MOTAT

THE WESTERN SPRINGS TRAMWAY EXTENSION

A PRESENTATION TO THE *COTMA* CONFERENCE

LAUNCESTON

AUGUST 2008

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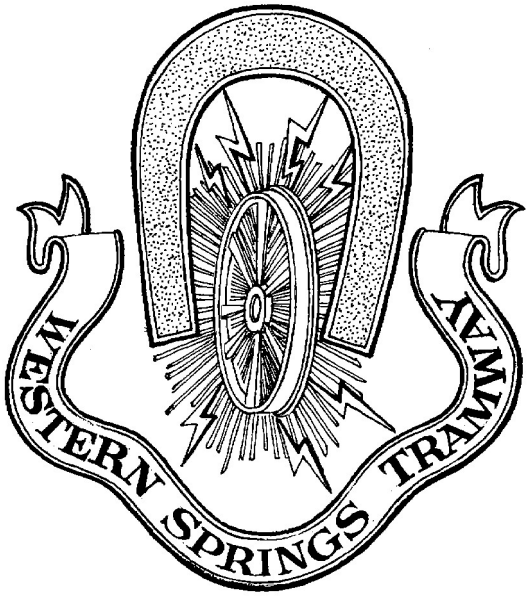
A division of The Museum of Transport and Technology
Auckland



HISTORY:
In the 1860s, Auckland, like many colonial towns in Australia and New Zealand, was suffering from uncontrolled development and seriously polluted domestic water supplies.

Away to the west, about 8 kilometres distant, was a large natural spring, imaginatively named Western Springs. A large pumping station was built powered by a very large double beam engine which delivered water to a reservoir on a hill behind the growing town of Auckland.

The beam engine, built by John Key and Sons in Scotland in 1876 worked continuously until it was retired in 1927, but it was then kept as a reserve or back-up to the new supply. It just avoided being cut up for scrap during the second World War.

Today that beam engine is the superb centrepiece of Auckland's Museum of Transport and Technology, and as of May of this year has been restored to full working order, powered by steam once again, after 80 years of resting.

THE MUSEUM OF TRANSPORT AND TECHNOLOGY (MOTAT):
The Museum was founded in 1964 on the site of the former Council Waterworks Depot. It started as a bringing together of a number of organisations that had saved a wide range of technical, industrial and transport machinery and vehicles.

The Museum also started to acquire a number of aircraft including a Lancaster bomber and two large flying boats, a Short Solent and a Short Sunderland. The Museum sought a larger site on which to display the aircraft and one was found, two kilometres away on top of what had been a landfill rubbish tip.

Right from the opening of the aviation museum, named the Keith Park Memorial Airfield in 1975, it was considered to be satisfactory to have MOTAT on two sites just as long as they were connected by a working tramway.

THE WESTERN SPRINGS TRAMWAY:
The tramway commenced operation on a short length of track within the museum grounds in 1967, a distance of about 250 metres.

