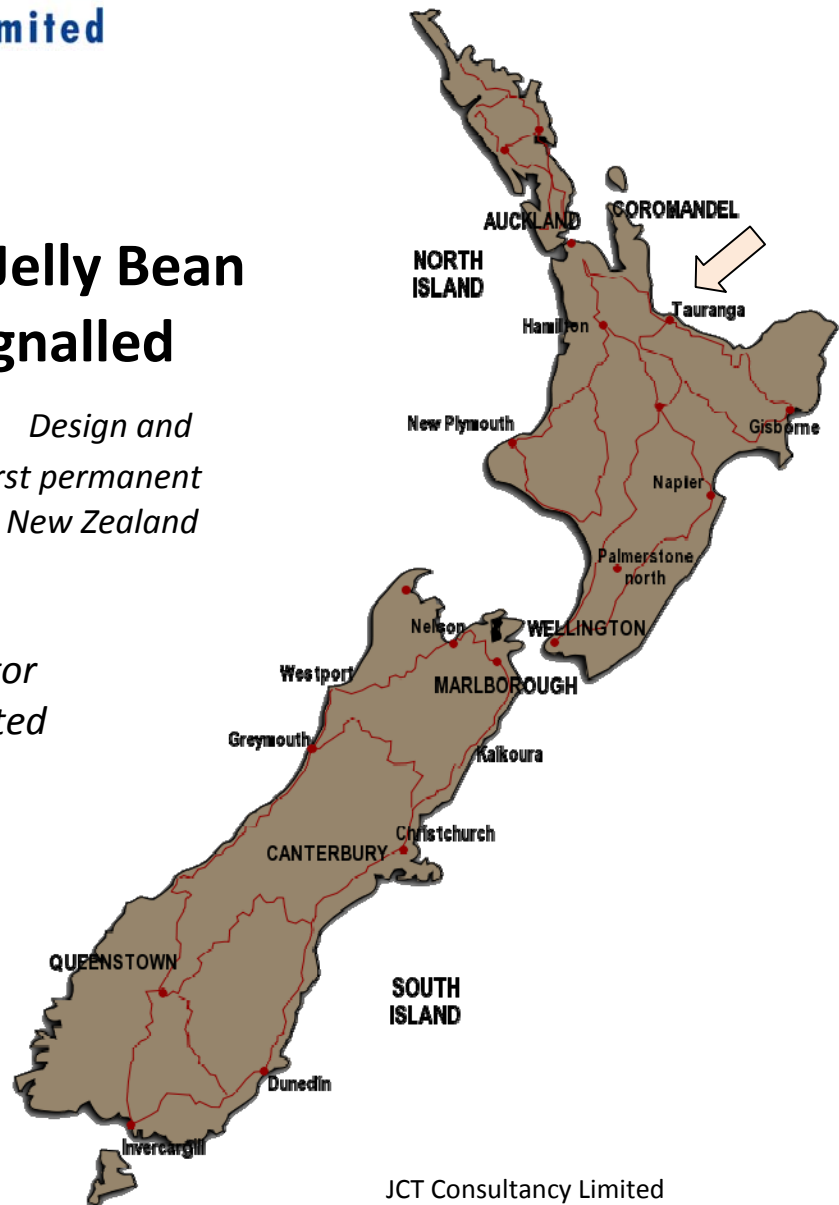


Kiwis Call it a Jelly Bean We Call it a Signalled Roundabout!

Design and implementation of the first permanent signalled roundabouts in New Zealand

by
*Barbara Chard, Director
JCT Consultancy Limited*



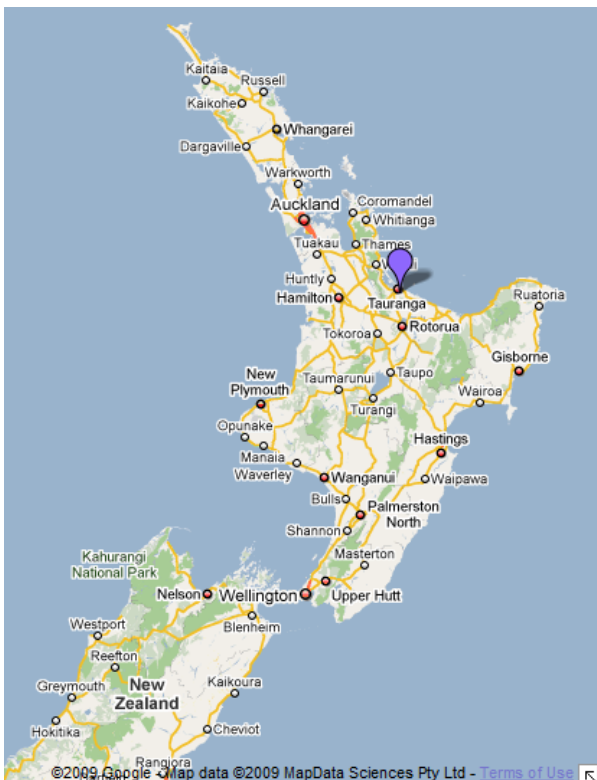
JCT Consultancy Limited
LinSig House
Deepdale Enterprise Park
Deepdale Lane, Nettleham
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Email: barbara.chard@jctconsultancy.co.uk

BACKGROUND

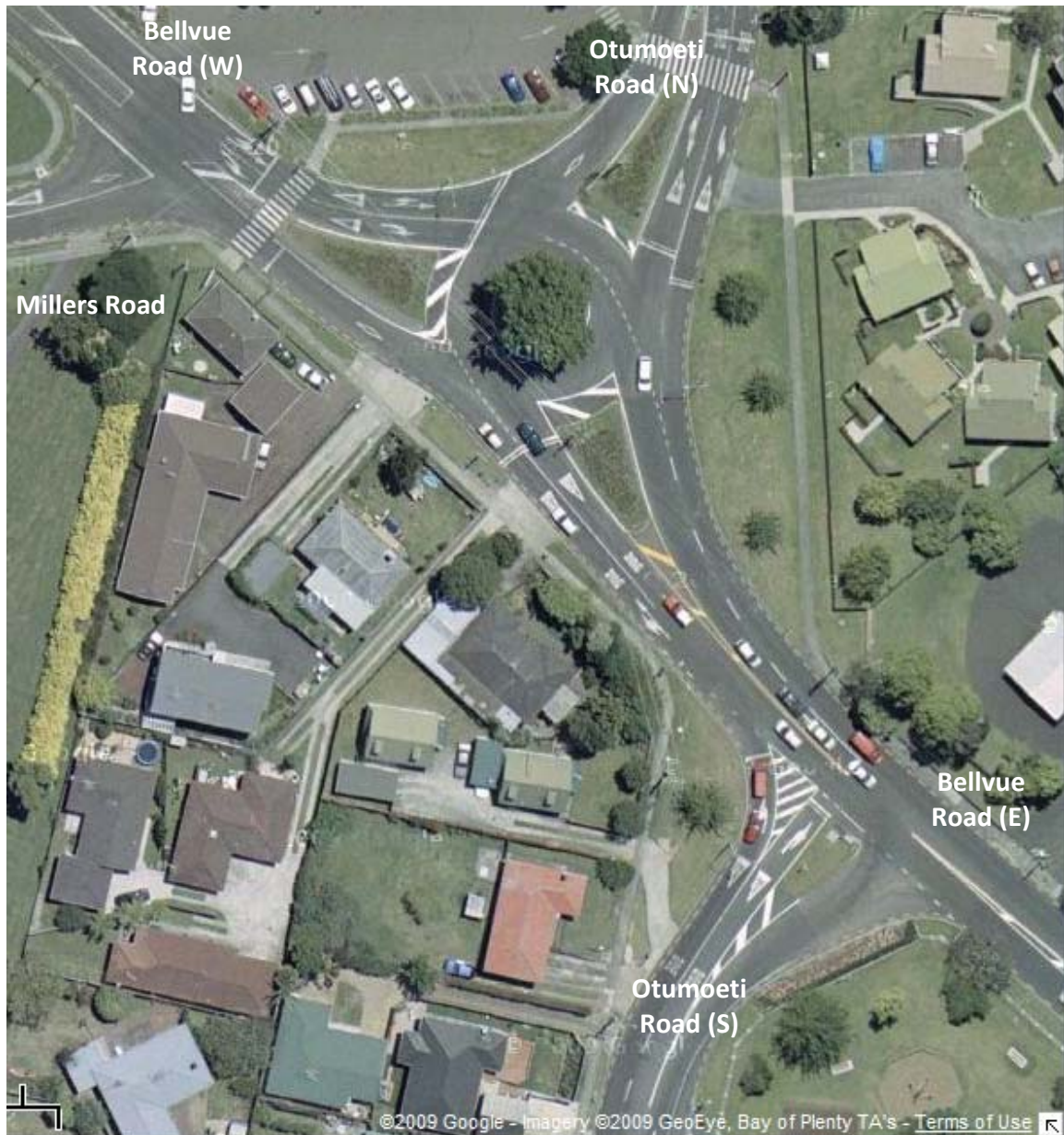
Several years ago, the author was approached by South Lanarkshire Council to review three adjacent roundabouts on the East Kilbride Corridor south of Glasgow and assess their suitability for signal control and linking. A success story followed with signal controlled designs produced and implemented in record time for Whirlies, Mavor and Nerston. Mavor roundabout, at 48m inscribed diameter was, and still is, one of the smallest roundabouts in the UK to be signal controlled by the author (ref: *'Doing it Backwards: An innovative Signal Control solution for a very small roundabout in East Kilbride: JCT Traffic Symposium, Nottingham, September 2005*). The South Lanarkshire officer responsible for commissioning this work emigrated to NZ shortly afterwards, taking up a post with the New Zealand Transport Agency (NZTA), in the city of Tauranga, North Island. His first instruction was to seek more affordable solutions for the highly congested Welcome Bay Corridor, and, lucky me, NZTA requested that I travel over to Tauranga, examine the problem, and suggest whether signalled roundabouts could offer a less expensive solution than the already proposed grade separation at Maungatapu and a tunnel solution at Welcome Bay.

