International Developments in Light Rail Transit Design & Planning

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Introduction

Nouveau Tramway France

World Review
Paper aims to review new developments in Light Rail

- Purpose is to understand current developments and new ideas
- Focus is:
  - Design
  - Planning
  - Technology
- The basis of the review is the authors research and visits to systems undertaken in 2015/16 as part of activities for the US Transportation Research Board and Monash University

...and is structured as follows
The largest world LRT development has been the Nouveau Tramway movement in France.
...during the Global Financial Crises...

Growth of French Tramways—kilometres of route

...using an integrated street design and transit design concepts
Including MACRO and MICRO design principles

**MACRO Design Principles**

- Develop a a concept of how public transport should tie the urban agglomeration together: a small number of light rail (nouveau tram) and/or BRT lines is key
- High-performance and -capacity vehicles designed to blend with the urban fabric and facilitate accessibility between lines and modes
- Fully accessible stops widely spaced
- Stops adjacent to, and integrated with major destinations; including in suburbs
- Local bus lines reconfigured around nouveau tram or BRT stations

**MICRO Design Principles**

- Almost 100% use of public rights-of-way
- At the expense of the auto, which are kept off tracks
- Examples: Roads, alleys, plazas, university campuses, hospital campuses
- All rights-of-way rebuilt from building façade to building façade to facilitate transit performance, pedestrian and bicycle flow, safety, aesthetics
- The Art of Insertion is a political process wherein stakeholder groups figure out how to design high performance transit that is compatible with their lifestyles

MACRO Design Principle 2: Long vehicles with lots of doors and a fare system that allows passengers to use all doors, bright, cheery, airy

Source: Thompson G Currie G and Parkinson T (2016) 'Structural Transit Streets: The French Approach ...and thoughts for America'

MACRO Design Principle 3: Fully accessible stops spaced widely to enable faster service

Source: Thompson G Currie G and Parkinson T (2016) 'Structural Transit Streets: The French Approach ...and thoughts for America'
MACRO Design Principle 4: Stops adjacent to major destinations; many in suburbs


MACRO Design Principle 5: Bus system reconfigured around light rail stops

MICRO Design: The ART of Insertion Center City insertion where two lines cross

Before

Source: www.publicspaces.org
Location: Rue des Frances Bourgeois, Strasbourg

Source: Thompson G Currie G and Parkinson T (2016) 'Structural Transit Streets: The French Approach ...and thoughts for America'

MICRO Design: The ART of Insertion Center City - High traffic street becomes pedestrian mall with LRT

After

Source: www.publicspaces.org
Location: Rue des Frances Bourgeois, Strasbourg

Source: Thompson G Currie G and Parkinson T (2016) 'Structural Transit Streets: The French Approach ...and thoughts for America'
MICRO Design: The ART of Insertion - Center City - High traffic street becomes pedestrian friendly with LRT

Before

After

Source: Marc Le Tourneur, Veolia Transdev
Location: Place Broglie, Strasbourg

MICRO Design: The ART of Insertion - Transit Plaza

Source: Thompson G Currie G and Parkinson T (2016) 'Structural Transit Streets: The French Approach ...and thoughts for America'

MICRO Design: The ART of Insertion - Insertion into an alley

Source: Thompson G Currie G and Parkinson T (2016) 'Structural Transit Streets: The French Approach ...and thoughts for America'
MICRO Design: The ART of Insertion - Insertion into an alley

MICRO Design: The ART of Insertion - Angers: Edge of center city

MICRO Design: The ART of Insertion - Stop shoe-horned into tight spot

Source: Thompson G Currie G and Parkinson T (2016) 'Structural Transit Streets: The French Approach ...and thoughts for America'

MICRO Design: The ART of Insertion - Stopping trains delay autos; not vice versa

Source: Thompson G Currie G and Parkinson T (2016) 'Structural Transit Streets: The French Approach ...and thoughts for America'
Versement Transport – flexible funding with deeper pockets for bigger projects

Versement Transport

- A payroll tax - levied on the wages provided by all businesses with 10 or more employees within a transport authority region
- Usually 1% of payroll but can be higher if a good case to improve mobility is made e.g. Reims 1.8%
- Covers Capital and Operating Costs
- Can be sensitive to economic performance

Funding Source - STIF Paris 1990-2004

State-of-the-Art Light Rail: Lessons from France, TRB 91th Annual Meeting 22-26 January 2012, Washington, DC, USA
Portland, Oregon; The Tilikum Crossing

Portland, Oregon; Streetcar
Out West USA: Streetcars

Smart Transit agencies think outside the box – Uber/Car Share and LRT

Transit runs the Car Share Scheme

Trams enter Den Haag Centraal Station in the Netherlands through large openings in the facades…


…Light rail is elevated while heavy rail is at-grade

Light rail is elevated while heavy rail is at-grade.

Bombardier has unveiled a new 3D optical sensor system to assist tram drivers in detecting obstacles...

- Developed in association with the Austrian Institute of Technology in Vienna
- Can accurately monitor the path in front of the vehicle to a distance of more than 60 metres while automatically identifying potential hazards
- Rolled out to the entire range of Bombardier trams
- First operations in Marseille, France
… is a future of driverless LRVs feasible?

Catenary Free Operations

Catenaryless service proven solutions

- APS: Power the tram from the ground
- Battery: box on tram roof for short distance autonomy
- Supercaps: box on tram roof for autonomy and energy saving

Source: Messelyn C (2012) ‘Designing Trams to Service Historic Districts with Speed, Capacity and Elan’
State-of-the-Art Light Rail: Lessons from France, TRB 91th Annual Meeting 22-26 January 2012, Washington, DC, USA
Benefits

- Greater operational range than super-capacitors.
- Significantly cheaper than super-capacitors.
- Do not use fossil fuels and improve air quality along lines.
- Do not require expensive third rail technologies such as electrified ground rails.
- Safer than third rail electric power transfer.
- With recent battery technology improvements, able to reduce long-term catenary maintenance costs significantly.

Issues

- Longer recharge times compared to other forms of on-board storage such as super-capacitors and fuels.
- Higher initial purchase price for rolling stock.
- Often require regular unit replacement due to short life cycles.
- Funding sources relatively poor for battery-only trams worldwide.
- Batteries have relatively limited range (although only designed for 500m sections of catenary-free track).
- Newer battery technologies are being developed at an accelerated pace, making current NiMH systems appear inefficient in relative terms.

Benefits

- PRIMOVE batteries are able to recharge quickly via pantograph at tram stops and through some acceleration points, allowing for a 90% catenary-free system.

Issues

- Technology is relatively new and has higher engineering costs than some other catenary-free systems.
- Battery lifespan not fully tested, could lead to regular replacement on high-traffic lines.
Super-capacitor LRVs are being introduced in Guangzhou, China...

- Catenary-free tram technology
- Evolved from battery powered trams as an alternative method of energy storage and capture
- Trams are able to run up to 4km between charging
- Onboard supercapacitors automatically charged at stops; takes 10-30 secs

…with hybrid systems (super-capacitor & battery) operating in Seville, Spain…


…and also in Almada-Seixal, Portugal

A disturbing video:
New ideas in LRT safety systems

Düsseldorf, Germany.

Pedestrian crossing on a busy light rail line located in the median of a dual carriageway / divided highway.


In-Road Warning Lights for Lighted Stop Bar Safety
Houston, TX

Arrive Safely

Spot DEVICES
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