

3. ROUTE:

- 3.1 The route proposal in this report has been devised to connect as many as possible of the activity locations in the central Henderson area.

There are many alternatives and this is not to say that this is the preferred or recommended route option, but it has been chosen to reflect the existing feature points of the area and to enable a realistic first estimate of cost to be prepared.

3.2 ROUTE LIMITATIONS:

Generally there are few physical limitations in planning a tram route. Trams mix well with motorised traffic and also go safely and well in pedestrian precincts, e.g. Christchurch, Melbourne.

Trams can use city roads as easily as other traffic and can in general be controlled by the same traffic signals and signage.

Danger to motorised traffic is minimised because the path taken by the tram is predicted by the track which is clearly visible in the road.

There are limitations of gradient, and it is recommend that this be limited to 1 in 20 where possible. There are limitations of curvature, predicated by the geometry of the tram cars. The minimum curvature should be based not for the two Lisbon trams, but for high capacity modern trams in the event that one day such vehicles may operate on this tramway.

The minimum radius specified by Bombardier for Flexity trams supplied to the city of Linz is 17 metres, and this is quite small so this will not present a problem as it is recommended that a minimum radius of 30 metres be used for track in the street.

The hub and spoke concept that was outlined in the first section of this report means that the chosen route has been laid out with consideration for the points at which the "spoke" lines might join into the "hub" circle.

The provision of a turning triangle is necessary because as the trams would always go one way around the circuit it is necessary to turn them frequently to even up tyre wear and therefore prolong tyre life.

3.3 SELECTED ROUTE:

The route selected for this exercise is simple and except for the Corban Estate, the line would run entirely in the streets. Note that while it may be nice to have a portion of the route "off road", the transitions from road to off-road are sometimes difficult to manage safely except with traffic signals. Refer to the map at the end of this section.

Building the tramway within the city streets has the advantage that no land acquisition is required and no zoning changes need be made. It also gives greater opportunity for visibility branding and stops for customers.

Starting on Great North Road and travelling north from the junction with Henderson Valley Road: (approximate distances only – and numbers referenced on the map)

1. 190m
Tram stop. Pedestrian access across the railway to Corban Estate.
2. 240m (430m)
Tram stop. Signalised intersection with Lincoln Road, Swanson Road and Buscomb Avenue.
3. Lincoln Road
205m (635m)
Tram stop. Signalised intersection with Sel Peacock Drive.
Turn right.
4. Sel Peacock Drive
145m (780m)
Intersection with Buscomb Avenue
Continue straight across
5. Sel Peacock Drive
170m (950m)
Tram stop. Retirement village, shopping and commercial.
6. Sel Peacock Drive
295m (1,245m)
Tram stop. Aquatic Centre, Pak-n-Save
7. Sel Peacock Drive and through to Alderman Drive.
200m (1,445m)
Tram stop. Falls Hotel and parking
8. Alderman Drive and through to Edsel Street
215m (1,660m)
Tram stop.
Great North Road. Signalised intersection.
9. Edsel Street
240m (1,900m)
Tram stop
Shopping Centre

10. Edsel Street, turn right, still Edsel Street
240m (2,140m)
Tram stop
Pioneer centre and parking
11. Edsel Street, turn right into Rainside Avenue
230m (2,370m)
Tram stop
Transit Centre
12. Rainside Avenue
115m (2,485m)
Tram stop
Signalised intersection with Great North Road
13. Turn left into Great North Road
180m (2,665m)
Tram stop
Signalised intersection with Great North Road

At this point there will be a triangular intersection of the tram track with the branch turning left into Henderson Valley Road.

14. Turn left into Henderson Valley Road.
Signalised intersection at new entrance to Corban Estate.
Turn right into Corban Estate
490m to terminus in creative precinct.
Tram barn. Storage and maintenance.

Note that many of the tram stops would be request stops but those at signalised intersections and the Transit centre would be compulsory stops.

There are a number of route options that can be considered:

OPTION 2: At stop #2 turn right into Buscomb Avenue and right again into Sel Peacock Drive. This would shorten the route slightly but the reason for the short Lincoln Road length in Option 1 was to make an easier tramway intersection for a future branch down Lincoln Road.

OPTION 3: At stop #9 in Edsel Street, carry straight on into Vitasovich Avenue turning right into Pioneer Street or Cranwell Street and thence to Rainside Avenue. This would increase the route length, serve a wider area particularly shopping and service businesses but would require a bridge over the Oratia Stream.

There are many other options that could be considered but, as mentioned before, this exercise is to establish possible costs and benefits of a tramway but not to finalise a route.

It should also be noted that Sel Peacock Drive is currently a designated over-size load route and the tramway on this road would limit the height of such loads to approximately 5.5 metres.

3.4 ADVANTAGES OF A STREET LOOP ROUTE:

- No requirement for land purchase or zoning changes.
- Pick-up and set-down points easily managed, particularly at signalised intersections.
- Single track loop would always be operated in a clockwise direction to minimise traffic conflicts.
- No requirement for tram passing loops.
- Simplifies connection to the Corban Estate and to possible future feeder lines.

3.5 STORAGE AND MAINTENANCE LOCATION:

This proposal requires that provision is made for a tram storage and maintenance facility. This would consist of a two-track tram barn with each track capable of accommodating two vintage trams.