The original Welcome Bay Roundabout had only a 36m inscribed diameter and a closely associated Tee junction sited only 40m distance from the roundabout on the Welcome Bay Road approach.



At the time, i.e. November 2006, there were no signal controlled roundabouts, and therefore no experience of signal controlled roundabouts, in NZ.

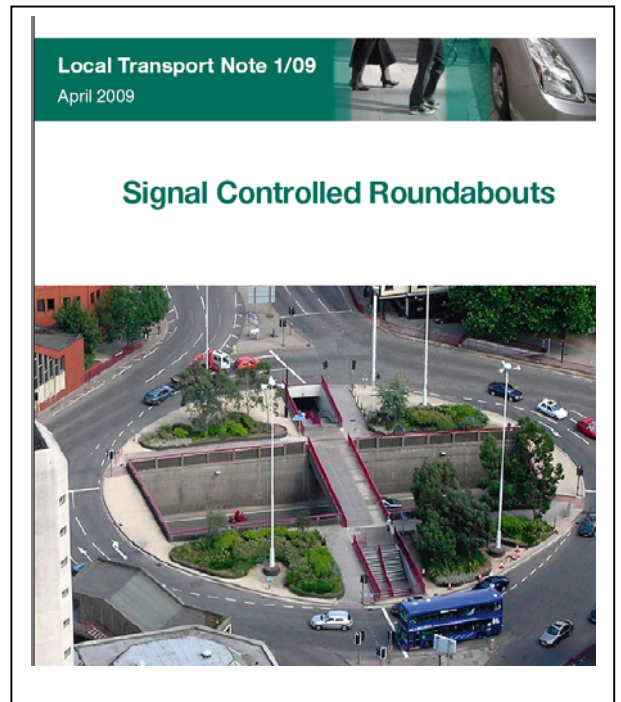
The subsequent success of implementing the first two permanent signalled roundabouts at Welcome Bay and Maungatapu, both of which were designed, built and commissioned in under two years, led to a further invitation to JCT, this time by Tauranga City Council, to resolve a serious congestion problem at Brookfield intersection (see below).



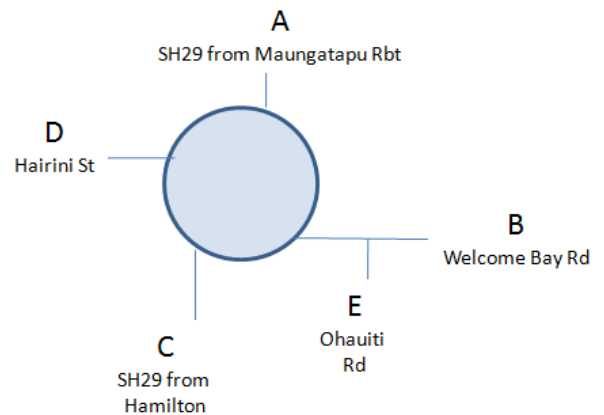
Our solution, which we thought of as a 'dumb-bell' or 'bone-about', was immediately nicknamed the 'peanut' by NZ engineers. However, following its successful implementation in April of this year, the press gave it the nickname 'Jelly Bean', and 'Jelly Bean', it has been ever since! All three signal controlled designs were produced using the JCT LinSig software. Welcome Bay and Maungatapu roundabouts were switched on for the first time on the 17th and 22nd December 2008, respectively. The Brookfield Jelly Bean was commissioned the week before Easter and switched on for the first time on Thursday 2nd April 2009. No one was quite brave enough to switch on something called the Jelly Bean on April Fool's Day!

Tyco Traffic controllers were used at all three sites. These have an excellent history running the SCATS (*Sydney Co-Ordinated Adaptive Traffic System*) responsive traffic control systems throughout many major cities in the world, but presented an interesting challenge for NZ Signal Control specialist Ross Thompson to get them to mimic what for most of us here in the UK are simple CLF time-of-day plans.

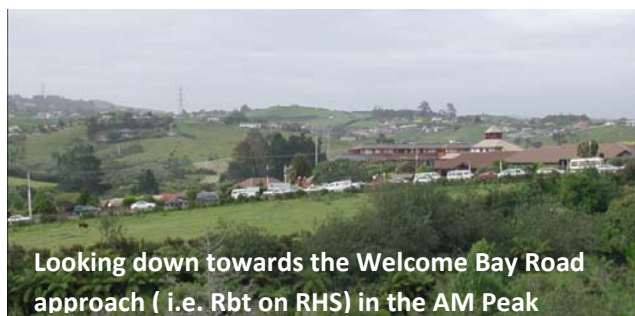
This presentation describes the successful application of the now formally recognised signalled roundabout design methodology (*reference Department for Transport Local Transport Note 1/09 Signal Controlled Roundabouts*) at Welcome Bay, Maungatapu and Brookfield. The interesting challenge each presented both prior to, at and post- implementation is also discussed.



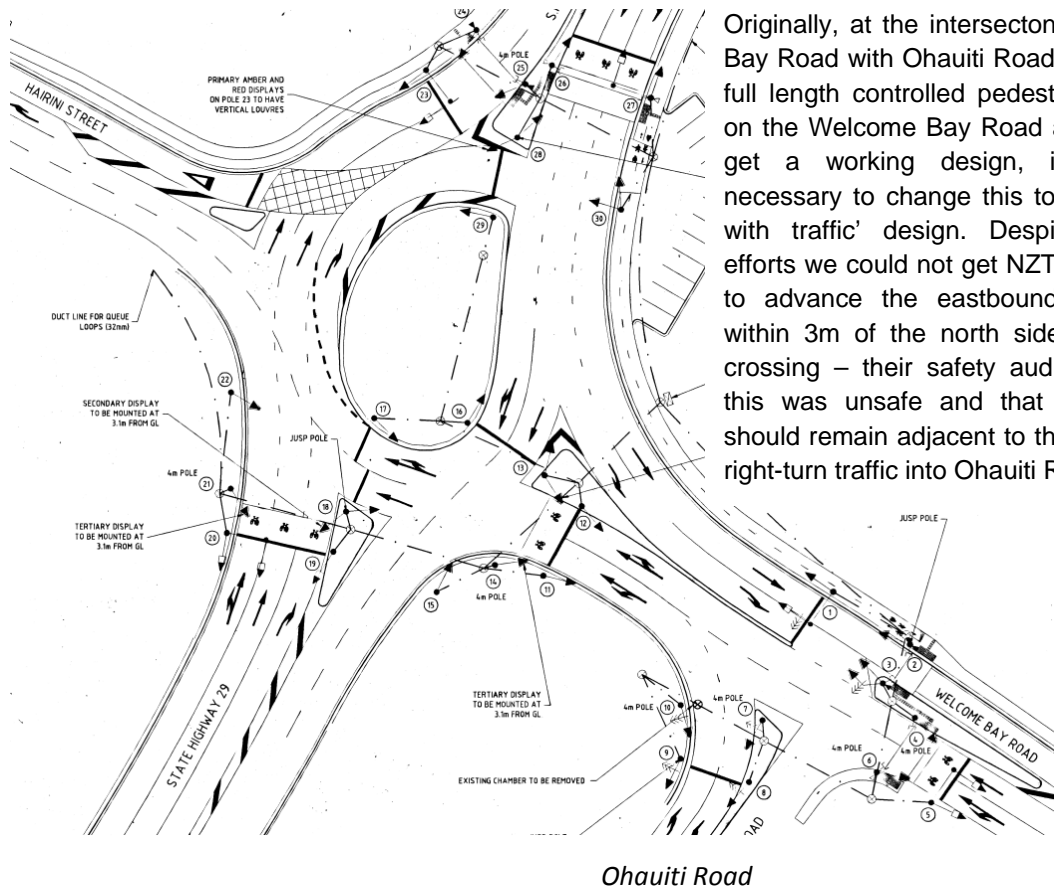
Welcome Bay Roundabout



Pre signal Performance: Regular and severe congestion occurred on the Welcome Bay approach (Arm B) in the AM peak period and on the northern SH29 approach (Arm A) in the pm peak. The latter regularly led to block-back to the Maungatapu roundabout, causing serious congestion in the PM peak there also.



Derivation of a 'working' design: Lane/Flow analyses were used to determine a 'best' working layout. At 36m inscribed diameter, it was obvious from the start that the current 'size' of the roundabout would have to increase. Land within the highway boundary was available to the north and south, and a little to the west, but was severely constrained in the north-east, and eastern sections by the presence of a Maori graveyard and Garden centre. The answer was to 'elongate' and reduce the width of the central island, flare to three lanes on the north and south approaches, and increase the west and east gyratory sections to three lanes. The nearside lane on the northern approach and eastern gyratory was designated a dedicated left-turn lane Welcome Bay. Hairini St was left as giveway.

