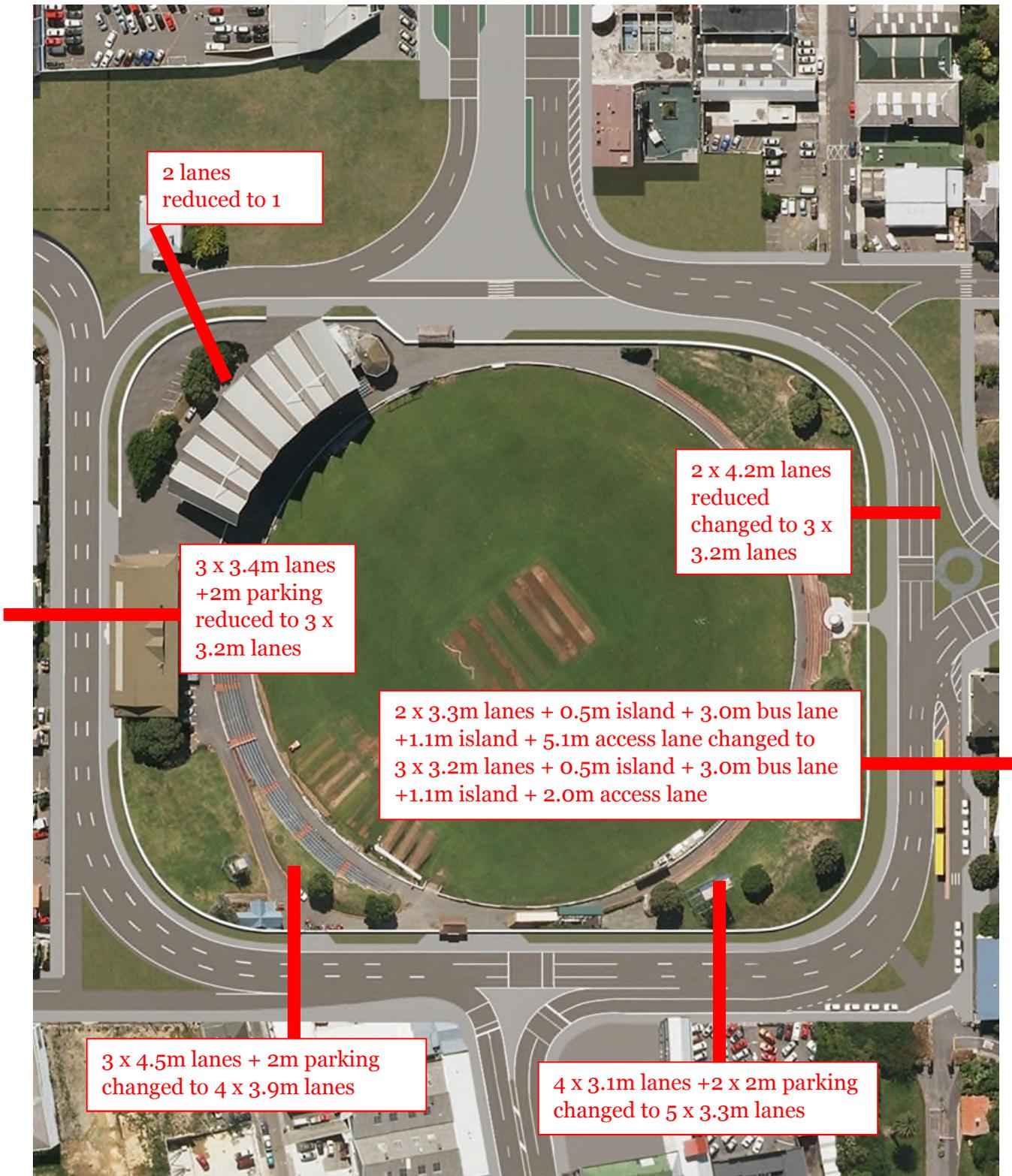


Figure 6-1: BRREO Cross Sections

A comparison of lane widths between the existing situation and with the BRREO and Project layouts are summarised in Table 6. Lane widths of BRREO were measured in AutoCAD by overlaying the drawing of BRREO on an ortho-rectified aerial and are indicative only.

Table 6: Comparison of Lane Widths (m)

Movement	Existing	BRREO	Project
Rugby Street East	3.1	3.3	3.5
Rugby Street West	4.5	3.9	4.5
Sussex Street	3.4	3.2	3.4
Buckle Street East	4.5	8.3	4.5
Dufferin Street North	4.2	3.2	3.5
Dufferin Street South	3.3	3.2	3.5

The lane widths required by the BRREO layout on Sussex Street and Dufferin Street are narrower than is provided at present. These are also less than the 3.5m standard width required for Principal/Arterial Roads by the Wellington City Council Code of Practice for Land Development (WCC CPFLD), 2012 (Table 1).

Where 3.2m lanes are proposed around curve radii of 30-50m (as exists at the Basin Reserve), an additional 0.6-0.75m of lane width should be provided to allow for safe turning². The BRREO appears to have allowed for this additional width.

Assuming the existing island widths outside St Marks School would need to be retained for student safety, the BRREO layout would reduce the available width of the bus access lane to 2m which would not meet the required minimum width. The minimum width required for a service lane is 3.0m³.

Further to the above comparison, a drawing as in Figure 6-2 was prepared to understand the property impacts of the BRREO layout as described in the Mr Richard Reid's evidence but assuming 3.5m lanes would be required to match usual road design standards. It has also been assumed that the inner kerb-line around the Basin Reserve would remain unchanged.

The key points from this assessment are:

- Some property impacts can be avoided (south west corner of Basin and southern edge of Dufferin Street) by utilising the existing carriageway.
- Property impacts on southern Rugby Street and eastern Dufferin Street are unavoidable given the proposed layout of lanes.
- It is noted the 2031 layout for Paterson Street shown for the BRREO layout has significant property impacts extending beyond that anticipated by either the Project or the current Duplication Scheme. The severity of these impacts could be reduced by better utilising the existing carriageway.
- The vehicle link from Sussex Street to Tasman/Tory Streets proposed as part of the National War Memorial Park project would probably not be feasible under the BRREO layout for safety reasons.

