TRANSPORTATION 2022 CONFERENCE
'*FIX CRASH CORNER*' – A ROUNDABOUT STORY
THIS PAPER HAS BEEN PEER REVIEWED

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ABSTRACT

This is a story about a project with big crash beginnings, fast-track design, effective project management, and '*Safe System*' endings.

The intersection of Church Street and Victoria Street was a cross-roads junction in Onehunga, Auckland, and nicknamed 'crash corner' by locals. Over the previous 5 years, 54 crashes had been reported at the junction, including 23 minor and 1 serious crash (DSI). Vehicle debris and property damage were a permanent feature on most corners of the junction.

Auckland Transport decided to convert the cross-roads to a roundabout.

A collaborative team effort resulted in the project progressing from scheme to construction in under 6 months. Advanced scheme and detailed design plans were prepared within a month. Frequent progress meetings and stakeholder liaison facilitated delivery. Construction began in parallel, while construction plans were still being finalised.

Construction was a short 2 stage process over New Year holidays, minimising disruption to the community. Zero complaints were received during construction, and an MP's commendation received afterwards.

The constructed roundabout was the first '*Safe Systems – Vision Zero*' design of its kind in New Zealand, being a fully raised roundabout with 4 pedestrian crossings.

Independent crash analysis in June 2021 determined that the new roundabout had reduced reported crashes to **zero**, with additional crash savings nearby.

Community benefits included enhanced pedestrian amenity, upgrading of bus stops, and improved access to public transport (mode shift, social well-being, and reduced carbon emissions).

Environmental sustainability was achieved by protecting roots during footpath excavations, permeable surfacing at bus stops, silt socks on catchpits, recycled water in construction trucks, and material sourcing from nearby sites (reduced carbon emissions).

The project was selected as a finalist in the IPWEA NZ '*Asset Management Excellence Awards*' (2022), based on '*Excellence and Innovation*', '*Community and Economic Contribution*', '*Project Management*', and Road Safety Benefits.

FIGURE 1: NEW ROUNDABOUT

INTRODUCTION

The new roundabout constructed at the intersection of Church Street and Victoria Street was a collaborative project between Auckland Transport, Traffic Engineering Solutions, and Liveable Streets.

The intersection of Church Street and Victoria Street was a cross-roads junction in Onehunga, Auckland, and nicknamed '*crash corner*' by locals. Over the previous 5 years, 54 crashes had been reported at the junction, including 23 minor injury crashes and 1 serious injury crash (DSI). Vehicle debris and property damage were a permanent feature on most corners of the junction.

The site location is a residential and industrial mix. Church Street is a main route to both the southern motorway and Onehunga Town centre. In the vicinity of Victoria Street, Church Street has Annual Daily Traffic of around 10,500 vehicles per day and 8% Heavy Vehicles.

FIGURE 2: FIX CRASH CORNER SIGN, AND NEARBY VEHICLE DEBRIS

The new roundabout was originally planned for construction in 2021, however construction was brought forward to 2019 thanks to the community request, which was channelled through the local MP; Denise Lee.

As a result of a tight, collaborative team effort the project went from scheme to construction completed in 6 months. It is understood to be the first '*Safe Systems*' design of its kind in New Zealand, being the first fully raised roundabout with 4 pedestrian priority legs.

Since installation, independent crash analysis has determined that there have been **Zero** crashes reported at the roundabout itself.

Other benefits attributable to the works include an increase in bus patronage at nearby bus stops, an increase in pedestrian traffic, and community expectations being met and exceeded.

PLANNING

Due to the required expedited delivery of the project, a collaborative working model was formed between the project team at Auckland Transport, the design consultant (Traffic Engineering Solutions), and the contractor (Liveable Streets), who were all involved from the draft detailed design phase.

It was the first time for a minor safety project of this size for Auckland Transport using such early contractor involvement, and allowed the design to be progressed much faster as it identified potential constructability risks early during the design phase.

The project teams '*can-do'* attitude lead to the delivery of the project 12 months ahead of schedule, going from scheme design to completion of construction in 6 months.