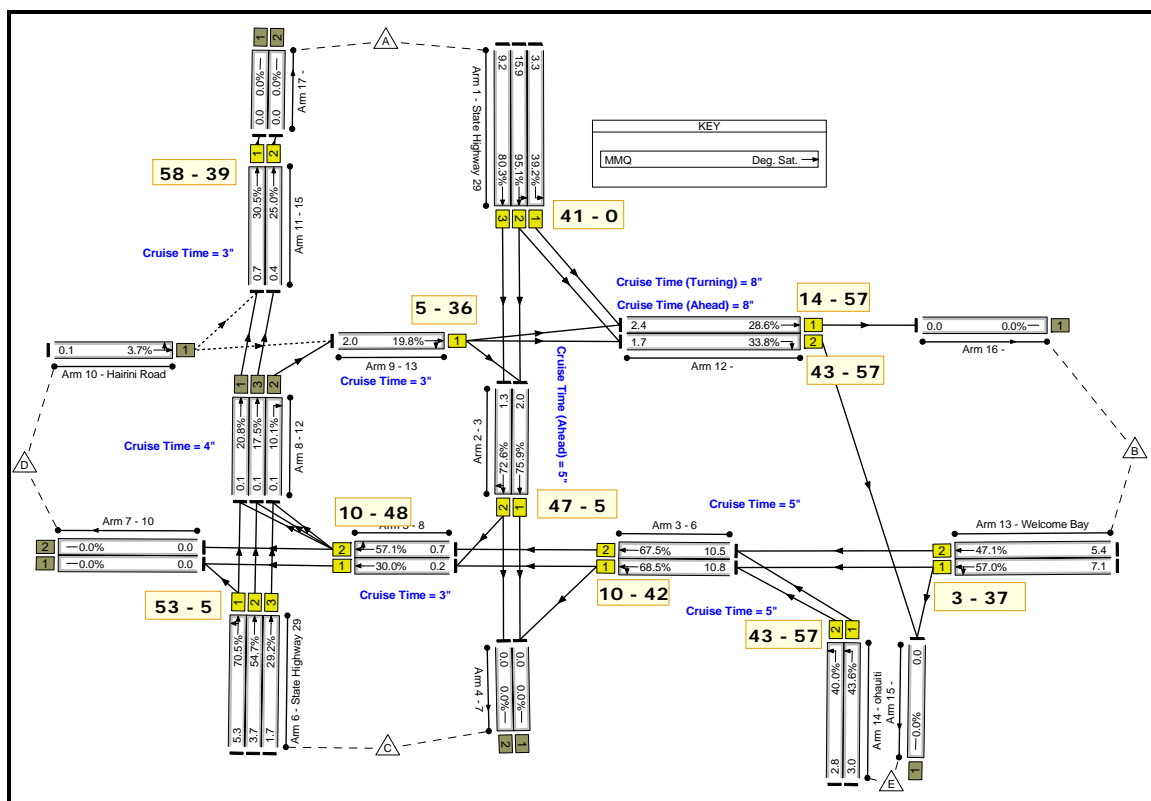


Originally, at the intersection of Welcome Bay Road with Ohauiti Road, there was a full length controlled pedestrian crossing on the Welcome Bay Road approach. To get a working design, it was also necessary to change this to a split 'walk with traffic' design. Despite our best efforts we could not get NZTA to allow us to advance the eastbound stopline to within 3m of the north side of the split crossing – their safety auditors felt that this was unsafe and that this stopline should remain adjacent to the stopline for right-turn traffic into Ohauiti Road.

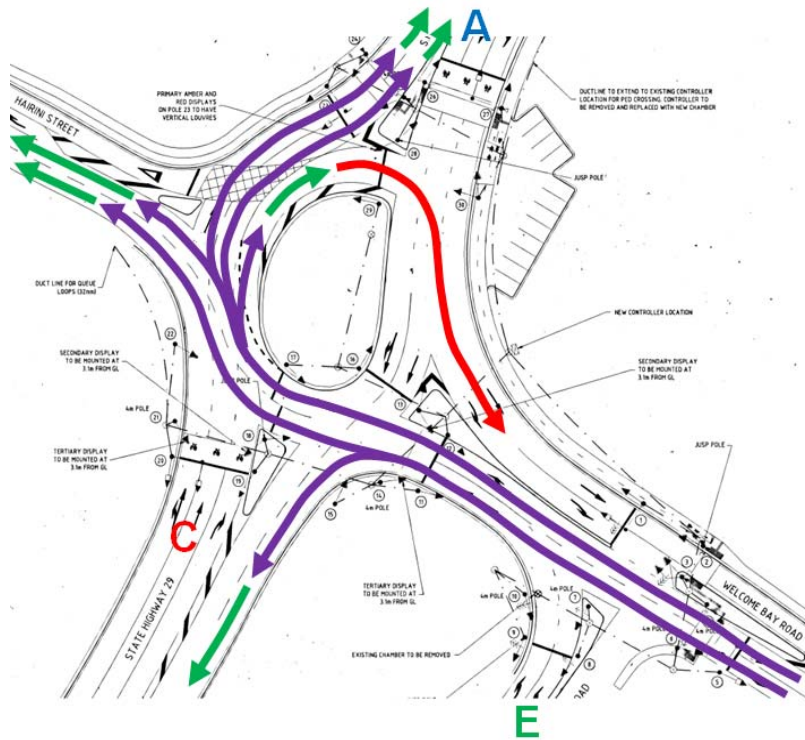
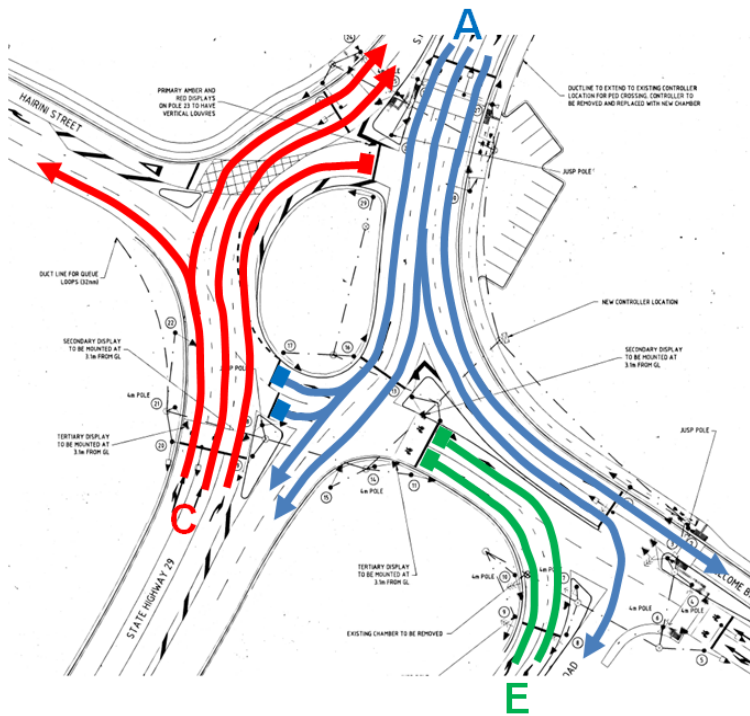
You can view the Welcome Bay Roundabout on the Tauranga City Council Web Cam (Site 7) at: www.trustpower.co.nz/TrafficCam. The still pictures refresh every 30".



Signal Control in Operation: The LinSig CLF Plan for the AM peak period is as follows:-



Essentially, the mode of operation is as described below and illustrated overleaf. Although there is a 12" stagger in start-up times, traffic from the north and south broadly run together with right-turns from each stopped within the gyratory. The right-turn movement from the north, was, at the time of design, minimal (about 1 pcu/cycle according to traffic count data). While these two movements are running, traffic from the side road, Ohauti Rd (Zone E), also receives green and cars from here proceed into the empty reservoir between Welcome Bay Rd stopline and the stopline at the roundabout on this approach. The right-turn movement from Ohauti Road is banned and traffic wishing to turn right to Welcome Bay must u-turn at the Welcome Bay roundabout. The timings ensure that no traffic from the north is caught at the next gyratory stopline. On closure of the North/South Traffic, the Welcome Bay Road traffic is released. The first gyratory stopline for this traffic goes green at the same time as the Welcome Bay approach stopline. In our original design, we achieved further capacity gains if this gyratory stopline started 3" later. However, at commissioning, it became clear that 'nobody would move' until they saw the next stopline primary signal head go green! Once again, the closing times ensure that the reservoir between Welcome Bay Road and the roundabout is left empty ready to receive Ohauti Road traffic at the start of the next cycle. **Commissioning:** Thunderstorms, refusal to move on green, traffic cones not removed in time, red light jumping, a major city accident necessitating the re-routing of several thousand additional vehicles via Welcome Bay without informing me, are but a few of the events that assailed me on commissioning day – definitely not a job for the weak hearted ! However all was soon resolved, the events giving me a chance to show off LinSigs versatility and speed which allowed me to rapidly come up with an emergency plan to more rapidly clear the very large queues that built up from the city. *As the Bay of Plenty Times put it so quaintly next day "Traffic this morning from the Welcome Bay area was flowing like a runny nose".* Since commissioning on 17th December 2008, the NZ signal control engineers have managed to also link timings between the two roundabouts, favouring primary movements in the AM and PM peak periods.



