The Christchurch Tram Transporter

Presenter: John Shanks, supported by Bruce Dale
Session Chair: Rod Atkins
Session Secretary: Peter Kahn

John Shanks presented the Paper prepared by David Hinman. Videotape and an overhead projector presentation covered the actual procedures involved in transporting the City Loop tramcars from the Tramway Historical Society Museum at Ferrymead to the City.

1. Introduction

1.1 One of the many problems which needed to be solved during the planning and development of the new Christchurch tramway was a safe and economic method of transporting trams between their "home" at Ferrymead and the new city site. This was a distance of some 10 kms, generally readily accessible by major roads, virtually flat all the way.

1.2 While it would ultimately be the responsibility of the tramway operator to arrange transport, Shotover Jet Ltd were not appointed until some three months before opening date, and by that stage the City Council had entered into a contract with the Tramway Historical Society for the provision of the trams for the new tramway. Restoration/refurbishment was well in hand, and it seemed prudent to determine an appropriate means of transport, particularly if it involved construction or acquisition of equipment. It was therefore the City Council which took the initiative and investigated and designed an appropriate transport system, which it passed on to the operator for construction and execution

2. Tram Transport Options

2.1 Based on past experience, the "conventional" methods of transportation involved either:

(a) The use of a crane or cranes to load on to a road transporter, or

(b) The use of jacks (such as the THS's own body jacks) to facilitate access by a road transporter.

(c) Having a ramp (preferably at both locations) so trams could be driven or winched on to a truck or load loader.

2.2 The following principles in regard to transportation were established:

(a) The method needed to be safe and efficient and cost effective, with possibility of damage to the trams being minimised.

(b) The trams should be able to be moved in as complete a condition as possible, noting that from time to time there could be a need to transport them to and from Ferrymead. Removal of trolley poles and other roof features, or trucks, brake rigging, lifeguards, etc was seen as undesirable and noting height restrictions and the presence of power/telephone wires in some streets there was the need to keep the tram as low to the ground as possible.

(c) The task should not be too labour intensive—THS resources were fully extended in restoration and other activities, and time and labour could add significantly to the costs of the operation.

2.3 The use of cranage was seen as having some major disadvantages, in particular the possibility of damage from strops (based on past experience!), and the perceived difficulty of using cranes in the vicinity of overhead tram wires. The possible need to separately transport bogies was also seen as a disadvantage. Largely out of concerns for potential damage to the vehicles, the THS were very reluctant to allow cranage as part of the transportation process.

2.4 The conventional jacking option was seen as quite time consuming, also likely to require removal of bogies (including stripping of brake rigging, etc).

2.5 There was no practicable site in the city for a ramp, and if temporary would be time and labour consuming.

3. The Solution for Christchurch

3.1 The idea which finally developed into the Christchurch Tram Transporter had begun as an idea scribbled on the back of an envelope while en route to the Rail Federation Conference in Greymouth as long ago as 1991. During an informal discussion on plans for the new tramway, Alan Campbell of the Excursion Train Trust suggested using the containerisation principle where the whole tram could be lifted as a unit using, as suggested at that time, a container base and container jacks or cranes.

3.2 A year or so later, with the full tram loop confirmed and construction underway, this concept was investigated by members of the City Council's Tram Project Team who subsequently commissioned the Council's Design Services Unit to develop a practical solution.

3.3 Another important element of the final design had, by this time, emerged, and this was the use of building removal technology to assist in the lifting and transporting. Contact was made with a local building removal company which specialised in the lifting and relocation of houses and other buildings. Their equipment included hydraulic lifting jacks which could be interconnected to a portable control panel, allowing each to be lifted or lowered as required. In addition, the company's vehicles also included the ability to lower and raise the truck deck and adjust its length hydraulically (see attached CCC report). The use of this equipment was provided for in the design and the Company was employed to undertake the removal task.

3.4 The engineering design solution involved a U-shaped design with provision for four jacks per side and the use of rails and sleepers for the tram to sit on. This latter provision meant the rail was some 250 mm above ground level, thus requiring the construction of a ramp to allow the tram to be driven on and off.

3.5 The sides were of a simple truss design and readily allowed the addition of lugs and clips for attaching the jacks.

3.6 The ramp design proved to be one of the more difficult parts of the exercise because of the need to:

(a) Keep it as short as possible, and

(b) Allow for the overhang of various parts of the tram, including lifeguards, trip gates, etc.

3.7 A short ramp (3 metres) proved sufficient for most vehicles. However, 4-wheel tram No. 11 had, because of the overhang and such features as the lifeguards and steps, required a longer (7.8 metre) ramp to be built. This required the use of a truck mounted crane ('hiab') for lifting and lowering, and the ramp was separately transported on a flat deck truck.

