Overhead wiring for Light Rail and Tram operation with pantograph and trolley power collection, Melbourne, Australia

Melbourne, the capital city of the state of Victoria in Australia, maintains the third largest tram network (245 km) in the world and the largest in the southern hemisphere. 567 trams are moving approx. 369,000 passengers on 28 routes daily. The network consists of mostly straight sections and some right-angled curves due to the city’s grid road layout. Tram tracks are usually located in the middle of the streets; 15% have separated tracks. The expansive infrastructure is partly out of date.

System characteristics with relevance to overhead wiring

- Average distance between stops: 300 m
- Minimum inner-city headways: 1 – 2 minutes
- Rolling stock: 4-axle standard cars + articulated cars with 2 or 3 segments

Overhead Contact Line System

Based on government heritage requirements, some parts of the tram network has to be suitable for pantograph and trolley power collection. Consequently this presupposes a dual overhead contact line system. Due to the rigid suspension of overhead contact wires on sections, turnouts and on crossings, temperature changes cannot be equalised. In hot weather conditions, the rigid suspension points will cause uneven wear of the contact wire and the hard suspension points can cause pole dewiring and pantograph bouncing. This results in noise emission, cracks or even breaks in the contact wire as well as reduced operating speeds. Overhead crossings and frogs are anchored and not suspended also forming hard spots. All of these lead to higher maintenance costs on overhead wiring and vehicles. Existing overhead wiring in right-angled curves is suspended from up to twelve cross-spans with rigid suspension of the trolley wire. The visual impact of the multitude of overhead wires and cross-spans on the urban environment is even worse at tram junctions. In line with on-going renewals and extensions it was requested that a modern dual mode overhead contact line system be implemented, taking into account operational and maintenance requirements and equally as important the visual urban integration.

Requirements of the Overhead Wiring System

- Dual operation of pantograph and trolley poles.
- Making best use of possible maximum speeds, without the hindrance from thermal expansion of contact wires
  - On separated tracks up to 60 km/h
  - In curves and at intersections without the drivers having to worry about the overhead contact wire.
- Minimum headways with uniform contact pressure of the current collector at the suspension points, that means no bouncing of the collector.

Urban Environment

- Minimal visual impact and noise.

Maintenance

- Minimal service interruptions due to dewirements of trolley poles or defects on pantograph current collectors.
- Reduced maintenance of overhead contact lines and power collectors on tramcars.
- Longer life cycles of overhead contact lines.

Technical Solution

Fully flexible contact line system K+M (using a maximum of locally manufactured components such as contact wires, span wires, poles) characterised by:

- Elasticity of the contact wire at the suspension points and therefore partial compensation of the contact wire expansion due to the temperature changes.
- Safe operation with reduced risk of dewirement and extended lifecycle due to minimum wear of contact lines.
- Extended span width in curves, therefore reduced quantity of poles. In comparison to the existing old system reduction of 30% and more of required cross-spans in curves due to curve rails and fewer but stronger masts.
- Low maintenance costs.

K+M Overhead Contact Line Applications in Melbourne

- 2002 Pilot project St. Vincent’s Interchange (0.4 km)

2002 Pilot project St. Vincent’s Interchange

Triple track tram junction used by 5 tram routes and more than 1,000 tram services per day. Demanding configuration of curves, straights and turnouts.

K+M Services

- Design, delivery of overhead wiring components and implementation
- Supervision on site for new projects as well as for modifications of crossings, junctions and sections.

K+M Overhead Contact Line System

- New K+M overhead curve wiring system with curve rails for dual operation pantograph and trolley poles, photo taken shortly after installation at St. Vincent’s Interchange

Other Applications

Before 2000:
- New outer branches LRT:
  - Port Melbourne (0.2 km)
  - Airport West (2.5 km)
  - Burwood, Plenty Road (5.4 km)
  - Burwood, Burwood Highway (5.2 km)

Separated track:
- Batman Av Bridge - Yarra Park (1.4 km)

After 2001:
- New overhead wiring in the core network, in particular in curves and at intersections
- New outer branches LRT:
  - Docklands (4.8 km)
  - Boxhill (2.2 km)
  - Vermont South (2 km)