Introduction

City Design is a Engineering Consultancy Business Unit of the Christchurch City Council. City Design has a small team of engineers who specialise in the design of cycle facilities. A cycle facility must be well designed or cyclists will not use it. When a facility is well used it gives confidence to undertake other projects and it helps to secure continued funding.

City Design is able to work for other Local Authorities and we are happy to share our knowledge and experience of cycle facility design.

This paper presents some of the technical information on the process and design of "**The Papanui Railway Cycle way"** and in particular "**Dedicated Cycle Signals**"

Background

The current section of the Papanui Railway Cycle Way will be some 2.9km long. It runs, in the north, form St James Park to the Matai Street Rail crossing in the south.

The Cycle Way runs parallel to The South Island Main Trunk Line and crosses 5 roads, 1 is a Local Road, 3 are Minor Arterial Roads and 1 is a Major Arterial Road. See Table 1

Blighs Road	Minor Arterial	9,600 Vpd
Wairakei Road	Minor Arterial	14,750 Vpd
Glandovey Road	Minor Arterial	13,300 Vpd
Wroxton Terrace	Local Road	1,350 Vpd
Fendalton Road	Major Arterial	19,500 Vpd

Table 1 Intersecting Roads

The Cycle Way also crosses 4 rivers. This requires structural design and consents for the bridges, it also includes Landscape Architectural input for enhancing the area around the bridge, the landscaping also includes water dissipation for surface water run off from the Cycle Way.

The Cycle Way provides an alternative "off-road" facility to riding on the main roads. This is a significant feature as it links communities to Many Schools and The City. Because it is an "off road" facility, it makes cycling and walking a more desirable option for a wider group of people.

Consultation

The project has involved, since 1995, and continues to involve extensive consultation with the community in the cycle way catchment and particularly residents adjacent the cycleway. Public acceptance is the key component to getting the project backed by Council. There was some public concern for safety at intersections during the consultation process.

Consultation also included liaison with public utility service providers from storm water through to fibre optic cable networks, the Police and of course Tranz Rail New Zealand.

Staged Construction

The Papanui Railway Cycle way has been split into 3 stages

Stage 1 & 2, St James Park to Wairakei Road, 1120m

Stage 3 & 4, Wairakei Road to Fendalton Road, 1060m

Stage 5, Fendalton Road to the Matai Street Rail Crossing, 620m

Design Decisions

There have been many decisions made in the process of achieving the optimum design for the Railway Cycle way. They include

- Cycle way surfacing, we have specified paver laid Asphalt Concrete to achieve the best possible surface finish. Gradients exceed the minimum standards to ensure the ease of use for both cyclists and pedestrians. The Cycle Way cross fall is sympathetic to the surrounding contour unless the storm water discharge enters private property in which case we have used kerb and channel to remove surface water.

- The Horizontal alignments have been designed to give a visually pleasing look while keeping the path viable for commuters. The design width is 2.5m with local widening at crossings where there will be larger volumes of cyclists and pedestrians. The Cycle Way also has decreasing radii alignment deflections on most approaches to road crossings, this provides a visual queue to cyclists and is a speed reduction facility.

- The Safety fencing of the railway line was the main concern that Tranz Rail had with respect to cyclists and pedestrians being in this area. We have agreed on a 1.5m high, black wire mesh fence. This fence is 1.2m high for 20m from intersections, where there won't be demand to climb over the fence. It then tapers up to 1.5m high over a distance of 30m. We have also used black mesh fencing for other hazards like drains and steep banks. The black mesh is used to minimise the visual impact of the fence.

- Bridge structures have been designed to compliment the adjacent environment. We have used natural timber and an epoxy grit surface treatment to ensure the bridge surface doesn't ice over during winter.

- Access to the Cycle Way is enhanced by providing links to adjacent Streets, Schools and Parks.

- Street lighting has been included in the design. There was considerable public feedback on the perceived dangers along the Cycle Way during the hours of darkness. The poles and fittings were tested to ensure minimal light spill into residential properties immediately adjacent the Cycle Way. During the lighting trials we also had to ensure the colour of the lamps did not look light Train Signals to approaching train drivers. The design complies with AS/NZS1158.3.1: 1999. The lighting system is dimmer ready where by the lights can be dimmed if required depending on public feedback.