One track would need to be equipped for maintenance and incorporate a pit between the rails. There would need to be staff amenities and facilities to cater for both operating and maintenance staff.

There also needs to be a power supply building attached that would contain the main power supply and the rectifier equipment for providing the traction power for the trams.

The location of this facility has been assumed to be on the Corban Estate with a view to the facility being a visitor attraction in itself, but consideration could also be given to locating this facility elsewhere on the proposed route.

Two alternative suggestions are:

1. Park area at the top of Corban Hill adjacent to Great North Road.
2. In the area behind the Aquatic Centre.

Whichever of the three locations is chosen will not affect the overall costs at this stage.

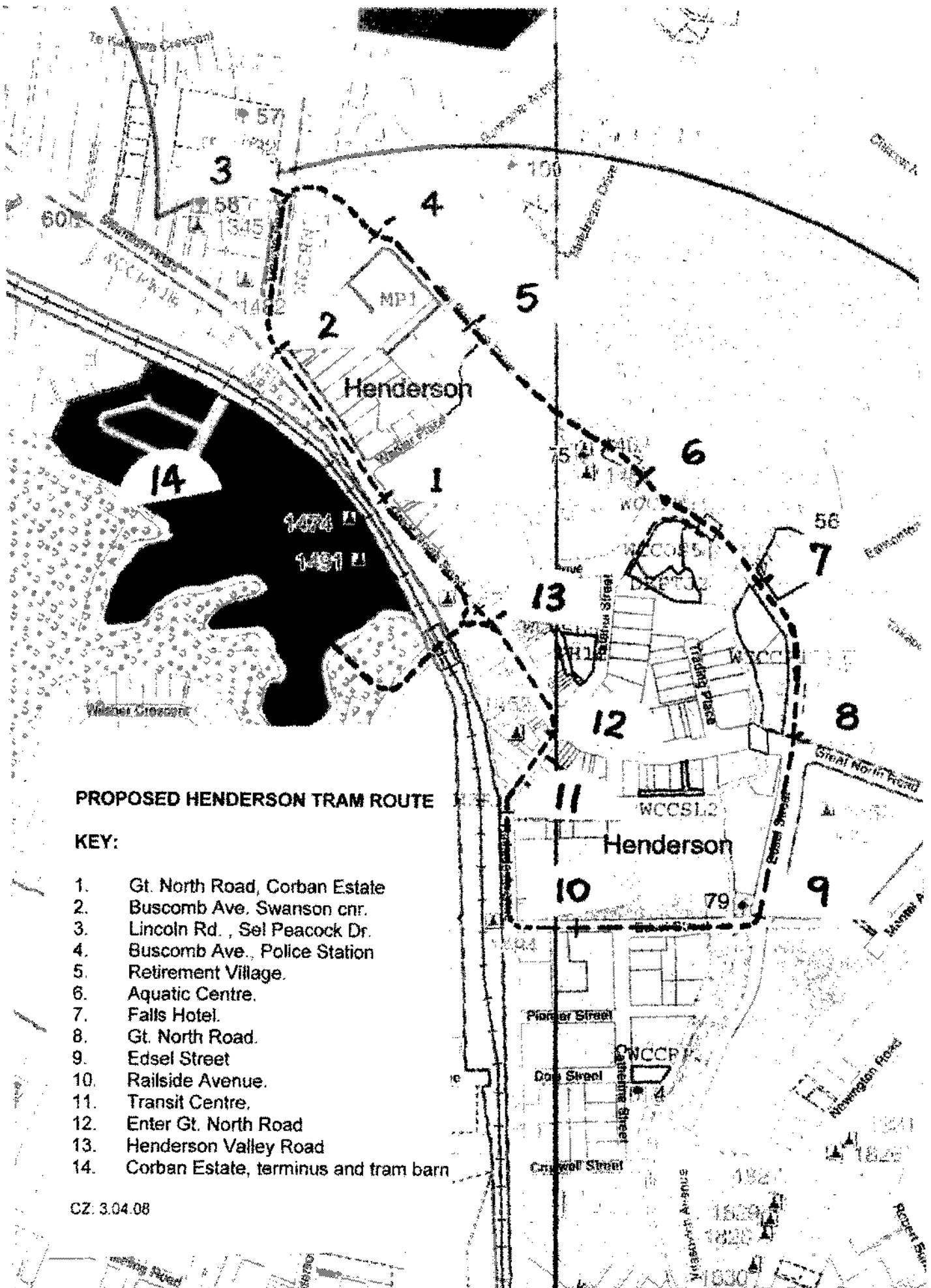
Refer to the Infrastructure List in section 6.2 of this report for more details of this facility.

Summary:

The route chosen for the proposed tramway is a closed loop that encircles the central Henderson business and commerce precinct and connects with the Transit Centre. The loop length is approximately 2.7 km. and would be operated in a clockwise direction only.

The route is entirely on city streets for maximum exposure and usefulness.

A branch is proposed leading to the Corban Estate which may include the storage and maintenance facility.