Each of the team members played their part, with the project manager managing the inputs from the consultant over design issues, and the contractor over constructability, as well as taking feedback from the community at the same time with regular engagement of the Local MP and Board, through dedicated stakeholder managers.

The design process continued right up to and including construction, and design iterations continued during construction, due to unexpected underground utility services and ground conditions, due to restricted timelines for prior investigations.

Options considered at scheme were alternative layouts of signalised intersections, and a roundabout. The signalised intersections, whist excellent for controlling the turning/crossing movements that were so prevalent in the existing crash type, required widening of the carriageway, excessive removal of parking, and adversely affected bus stop access. Also, all variations of traffic signal layouts had reduced operational performance as compared to a roundabout, and as such, the roundabout layout was favoured.

Going into the detailed design phase, the scheme had not allowed for pedestrian priority crossings, but the project team realised that this was an opportunity not to be missed to implement a full '*Safe Systems'* approach, and afford high priority to improving safety and amenity for pedestrians. The final outcome of a raised roundabout with 4 approach ramps took into consideration both the safety requirements of having a ramp angle that would slow traffic to the desired 30 kph approach speed, whilst allowing buses to traverse safely without too much discomfort for passengers.

The raised platform ramps were discussed with Auckland Transport Metro, which agreed to 1:10 raised platform ramp gradients, but a 75mm height with less impact for bus passengers.

Lighting at the intersection was also analysed and was improved at all pedestrian crossing legs, and extra lighting was designed and installed for the intersection and approaches. Due to the proximity of nearby powerlines, the lighting design was complicated and needed to be adjusted to suit powerline spacing requirements.

As an additional road safety improvements, High Friction Surfacing was also proposed to be included as part of the upgrade, to improve pedestrian safety at the pedestrian crossings on all approaches.

DESIGN

The design consultant created several project teams to work in parallel in order to achieve delivery of detailed design plans within the required short design timeframe, being one month. Teams were setup to design geometric layout, road-marking and signs details, pavement design, and street lighting. Extremely challenging deadlines were met under difficult design conditions, especially considering on-going feedback from multiple internal and external stakeholders during weekly design meetings. Also, the Stage 3 Road Safety Audit resulted in another revision, and that was in turn revised after the close out of external consultation.

Detailed design plans were in the process of being Road Safety Audited while construction plans were in progress. Construction plans were still in progress while the contractor was undertaking site setup, utility service investigations, utility service trenches, and pavement structure test pits.