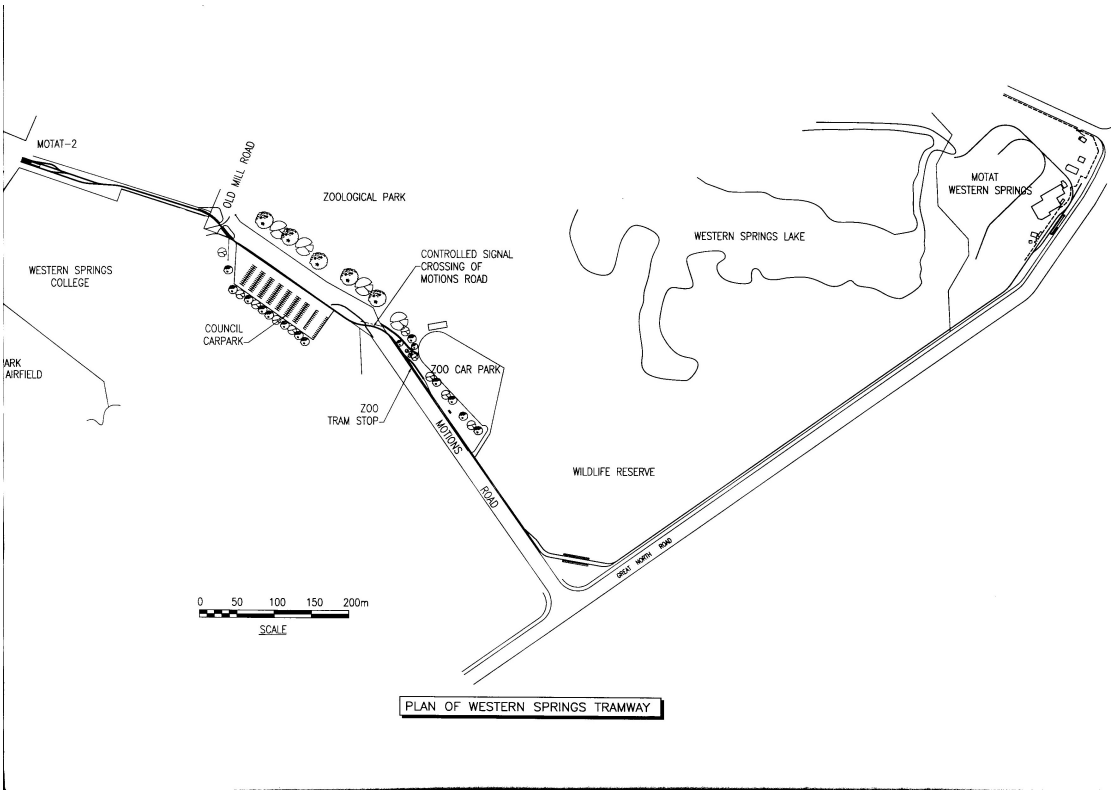
In 1980 a start was made on the link to the aviation museum. This was constructed under a make-work scheme of the Government of the day to give employment and training to the unemployed.

By 1981 the track had reached the Auckland Zoo, a little over half way to the aviation museum. A change of government saw an end to the scheme and a stop to tramway construction.

By 2004 a change in MOTAT management together with better funding arrangements saw a revival of the project and we set out to complete what had started as a dream in 1975.

THE EXTENSION PROJECT WAS BORN:
The writer had been doing project engineering work for MOTAT for a couple of years and had joined the Tramway Section as a volunteer. Then I was invited to take on the job of designing and building the extension from the Zoo to the aviation museum to complete the tramway.

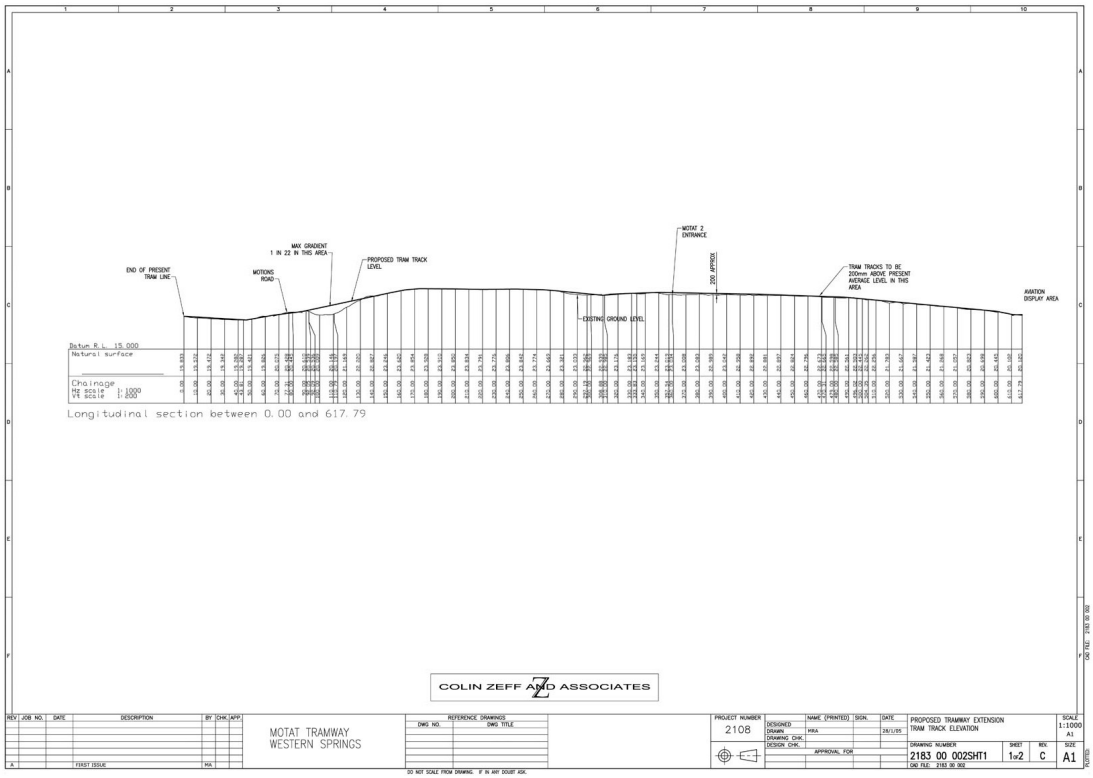
Reference to the map will show the extent of the tramway to the Zoo with the extension to the Aviation Museum and the MOTAT-2 site on the left hand side of the map.