PROPOSED HENDERSON TRAM ROUTE

KEY:

- 1. Gt. North Road, Corban Estate
- 2. Buscomb Ave. Swanson cnr.
- 3. Lincoln Rd. , Sel Peacock Dr.
- 4. Buscomb Ave., Police Station
- 5. Retirement Village.
- 6. Aquatic Centre.
- 7. Falls Hotel.
- 8. Gt. North Road.
- 9. Edsel Street
- 10. Rainside Avenue.
- 11. Transit Centre.
- 12. Enter Gt. North Road
- 13. Henderson Valley Road
- 14. Corban Estate, terminus and tram barn

CZ: 3.04.08

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4. RISKS AND REWARDS:

Electric tramways, commonly referred to as light rail or street cars are no longer seen as an interesting relic of early 20th century technology, but a valid means of moving public transport forward in an increasingly energy conscious world. 334 cities around the world operate street tramway systems and at last count 119 of them are building new systems or expanding existing systems, (ref: Tramway and Light Railway Assoc.)

Heritage tramways are also making their mark and a survey of 14 heritage tramway systems conducted in the USA in 1998 concluded that:

- Recently implemented vintage trolley (tram) systems are closely tied to revitalisation and enhancement of commercial districts.
- The collective business communities in the cities researched give vintage trolleys high marks for being positive influences in their cities.
- The projects have been positive activities for both the city as a whole as well as the commercial interests directly affected.
- Disruption due to construction has been minimal and more than overcome by the positive factors once operation began. There does not appear to be any significant impact on general traffic flow on those systems where mixed traffic is allowed.
- The use of an overhead wire for electric power is not perceived as having any negative impact on the aesthetic of the urban landscape. On the contrary, vintage trolley projects offer opportunities for improvement of the urban scene through lighting improvements, sidewalk amenities and other beautification.
- Vintage trolley projects have been shaped by the involvement of the local business community with individuals and associations playing major roles in planning, implementing and operating the systems.

[ref: The Feasibility of a Single-track Vintage Trolley in the Midtown Greenway, Twin Cities, Minneapolis, Minnesota, USA, 2001]

The principal risks to such a venture in Henderson are mainly financial. It is unlikely that in the first stage, that is, the city loop, that it could ever pay for itself from fares collected. So it has to be seen in a much wider context and the objectives have to be met with financing from other sources that are seen to benefit from the tramway's existence.

The other risk to be considered is that of track gauge. While the 900 mm. gauge is perfectly feasible, the availability of second-hand trams is limited but not that of new trams.

Without a doubt, if the gauge were to be decided without there being any earlier commitments, in this case the purchase and restoration of the Lisbon trams, then the decision would be to go with standard gauge (1,435 mm).

The reason is entirely because of the ready availability of new and second-hand trams and the ability to borrow, lease or even host visiting trams.

Because of their construction, the cost of converting the Lisbon trams to standard gauge would be beyond reason and it would be cheaper to source second-hand trams built for that gauge. For reference to available second-hand trams see the Gomaco Trolley Company in the USA or Bendigo Tramways in Australia.

For reference, Bendigo has for sale a number of standard gauge trams ranging from an operational but unrestored Melbourne class W2 tram at A\$70,000 to three fully restored Birney Safety Cars (4 wheel, steel body, one-man trams with air operated doors) at A\$490,000 each.

Summary:

The construction of street tramways is expanding fast in cities around the world.

Heritage tramways are seen as a means to revitalise city centres.

The adoption of the 900 mm gauge needs to be carefully considered.

5. TRAMWAY CONFLICTS:

As noted earlier in this report, street tramways mix well with pedestrian traffic and mix reasonably well with motorised traffic.

Trams are unable, of course, to take avoiding action other than to apply brakes which are usually most effective. On the other hand, the path that will be taken by a tram is entirely predictable as the rails in the street are quite visible.

The tramway can be controlled at intersections in the same way as motorised traffic and tram phases for traffic signals can be distinguished from other phases with the use of internationally accepted "T" light signals.

The current bridges along the route all appear suitable to carry the tramway as the loads imposed are not large and are well distributed.

The principal conflicts that arise are those during construction of the tramway as considerable disruption to traffic and hazards for pedestrians will occur. Again the USA survey suggested that the temporary disruptions were seen to be acceptable in view of the favourable long-term outcome.

Most of the streets in the proposed route are sufficiently wide that traffic lanes could remain open for both directions of travel while tramway construction takes place in the centre. In some narrower streets, temporary detours would be needed.

Jesmond Construction advises that, were they to be undertaking the construction, it would take place progressively over relatively short segments of the route so as to minimise disruption to traffic and business along the route.

Summary:

Disruption to traffic and business can be minimised by staging during construction.

When operating there will be little disruption to traffic.

6. COST ESTIMATE:

The following estimates have been drawn up from a number of sources:

- Colin Zeff and Associates Limited has experience with the MOTAT tramway extension that was completed in 2007
- Jesmond Construction Ltd has extensive experience in roading, drainage and civil engineering construction and were the main contractor for the MOTAT tramway extension.
- Suppliers of tramway track, points and crossings in Australia who supply to Melbourne, Adelaide and other railway and tramway projects in Australia and worldwide.

Preliminary estimates indicate that the tramway could be constructed for a figure of **\$7.25 million**. See the appendix to this section for details of how this sum is made up.