- Maintenance vehicle access is essential with routine mowing, landscaping, street lighting and Rail servicing required. This has been achieved with retractable bollards at the intersections and the pavement is constructed to a depth which accommodates light commercial vehicles.

Of all the design decisions the most complex was Intersection Treatments

Intersection Treatments

We decided the process to be used for determining the type of intersection control would be TR 11 (Traffic Research 11) Pedestrian Warrants and NZS 5431 The New Zealand Traffic Signals Warrants.

The rationale was, if the conditions warrant pedestrian protection, then cyclists would also need protection. (From historical records, we found crashes at mid block pedestrian signals occurred within 5 years of installation. It appears that drivers need time to become familiar with a new facility. This was not considered a problem along the Cycle Way as Rail Signals already existed. Note: A zebra crossing is not an option, as cyclists would have to dismount and walk across the road to get priority.

To determine the intersection treatment we used modelled cycle and pedestrian volumes against known traffic volumes. Using the warrant process we found three crossings required Dedicated Cycle Signals.

This caused considerable debate and concern from traffic planners and transportation engineers who needed assurances delays to traffic would be negligible and the facility would be responsive enough to ensure cyclists and pedestrians would use it. This required specialised design and the use of soft technologies. This can be described as an “intuitive design with intelligence” that is responsive to user demand.

Dedicated Cycle Signals

City Design had to achieve the objectives of Tranz Rail and the City Council. That is, provide minimal delays to drivers, cyclists and pedestrians while giving priority to public safety.

Trains

The cycle signals are linked to the Tranz Rail signals. The train detectors have been relocated the further away from the intersection

- To initiate a red signal for road traffic prior to starting the rail alarm bells and barrier arms.
- The barrier arms are now completely lifted prior to traffic getting a green signal.

Much of the Tranz Rail Hardware has been repositioned to improve cycle access across the road and improve signal visibility for approaching traffic.

Rail warning lights have been added on the cycle way for cyclists and pedestrians to warn of approaching trains.

Road Traffic

Giving priority to vehicles by keeping the signals resting in green for road traffic.

The presence detectors on the cycleway cancel a call for a cyclist if the cyclist leaves the detector to cross the road.

- This often occurs during low traffic flow when a cyclist sees a gap in the traffic and crosses the road regardless of the signals.

- This prevents drivers facing a red light when there is no one there to cross the road.

The traffic signals have been co-ordinated with adjacent intersection signals to ensure optimum traffic flow on the road network.

Cyclists

We've made the signals work for cyclists by providing dynamic detection.

- This is an advance loop that tells the controller a cyclist is approaching and registers a call for a green signal. If the cyclist arrives at the intersection within a predetermined time the signals go directly into the cycle phase.

- This ensures minimum delay to cyclists.

Holding rails have been installed to locate cyclists directly over the presence detector loops.

The cycle signals default to green *(with a red stop arrow)* when a train is passing regardless of cycle demand.

The cycle signals are completely independent of the pedestrian signals.

Pedestrians

Presence detection will be used for pedestrians.

A call button is on the pole to ensure pedestrians are standing in the right place.

The presence detector measures changes in pressure when pedestrians are standing on the detector, it then registers a call.

This technology is able to cancel spurious calls where the pedestrian is

- Just passing and pushes the call button

- Cross the road regardless of the signals.

The footpaths have been deflected with landscaping and cycle holding rails to minimise potential cycle and pedestrian conflict at the intersections.

Profile Statement

Warren Lloyd combines two years Rural Road Design from the Waikato District, six years Traffic Engineering from Tauranga District and four years Traffic Engineering with City Design, Christchurch.

Warren received NZCE Civil in 1992 and completed the NZCE Endorsement Paper 6006 Traffic Engineering in 1994. He is now a Registered Engineering Associate since 1998 following ten years experience and responsibility in the Civil Engineering discipline.

Warren currently specialises in the design of facilities for cyclists, complex intersection modelling and design, scheme plans for urban roads, road marking and traffic sign details, safety audits and crash reduction studies.