The extension has a route length of 620 metres and consists of a short straight beyond the Zoo tram stop, then a traffic-light controlled crossing of the road. There is then a rise for 130 metres at 1 in 22 before levelling out and running between a Council car park and the road. The line then crosses in front of Western Springs College and enters the MOTAT-2 property. Then there is another 280 metres to the terminus area at the Aviation museum.

It took a year to obtain all the necessary consents from the Auckland City Council and obtain the cooperation of the utility companies. The electric lines company, Vector, decided that this was a good opportunity to put the overhead power lines underground in Motions Road, a task that proved to be extremely difficult and time-consuming because of the presence of a great deal of volcanic rock in the area.

The water utility company, Metrowater, also decided that it was the opportune time to renew the water main in the road and to top things off, the Council decided to upgrade the kerbs and footpaths. So Motions Road became a very busy construction site which was not without its delays and difficulties.

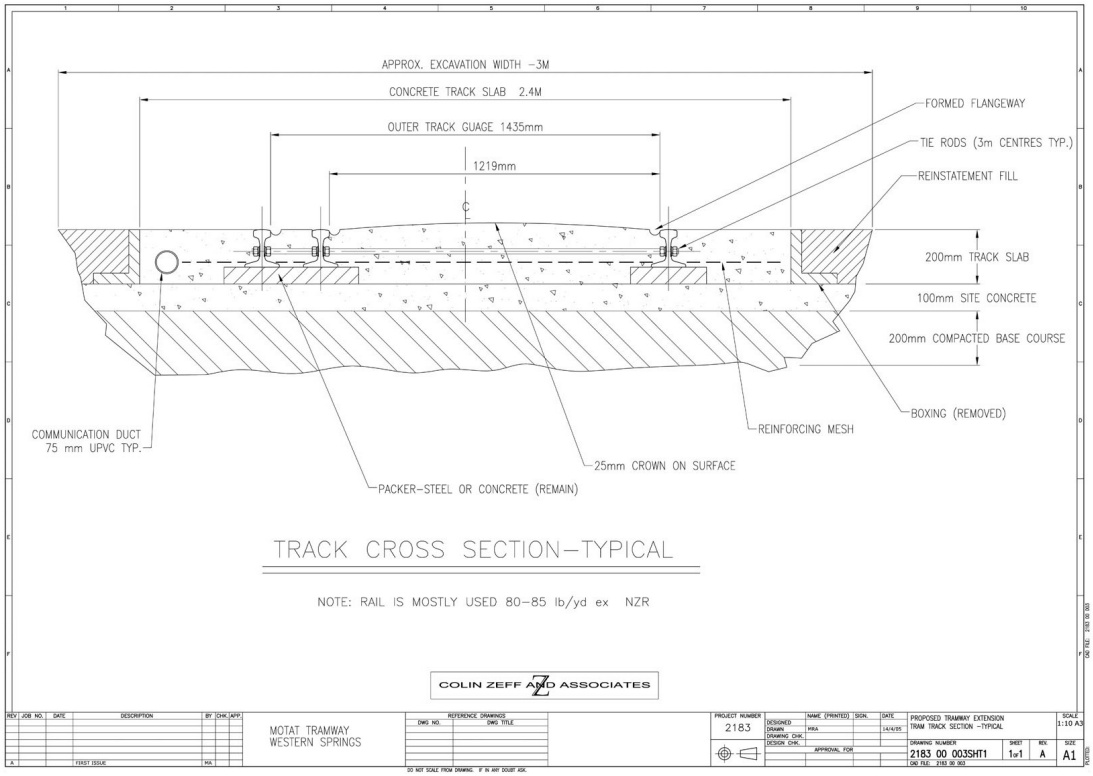


CONSTRUCTION:
Out of six tenders, we selected a construction company that specialises in unusual projects. Jesmond Construction started at the beginning of August 2006 and immediately started tackling what was a difficult project both technically and operationally.

The technical difficulties were to do with the terrain. For the first few metres there was solid basalt rock, some of which had to be excavated, but the biggest problem was that two thirds of the total length was over a former landfill rubbish tip that was in use from the 1930s to the 1960s. This required consolidation before the tramline could be constructed and a new technique called impact rolling was used.

This consists of a heavy square roller towed at fixed speed behind a tractor for about 50 to 80 passes. The ground level was reduced by between 300mm and 600mm and hard fill was applied, graded and rolled.

The track is all encased in a continuous concrete slab 300mm thick. First a reinforced slab 100mm thick is laid and this is used as a base on which the track is set up. We used various sizes of second-hand tram rail and railway rail but all was set with the top 200mm above the base concrete. The method is similar to that used on the Melbourne Docklands extension.