With a total track length of 3,265 metres this gives a per metre cost of \$2,220

It should be noted that this sum is for construction of the complete tramway as envisaged in this report. It has assumed that all new materials would be purchased but there could be considerable savings made with the use of second-hand ex-Ontrack rail that is often available, for example.

The estimate does include for the provision of additional traffic signals and for the alterations required to existing signalised intersections.

The estimate does NOT include for the further restoration of the two ex-Lisbon tram bodies which currently is being funded by the *Heritage Trams for Henderson Society Incorporated*. The re-furbishment of the two 4-wheel trucks or bogies is estimated to cost in the region of \$100,000

Also, the estimate does not include the cost of Resource Consents or Building Consents as the policy by which the Council operates in charging for these for its own projects is not known at this stage.

Summary:

It is estimated that the tramway could be built for \$7.25 million

6.1 APPENDIX -- COST ESTIMATES**CIVIL CONSTRUCTION:**

	\$	\$
Preliminary and General	406,000	
Excavation	172,000	
Track base	309,000	
Lay track incl. all welding	737,000	
Track encasement slab	588,000	
Drainage	32,000	
Pole bases	400,000	
Traffic management, lights and signs	1,245,000	
Erect poles and overhead	250,000	
Platforms, buildings, reinstatement	505,000	
15% contingency	697,000	
SUB-TOTAL		5,341,000

TRAMWAY DESIGN AND EQUIPMENT:

Engineering, design and supervision	200,000	
Power supply	300,000	
Traction poles	210,000	
Track, grooved and plain	560,000	
Turnouts, mates and crossings	360,000	
Conductor wire	80,000	
Support wire and fittings	120,000	
SUB-TOTAL		1,930,000
TOTAL		7,271,000

6.2 APPENDIX - 2

INFRASTRUCTURE LIST FOR HENDERSON TRAMWAY

The following is an outline list of the infrastructure items for the Henderson Tramway:

Track:	City loop	2,665 metres
	Branch to Corban Estate	490 metres
	Tram barn tracks (2)	110 metres
	TOTAL:	3,265 metres

Turnouts	Henderson Valley Road triangle	3
	Access triangle to tram barn	3
	Second tram barn track	1
	TOTAL	7

Note that if the "spoke" connections are provided from the start each will require a further 2 turnouts.

Poles and Overhead:

Without designing the overhead layout an estimate can be made that would indicate that the number of poles required would be about 140. The length of traction wire required would be the same as the track length, i.e. 3,265 metres.

Tram barn: A storage and maintenance building would be needed complete with workshop facilities, a pit between the rails on the workshop track and lifting jacks. The building should be designed for 4 trams but not necessarily all built at the start.

The tram barn would be the obvious place for the office and staff facilities. It could be that the workshop is designed to allow safe viewing of the trams and workshop space by the public without them entering the work area.

Tram storage and maintenance	24m x 10m vintage
tram barn appearance,	
Amenities , office etc,	15m x 5m

Power supply:

A power sub-station would need to be built and as long as the supply to the Corban Estate is adequate it should be located at the tram barn.

Power sub-station, concrete construction with floor ducts
12m x 5m

Traffic signals:

Alterations would be needed to 8 sets of traffic signals plus the provision of at least one additional set.

7. OPERATION:

7.1 REGULATION:

The operation of a street tramway in New Zealand is governed primarily by the **Railways Act 2005**. The Act is not prescriptive and the objective is that railways and tramways will be self-regulating, operating under an approved **Safety Case** that sets out what the railway or tramway operator will do and how they will ensure that they continue to operate within the terms of the approved safety case.

The Act is administered by Land Transport New Zealand (LTNZ) and that includes regular audits of the system and operations.

7.2 LICENSING:

All **Rail Participants** have to hold a **Rail Licence** which is issued by LTNZ. The participants include the rail Access Provider and the Rail Operator. These may or may not be the same organisation, e.g. Ontrack provide the track and Toll Rail runs the trains. It is likely that in this case the Waitakere City Council will own the tracks as they will be set in the city streets and the rest of the infrastructure and would make it easier to expand the route at a later date, especially if more than one operator was licensed. An operating company or trust company will own and operate the trams. The operation and ownership need not be the same company, however. All parties will need to hold a Rail Licence.

7.3 PERSONNEL:

The operating company will need to have an appointed manager and a Safety Officer who could well be the same person. The heritage trams will need drivers and conductors (for safety) as the trams have open platforms and no automatic doors. The number of drivers will depend on the frequency of service to be provided and the hours of operation. The operation will also need a maintenance person but this may not have to be a full-time position. Maintenance work could be contracted out but some specialist knowledge is required, both electrical and mechanical. Refer to Section 8 of this report for costs.

7.4 TRAM OPERATION:

It is likely that in the early life of the tramway it would only operate during the day as there are limited evening and night time activities within the area. A one-tram operation is envisaged with the second tram available as a stand-by. At busy periods the second tram could be used, subject to availability and crew.

7.5 TIMING AND SERVICE FREQUENCY:

It is estimated that a round-trip on the loop would take about 30 minutes, allowing for traffic lights and loading and unloading time. Two trams could therefore provide a 15 minute service frequency if required.

This indicates that the service within the area would not be particularly quick but it would likely be more convenient than other modes of transport within the central area.