Cycle Times were as follows:-

AM and PM peak 60"
 Post AM and Pre-PM Peak 50"
 Weekday Mid-Day 40"
 After 1845 hrs 40"
 Overnight 35"
 Number of CLF Plans 8
 Advised CLF Plan Schedule
 (Code 8 = Weekday, Code 13 = Weekend)

Schedule	Code	Time	Plan
1	8	0600	1
2	8	0930	3
3	8	1030	4
4	8	1400	5
5	8	1545	6
6	8	1845	9
7	8	0030	8
8	13	600	3
9	13	1030	2
10	13	1500	6
11	13	1845	9
12	13	0030	8

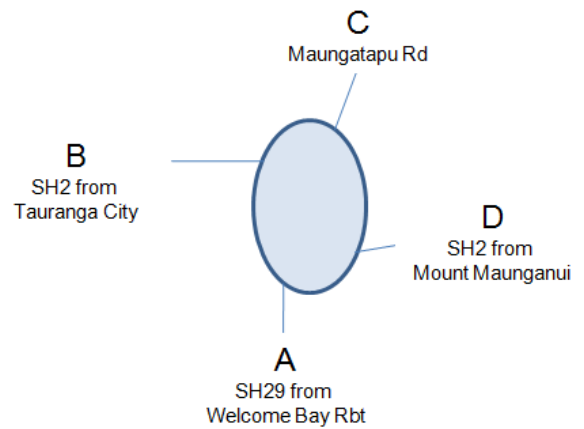
Bay of Plenty Times Thursday
 December 18th 2008 – Day after
 Commissioning

by **John Cousins**
 cousins@bopp.co.nz

“It was flowing like a runny nose.”
 This was the enthusiastic response of Welcome Bay resident Pamela Decke to the second day of the roundabout’s new traffic lights.

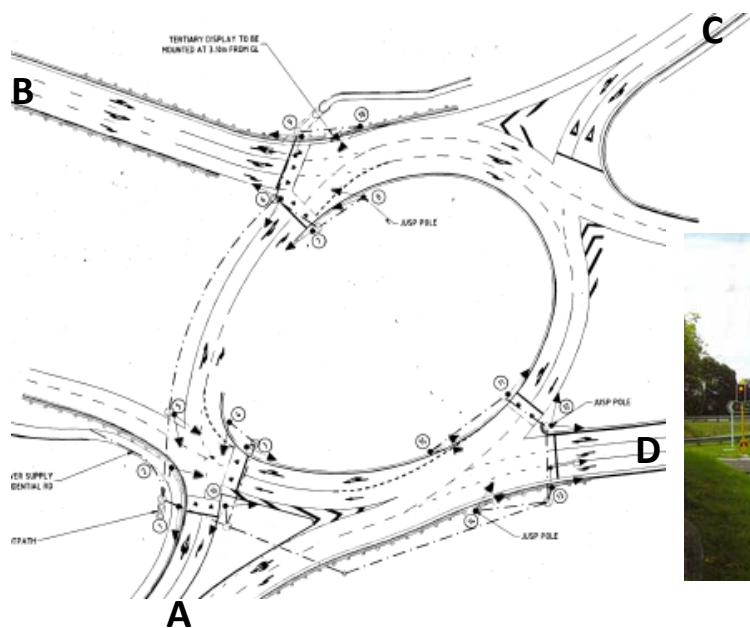
Traffic flowed freely through the Welcome Bay roundabout this morning and she cruised virtually unhindered to work at the peak of the rush hour this morning.

Maungatapu Roundabout



Pre-signal Performance: Significant congestion occurred on the SH2 from Tauranga City, and also on SH29 from Mount Maunganui in the PM peak period. This congestion was often exacerbated by block-back from the Welcome Bay Roundabout. Queuing was also significant on the Maungatapu Road approach in the AM peak period.

Derivation of a 'working' design: Maungatapu roundabout is a much larger roundabout than Welcome Bay (120m / 92m inscribed diameters) and accordingly it was much easier to find a working solution. Lane/Flow analyses quickly identified a 'best' design which necessitated widening Arms B and D, and the also north gyratory section from 2 to three lanes. Optimum direction lane marking were also quickly established from the Lane/Flow Diagrams for the weekday AM and PM peak periods. From the very start it was 'obvious' that Arm C, from Maungatapu, should be left as giveaway. Residents using this approach were particularly concerned, since under the current priority regime, they regularly suffered significant delay in the AM peak. However, immediately following commissioning, they 'honked' their approval at the large gaps afforded for egress by the new signal control.

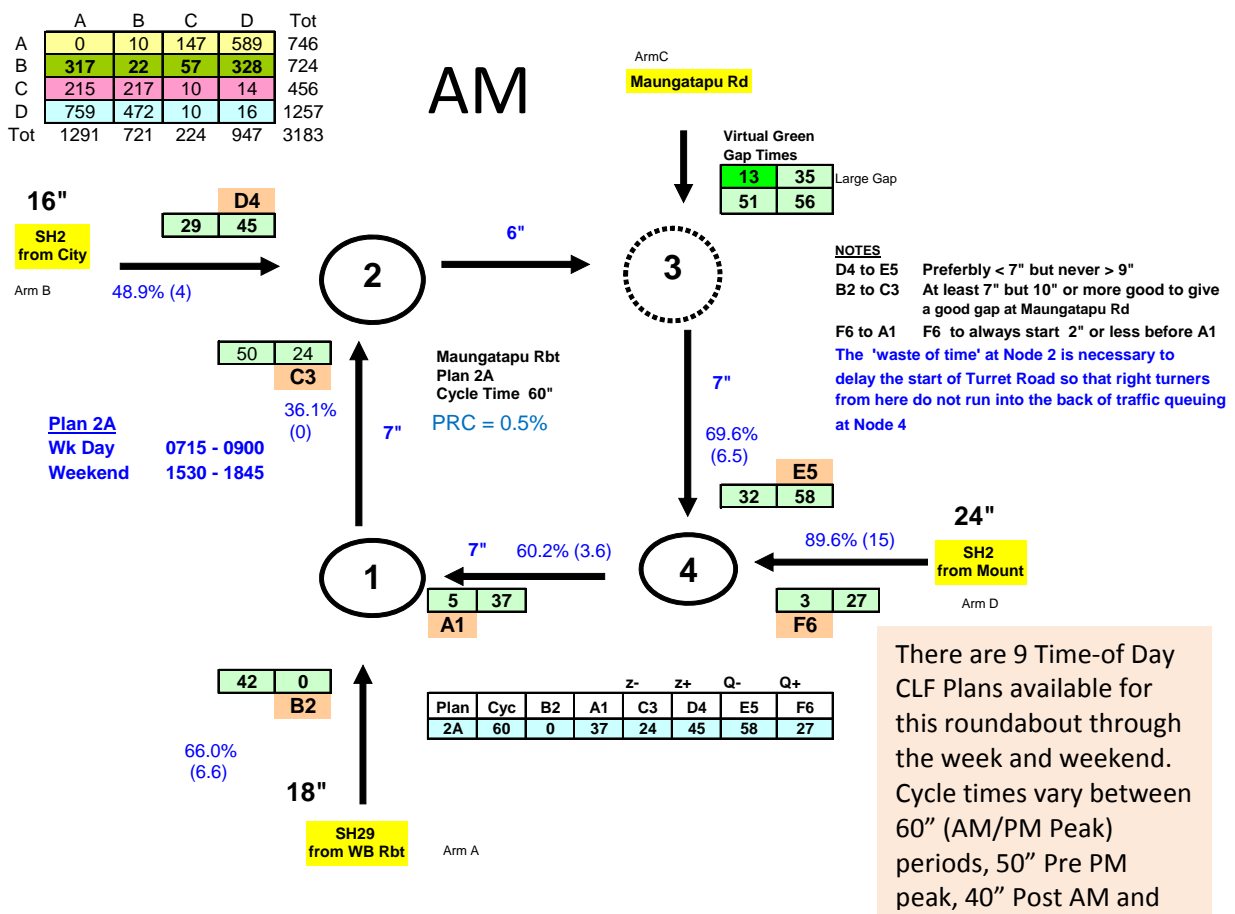


Signal Control in Operation: This is illustrated below for the AM peak period. A particular feature to note is that there is about 22" (AM Peak) and 10" (PM Peak) of wasted green time purposely introduced at the Arm B (SH2 from Tauranga city) gyratory stopline (i.e. the last car from the SH29 Welcome Bay approach will pass the SH2 (City) stopline at about 7". The SH2 (City) approach does not receive green until 29", some 22" later). This 'wasted green time' serves two purposes:-