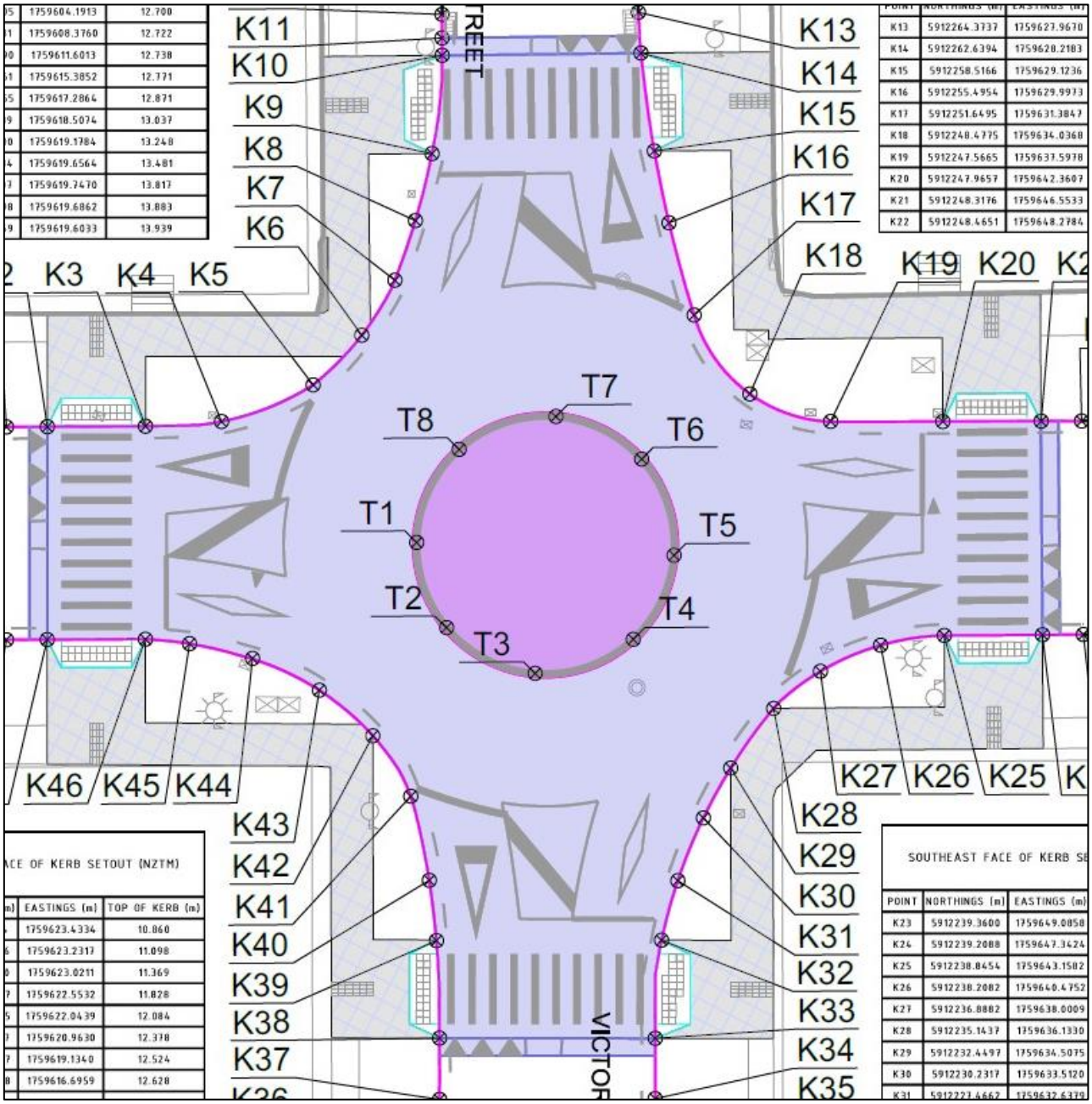

FIGURE 3: GEOMETRIC DESIGN SETOUT

During construction, the kerblines and pavement design had to be adjusted due to excessively tough ground conditions, including basalt and volcanic rock at shallow depths. Also, there was an unexpected surprise in the form of a 1950's Chorus cables that at only 200mm depth. The design consultant managed to turn around revised geometric designs and pavement designs inside of 3 days, while construction commenced, eliminating project delays while construction progressed.

FIGURE 4: FULL TRAFFIC CLOSURE - ROUNDABOUT ISLAND CONSTRUCTION

CONSTRUCTION

Construction was planned in 3 phases; with enabling works (footpaths, tactiles, berm, streetlighting prep, investigations) planned for 2 halves, northern and southern sections, followed by a full closure for the final works over the Christmas break.

The first stage started on 4th November 2019. Conscious of the Christmas traffic increase in December, and a very busy nearby shopping centre, the enabling works were completed by the second week of December, with the main road opened to normal capacity for the two weeks leading up to Christmas.

In order to reduce the time to install the roundabout and ramps and 'cure' the concrete, and asphalt pave the intersection approaches, the project utilised a full road closure with detours, so that full width concrete pours could be implemented for increased structural integrity of the concrete.

FIGURE 5: STORM WATER WORKS

The contractor's site manager, Sharath Chitturi handled the site exceptionally well and was key to its success. Unfortunately, he passed away in 2020. The Project owes him recognition for his exemplary efforts

EXCELLENCE AND INNOVATION

As far as Innovations go, this design; an entirely raised, non-signalised intersection with 4 legs of pedestrian priority crossings, was the first '*Vision Zero*' inclusive installation of its kind in not just Auckland, but New Zealand wide.

The innovative approach to design included Auckland Transport running a parallel design review process internally, with a weekly workshop with all internal stakeholders, at the same time as a Stage 3 Road Safety Audit.