7.6 TRAM BARN:

It is considered that the best location for the tram barn would be on the Corban Estate as it would avoid the need to buy a relatively expensive piece of commercial land elsewhere on the route or occupy Council park land.

The tram barn itself will fit in well with the "arts and leisure" theme of the Estate and can become a feature in it's own right with viewing facilities for visitors.

It is certainly necessary to provide a connection to the city loop into the Corban Estate and this can be used as an extension to the loop service as and when required, for example at weekends.

The tram would proceed to the northern end of the Estate and then change ends or reverse to resume the journey. As the Lisbon trams will be double-ended when restored, reversal of the tram's direction of travel is simple and necessary anyway on a closed loop route to even up tyre wear.

Other limitations include the fact that it would be close to impossible to have a level crossing with the railway, and undesirable for several reasons. Thus the access from the central business district into the Corban estate is limited to a turning off Henderson Valley Road.

However, it is considered that the incorporation of the Corban Estate into the city loop would be a mistake as it would substantially increase the journey time and may be of limited use.

Having entered the estate it is difficult to engineer another access point at which the tramway could leave. This leaves the conclusion that the track to the Corban Estate could in fact be a dead end and could also lead to the tram barn and maintenance facilities.

Summary:

Operation of the tramway is regulated by the Railways Act 2005. All rail participants need to hold a Rail Licence.

Traversing the whole of the loop line will take about 30 minutes.

The track to the Corban Estate should not be within the proposed loop line but a branch from it.

8. OPERATING COSTS

The operation of the tramway requires three functional groups

- Tram crews
- Administration
- Maintenance

8.1 TRAM CREWS:

Assuming the tramway is to operate business hours only but for 7 days per week there will be a need for 2 or 3 drivers and 2 or 3 conductors. If the trams are to be operated on extended hours then more crews would be required.

It should be noted that the Lisbon heritage trams are open platform cars and a conductor is needed to ensure the safety of the passengers, particularly children.

The trams could only be operated as one-man cars if they were to be modified with air operated doors, as on a bus.

Tram crews could be part-timers who share the full day roster or full timers, but meal breaks would be needed for operation within a full 8 hour or more day.

8.2 ADMINISTRATION:

The duties of the Tramway Manager will include the following functions:

- Ensure that all conditions of the Rail Licence are met including safety and training.
- Employment of tram crews including rostering and wages
- Providing information to the public.
- Reporting to Waitakere City Council as required.
- Managing the maintenance function.

8.3 MAINTENANCE:

The maintenance of the trams and the infrastructure could be contracted out or could be handled in-house by a suitably competent person.

It is estimated that the cost of salaries, wages, holiday pay, allowances and ACC would be of the order of \$300 - 400,000 per annum.

In addition to the staff costs there will be the following to be met:

- Rail Licence fees
- Electricity (not a big item)
- Insurance
- Telephone, cell-phones (for driver communication) and other service costs.

Assuming that the tramway attracted 100,000 riders per annum at an average revenue of \$1.50 each (say \$2.00 adults, \$1.00 children) that would only bring in \$150,000 per annum. For comparison, Christchurch City Tramway gets 156,000 riders per annum and MOTAT tramway, about 110,000.

The result is that the tramway is unlikely to ever cover it's direct costs and the shortfall will need to be met from rates, sponsorship by local business, advertising and/or a levy on car parking.

Summary:

Total operating costs are likely to be in excess of \$400,000 per annum.

Revenue from fares would likely cover only a third of this so other forms of funding will be required such as sponsorship, advertising, parking levies etc.

9. TRAMS AS A FEATURE:

It is interesting to note that the Christchurch City Tramway has only been operating for 13 years, yet in that relatively short time it has become absolutely iconic to the extent that it would be hard to see an illustration of Christchurch or even a postcard that did not contain a picture of one of their trams.

In Christchurch, the focus is very much on the tourist trade as a very large volume of foreign and local tourists use Christchurch as a gateway to the South Island. The same could not be said of Henderson and the tourist potential is probably limited in the short to medium term.

The price for an all-day ticket in Christchurch is \$14 and there are no "short hop" fares. Their annual passenger count is in excess of 150,000 per annum. Despite the apparent high cost, the tramway is shortly to be extended to cover more of the central city business and shopping area.

It is also interesting to note that the city of Wanganui is planning a vintage tram circuit of the inner city using restored trams that were originally from Wanganui. To date one tram has been restored and is nearly ready for service. A short length of track, about 240 metres, is to be laid shortly along the river front as a demonstration of how the tramway might look and work. Wanganui expects that their patronage will be a mix of tourists and locals, and a low fare for short journeys will be applied.

Trams in Henderson could certainly draw a number of "tourists" or visitors from outside the immediate area by their novelty value alone, although it could be said that a visit to MOTAT would do the same.

The trams certainly would be a bright and novel feature in the street particularly if the distinctive yellow and white colour scheme is retained.

Potential uses of the trams are:

- People needing to get around the CBD without walking or taking a car.
- People needing to connect with buses and trains at the transit centre.
- As a parking "distributor". i.e. leave the car in the car park, move around with the tram.
- As a novelty ride particularly for children, and this will bring parents to the shopping area.
- As a viable means of getting around the town for the residents of the large retirement village.
- As a connector between the shopping areas.
- As a connector for the Corban Estate arts precinct.
- As a connector for Waitakere Central.
- An ECO-CITY visible commitment.