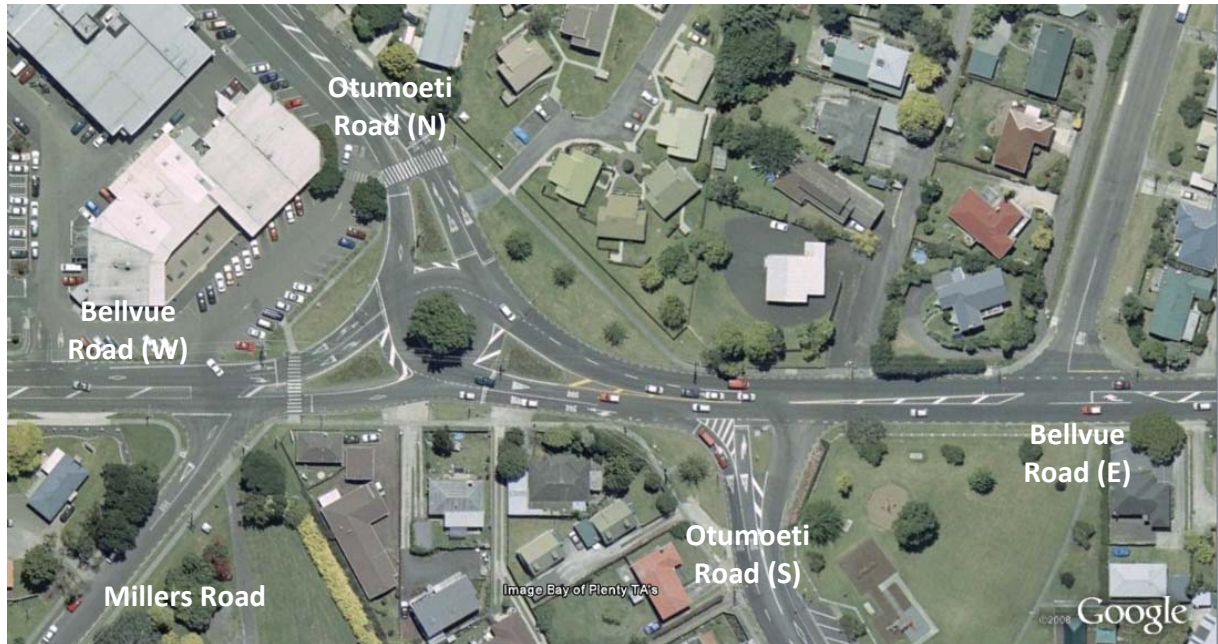
- i) It affords large gaps for egress of the Arm C traffic from Maungatapu Road; and
- ii) It ensures that the right-turning traffic from Arm B does not arrive too soon at the Arm D gyratory stopline. The timings ensure that as this traffic approaches the Arm D Gyratory stopline, that the back of the previously queue (i.e. gap takers from Maungatapu Road) are already 'on the move'.

This roundabout favours a 50" Cycle time in the AM and PM peak periods. However this was increased to 60" to afford linkage with the Welcome Bay roundabout downstream, which needs to run at 60" in both peak periods.

Commissioning was uneventful (other than the elderly gentleman who decided to turn immediately right from the offside lane on the Arm B entry!). Smooth progression was immediately evident and almost everyone got through in the first cycle. The historical congestion literally disappeared overnight!



Brookfield 'Jelly-Bean'



Pre-signal Performance:

This intersection comprised a mini-sized roundabout at the western end and Tee Junctions to the west and east at Millers Road and Otumoeti Road (S). The site was very congested in the peak periods with many opposed movements. In both peak periods pedestrians complained bitterly about how difficult and dangerous it was to cross at this intersection. The decision by Tauranga City Council to seek a signal controlled solution was taken primarily to address the pedestrian safety and accident issues. The pedestrian flow at this intersection is particularly high at school start and end times (there is a primary school on Millers Road). Pedestrian flow is also significant throughout the day and at weekends due to the presence of shops on the north-west quadrant.

Derivation of a 'working' design: Lane/Flow analyses was a secondary issue for this project in that within minutes of looking at the AM and PM peak period origin-destination matrices, the optimum design presented itself!

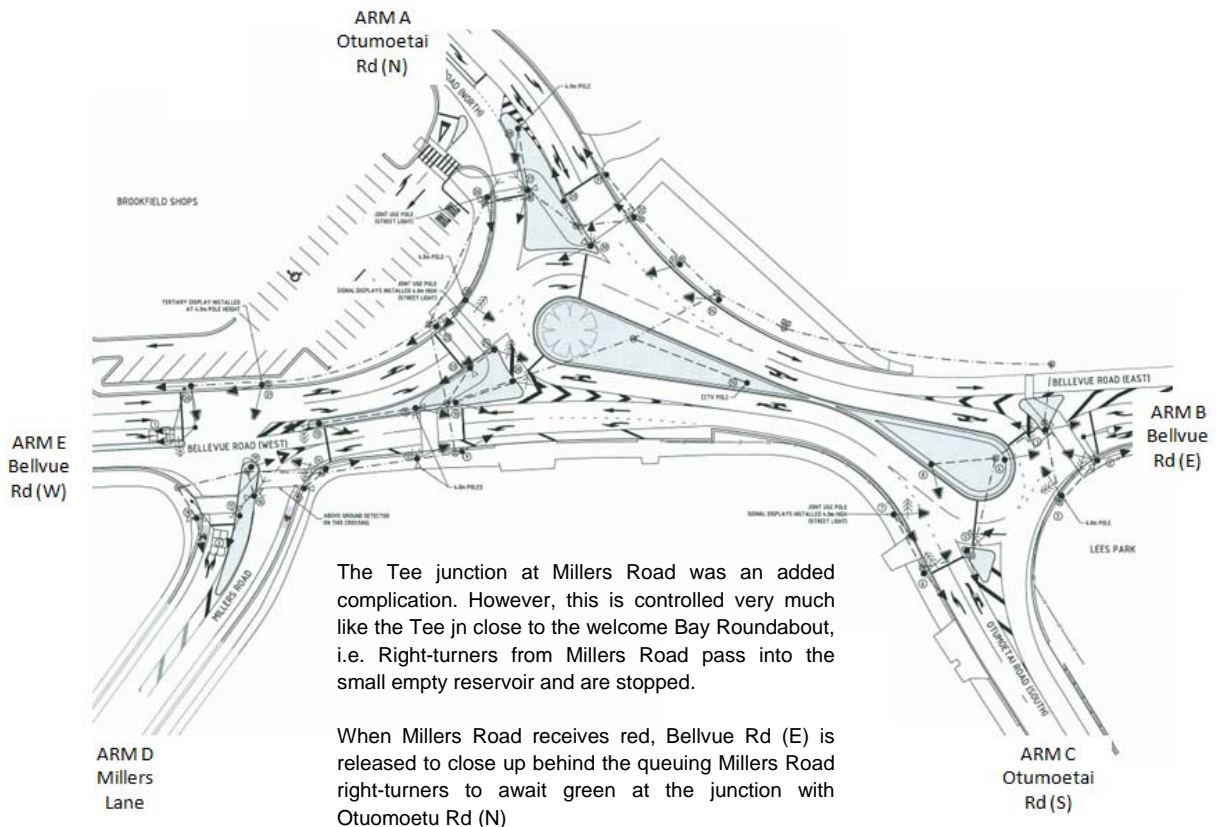
AM Peak (0745 - 0845) Year 2007

	A	B	C	D	E	F	Total
A	0	469	411	80	10	0	970
B	232	0	72	58	179	0	541
C	271	4	0	81	208	0	564
D	64	110	84	0	103	0	361
E	102	183	140	50	0	10	485
F	18	89	17	16	0	0	140
Total	687	855	724	285	500	10	3061

PM Peak (1630 - 1730) Year 2007

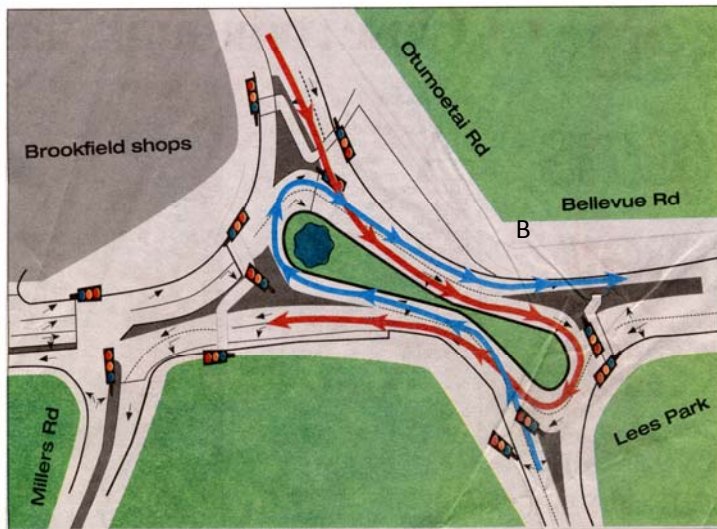
	A	B	C	D	E	F	Total
A	0	321	201	162	10	0	694
B	506	0	96	111	272	0	985
C	325	3	0	76	152	0	556
D	66	73	46	0	87	0	272
E	119	178	112	81	0	15	505
F	24	88	57	40	0	0	209
Total	1040	663	512	470	521	15	3221

In the AM peak – only 90 pcus of the 970 pcus approaching Arm A want to travel to Arms D and E and only 4 pcus want to turn right from Arm C. In the PM peak – only 170 pcus of the 694 approaching Arm A want to travel to Arms D and E and only 3 pcus want to turn right from Arm C. This immediately indicated that an elongated single signal controlled roundabout was an obvious choice and the 'Dumb-Bell' shape (see overleaf) soon appeared beneath Brian's pencil!



NEWS

Our People, C



NEW WAY ROUND: An artist's impression of the new layout at Brookfield.

PICTURE / SUPPLIED

Watch for changes at Brookfield intersections

The way motorists drive around the Brookfield intersections has changed.

Work began yesterday on forming the central islands joining Otumoetai Rd and Bellevue Rd intersections.

Traffic approaching the new island from Otumoetai Rd south and Otumoetai Rd north will no

longer be able to turn directly right into Bellevue Rd. Drivers will need to go around the newly formed central island. The existing roundabout will be incorporated into the new central island.