² Number has been interpolated from Table 11 of the WCC CPFLD, 2012

³ Table 1 WCC CPFLD, 2012

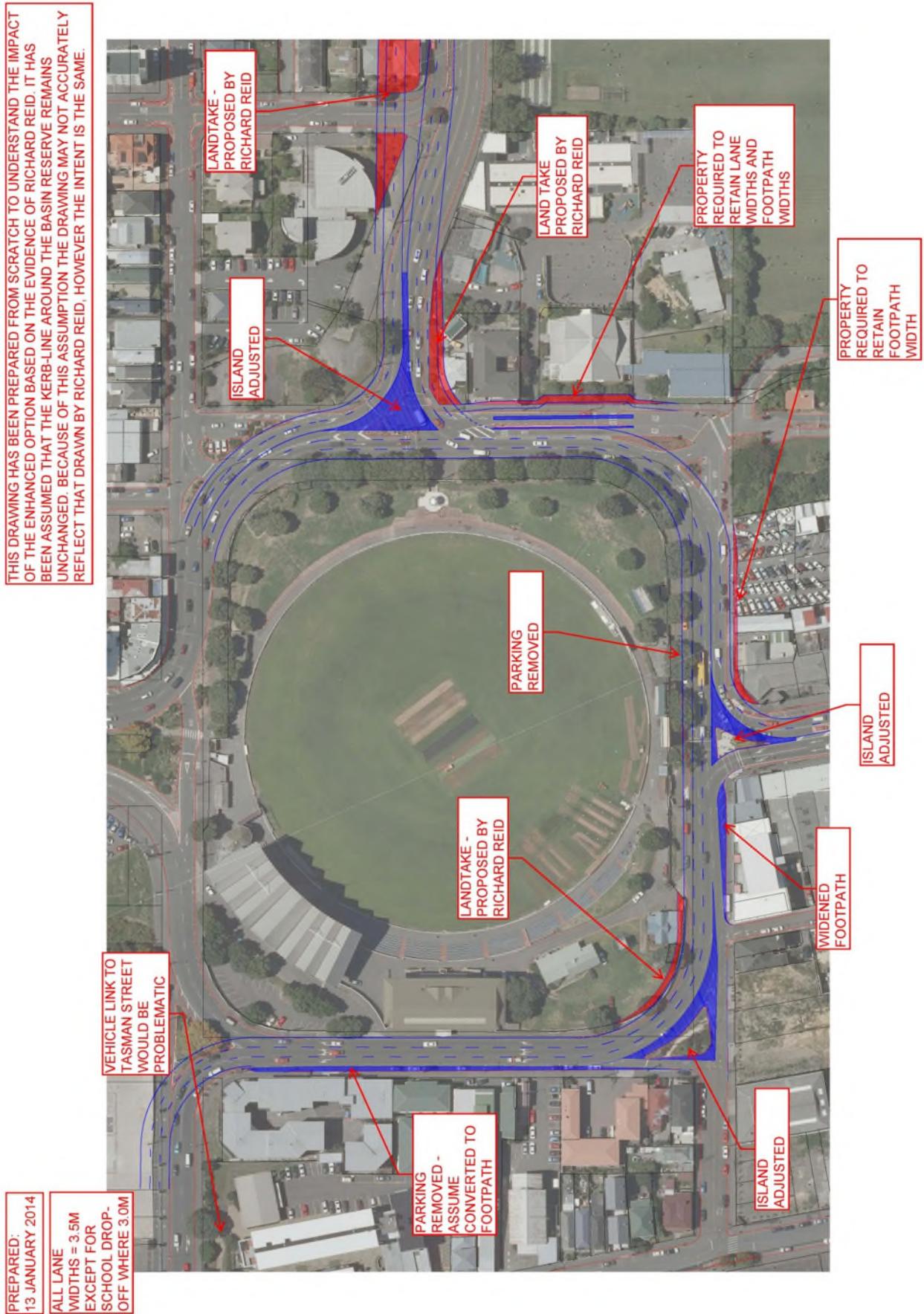


Figure 6-2: Property Impact of BRREO (including 3.5m lanes and acceptable service lane widths)

7 PT Spine BRT / LRT

An assessment has been undertaken to show the path a BRT (Bus Rapid Transit) vehicle would be required to follow in travelling around the Basin Reserve within the allocated lanes. This movement (tracking) is shown in Figure 7-1 (based on information provided by GWRC). Traffic volumes for 2021 that would be circulating with the BRT vehicle have also been included on Figure 7-1 for each of the Do- Minimum, BRREO, and Project scenarios.

As is shown, the BRT tracking encroaches into adjacent lanes to a similar degree for both the BRREO and Project scenarios. In several locations the BRT vehicle requires the use of two lanes to get around some curves. Where lane changing is required, the BRT vehicle would cross all lanes.

Because of the comparatively tight curvatures required in circulating around the Basin Reserve; a BRT or LRT vehicle will necessarily be operating at approximately 10km/h. In order for lane changes to be undertaken safely, other traffic would need to be held back which will in turn have a significant impact on the ability for the roundabout to operate effectively. The higher the circulating volume, the greater such an impact will be on the effective operation of traffic around the Basin.

Figure 7-1 shows the 2021 AM peak flows (Project and BRREO). The key point to note is that even in 2021 (without the Tunnel Duplication flows), the BRREO flows are significantly greater than will occur with the Project in place, which means that implementation of either BRT or LRT with the BRREO layout will have a considerably greater adverse effect on other traffic.

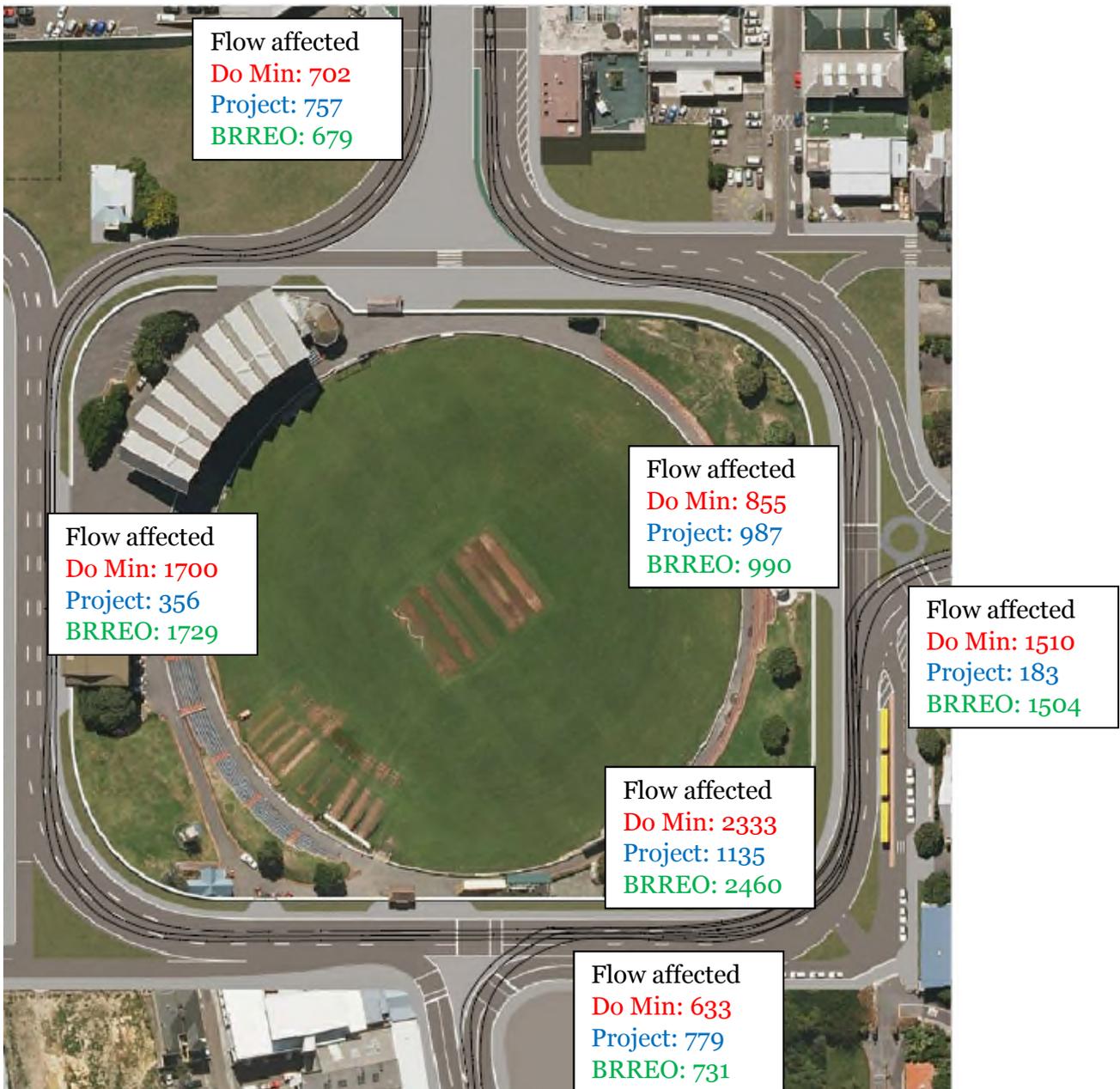


Figure 7-1: BRT Tracking Overlay with 2021 AM Peak Flows

Expanding on the above, the following seeks to highlight the key issue regarding the operation of BRT or LRT through the Basin Reserve. For simplicity, it has been assumed that BRT / LRT can reach the Dufferin Street or Paterson Street stop lines without encroaching on the adjacent lanes (some kerb changes may be required to achieve this).