The Internal Stakeholders included feedback from Auckland Transport Metro on bus access, ramp heights, and bus stop upgrades, and was expanded early on to include both the physical works and streetlighting contractors, to enable the project to be designed with constructability in mind, in addition to meeting design standards.

FIGURE 6: NEW ROUNDABOUT

Auckland Transport also involved the road maintenance team during the design investigations, to future proof the integrity of the design. With the design advice received from the consultant pavement specialists (Bartleys), and involvement of the maintenance team, two stretches of asphalt approaching the new intersection were identified as due for replacement, pulling them into the project scope to be completed at the same time to eliminate the need for future maintenance closures in the area.

Construction planning, including closures was approached in an innovative way, as the team planned to carry out the works in 3 stages. In order to minimise the disruption to the community it was proposed that Stage 1 & 2 enabling works be carried out around the intersection (kerb, channel, excavations, footpaths), whilst maintaining two-way traffic in the months approaching the Christmas period. This allowed all the surrounding works to be completed, ready to install the central roundabout in one go using full traffic closures of the intersection (Stage 3). The full closures were carried out over the 2019 / 2020 New Year's break, when traffic volumes were down by up to 40%. The full closures meant that while we were creating a larger construction impact overall, it was over a much shorter duration.

The traffic detours that were available were re-configured to become easy to use, with the designer investigating the detour routes and preparing a TIA report in relation to the contractor's Traffic Management Plan. The alternative route was confirmed suitable by the consultant for buses, using vehicle tracking software and with only minor temporary changes to the road's layout, and confirmed it could handle the traffic that was going to be generated. The full closures reduced the construction timeline by around 24 weeks, overall a much better outcome.

Pedestrian access was maintained throughout the closures at all times. The result was efficient with zero complaints received during the entire construction timeline, and zero incidents. In fact, the project received a complimentary letter from a resident within the works area, during the full closure process. Many locals commented on site how nice and quiet their streets were, stating that they wish the full closure would be permanent.

STAKEHOLDER ENGAGEMENT

Communication is key to any successful project, and the project team went above and beyond in ensuring every stakeholder was identified, consulted and involved in the final design of this project, and could relate to the outcomes delivered.

As part of the initial project team formation, the project manager engaged an internal stakeholder manager who then worked together to develop a robust and comprehensive communications and Stakeholder management plan. This was done by identifying all internal and external stakeholders that would be affected, outlining contacts for them, and devising a relevant communications strategy for each.

In the lead up to, and during the construction, Liveable Streets also assigned a full-time stakeholder manager, Gareth Jones, who carried out face to face visits to residents, was the direct contact for enquiries, and maintained positive relationships with all businesses in the area.

The retail association, heavy haulage association and nearby industrial area were also canvassed for direct contacts and received regular updates to assist with reducing traffic during the closures. The project manager checked in with the stakeholder manager daily to stay on top of all potential issues, and it was this that was the reason for zero complaints during the installation of the project, and in fact a compliment from a resident.

FIGURE 7: NEW PEDESTRIAN CROSSING WITH STREET LIGHTING

EFFECTIVENESS - 'SAFE SYSTEM' BENEFITS

Independent crash analysis was commissioned by Auckland Transport to examine reported crashes '*before*' and '*after*' at the roundabout, and on nearby surrounding roads.

At the previously existing cross-roads intersection, before the roundabout was installed, 54 crashes were reported over 5 years (11 reported crashes per year in a 50m vicinity of the roundabout). These reported crashes included 1 serious injury crash and 23 minor injury crashes.

It is noted that reported crashes do not take into account the full picture and crashes that remain unreported, which are typically significantly higher than reported crashes. Total crashes, including unreported crashes, were likely to be in the region of around 295 crashes every 5 years.

Since installation, independent crash analysis has determined that there were **ZERO** crashes reported at the roundabout, over an 18 month period since construction.

The independent analysis concluded that "*Given the very high number of recorded crashes of one particular type before the intersection was upgraded and the absence of any crashes post upgrade it can be concluded that the roundabout has been effective at addressing the crash pattern at this intersection.*"

Indeed, chi-squared analysis indicates an approximate 99.9% probability that the 'intervention' had a significant effect on reported crashes at the junction.