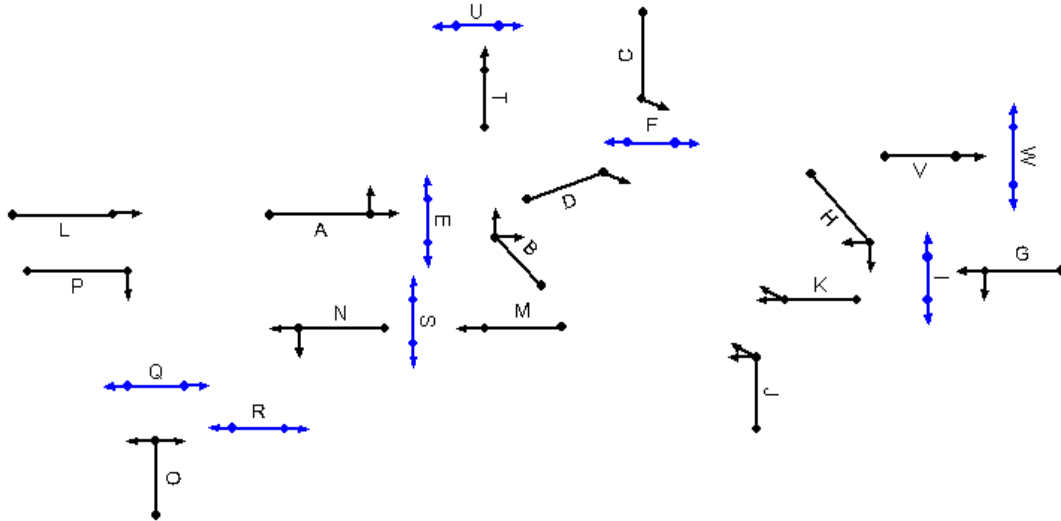
Tauranga City Council Project Manager Helmut Marko said traffic signals were not yet operating on the intersection, so

contractors would have temporary traffic management in place to ensure drivers knew where to go.

Changes would be marked with cones and notified using electronic message boards, and some signage would be put in place to assist motorists. Shops and businesses in the area will receive leaflets explaining the new routes.

Special Design Features of the Brookfield Signal Control

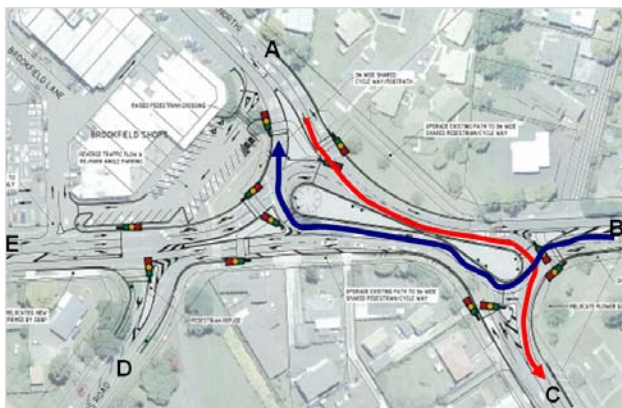
With respect to the phases, the following associations need to be maintained:-



In terms of UK Phase names:-

- G and K must start at the same time (safety issue)
- K must shut down at 3 or more seconds after G (to ensure clearout of traffic on G)
- C and B need to close at the same time (NZ Controller Programming Issue)
- H and J need to terminate at the same time (Controller Programming issue)
- L and P need to start at the same time (Safety Issue – no splitter island)
- L and N need to terminate at the same time (Controller Programmed)
- N is to close down 2" after M (to ensure clear-out of traffic on M)
- N is to start at the same time as M (Safety Issue)

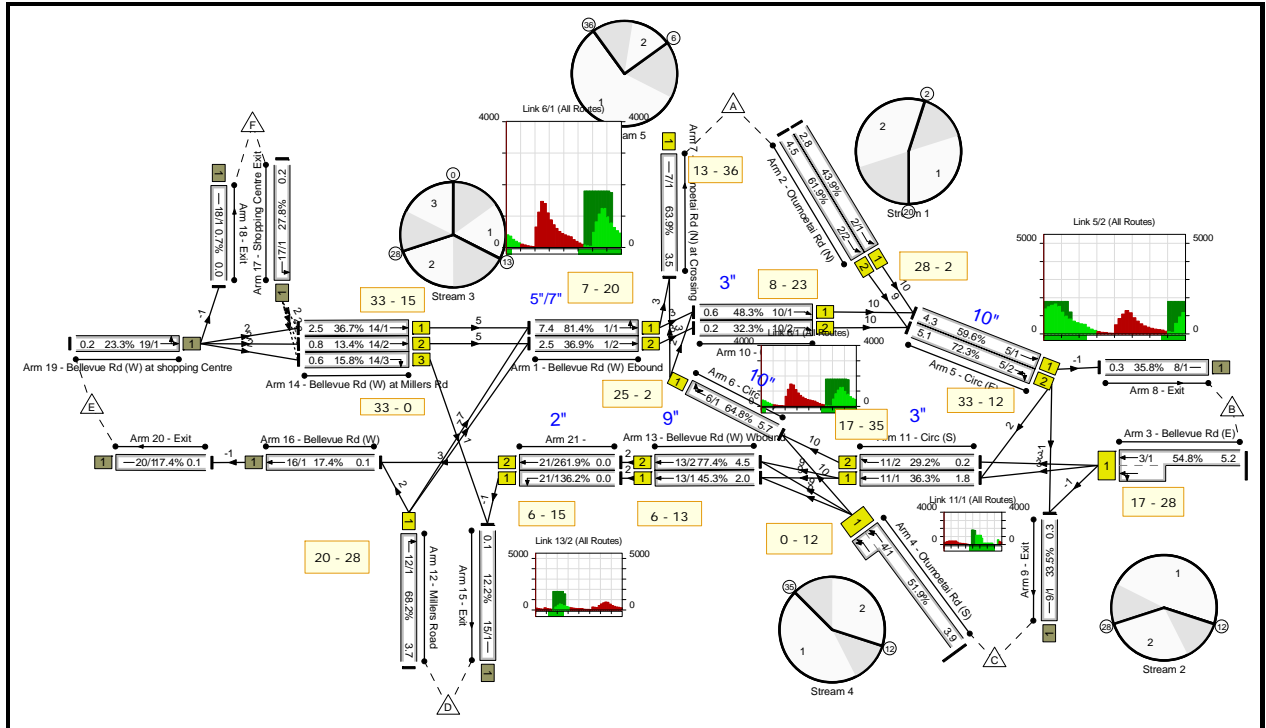
Coordination: 'Best coordination' proved to be to progress southbound traffic from Outomoetai Rd (N) and northbound traffic from Bellvue Road (E) in both peak periods. Use is made of the large queuing capacity on both the north and south sides of the dumb-bell design.



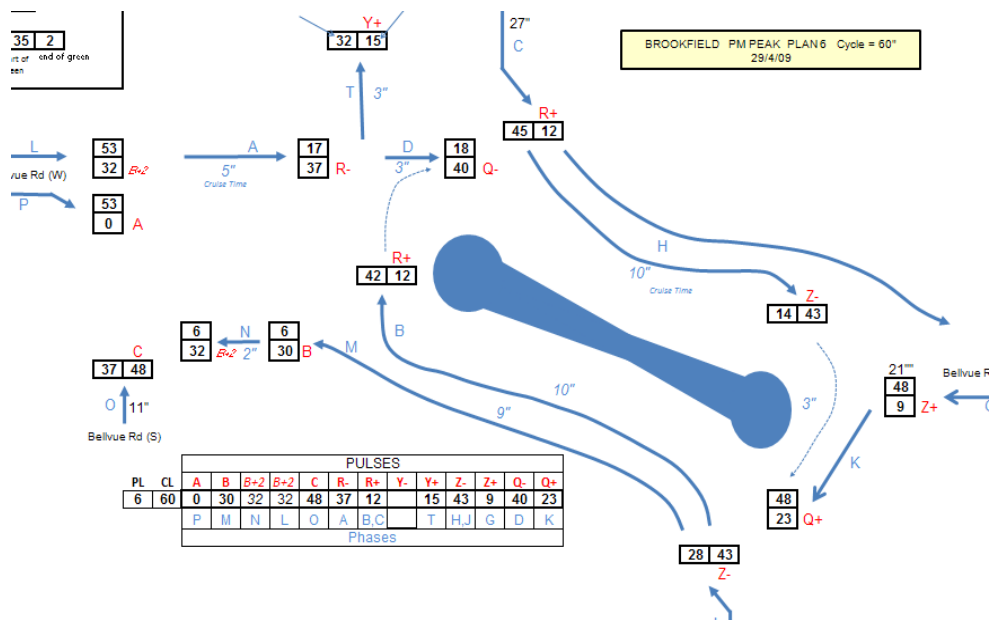
All pedestrian crossing points are split 'walk with traffic'. Demand is located kerb-side and all 'invitations to walk' are set to the minimum 6". The author is encouraging Tauranga Signal engineers to lengthen these 'invitation' windows to their possible maximum.

Timings at the exit crossing on Otumoetai Rd (Arm A) are set so that traffic leaving the roundabout are never stopped. Strangely, Tauranga city engineers elected not to complete the controlled crossing on the north side of Bellvue Road (E), seeing it as a possible safety issue. However, the author has assured them this can be safely implemented and set so that the minor flow from Millers Road (D to B movement) will be the traffic that is stopped.

Cycle times range from 60" (Peak) to 40" (offpeak) in 11 CLF Plans. The LinSig Model for the most useful 40" off-peak plan is as follows:-



The PM Peak Plan (Cycle = 60") is as follows:-



Brookfield was commissioned on 8th April 2009.