When a BRT or LRT vehicle reaches the stop line the following will be required:

- All general traffic will need to be stopped at the Dufferin Street / Paterson Street intersection to allow time for any traffic between there and the Adelaide Road / Rugby Street intersection to clear.
- Green signal provided solely to BRT / LRT to provide total priority and safety for the vehicle to get through the Adelaide Road / Rugby Street intersection before other traffic can interact with the BRT / LRT vehicle.

The indicative delay to general traffic stopped at the Dufferin Street / Paterson Street intersection will be 59 seconds every time a BRT / LRT vehicle comes through. This is based on the following assumptions.

ANNEXURE B

- Distance between intersections = 230m
- BRT / LRT speed = 10km/h (82 second travel time)
- Other vehicle speed = 30 km /h (28 second travel time)
- The queue clears faster than BRT / LRT can travel.
- Five second follow-up gap required.
- $59 \text{ sec} = 82 \text{ sec} - 28 \text{ sec} + 5 \text{ sec}.$

Assuming that BRT / LRT peak services occur at 5 minute intervals, this equates to approximately 12 minutes of delay every hour equivalent to 20% of the priority at the intersection being allocated to BRT / LRT movements.

The amount of traffic per hour that potentially suffers this delay varies significantly between the options as described below for 2021 (and 2031)⁴:

- AM Peak Do Minimum = 2365 vehicles (3091)
- AM Peak Project = 1170 vehicles (1448)
- AM Peak BRREO = 2494 vehicles (3408)

The key point to note are that under the Project less than half of the volume of traffic will be affected when compared to the do-minimum and BRREO layouts. Also of importance is that all of the extra traffic volume being impacted in the do-minimum and BRREO is the strategic SH1 traffic (which is separated onto the Bridge in the Project). As well as the strategic traffic being separated from this delay under the Project the reduced traffic volumes in the Project mean that the intersections will cope better with being less efficient.

It should be noted that this indicative assessment has focussed on the delays incurred at the Dufferin Street / Paterson Street intersection. Additional delays will also occur at the Adelaide Road / Rugby Street intersection for vehicles and non-motorised users where Adelaide Road northbound would be stopped to allow traffic to clear from Rugby Street so as to allow the BRT / LRT total priority. The Project will fare markedly better (than the do-minimum and BRREO) in this scenario, as traffic on Rugby Street and Adelaide Road northbound can operate concurrently.

In addition when such a BRT / LRT vehicle travels northbound on Adelaide Road, then similar delays to those identified above will be encountered at the Adelaide Road / Rugby Street intersection. As above, the strategic SH1 traffic and higher traffic volumes will be affected under the do-minimum and BRREO with reduced volumes. There would be no strategic traffic affected with the Project in place.

⁴ These numbers from the figures in Section 9 and include the traffic on both approaches to the Dufferin and Patterson Street intersection.

8 Vehicle Routes

A range of different vehicle routes has been similarly compared to quantify changes in route length, geometry (vertical and horizontal), and the different controls that the routes would pass through.

SH1 Westbound (Brougham Street to Buckle Street)

The Table 7 below describes the key differences for the above route.

Table 7: Key Differences for Paterson to Tory Street (Brougham Street to Buckle Street)

Criteria	BRREO	Project
Length	645m	455m
Vertical Change	17.8m	6.3m
Minimum Horizontal curve radii	26m	75m
Controls	Two signalised intersections	None

SH1 Eastbound (Kent Terrace to Brougham Street)

The Table 8 below describes the key differences for the above route.

Table 8: Key Differences for Kent Terrace to Paterson Street (Brougham Street)

Criteria	BRREO	Project
Length	270m	265m
Vertical Change	Same	
Minimum Horizontal curve radii (excluding Kent to Ellice corner)	24m	55m
Controls	Same	

Local Road northbound (Adelaide Road to Cambridge Terrace)

There are no key differences for the above route.

Local Road southbound (Kent Terrace to Adelaide Road)

There are no key differences for the above route.

Buses northbound (Adelaide Road to Cambridge Terrace)

The Table 9 below describes the key differences for the above route.

Table 9: Key Differences for Northbound Buses (Adelaide Road to Cambridge Terrace)

Criteria	BRREO	Project
Length of bus lane	0m	140m

Buses southbound (Kent Terrace to Adelaide Road)

The Table 10 below describes the key differences for the above route.

Table 10: Key Differences for Southbound Buses (Kent Terrace to Adelaide Road)

Criteria	BRREO	Project
Length of bus lane	0m	200m

9 Traffic Flows

Traffic volumes have been extracted from the 2011 WTM model with the assumptions as listed in Table 11.

Table 11: Summary of Modelling Assumptions

Assumption		2021 Do Min	2021 Project	2021 BRREO	2031 Do Min	2031 Project	2031 BRREO
Local Road Improvements	Bus Lanes: Courtenay Place (All Peaks)						
	Kent, Cambridge Terraces and Adelaide Road (AM and PM Peak only),	✓	✓	✓	✓	✓	✓
	30Km/h speed zone Tory/Tasman and Cuba Streets	✓	✓	✓	✓	✓	✓
NZTA Improvements	Buckle Street Underpass	✓	✓	✓	✓	✓	✓
	Inner City Bypass Optimisation (moderate intervention) WB to Terrace Tunnel, EB to Tory Street)	✓	✓	✓	✓	✓	✓
	Aotea Quay to Ngauranga Gorge (8 laning)	✓	✓	✓	✓	✓	✓
	MacKays to Peka Peka*	✓	✓	✓	✓	✓	✓
	Peka Peka to Otaki*	✓	✓	✓	✓	✓	✓
	Airport to Mount Victoria	X	X	X	✓	✓	✓
	Basin Reserve / BRREO	X	✓	✓	X	✓	✓
	Terrace Tunnel Duplication	X	X	X	✓	✓	✓
	Transmission Gully*	X	X	X	✓	✓	✓
	North of Otaki to Levin* ⁵	X	X	X	✓	✓	✓
Petone to Grenada link*	X	X	X	✓	✓	✓	

*These Projects have been included in the WTSM modelling but are located outside of the WTM SATURN and Wellington S-Paramics model areas. It is important to note that other projects geographically remote from the Basin Reserve have negligible impact on the assessment

⁵ At the time modelling was completed the North of Otaki to Levin was assumed to be a four lane expressway. It has since been announced that the upgrade of this section of SH1 will be in the form of safety and capacity improvements at various intersections and links. Regardless the distance from the location of this Project means that assumptions in this respect will be of negligible consequence for this assessment.

Figure 9-1 below shows the Annual Average Daily Traffic (AADT) traffic flows in 2021.