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With the Henderson Trams, as the distances involved are short, none of this will work without a cheap fare which probably means that the costs would

need a subsidy from the Council or elsewhere. It is the writer's opinion that a flat \$2 fare would be suitable and at that level would get a lot of patronage. \$5 or even \$4 would be a definite put-off.

The tram could serve as a feeder for parking sites around the town and one option would be that the parking ticket also allows use of the tram – so the parking fees would help subsidise the tram operation.

Summary:

Vintage trams can quite quickly establish themselves as an iconic feature of a city or district. Christchurch has demonstrated this, as has Bendigo in Victoria.

Wanganui is proposing a tramway similar to that proposed for Henderson and they are about to start the first stage of construction.

*Not only would trams in Henderson be a visual feature but they would serve a useful function as a district **connector**.*

10. MANAGEMENT STRUCTURE:

At present the two trams are owned by *Heritage Trams for Henderson Society Incorporated*. It is the intention of the Society that, on completion of the restoration of both trams, they will be donated to the Waitakere City Council.

It is unlikely the Council will want to operate the tramway but they could own the trams on behalf of the citizens of Waitakere City, and they can be leased to an operating company or trust.

Waitakere City would also own the tracks in the streets and the overhead traction wire with it's supporting poles and span wires.

Christchurch Tramway Ltd. does not provide a suitable model on which to base the Henderson operation. It was originally part-owned by the Christchurch City Council, Tourism Canterbury, and tourist operator Shotover Jet. This arrangement was unsuccessful and the operation was sold to private investors under the name of The Wood Scenic Line Limited about three years ago. This company also owns the Port Hills gondola operation.

The Company's income is derived from ticket sales only with no subsidy from the Christchurch City Council. They also pay a lease to the Council for the use of the tracks, owned by the CCC, and are responsible for day to day maintenance of the infrastructure. All their trams except one are leased from the Tramway Historical Society, who operate the museum tramway at Ferrymead, near Christchurch.

The Bendigo (Victoria) operation is similar in that it is based almost entirely on tourist patronage. The Bendigo Talking Tram takes passengers for a 72 minute tour of the city attractions, principally the splendid architecture created from the wealth generated by gold mining in the 19th century and the remaining gold mine that is right in the city.

A two-day ticket costs A\$12.50, shortly to be raised to A\$14. They do cater for local events and holidays at which times they put on shuttle services and have a limited time short ride ticket costing A\$2.

The Bendigo Trust is a not-for-profit organisation that has two divisions. The Heritage Restoration Division that restores trams for their own operation and for sale to other operators. The other division is the Bendigo Talking Tram. The Trust is self funding except for an annual grant from the Bendigo City Council of A\$50,000 annually (at present) which is for infrastructure upgrading. The track and overhead, tram barn and workshops are owned by the City and the trams vested in the Trust. They use a combination of paid staff and volunteers for all operations.

The Henderson Tramway would not be able to base it's income on tourism which is almost the sole source of patronage of the Christchurch Tramway and the Bendigo Tramway.

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It would need to be operated by a trust that would draw income from a variety of sources, possibly including rates.

It is suggested that the trust would be managed by a board appointed by Waitakere City and business interests and groups interested in the promotion of Henderson as a destination for business and retail.

Like Bendigo, the staff could be a combination of paid staff and volunteers.

If the second stage of the Vision were to be contemplated at some future date, that is, commuter lines to the suburbs, then the involvement of an experienced transport operating company would be needed.

Summary:

The Henderson Tramway would be most likely operated by a Trust. The Trust Board would appoint a Manager who in turn would hire the staff. The Trust Board would report to the Waitakere City Council.

As the income from fares is unlikely to cover costs it will be necessary to provide an income stream from other sources

11. THE QUADRUPLE BOTTOM LINE

It is necessary to consider the tramway proposal to determine how it meets the Quadruple Bottom Line analysis.

ECONOMIC:

This is a proposal that does not directly have an easily defined return on the assets employed. The benefits will flow to Henderson and the wider Waitakere City in the form of awareness of the city as an interesting and fun place to do business, shopping and cultural activities. All the businesses of the area will benefit, and this is backed up by studies of Heritage Tramways in cities overseas, but the actual monetary benefit is impossible to assess.

CULTURAL:

Tramways are very much a product of the European industrial revolution that started in the 18th century in Britain, the western countries of Europe and later North America. The products and processes of that revolution were eagerly imported into New Zealand by European settlers and shaped our way of life. Tramways are in effect a visible celebration of that imported culture and would enrich the city scene.

SOCIAL:

Tramways were once part of many cities in New Zealand and overseas. The tram experience is a fond memory for many of the older generation and an interesting history lesson for the younger folk. Tramways were very much part of the development and growth of cities and spanned many decades between horse drawn transport and the age of the private car.

ENVIRONMENTAL:

The environmental benefits of street tramways are easy to sell.

- The trams are powered by electricity, some or all of which is derived from renewable resources.
- There are no emissions to atmosphere in the street.
- They are very efficient users of energy due to the low rolling resistance of steel wheels on steel rails.
- There is very little noise pollution, an important point in confined city streets.
- Trams have a very long service life, typically between 40 and 80 years, thus conserving resources such as timber and steel.