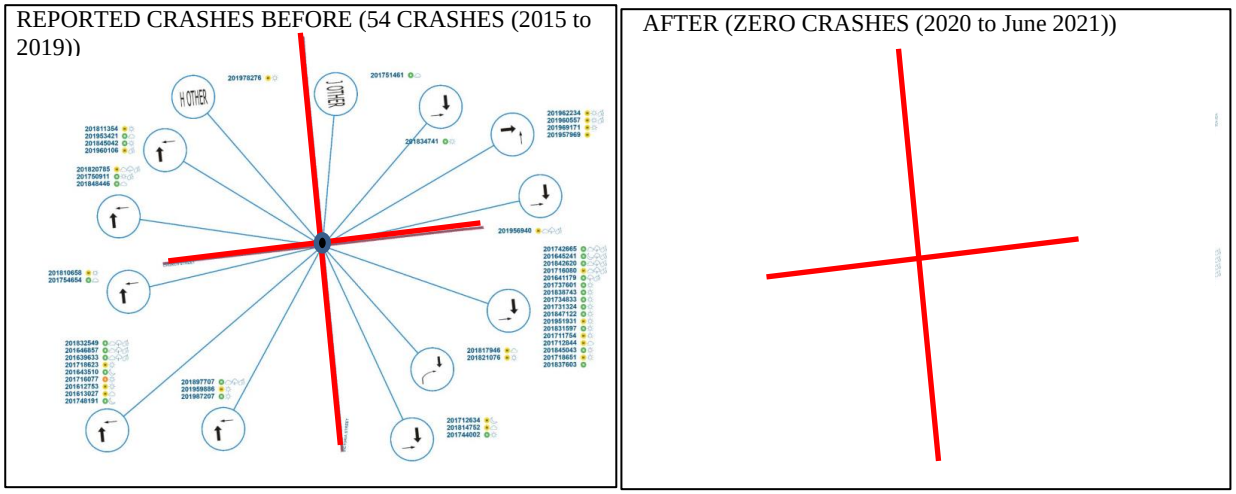

FIGURE 8: REPORTED CRASHES 'BEFORE' AND 'AFTER'

The financial cost of the on-going crashes at the cross-roads junction were estimated at over $700,000 per year. Using NZTA EEM guidelines, the Present Value of the crash cost savings due to construction of the roundabout are estimated at over $10m.

Furthermore, in order to ensure that crash migration did not occur, crash statistics were reviewed 'before' and 'after' on the surrounding road network in nearby proximity to the roundabout. This analysis determined that as well as achieving crash reduction at the junction, the roundabout created a 'halo effect' east of the intersection, with crashes nearby reducing from 16 crashes (over 5 years) to zero at the nearby junction. This shows that the project has not only benefited those that live directly near the intersection, but also further along the roads outside the project boundaries. The new roundabout had a traffic calming effect and road safety benefit on the subject junction and nearby intersections.

Note: *The full independent crash analysis report is available as a separate document for perusal if needed.*

COMMUNITY CONTRIBUTION

The project was a community requested project. It was originally on Auckland Transport's radar for installation in 2021, but was brought forward as part of a concerted effort by the locals, and spearheaded by the local MP. The community strongly desired a reduction in crashes, and to feel safer when using the intersection both in vehicles, and as vulnerable road users (pedestrians and cyclists).

Auckland Transport committed to a '*Vision Zero*' compliant design at the intersection, going with the addition of a completely raised intersection and pedestrian crossings on all 4 legs, even when pedestrian data at the time only supported 1 of the legs when carrying out a Road Safety Audit.

Pedestrian numbers were approximately 20 per day in the pre-construction survey in August 2019, and in May 2021 the numbers were 36, showing a clear increase of use now the access has improved. Also, pedestrian amenity has significantly improved, as pedestrians now have priority crossing all legs at the intersection, providing a high level of service.

From site observations the raised roundabout appears to operate with a good level of service for motorists, with minimal vehicle delays and queues observed. The roundabout option was preferred over alternative proposals (signalisation) partly due to its operational efficiency.