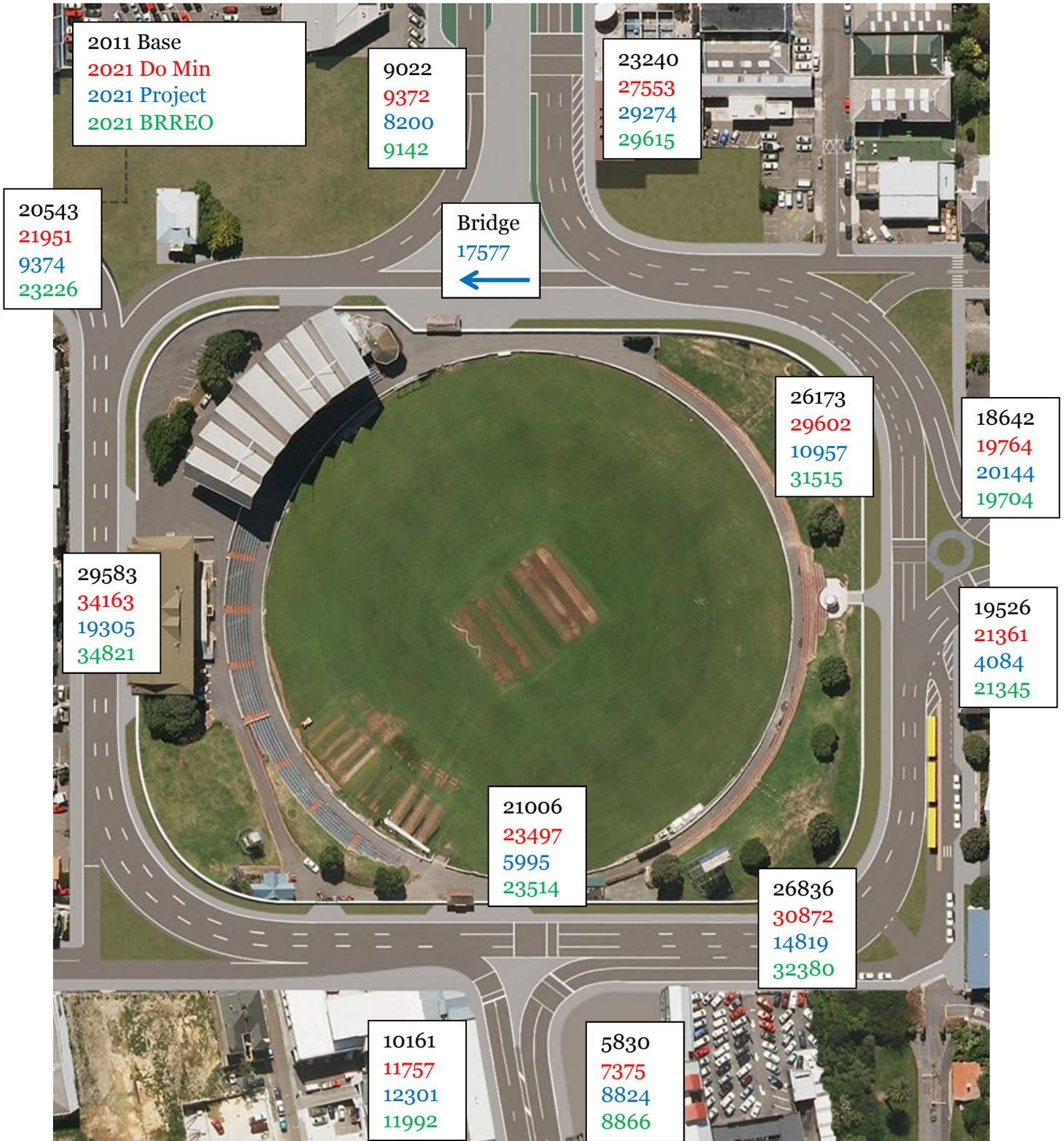


Figure 9-1: 2021 AADT Comparison

Figure 9-2 below shows the AADT traffic flows in 2031.

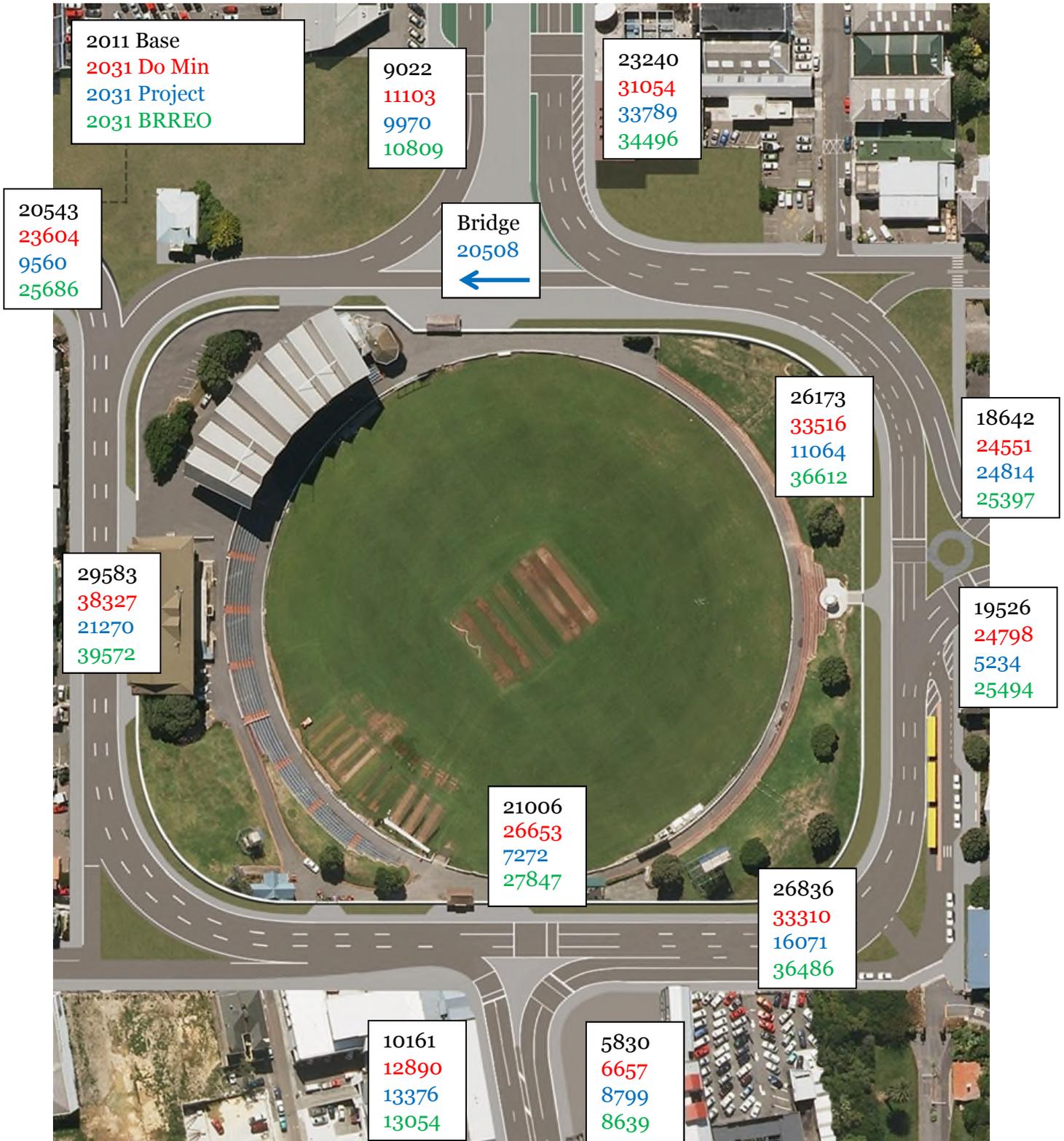


Figure 9-2: 2031 AADT Comparison

Figure 9-3 below shows the AM Peak traffic flows in 2021.