Adding to the difficulties is the fact that the whole of the tramway is dual gauge, 1,435 mm (4'8½") and 1,219 mm (4'0"). This came about because the first year of MOTAT's existence (1964) was also the last year of Wellington's trams and MOTAT was able to acquire six trams directly from the 4 ft. gauge system.

This complicates track-work and particularly turnouts. WST adopted the single switch type and this is always on the single rail. The matching double mates and crossings are complicated and have to be fabricated from grooved tram rail. This is a difficult exercise in visualisation, marking out, gas cutting and welding. 3D CAD drawings were used to assist with this.

As far as possible, the rail joints on the extension were Thermit welded and the rest were arc welded using base-plates and fishplates.

Traction pole bases were also set in concrete joined to the continuous track slab in most places.

All 30 traction poles were tramway poles recovered years ago from the streets of Auckland although some turned up quite recently. They were all cut to 7.6 metres length, sand blasted and painted, and fitted with welded flanges for mounting to the base plates.

The cross-arms and brackets were new but most of the overhead fittings were recovered from Auckland's tramway or trolley bus system and refurbished by

our volunteers. The overhead was erected by a specialist lines company, Electrix.

By March 2007 we were testing the track and the overhead and on April 27th the extension was officially opened by the Prime Minister, Helen Clark, in whose electorate the museum lies.

The total cost including all design and compliance work, all construction, and refurbishment of used equipment, traffic signals, road markings and signs came to just under NZ$2 million, or about A$1,560,000 at today's rates.

OPERATING EXPERIENCE:

A year on and tramway patronage has risen by over 25% and admission to the Aviation Museum has increased by nearly 70%. Total tram patronage is now over 127,000 per annum and still rising. We have 8 operating electric trams and one Baldwin steam motor, and the recently landed Melbourne SW6 #893.

The experience with the extension has all been good. In particular, the traffic light system works perfectly for us, but it is still necessary for tram drivers to watch out for the occasional red light runners.

The tramway runs every day of the year except two and operates to a fixed timetable. Between one and four trams are in use at any time depending on demand.

The tramway is now an integral part of the operation of MOTAT and adds significantly to the visitor experience.