3.8 One limiting feature of the transporter as built, was its length. At the time of construction, no serious consideration had been given to the importing of "foreign" trams and so the design was tailored to meet the requirements of the local fleet. Even then, the tolerances were rather fine and small extensions/buffers were added to either end to ensure safety for trams 152 and 178.

3.9 The all-up cost of the transporter was $NZ15,975, and the transport charges of the Building Removal Company for shifting the five trams amounted to $NZ10,200. An early estimate of transporter building cost had been $30,000.

3.10 In operation, the transporter has proven to be most successful and while to date it has not been necessary to return any trams to Ferrymead, the transporter remains available when occasion demands. When ex-Melbourne W2 tram 244 arrived, consideration was given to extending the base, but on that occasion the use of cranage was found to be both practical and more cost effective. The tram, in fact, arrived lashed to a 40-foot container base, was craned off the ship on to the transporter, and with the clever use of appropriate spreaders and the overhead switched off, was able to be off-loaded in Cathedral Square with only minimum paint and wood bruising.

4. Conclusion

4.1 The combination of the containerisation principle with building removal technology is a successful way of shifting trams in situations where it is not practical to have permanent ramps nor desirable to use cranes.

4.2 There are some elements of this particular design which, with experience, would perhaps be done differently, including:

(a) Increasing the length, and

(b) Not using conventional rails and sleepers so as to reduce as far as possible the rail height from the ground.

4.3 A copy of the plan is attached, and COTMA members are welcome to borrow and adapt the idea for their own use. The Christchurch transporter currently sits at Ferrymead awaiting its next job, with its owners, Christchurch Tramway Ltd, willing to consider any requests for loan or hire.

Dave Hinman
27 August 1996

CCC Report April 1994

CHRISTCHURCH TOURIST TRAMWAY METHODS OF TRANSPORTING TRAMS

INTRODUCTION

To transport the trams and trailers from Ferrymead Historic Park to the Tourist Tramway will involve loading the tram onto a transporter, driving into the City Centre and unloading the tram onto the track.

The problems envisaged are:

1. The trams cannot easily be craned onto a transporter since the bogies are not attached rigidly enough to the chassis, and also the overhead power wire will restrict lifting access.
2. Loading the tram by driving up a ramp will entail a very long ramp—about 10 to 16 metres long, that also needs to be transported.
3. The trams need a flat deck of about 12 metres for the longer trams, even then there will be 2 metres overhanging at the rear.

The trams, with dimensions, are detailed in Appendix A (not included).

TRANSPORTERS AVAILABLE

There are several low loading transporters available, including one owned by Works Operations. They vary in length from about 5m up to 8m. None are long enough to transport the two larger trams 152 and 178, although the longer transporters may be able to transport the Dunedin Trams and the trailers.

The next size up in transporters are the rigs used to move houses. These rigs are generally about 1 metre high, but can drop a little lower if the hydraulic suspension is lowered right down. The trailer can be tilted from the horizontal in two planes, thus compensating for road camber and steep hills, although neither should be encountered between Ferrymead and the City Centre. The trailer deck can also be extended from 12m to 18m long long enough for any of the present or proposed trams.

METHODS OF LOADING/UNLOADING

There appear to be two viable methods of loading.

1. Drive or winch trams or trailers up and down a ramp. The practical maximum angle for the ramp is about 1:12, leaving clearance for the brake trip bar. An angle of 1:10 is possible if the trip bar is disconnected.

   To climb onto the house transporter trailer 900cm high, the ramp would need to be more than 10m long, and in itself would need transporting, unloading and setting up at each end of the trip. Driving the tram up and down the ramp would also be hazardous should the winch or rope fail, or the tram brakes not hold on the ramp. A runaway tram on city streets could prove a traffic hazard at the very least.

2. The tram could be jacked up to the required height and the trailer manoeuvred underneath. This would enable a broken down and immobile tram to be moved also. Since the tram chassis cannot be jacked without also supporting the bogies, it is considered better to run the tram onto a base that can be lifted complete with the tram.

   The jacks used for house lifting each can lift about 4 tonne and lift up to 1.4 metres high, ample height for the transporter. Since the heavier trams weigh about 16 tonnes it would be best to use eight jacks for the lift. It is estimated that the lift would take about one hour for eight jacks lifting one metre. For the lighter trams of 12 or so tonnes weight six jacks could be used, and the lift would take about ¾ hour. Lowering would take about the same time, allowing for some manoeuvring to align the tram with the rails.

The transporter is 3.1 metres wide, and requires a clearance of about 0.2 metres each side to manoeuvre under the tram lifting base.