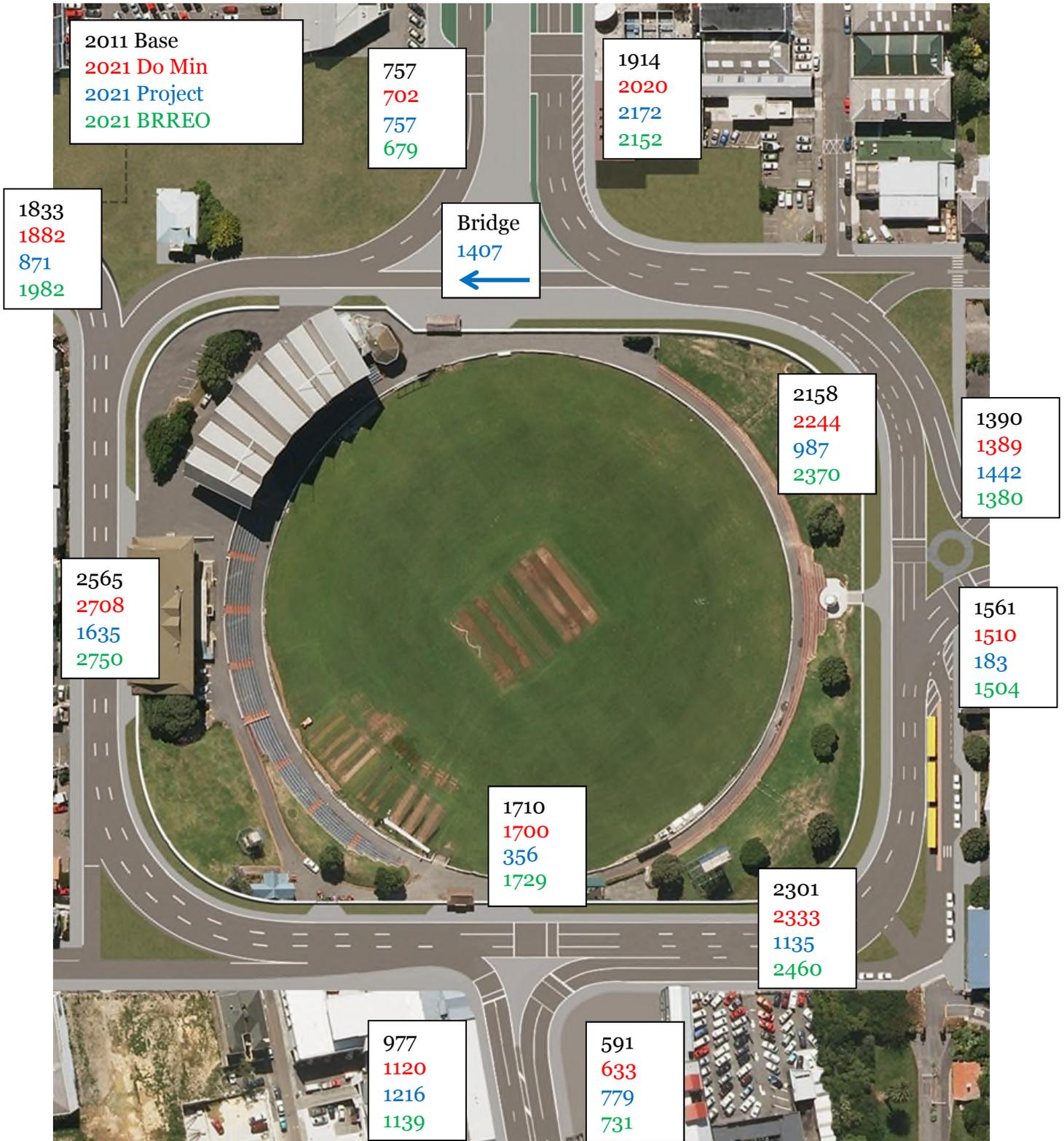


Figure 9-3: 2021 AM Peak Flow Comparison

Figure 9-4 below shows the AM Peak traffic flows in 2031.

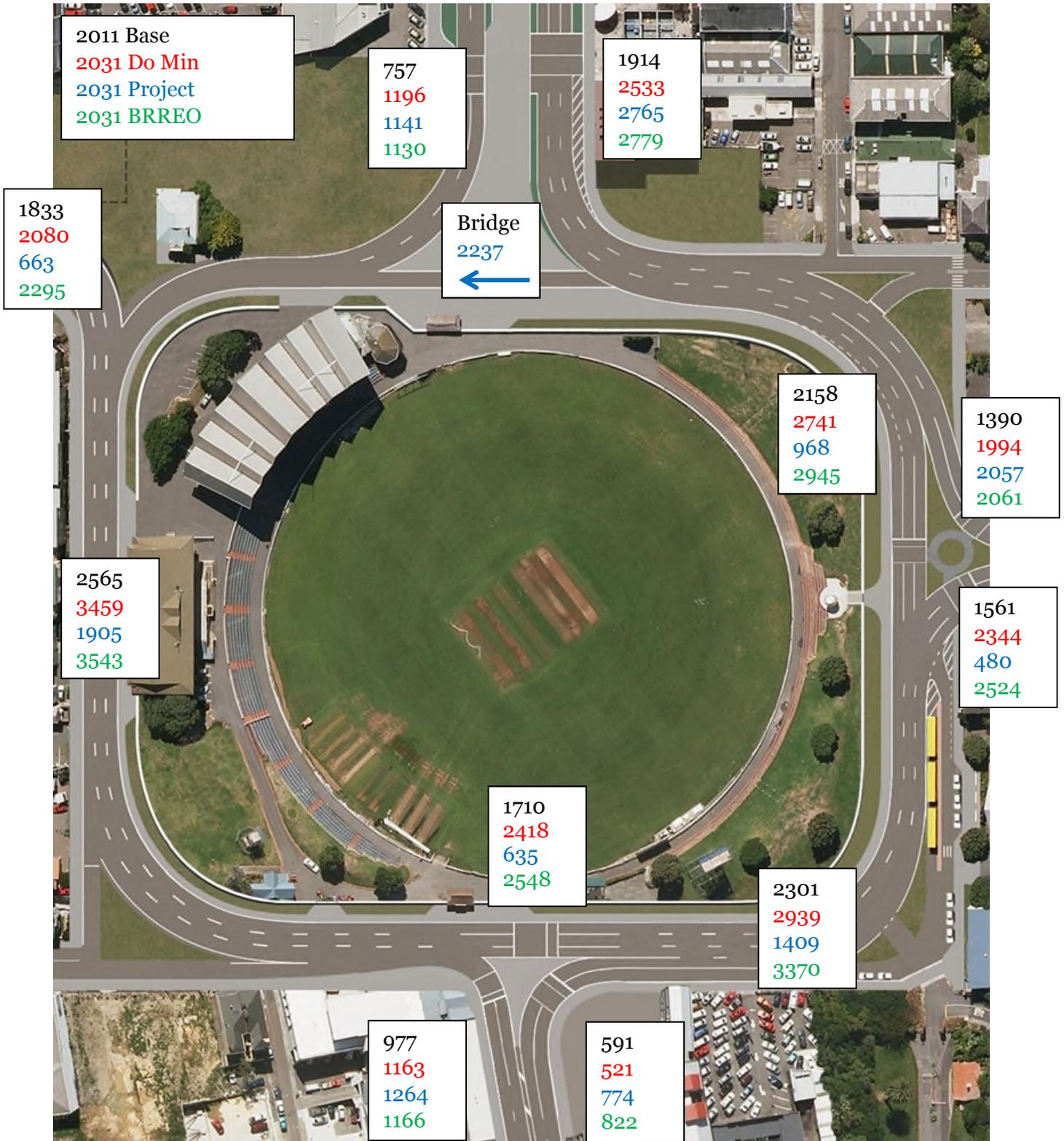


Figure 9-4: 2031 AM Peak Flow Comparison

Figure 9-5 below shows the Interpeak traffic flows in 2021.