They are a mode of transport whose time has come again for all of the above reasons. For Waitakere City, it would be a clear statement of their ecological strategies.

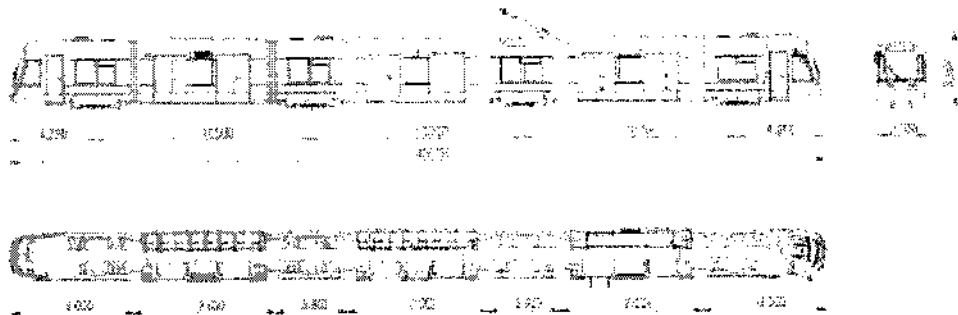
12. MODERN TRAMS:

The details and illustrations that follow show modern trams (ULF-LRV) built for the 900 mm gauge and in use in Lisbon and Linz.

Bombardier FLEXITY Outlook – Linz, Austria

Operator	Linz Linien GmbH
Length	40,000 mm
Width	2,300 mm
Max. Speed	70 km/h
Minimum Horizontal Curve Radius	17 m
Maximum Gradient	60‰
% Low Floor	100%
Seated Passengers	68 + 3 tip up seats
Standees	153 (4 pass/m ²)

Bombardier FLEXITY Outlook – Linz, Austria



Bombardier FLEXITY Outlook – Linz, Austria

The Linz Transport Authority (Linz Linien) ordered a total of 33 *Bombardier FLEXITY Outlook* trams. These 100 % low-floor vehicles are first world-wide to combine a stepless interior with conventional wheel-set bogies. The advantages of this new technical solution result in increased passenger comfort and operating efficiency.

In close co-operation with the customer, the *FLEXITY Outlook* concept was optimized for disabled passengers. A spacious room for wheelchair users, prams and passengers with heavy luggage is provided. A 40-t buffer load ensures active and passive passenger safety as requested by the Linz Transport Authority.

LINZ, AUSTRIA:



LISBON, PORTUGAL



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Appendix BXX: HISTORIC & MODERN LISBON TRAMS