Commissioning the 'Jelly Bean' was especially poignant for JCT since it was very much the concept design of Brian Simmonite. I have no doubt he would very much have enjoyed commissioning this one himself. Brian – they loved it!

INTERSECTION designer Barbara Chard of English firm JCT Consultancy checks as technician Brian Duffy makes final adjustments to the master controls of traffic lights at the new Brookfield roundabout last week.

Peak flows now a piece of cake

BROOKFIELD'S new roundabout system has received a provisional thumbs-up from the local community.

Pedestrians "love" having controlled crossings instead of taking their lives in the hands to cross the road.

And the general opinion among people spoken to by *Bay News* this week is that traffic flows, particularly at peak hours, have been greatly improved too.

Perhaps the only fly in the ointment is the layout of the parking area at the small Brookfield shopping centre.

That is causing a good deal of confusion. But it is still early days and general opinion is that people will "get used" to the new layout.

Traffic lights on the new intersection, with its unusual elongated "jellybean" traffic island, were officially switched on last Friday after two days' of tests

and synchronisation.

Of more than 20 local people approached this week none were unhappy with the result.

There was unanimous agreement that traffic flows had improved significantly. Traffic signals had eliminated lengthy delays at times for drivers waiting for a break in streams of traffic approaching from their right.

"It is great coming down Otumoetai Road or Bellevue Rd now," said one woman. "You get a clear run once you get a green light."

Several people said peak hour flows were now much better, though people were still getting used to the "right lanes".

Pedestrians, specially older people, were very happy. They said the light-controlled crossings were a vast improvement and they could now cross the roads with confidence where they had previously feared for their lives.



Brian Simmonite, founder of JCT Consultancy and concept designer of the Brookfield 'Jelly Bean', Tauranga, NZ

Acknowledgements

The design and implementing of the first three permanent signal controlled roundabouts in New Zealand has involved contributions from many individuals and organisations. The author would especially like to thank the following persons for their contributions:-

- Simon Swanston – Senior Modelling Engineer, JCT Consultancy for his valued assistance on the LinSig modelling of all three roundabouts including sensitivity testing of the many issues that arose throughout the design process.
- Ross Thomson, UTD Ltd New Zealand who converted (using Flexilink methodology) the JCT CLF plans into a format that could be ‘understood’ by the NZ Tyco Controllers, and who worked in tandem with me throughout the commissioning periods, adjusting, refining and improving coordination at all three roundabouts.
- Angus Bargh, TDG Consultants NZ for his Paramics Models for Welcome Bay and Maungatapu roundabouts. These models played a major part in reassuring NZTA and others that the signalled roundabout designs would ‘work’. The Paramics models were also used to demonstrate the economic benefits and saving over previously proposed grade separation and tunnel proposals. TDG are our elected agents in NZ for marketing and selling the LinSig software. They are also looking forward to both using and promoting the new JCT LinSig/Paramics and LinSig/Vissim link tools due for release in the Autumn.
- Martin Parkes and Haydyn Wardley, Tauranga City Council for their most helpful contributions throughout both the design, build and commissioning stages. A special thank you to Haydyn Wardley who spent even more hours on site than I did ensuring, among many other things, that all the signal poles were correctly located and louvered. The latter exercise was a particularly challenging task with so many poles located in close proximity to one another.
- Mike Tapper, Associate Beca Consultants and project build Consultant. A special thanks to Mike for his friendly, instant and most effective response to the many difficulties and issues that arose throughout the JCT design and commissioning period.
- Kevin Reed and Ulvi Salayev, NZ Transport Agency (project Client). Thank you Ulvi for getting those traffic cones lifted from the Maungatapu roundabout during the first day of commissioning Maungatapu roundabout .
- Fulton Hogan Ltd- project Contractors Thank you for the offer of a family home to spend Christmas in if I missed the last plane out to the UK before Christmas day!
- Darell Carlin and Sharon Butler of Carlin Valenti (public relations). Thank you for your huge enthusiasm for the project, the press interviews, your obvious interest at each of the first day commissioning periods and the occasional use of an office when required.

IN CONCLUSION: The Welcome Bay and Maungatapu Roundabout Signalisation scheme has been submitted for the Ingenium Excellence award for Public Infrastructure, 2009, by the NZ Transport Agency, Fulton Hogan Ltd and Beca.

Page last updated at 11:22 GMT, Monday, 7 April 2008 12:22 UK

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[Printable version](#)

New Zealand city to get Whirlies

A city in New Zealand is set to replicate East Kilbride's famous 'Whirlies' roundabout in a bid to ease its congestion problems.

Planners in the North Island city of Tauranga said it would be the first signalised roundabout in the country.

The idea came from a former South Lanarkshire council

worker who found similarities between the roads.

The network of traffic lights on the Whirlies is credited with solving the South Lanarkshire town's traffic jams.



Traffic lights were added to the Whirlies in 2005 to ease congestion

He suggested Transit contact UK intersection expert Barbara Chard for advice.



The roundabout in Tauranga is said to be similar to the Whirlies

Kevin Reid, Transit's project manager for the roundabout in Tauranga, said the East Kilbride model should help solve their traffic problems. He said: "We are confident that the travelling public will see a marked improvement in journey times once this work is completed."

Work on the roundabout in Tauranga is due to start in August.

Jim McGuire, who left South Lanarkshire Council to work for the New Zealand highways agency, Transit, noticed the congestion hot spot at Welcome Bay, Tauranga, was almost identical to that in East Kilbride. **'Small world'**

IMPORTANT CHANGES TO THE ROUNDABOUT SYSTEM

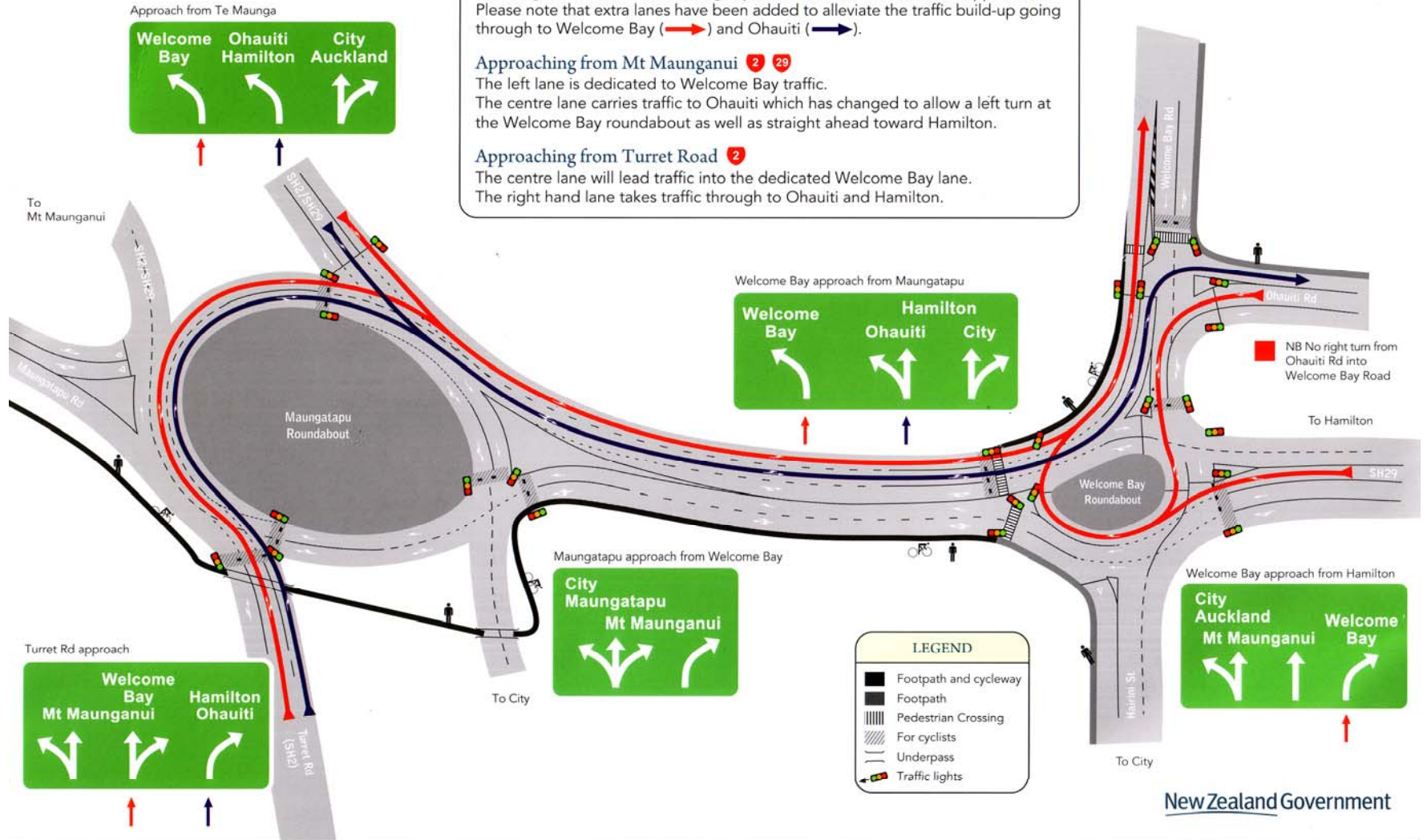
This diagram indicates the new signs you will see at the roundabout approaches. Please note that extra lanes have been added to alleviate the traffic build-up going through to Welcome Bay (→) and Ohauiti (→).