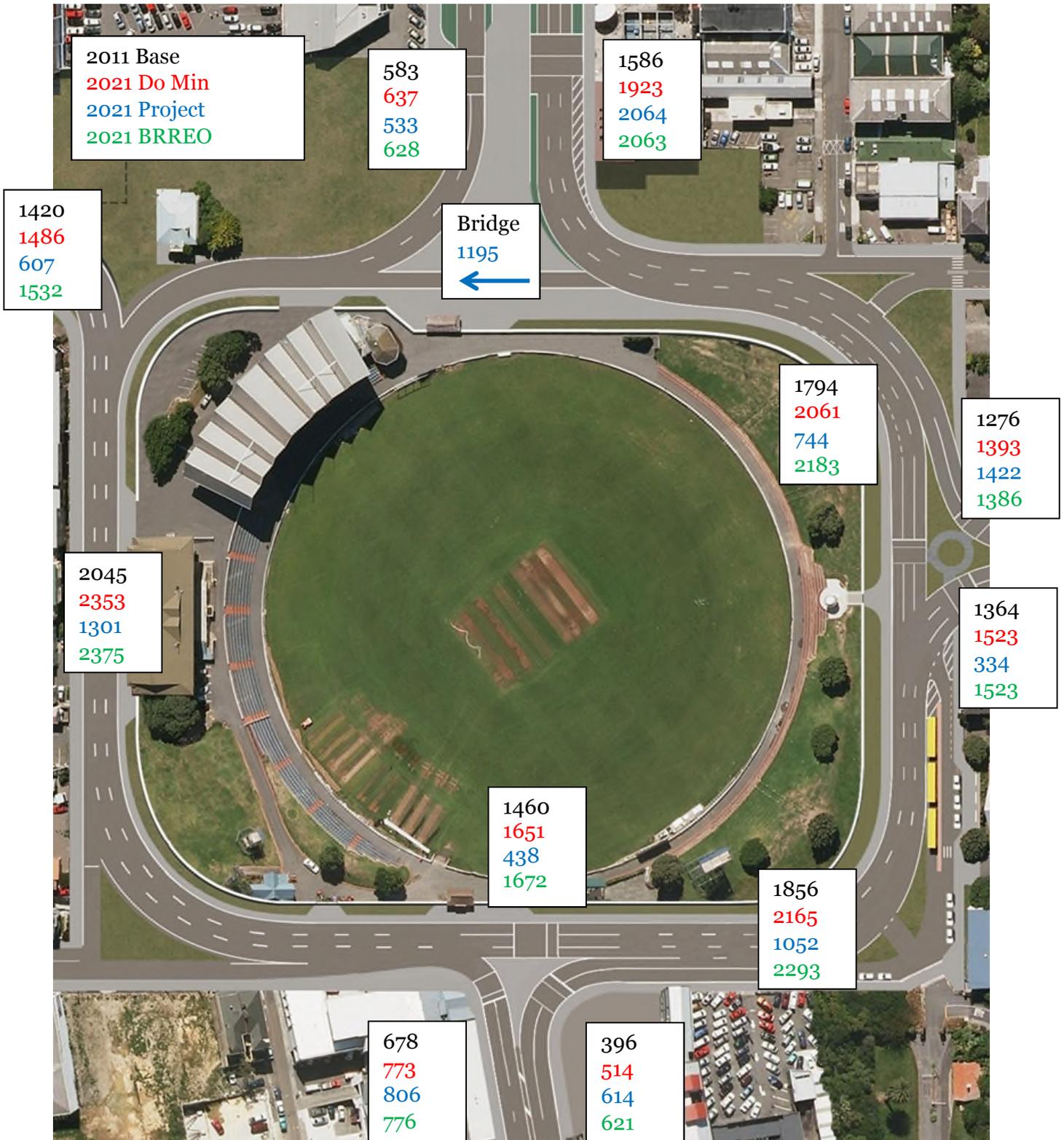


Figure 9-5: 2021 IP Peak Flow Comparison

Figure 9-6 below shows the Interpeak traffic flows in 2031.

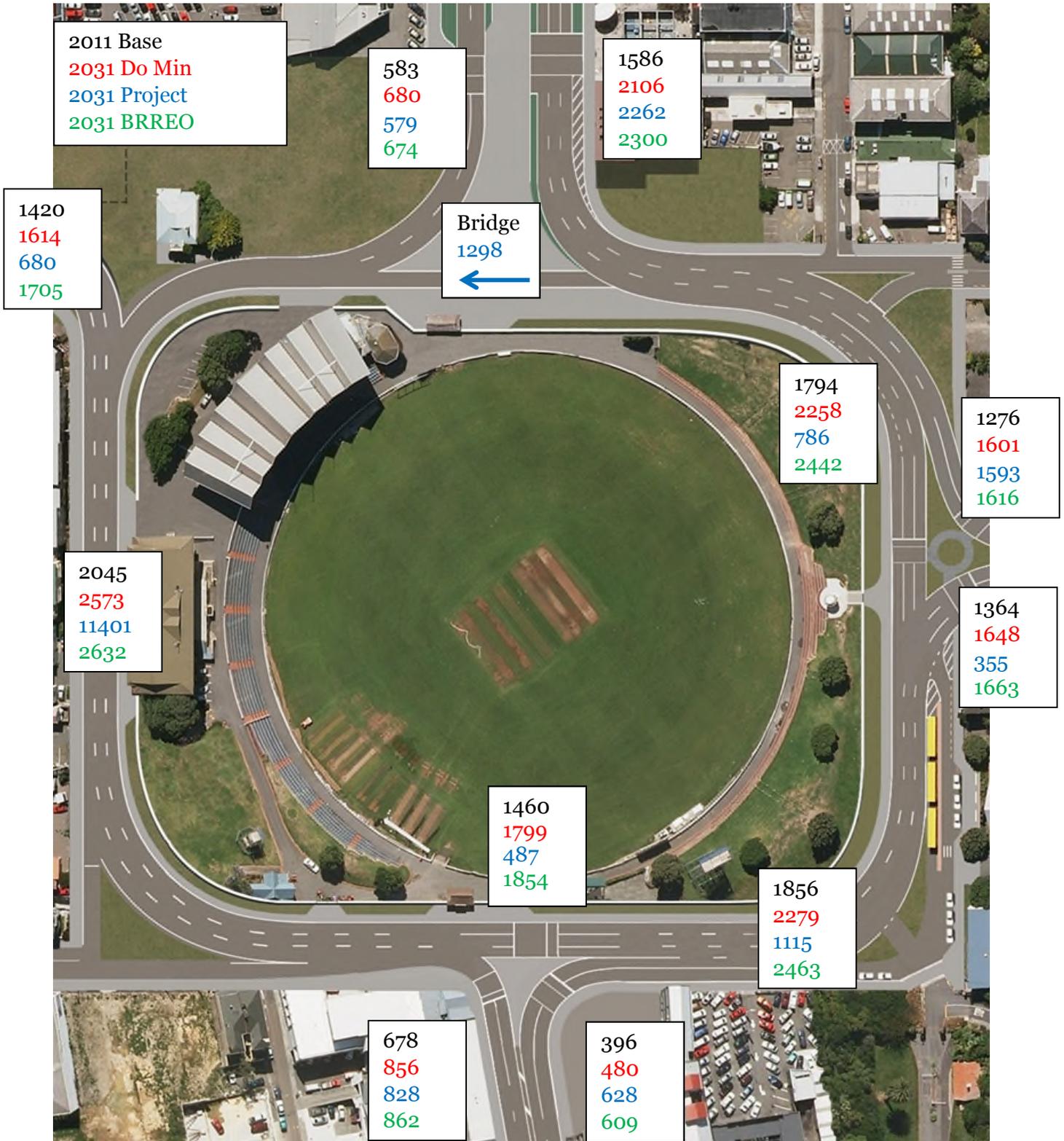


Figure 9-6: 2031 IP Peak Flow Comparison

Figure 9-7 below shows the PM peak traffic flows in 2021.