CHRISTCHURCH TRAM TRANSPORT BASE

TECHNICAL DETAILS

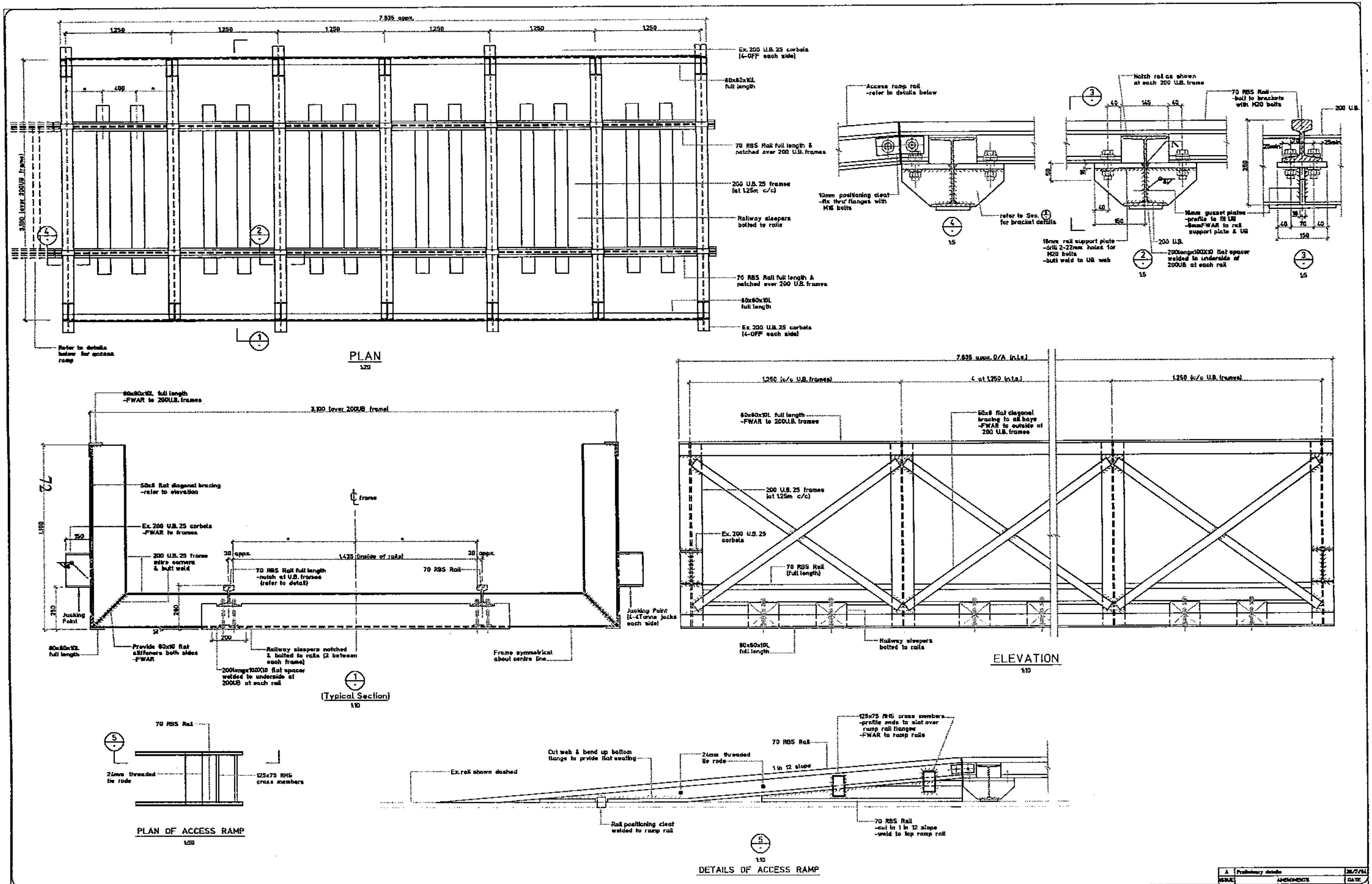
Length of base		7635 mm
Width (includes jack lugs)		3400 mm
Length of ramps	1)	3100 mm
	2)	7800 mm