Approaching from Mt Maunganui ² ²⁹

The left lane is dedicated to Welcome Bay traffic.
The centre lane carries traffic to Ohauiti which has changed to allow a left turn at the Welcome Bay roundabout as well as straight ahead toward Hamilton.

Approaching from Turret Road ²

The centre lane will lead traffic into the dedicated Welcome Bay lane.
The right hand lane takes traffic through to Ohauiti and Hamilton.



Arm C

Maungatapu Road

AM Peak - Number Plate Survey 2007

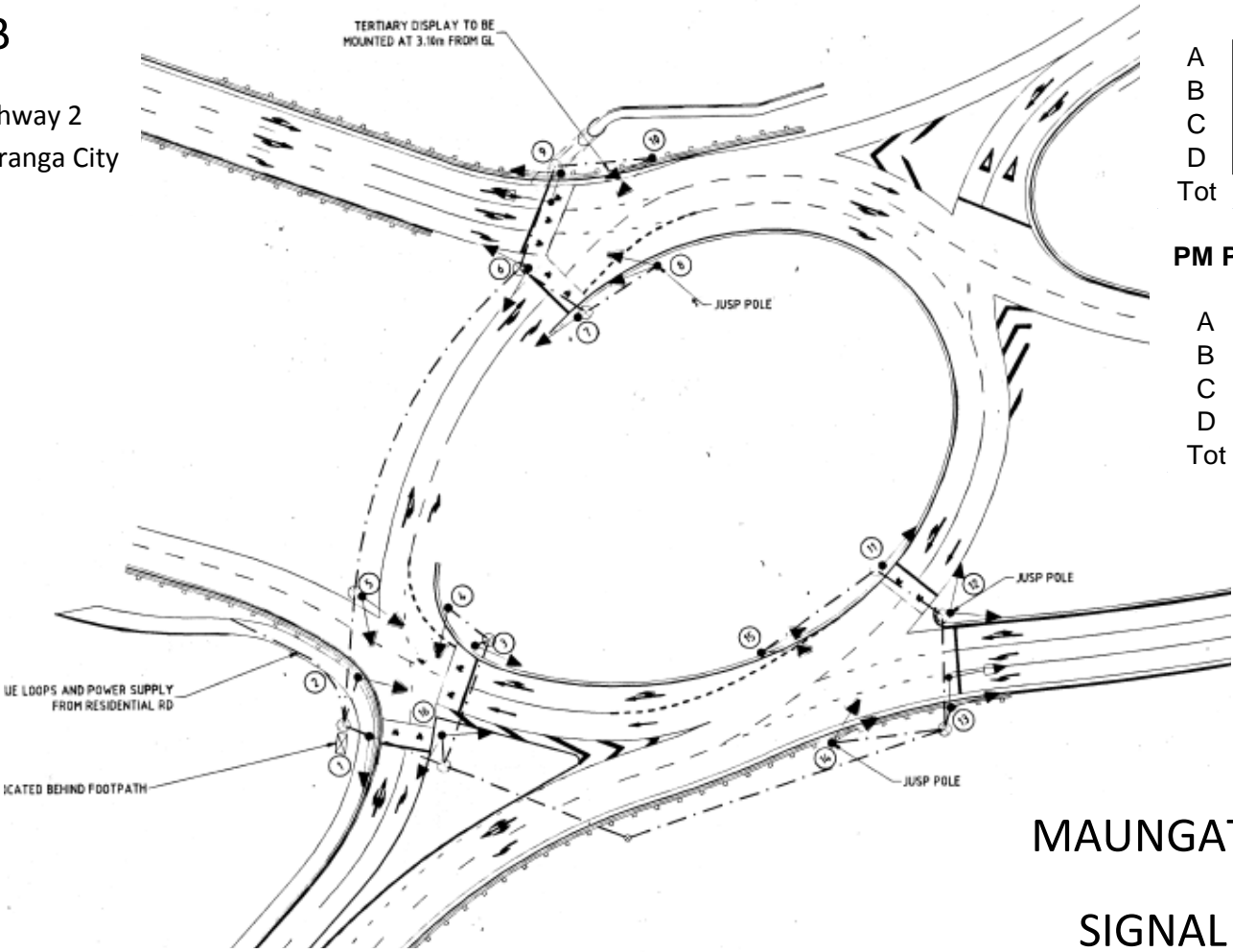
	A	B	C	D	Tot
A	0	10	147	589	746
B	317	22	57	328	724
C	215	217	10	14	456
D	759	472	10	16	1257
Tot	1291	721	224	947	3183

PM Peak - Number Plate Survey 2007

	A	B	C	D	Tot
A	0	10	76	751	837
B	902	20	73	691	1686
C	145	87	10	10	252
D	762	269	10	10	1051
Tot	1809	386	169	1462	3826

Arm B

State Highway 2
from Tauranga City



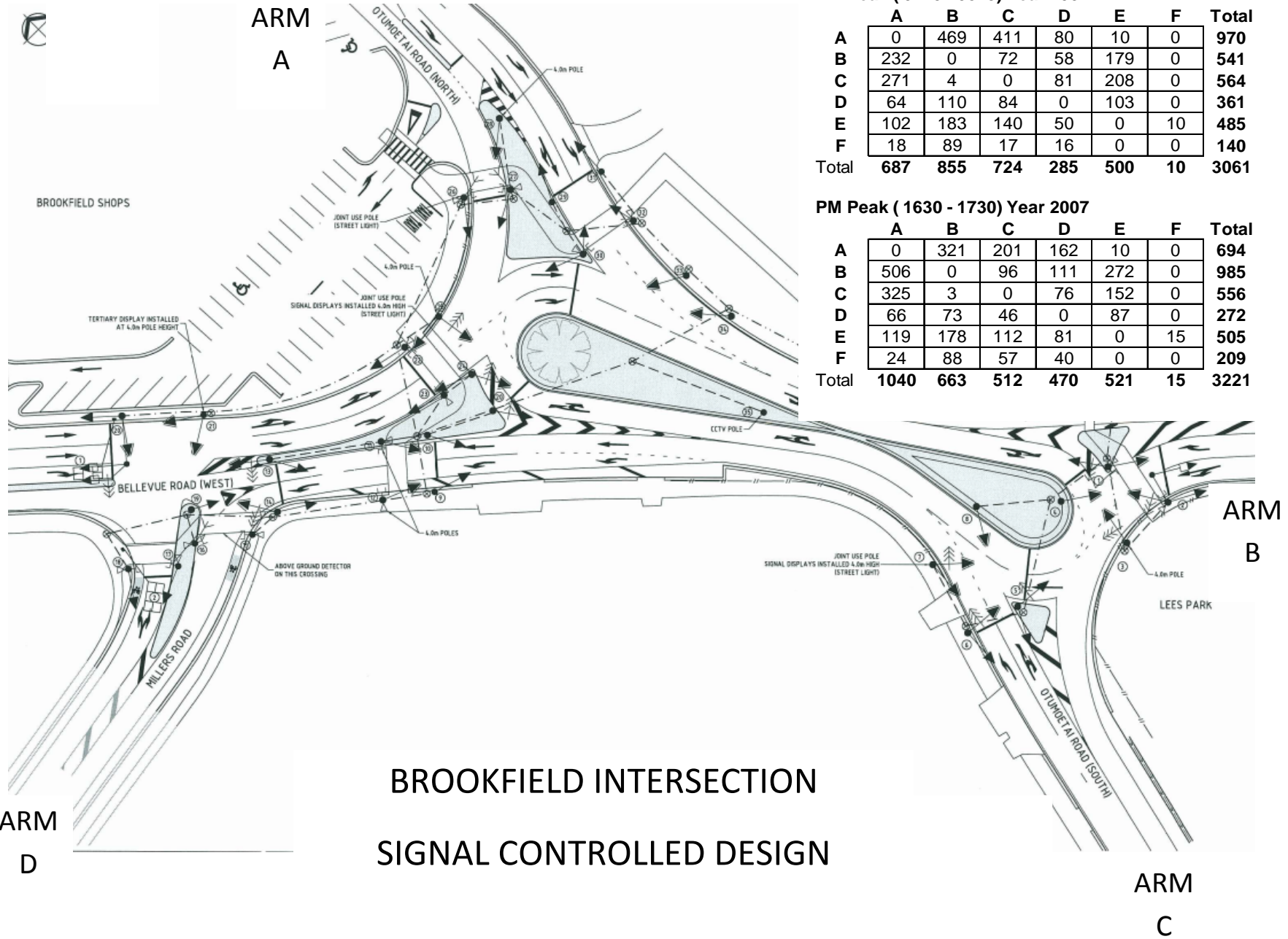
Arm D

from Mount Maunganui

Arm A State highway 29 from
Welcome Bay Roundabout

MAUNGATAPU ROUNDABOUT SIGNAL CONTROL DESIGN

(Arm C left as giveway)



**BROOKFIELD INTERSECTION
SIGNAL CONTROLLED DESIGN**

AM Peak (0745 - 0845) Year 2007

	A	B	C	D	E	F	Total
A	0	469	411	80	10	0	970
B	232	0	72	58	179	0	541
C	271	4	0	81	208	0	564
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C	325	3	0	76	152	0	556
D	66	73	46	0	87	0	272
E	119	178	112	81	0	15	505
F	24	88	57	40	0	0	209
Total	1040	663	512	470	521	15	3221

New Brookfield Intersection