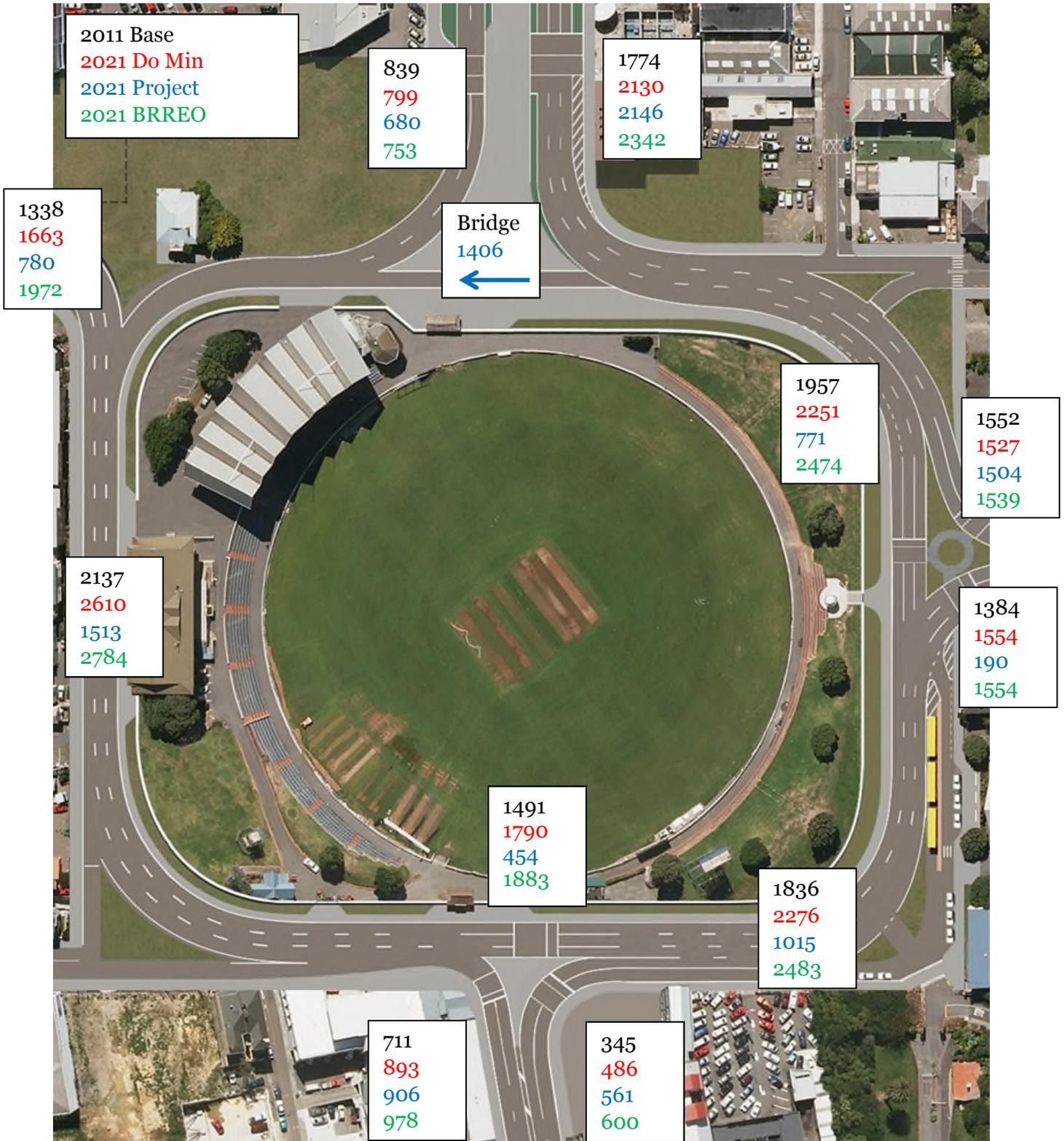


Figure 9-7: 2021 PM Peak Flow Comparison

Figure 9-8 below shows the PM peak traffic flows in 2031.

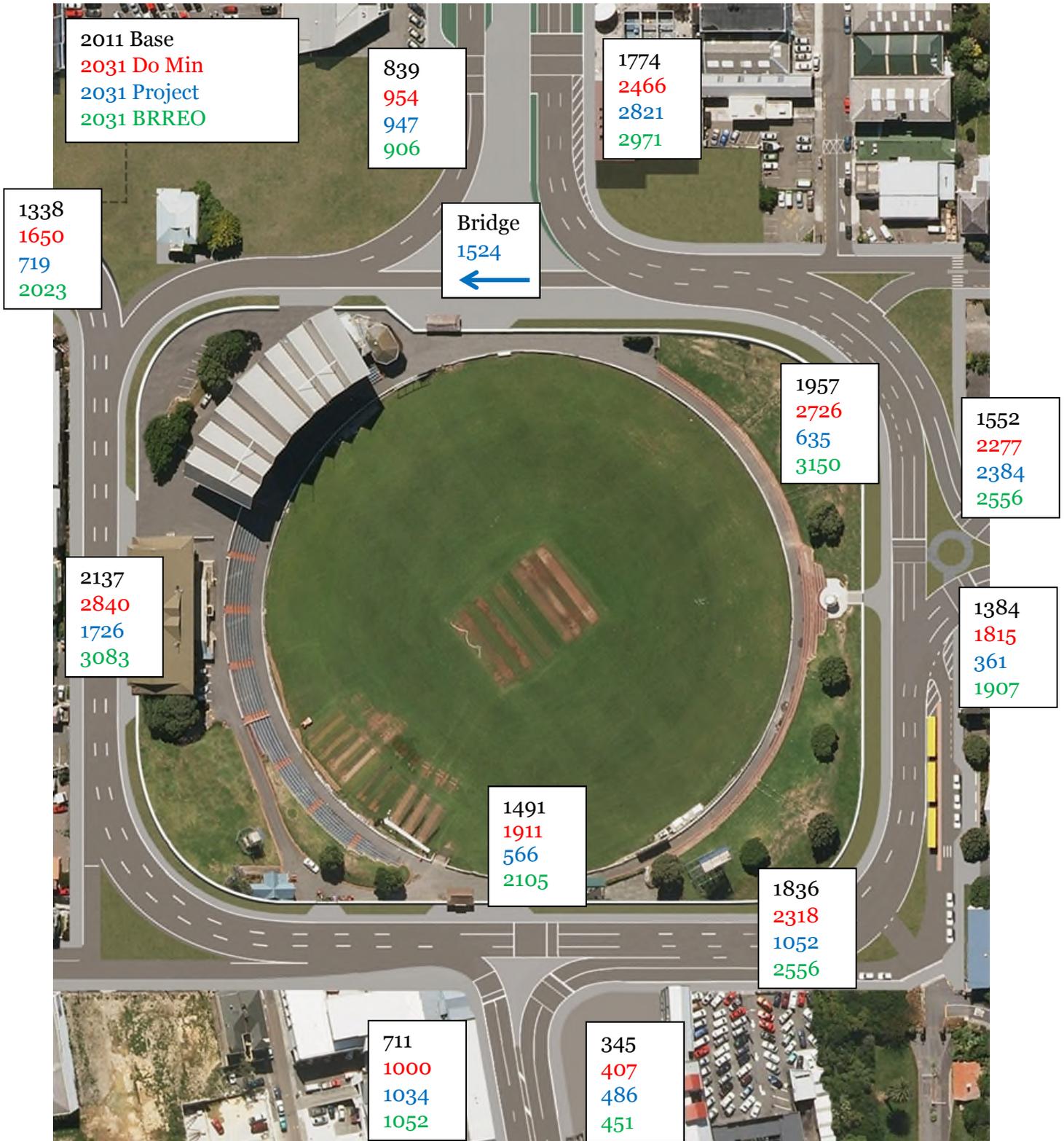


Figure 9-8: 2031 PM Peak Flow Comparison

10 Benefits

A comparative summary of the traffic operation benefits (compared with the do-minimum) for the Project and for the BRREO layout are provided in Table 12 and Table 13 below.