Designed by: D Clark, City Designs, Christchurch City Council

Constructed by: Southern Cross Engineering Co Ltd

Cost: $NZ15,975

Road transport and jacking: Laing Properties – Building Relocaters


PLAN
1:20
7,835 appx.
1250
3,100 (over 200UB frame)
Ex. 200 U.B. 25 corbels (4-OFF each side)
80x80x10L full length
70 RBS Rail full length & notched over 200 U.B. frames
200 U.B. 25 frames (at 1.25m c/c)
Railway sleepers bolted to rails
Refer to details below for access ramp
Access ramp rail -refer to details below
10mm positioning cleat -fix thru' flanges with M16 bolts
refer to Sec. 2 for bracket details
Notch rail as shown at each 200 U.B. frame
70 RBS Rail -bolt to brackets with M20 bolts
200 U.B.
16mm gusset plates -profile to fit UB -6mmFWAR to rail support plate & UB
16mm rail support plate -drill 2-22mm holes for M20 bolts -butt weld to UB web
200longx100X10 flat spacer welded to underside of 200UB at each rail
(Typical Section)
1:10
80x80x10L full length -FWAR to 200U.B. frames
50x8 flat diagonal bracing -refer to elevation
Ex. 200 U.B. 25 corbels -FWAR to frames
200 U.B. 25 frame mitre corners & butt weld
1,435 (inside of rails)
30 appx.
70 RBS Rail full length -notch at U.B. frames (refer to detail)
70 RBS Rail
Jacking Point
Jacking Point (4-4Tonne jacks each side)
Provide 80x10 flat stiffeners both sides -FWAR
Railway sleepers notched & bolted to rails (2 between each frame)
Frame symmetrical about centre line
ELEVATION
1:10
7,835 appx. O/A (n.t.s.)
1,250 (c/c U.B. frames)
4 at 1,250 (n.t.s.)
50x8 flat diagonal bracing to all bays -FWAR to outside of 200 U.B. frames
Ex. 200 U.B. 25 corbels
70 RBS Rail (full length)
PLAN OF ACCESS RAMP
1:50
24mm threaded tie rods
125x75 RHS cross members
DETAILS OF ACCESS RAMP
1:10
Ex. rail shown dashed
Cut web & bend up bottom flange to prvide flat seating
24mm threaded tie rods
1 in 12 slope
125x75 RHS cross members -profile ends to slot over ramp rail flanges -FWAR to ramp rails
Rail positioning cleat welded to ramp rail
70 RBS Rail -cut to 1 in 12 slope -weld to top ramp rail
A Preliminary details 28/7/94
ISSUE AMENDMENTS DATE

DESIGN SERVICES UNIT

CHRISTCHURCH THE GARDEN CITY

	INITIALS	DATE	
DESIGNED		7/94	
DRAWN	A.U.B.	7/94	
TRACED			
DES. CHK.			
DRG. CHK.			
CHECKED		7/94	

APPROVED / / DATE

DESIGN SERVICES MANAGER

JOB TITLE

TRAM TRANSPORT BASE

DRAWING TITLE

STRUCTURAL DETAILS

SCALES As shown

C.N. D.4497

e:/as/sd001705.dgn Aug. 22, 1996 14:09:53 Design Services Unit, CCC.

CHRISTCHURCH CITY COUNCIL

MEMORANDUM

(Mr Clark, Ext 8754)

15 July 1994

From: DESIGN SERVICES MANAGER

To: PROJECTS ENGINEER TRAFFIC
Att: Mike Grady

TRAM TRANSPORT BASE

Thank you for your instructions of 9 June 1994 regarding design and estimate for a Tram Transporting Base.

In addition to the base we have allowed a detachable ramp at a slope of 1 in 12. We have minimised the height of the rails on the base. These will be 250 mm off the ground, and any further lowering would be expensive to achieve.

We have visited Laings Properties, and inspected one of the jacks there. We understand that four jacks would be used each side, with each set hooked up to a common pump system (ie equal force on each jack) with the sets of jacks at 3.600 m c/c to allow for transporter clearance.

The estimated cost for the above base and approach ramp is $11,600 as follows:

Base and ramps		$9,580
Contingency say 10%		$960
	Sub Total	$10,540
Design and supervision say 10% (but charged at hourly rates)		$1,060
	Total	**$11,600**

Please note that the above estimate excludes GST and does not include approximately $800 for the preparation of this report.

We look forward to your further instructions.

M J Stockwell
DESIGN SERVICES MANAGER

DEC:LHT
DEC

Mike
- Draft copy
- allowance for
preparing Stockworth only

Questions/Discussions

One of the factors that emerged was that inexpert professionals did not have much idea of what was involved in this sort of operation but were not prepared to take advice from the expert amateurs (THS).

John commented in support of the paper that lack of expertise was noted such as with the handling of the tramcar trailers, as having no motors, how would they be unloaded, having been winched on at Ferrymead. He said that jacks were used for lifting and dropping of framework and earthed. The ramp unit was bolted to the transporter and rails and sleepers fitted. Attachments were fitted at the ends of the rails to avoid running off the ends.

After the presentation, questions were called for.

Was the short ramp disposed of? Both ramps have been retained for City Council use and THS does not accept responsibility for the transporting equipment.

How are the trams leased? On an annual basis, arrived at by negotiation, arranged with the City Council. Concerning insurance, an incestuous decision was made requiring the tramcars to be insured for $1,000,000 each. A condition in the insurance is that in the event of a smash the tramcar is not written off but returned to the THS as is. Being heritage cars, add-ons would be removed and the cars returned to heritage condition.

The workshop then concluded with Rod Atkins thanking John Shanks and Bruce Dale and commented on the experiences with ex-Melbourne cable car movements.