The bus stops near the intersection were upgraded, and while they previously had an average of 6 unique trips per day, now they are showing an average of 7 unique trips per day. This might seem like a negligible increase, but for a bus network that is 30% down on total trips across the board due to COVID effects, this is effectively 50% improvement in the time since installation.

With the area home to several schools, a busy shopping centre, several churches, and also increasing housing intensification, future planning for pedestrian and vulnerable road users was important. Providing improved pedestrian access for the expected population growth in the area through upgraded pedestrian and bus facilities, was an important feature. Also, creating a safer environment for all user types through reduction in vehicle speeds using raised platform ramps and roundabout layout, were '*Safe System*' objectives and a project highlight.

The installed roundabout has significantly increased the safety of the community as a whole for the future. The housing development that was under construction nearby on Victoria Street has been recently completed, and 500 newly occupied homes will contribute to increased pedestrian volumes benefiting from the roundabout upgrade. Those that live there will be able to move-in and experience safer footpaths, better bus stops, access to the bus network, and safer and easier access to nearby retail and commercial facilities.

The results of this project are the reason local council's do what they do, to make the roads safer for all user types in a sustainable, cost effective manner. The reduction down to ZERO crashes at this intersection benefits the immediate residents who don't have to deal with constant crashes, the road users who can now safely traverse this road, and the community as a whole, whose safety and ease of access was considered paramount throughout the project.

ENVIRONMENTAL MANAGEMENT

An arborist was engaged at the design and construction stages to ensure all potential trees in the project zone were carefully considered, and root zones were protected during footpath excavations. Permeable semi-flexible surfacing was used for a bus stop upgrade to avoid affecting the dripline of a large nearby tree.

Recycled water trucks were used on site, and the planning of material sourcing as near to site as possible to reduce the number of trips by contractors (reducing carbon emissions). The stormwater system was protected during construction through the use of silt socks on existing catchpits, and as there is a very steep flow down Victoria Street, these were doubled around the downhill catchpits.

RISK MANAGEMENT

The biggest risk to this project was the ongoing challenges during construction due to the limited early investigations (due to time constraints), and changing ground conditions and services locations that differed to the recorded plans. A Risk Register was maintained from project handover, and was updated weekly at the weekly design and site meetings. Underground utility services and ground conditions were a recognized risk, due to the expedited timeframe, and that limited prior investigations were possible. The mitigation was to have designers on standby for any changes and when they occurred, the turnaround time for any redesign elements was minimal, and did not impact programme progress.

Over the Christmas break the key risk was a break in materials supply, and a backup concrete plant was arranged. This proved prudent, with the main supplier suffering a breakdown, and the backup plant was required to complete the pour of the roundabout, with no delays.

PROJECT MANAGEMENT

The delivery timeline of the project was met a full 12 months ahead of schedule. It is one of the most efficient projects delivered by Auckland Transport Technical Services team in the last 5 years. The project was at scheme design in July 2019 and was originally scheduled for construction in 2021. Due to community requests, the project was brought forward for design and construct in the 2019/2020 financial year. The project manager and design consultant were assigned early August 2019. The contractor was selected due to their availability and local knowledge as they were the area maintenance contractor at the time. They were brought into weekly meetings from 5 September 2019, by which time draft detailed design plans were already completed. The design was finalised after consultation and safety audit findings on 22 October 2019, ready for construction start on 5 November 2019. The roundabout was opened to the public on 16 January 2020, and was temporarily closed again for power connection and line-marking works for two weekends in February 2020.

CONCLUSION

This concludes the story about a junction with big crash beginnings, innovative design, fast-track project management, great community outcomes, and '*Safe System'* endings. A fairly complex design and construction project was implemented efficiently and successfully, despite adverse on-site conditions, mainly due to a collaborative team spirit and '*can do'* team attitude.

FIGURE 9: LOCAL MP DENISE LEE AT THE NEW ROUNDABOUT

FIGURE 10: ONEHUNGA RESIDENTS CELEBRATING AT THE NEW ROUNDABOUT

ACKNOWLEDGEMENTS

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