It should be noted that the tables below do not include crash, passenger transport, pedestrian & cyclist or reliability benefits that have been previously calculated for the Project. These other benefits have not been calculated for the BRREO, but I expect that the BRREO would not provide the same level of benefits as the project and could have negative benefits for the reasons described in the preceding sections.

The summaries provide the total package benefits for both the Project and BRREO as well as isolating the benefits associated solely with the improvements in the vicinity of the Basin Reserve (excluding the improvements to the Vivian Street / Pirie Street and Taranaki Street / Buckle Street Intersections).

Table 12 shows the breakdown of benefits for the Project.

Table 12: Benefit Summary for the Project

Benefits	Bridge Only	Vivian & Taranaki Improvements⁶	Total Benefits
Travel Time Benefits	\$61,620,000	\$40,650,000	\$102,270,000
CRV	\$21,020,000	\$7,760,000	\$28,780,000
Vehicle Operating Benefits	\$13,300,000	\$1,520,000	\$14,820,000
Carbon Dioxide Benefits	\$530,000	\$60,000	\$590,000
Total Tangible Benefits	\$96,470,000	\$50,000,000	\$146,470,000
Total Annual Benefits 2021	\$5,510,000	\$500,000	\$6,010,000
Total Annual Benefits 2031	\$8,380,000	\$5,020,000	\$13,400,000
Change in Annual Benefits (2031 – 2021)	\$2,870,000	\$4,520,000	\$7,390,000

Table 13 shows the breakdown of benefits for the BRREO.

Table 13: Benefit Summary for the BRREO

Benefits	BRREO Only	Vivian & Taranaki Improvements	Total Benefits
Travel Time Benefits	\$28,120,000	\$40,650,000	\$68,780,000
CRV	\$8,530,000	\$7,760,000	\$16,290,000
Vehicle Operating Benefits	\$2,160,000	\$1,520,000	\$3,680,000

⁶ The Taranaki Street improvements include the third lane through the National War Memorial Park Underpass and is achieved because of the bridge as described in Mr Blackmore's evidence.

ANNEXURE B

Carbon Dioxide Benefits	\$90,000	\$60,000	\$150,000
Total Tangible Benefits	\$38,900,000	\$50,000,000	\$88,900,000
Total Annual Benefits 2021	\$820,000	\$500,000	\$1,320,000
Total Annual Benefits 2031	\$3,780,000	\$5,020,000	\$8,800,000
Change in Annual Benefits (2031 – 2021)	\$2,960,000	\$4,520,000	\$7,490,000

This comparison shows that the Project (\$96M) has over twice the amount of total tangible benefits when compared to the BRREO (\$39M). The main reason for this is that the Bridge provides six times the benefits per annum of BRREO in 2021. In 2031, the benefits associated with the additional traffic demands increase the benefits for both the BRREO and Project by about the same amount.

Table 14 shows the breakdown of benefits for the BRREO only with two different bus lane schemes implemented. The comparison shows that when the bus lanes are included the benefits reduced from \$39M to \$32 – \$10M compared with \$96M for the Project.

Table 14: Benefit Summary for the BRREO (excluding Taranaki & Vivian improvements)

Benefits	BRREO Only (no bus lanes)	BRREO Only (bus lanes, except Adelaide Road NB)	BRREO Only (all bus lanes – as per section 3)
Travel Time Benefits	\$28,120,000	\$22,940,000	\$5,350,000
CRV	\$8,530,000	\$6,990,000	\$2,780,000
Vehicle Operating Benefits	\$2,160,000	\$1,780,000	\$1,970,000
Carbon Dioxide Benefits	\$90,000	\$70,000	\$80,000
Total Tangible Benefits	\$38,900,000	\$31,780,000	\$10,170,000
Total Annual Benefits 2021	\$820,000	\$540,000	-\$180,000
Total Annual Benefits 2031	\$3,780,000	\$3,130,000	\$1,090,000
Change in Annual Benefits (2031 – 2021)	\$2,960,000	\$2,590,000	\$1,270,000

Note that the assessed benefits during the periods where the bus lanes are actually operating are negative, and the positive overall benefits are due to the weekend and interpeak periods where the bus lanes are not operational.

11 Journey Times

The following table provides comparative journey times from the AM Peak 2021 PARAMICS model for key north-south and east-west routes (as used in TR4).

The analysis shows that both the Project and the BRREO show significant journey time savings over the Do-Minimum scenario. However significant portions of these savings are from the implementation of the improvements to the Vivian Street / Pirie Street and Taranaki Street / Buckle Street Intersections. As these improvements are common to both the Project and BRREO, the savings from these improvements can be ignored for comparison purposes. These improvements provide significant savings when compared to the do-minimum for the SH1 routes (6 minutes westbound and 44 seconds eastbound), although the local road northbound (Adelaide Road to Cambridge Terrace suffers) with additional delays of up to one minute.

Looking solely at the improvements around the Basin Reserve the bridge provides twice the savings compared to the BRREO on the northbound and southbound bus routes and northbound local road route. The difference in travel time savings for the southbound local road route (Kent Terrace to Adelaide Road) is lower. For SH1 westbound the bridge provides savings of 90 seconds compared to virtually nil for the BRREO. As a comparison, the Peka Peka to Otaki project I was recently involved in was granted draft approval through the Board of Inquiry process and provided almost two minutes (108 seconds) of travel time savings over an approximately 13km stretch.

Both the BRREO and the Bridge result in an increased journey time of around 20 seconds for SH1 eastbound on their own. Both provide improvements over the do minimum when considered as part of a package (improvements to the Vivian Street / Pirie Street and Taranaki Street / Buckle Street Intersections).

The inclusion of bus lanes in the BRREO scheme provides improved journey times for buses (although still less than the Project); however this comes at the expense of the local road journey times where journey times increase by almost two minutes in the northbound direction.

These results should also be considered in relation to changes in traffic demands (e.g. a journey time saving with additional traffic demand represents an even greater improvement than that which would be achieved through the use of a fixed matrix approach or a very small model cordon). It should also be noted that these results have only been assessed for the 2021 year with traffic demands that do not include the effects of the tunnel duplication projects (particularly Mt Victoria) which has a significant impact on traffic demand and journey times as demonstrated in sections 9 and 10 above.

ANNEXURE B

Table 15: AM PARAMICS journey time change from Do-minimum (seconds) at 2021

Route (as per TR4)	Do Minimum	Journey time changes from do-minimum (negative is an improvement)			
		Vivian & Taranaki Improvements	BRREO (Paterson to Tory)	BREEO with Bus Lanes (Paterson to Tory)	Project (Paterson to Tory)
SH1 Eastbound (Terrace Off-ramp to Goa Street)	468	-44	21	69	22
SH1 Westbound (Goa Street to Boulcott Street On-ramp)	841	-360	-2	-8	-91
Local Road Southbound (Courtenay Place to Hospital Road)	238	-1	-26	-19	-36
Local Road Northbound (Hospital Road to Courtenay Place)	305	58	-80	35	-176
Bus Route Southbound (Pedestrian Crossing to Girton Terrace)	144	-10	-18	-28	-48
Bus Route Northbound (Douglas Street to Pedestrian Crossing)	132	-7	-11	-16	-32