Economics of Transportation xxx (2017) 1–16

Contents lists available at ScienceDirect

Economics of Transportation

journal homepage: www.elsevier.com/locate/ecotra

Tram development and urban transport integration in Chinese cities: A case study of Suzhou

Chia-Lin Chen

Department of Urban Planning and Design, Xi'an Jiaotong-Liverpool University, Room EB510, Built Environment Cluster, 111 Renai Road, Dushu Lake Higher Education Town, Suzhou Industrial Park, Jiangsu Province, 215123, PR China

ARTICLE INFO

JEL classification:
H7
J6
P2
R3
R4
O2

Keywords:
Tram
Urban development
Urban transport integration
Suzhou
China

ABSTRACT

This paper explores a new phenomenon of tram development in Chinese cities where tram is used as an alternative transport system to drive urban development. The Suzhou National High-tech District tram was investigated as a case study. Two key findings are highlighted. Firstly, the new tramway was routed along the "path of least resistance" – avoiding dense urban areas, to reduce conflict with cars. Secondly, regarding urban transport integration, four perspectives were evaluated, namely planning and design, service operation, transport governance and user experience. Findings show insufficient integration in the following aspects, namely tram and bus routes and services, fares on multi-modal journeys, tram station distribution, service intervals, and luggage auxiliary support. The paper argues there is a need for a critical review of the role of tram and for context-based innovative policy reform and governance that could possibly facilitate a successful introduction and integration of tram into a city.

1. Introduction

The past decade has seen rapid development of urban rail systems in the People's Republic of China (hereafter referred to as China). By 2015, more than 3600 km of urban rail tracks had been constructed in 26 Chinese cities. By comparison, tram development is in its infancy, with only 161 km of tramways in ten Chinese cities (CAMET, 2016). However, more than 2000 km of new tram networks are currently being planned across the country, as a result of supportive national policies and gradual cost reduction through consolidation of the tram-building industry.

Since the economic reform of 1978, urban transport network in China has been rapidly developed to cater for economic and industrial development, which often did not coordinate well with wider urban development strategies, whereas transport had significant impacts on urbanization patterns. After an era of massive construction of highways in the 1980s, the automotive industry was designated as one of the key pillar industries for the national economy in the mid-1990s. Around this time, because of increasing problems with traffic congestion, several large cities began developing metro systems. However, public urban rail development was not officially regulated on the national scale by the Central Government until 2003, and was not advocated until the early 2010s. Smaller Chinese cities could not justify the construction and operation cost of urban rail, and so instead began planning tram networks. There has been relatively little research examining how new trams have been introduced into cities and whether these tramways provide an effective alternative to private car use. This article therefore explores the role of new tramways in Chinese cities, how well they integrate with other urban transport systems, and any particular issues and challenges. To do this, I focus particularly on a case study of the Suzhou National High-tech District (SND) tram.

This article is structured into four main parts. Section 2 reviews key policies and mechanisms underlying urban rail development and decision-making in the Chinese context. Section 3 provides a background introduction to the wider context of rapid urbanization and rail development. Section 4 focuses on the SND tram, to gain insights into the uniqueness of Chinese approaches, including the motivation for choosing a tram over other options, and the current approaches to urban transport integration and its impacts. Section 5 summarizes the issues identified and discusses implications.

2. Policies and mechanisms of developing urban rail

2.1. Classification of urban rail systems in China

According to the "Standard for Classification of Urban Public Transport", urban public passenger transport has four top-level ("Level 1")

E-mail address: chia-lin.chen@xjtlu.edu.cn.

https://doi.org/10.1016/j.ecotra.2018.02.001
Received 7 February 2018; Accepted 8 February 2018
Available online xxxx

Table 1
Categories of rail urban public passenger transport in China.

Level 1	Level 2	Notes
GJ2 Rail urban public passenger transport	GJ21 Metro	• For high and large passenger capacity • Suitable for underground, ground, or elevated tracks • Type of Metro railcar: A, B, L_B
	GJ22 Light Rail	• Medium passenger capacity • Suitable for underground, ground, or elevated tracks • Type of Light Rail railcar: C, L_C
	GJ23 Monorail	• Medium passenger capacity • Suitable for elevated tracks
	GJ24 Tram	• Low passenger capacity • Suitable for ground tracks (Independent right of way), mixed use, or elevated tracks
	GJ25 Maglev	• Medium passenger capacity • Suitable for elevated tracks
	GJ26 Automatic People Mover (APM)	• Medium passenger capacity • Suitable for underground or elevated tracks
	GJ27 City-regional Express Rail	• Serving city-regional territory • Medium-to-long distance passenger transport

Source: Ministry of Construction (2007, the document code: CJJ/T 114)

categories, including street, rail, water and other transport modes. Each category can be further sub-divided into more detailed definitions (Levels 2 and 3) (Ministry of Construction, 2007).