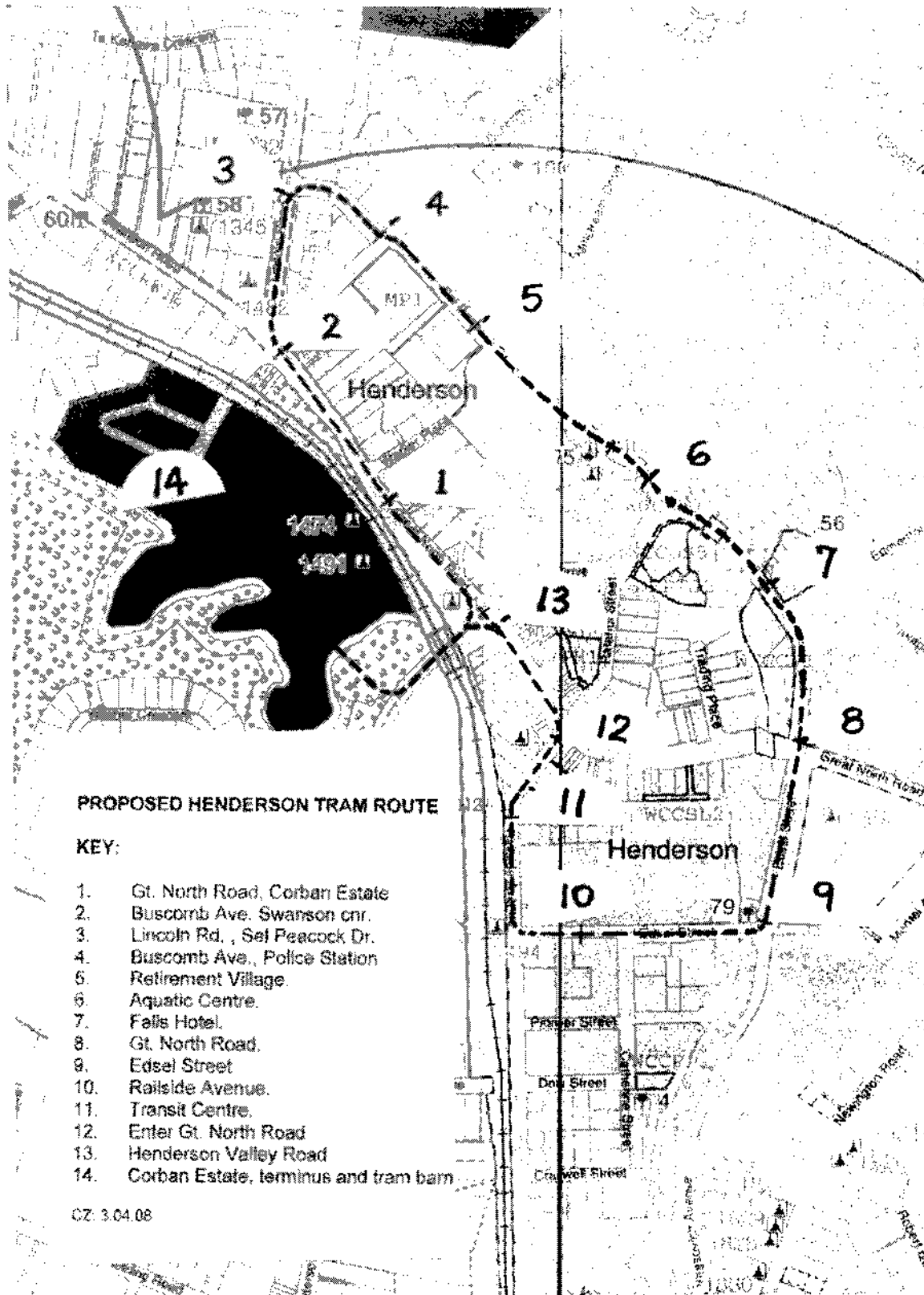


1925 Heritage Lisbon Tram stored at Corban Estate



Modern tram in Lisbon, with 210 passenger capacity

APPENDIX CXX: PROPOSED HENDERSON TRAMWAY ROUTE



Starting on Great North Road and travelling north from the junction with Henderson Valley Road: (approximate distances only – and numbers referenced on the map)

1. 190m.
Tram stop. Pedestrian access across the railway to Corban Estate.
2. 240m (430m).
Tram stop. Signalised intersection with Lincoln Road, Swanson Road and Buscomb Avenue.
3. Lincoln Road.
205m (635m).
Tram stop. Signalised intersection with Sel Peacock Drive. Turn right.
4. Sel Peacock Drive.
145m (780m).
Intersection with Buscomb Avenue.
Continue straight across.
5. Sel Peacock Drive.
170m (950m).
Tram stop. Retirement village, shopping and commercial.
6. Sel Peacock Drive.
295m (1,245m).
Tram stop. Aquatic Centre, Pak-n-Save.
7. Sel Peacock Drive and through to Alderman Drive.
200m (1,445m).
Tram stop. Falls Hotel and parking.
8. Alderman Drive and through to Edsel Street.
215m (1,660m).
Tram stop.
Great North Road. Signalised intersection.
9. Edsel Street.
240m (1,900m).
Tram stop.
Shopping Centre.
10. Edsel Street, turn right, still Edsel Street.
240m (2,140m).
Tram stop.
Pioneer centre and parking.
11. Edsel Street, turn right into Railside Avenue.
230m (2,370m).
Tram stop.
Transit Centre.

12. Railside Avenue.
115m (2,485m).
Tram stop.
Signalised intersection with Great North Road.

13. Turn left into Great North Road.
180m (2,665m).
Tram stop.
Signalised intersection with Great North Road. At this point there will be a triangular intersection of the tram track with the branch turning left into Henderson Valley Road.

14. Turn left into Henderson Valley Road.
Signalised intersection at new road bridge entrance to Corban Estate.
Turn right into Corban Estate.
490m to terminus in creative precinct.
Tram barn. Storage and maintenance.

Note that many of the tram stops would be request stops but those at signalised intersections and the transit centre would be compulsory stops.

There are a number of route options that can be considered:

OPTION 2: At stop #2 turn right into Buscomb Avenue and right again into Sel Peacock Drive. This would shorten the route slightly but the reason for the short Lincoln Road length in Option 1 was to make an easier tramway intersection for a future branch down Lincoln Road.

OPTION 3: At stop #9 in Edsel Street, carry straight on into Vitasovich Avenue turning right into Pioneer Street or Cranwell Street and thence to Railside Avenue. This would increase the route length, serve a wider area particularly shopping and service businesses but would require a bridge over the Oratia Stream.

There are many other options that could be considered, this exercise was to establish possible costs and benefits of a tramway, but not to finalise a route.

APPENDIX DXX: PRELIMINARY HENDERSON TRAMWAY ROUTE COSTS
CIVIL CONSTRUCTION:

	\$	
Preliminary and General	406,000	
Excavation	172,000	
Track base	309,000	
Lay track incl. all welding	737,000	
Track encasement slab	588,000	
Drainage	32,000	
Pole bases	400,000	
Traffic management, lights and signs	1,245,000	
Erect poles and overhead	250,000	
Platforms, buildings, reinstatement	505,000	
15% contingency	697,000	
SUB-TOTAL		5,341,000

TRAMWAY DESIGN AND EQUIPMENT:

Engineering, design and supervision	200,000	
Power supply	300,000	
Traction poles	210,000	
Track, grooved and plain	560,000	
Turnouts, mates and crossings	360,000	
Conductor wire	80,000	
Support wire and fittings	120,000	
SUB-TOTAL		1,930,000
TOTAL		7,271,000

NB: Excludes resource consent costs (approx \$100,000) and additional traffic signals and alterations to existing signalised intersections.