Rail urban public transport is classified into seven systems depending on coach types and carrying capacities (Table 1). Metro in China is defined as having large carrying capacities while light rail, monorail, maglev, and automated people mover (APM) have medium carrying capacities. In addition to carrying capacities, a major distinction between metro and light rail lies in the types of railcar.

Tram (GJ24) is defined to provide low passenger capacities and is the main focus of this paper. There is no worldwide standardized definition of a 'tram system'. In Europe, a tram is a light rail system that runs (at least part of its way) on existing roads, and shares these roads with cars. While in China tram and light rail are regarded as different systems. A key purpose of this paper is to understand how and whether transport planners can successfully introduce trams as part of an existing transport system in a city.

2.2. National policy for urban rail development

Although the first metro system appeared in Beijing in 1969, it was arguably not rail, but road building that facilitated rapid urbanization in China from the 1980s onwards. Prior to 2000, China's urban rail systems covered a total of just 135.8 km in four cities (Beijing, Tianjin, Shanghai and Guangzhou). It was not until the early 2000s that the national government started to formalize urban rail development in China.

2.2.1. Policy framework

Since 2003, the national policy framework related to the development of urban rail has expanded to involve four major ministries: the National Development Reform Commission (NDRC), Ministry of Housing and Urban-Rural Development (MHURD), Ministry of Finance (MoF), and Ministry of Environmental Protection (MoEP). The framework has four main objectives: 'integration and linking up', 'economic efficiency and suitability', 'convenience and efficiency', and 'safety and reliability'. The framework also sets out the procedure for evaluating and approving specific projects, as well as the guidance for planning and design, environmental protection, and financial capacity (Fig. 1).

2.2.1.1. Planning integration. Urban rail network planning is required to integrate with wider urban development and transport system plans. According to Chinese national regulation No.81 (General Office of the State Council [GOSC], 2003), a 'Rail Network Plan' sits under an 'Urban Comprehensive Transport System Plan', which in-turn sits under a long-term 'Urban Master Plan'. Once the Urban Rail Network Plan is determined, rail construction plans need to be proposed in-line with urban development needs and financial capacities, including corresponding short-term (5–6 year) and long-term financial schemes.

In practice, rail development often deviates from this strict approach according to local demands. A local municipality might propose a rail construction plan after higher-level planning documents have been drafted, but not fully complete the approval process. Although the higher-level planning documents have a top-down guidance role, they are required to reflect and integrate the latest rail construction plan. There is therefore an interactive relationship between the higher-level plans and lower-level construction plans in China, with both top-down guidance and bottom-up integration (see Fig. 2). In most cases, Urban Master Plans will be approved before Rail Construction Plans, meaning that Rail Construction Plans will not be approved if they are non-compliant. However, if the local municipalities insist on specific Rail Construction Plans, Urban Master Plans may need to be revised and approved before Rail Construction Plans are approved.

2.2.1.2. Environmental protection. An Environmental Impact Assessment (EIA) is required for each rail proposal before construction can be permitted. The EIA aims to facilitate a balance between construction and environmental protection. There are three key principles guiding the EIA:

1. EIAs are approved by the Ministry of Environmental Protection.
2. Schemes with favorable EIA results should be prioritized. Sites for urban rail schemes should be consistent with Urban Master Plans.
3. Facilities for reducing pollution should be designed, constructed and operated as an inseparable part of the main construction project.

2.2.1.3. Financial capacity. Urban rail schemes are the remit of local governments. To prevent over-borrowing by local governments, national guidance instructs that public capital out of local capacity should constitute no less than 20% of the project's total capital cost, and this government contribution is generally not allowed to be higher than 5% of its municipal annual financial budget. Moreover, a rail construction project is not allowed to exceed 30% of the local government's urban construction budget. The percentage of borrowing allowance is also subject to adjustments announced by central government. The guiding principles of the financial assessment are:

1. Every city has to establish a transparent mechanism to manage long-term public capital investment, balance financial expenses and incomes, and ensure sufficient income to cover operational costs.
2. Innovative financial approaches are encouraged by the national policy framework. Private investment is possible through a wide range of public-private partnerships, such as franchise concessions for rail construction and operation, and private-led transit-oriented developments.
3. Rail operators are entitled to have discounted electricity bills and receive support from the government with issuing bonds.

2.2.2. Criteria qualifying settlements for urban rail development

The Chinese central government has strict numerical criteria which must be met before a city is officially permitted to undertake urban rail development. These fall into three main categories, namely: population size, transport requirement and economic development level. Each criterion has a numerical threshold (see Table 2), and meeting these criteria is necessary (but not sufficient) for a city to be considered eligible for development of a metro or light rail system.