



POLICY-DRIVEN STRATEGIC TRANSPORT PLANNING FOR THE WESTERN PROVINCE, SRI LANKA

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ABSTRACT

Sri Lanka's transport sector strives for efficient and effective mobility solutions in terms of the quality and quantity of services provided. However, the modal share of public transport continues to decrease with increasing personal incomes, resulting in the deterioration in service quality of all transport systems in the Western Province. This occurs despite significant government investments in expressways and plans for rapid transit projects. The recent economic crisis in Sri Lanka and the consequent fuel crisis have forced the government to limit investment on transport projects that would be sustainable and bring maximum return on investment. Such selection requires careful consideration of appropriate transport policies and plans. Based on a critical review of existing transport policies and programs, this paper proposes selecting policy-based projects found to be best suited to the Western Province. Several proposals to improve the service quality in different transport modes through better regulation integration of IT and other modern technologies are discussed in terms of selecting policy parameters.

Keywords: Western Province, Public Transport, Transport Plans and Policies, Transport Projects

1. INTRODUCTION

Annual spending in recent years for transport infrastructure projects in Sri Lanka has been substantial compared to other sectors (Department of National Planning, 2021a). However, the quality of transport services, especially public transport, has yet to improve satisfactorily. The impact of the recent economic crisis on personal incomes and the rising global fuel prices has temporarily increased the demand for public transport. Consequently, a national-level discussion regarding the role of public transport and the direction of transport sector investment has surfaced.

Many recent policy documents have identified public transport as a high priority in public investment (Ministry of Transport, (2009), Munasinghe et al., (2019)). However, other projects that have greater political appeal, such as expressways that serve limited user groups—particularly the corporate sector and high-income households—have been prioritised over public transport in budget allocations for nearly two decades. Light Rapid Transit (LRT) has recently been promoted as a practical and timely urban transport solution for the Western Province, but this too has been stopped as too costly without proposing suitable alternative solutions.

The Western Province, which includes the three districts Colombo, Kalutara, and Gampaha, covers 5.5% of the country's land area and is home to over five million people: nearly 30 % of the country's population. It houses both the administrative and business capitals and includes a large proportion of industries as well. The province is also the most economically developed and has the highest urban density. The area is predicted to have the country's highest urban development potential, with increased household incomes and the corresponding increase in private vehicles. A series of transport-related problems and solutions, including those related to railways, bus and other road-based public transport, road network, and traffic control and management, have been identified in the CoMTrans Masterplan (Oriental Consultants Co., 2014) and reviewed by the University of Moratuwa, (2015) and the Megapolis Transport Plan, (Ministry of Megapolis and Western Development, 2016). Given this background, this paper focuses on deriving policy-driven transportation solutions towards the sustainable development of the Western Province.

2. BACKGROUND

This section discusses several salient background issues facing Sri Lanka's transport sector today.

2.1. Changing Modal Share

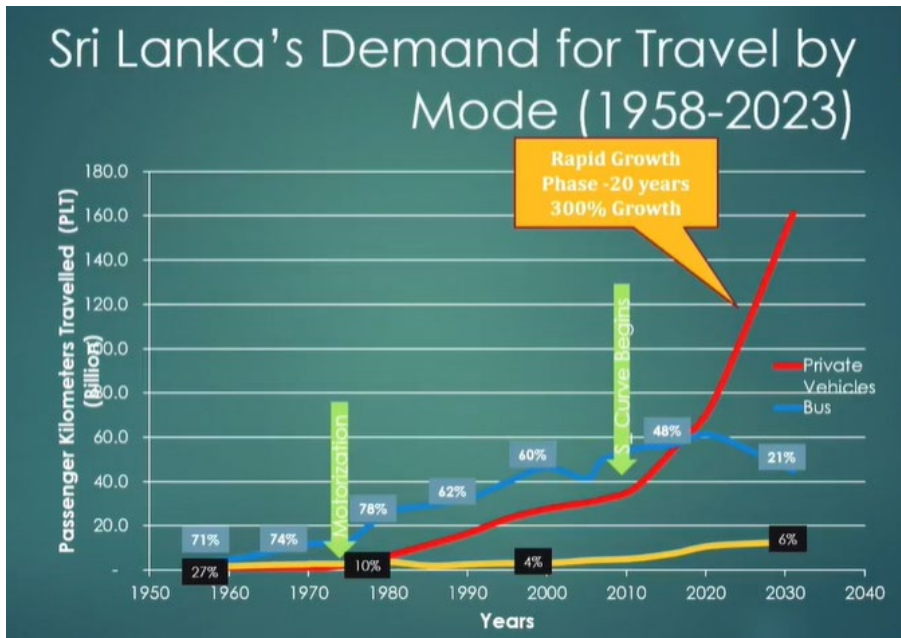


Figure 1: Variation of Passenger Travel Demand in Sri Lanka (1958-2040)

Source: Kumarage, A.S, 2012

Figure 1, based on the demand model projection of historical modal share data (Kumarage, A.S, 2012), depicts the variation of the Sri Lankan passenger transport mode share over the last several decades and its estimates to change in the next two decades under the status quo in 2012. The initial period reflects a modal share dominated by public transport modes where the modal share of buses, trains and private modes was 71%, 27% and 2%, respectively. As the Ceylon Transport Board (CTB), the monopolised state bus operator, was performing well, the proportion of bus usage continued to increase while the modal share of trains decreased. Heavy taxes and embargos on the import of private vehicles also consolidated this large share of public transport.

When large-scale motorisation was allowed under an open economic policy in 1977, it was found that 78% of people were travelling by bus. The share of railway decreased to 10%, and the percentage of private modes was only 12%. After the policy of motorisation, the private modal share experienced steady growth, turning into exponential growth after 2010 when the vehicle import tax was heavily reduced and per capita incomes reached USD 3000. This continuing growth trend predicts the private modal share which burdens road network capacity. It is seen in the rapidly increasing urban traffic congestion—given that the growth of private vehicles has yet

to be matched by a corresponding investment in the road and traffic management infrastructure. On the other hand, a steady growth in vehicle ownership has been widely promoted politically, especially as an indicator of a growing economy.

2.2. Vehicle Ownership and Increasing Incomes

When the per capita income of a country increases and mobility requirements become more significant and complex, people tend to buy private vehicles to exercise more control over their ability to meet mobility requirements. This increases vehicle ownership. Governments may consider different approaches: ranging from actively encouraging vehicle ownership, as is done in New Zealand or the USA, to regulating it through quotas and restrictive measures, such as in Singapore (De Silva et al., 2022). In the latter instance, restrictions are placed strategically to prevent congestion, fuel and vehicle importation costs and other issues such as accidents and vehicle emissions resulting from increased private vehicle ownership. As a developing country, Sri Lanka should consider if the growth in personal vehicles is sustainable.

Figure 2 shows how vehicle ownership varied with the variation of per capita income of countries around the world, generalised through four distinct profiles.

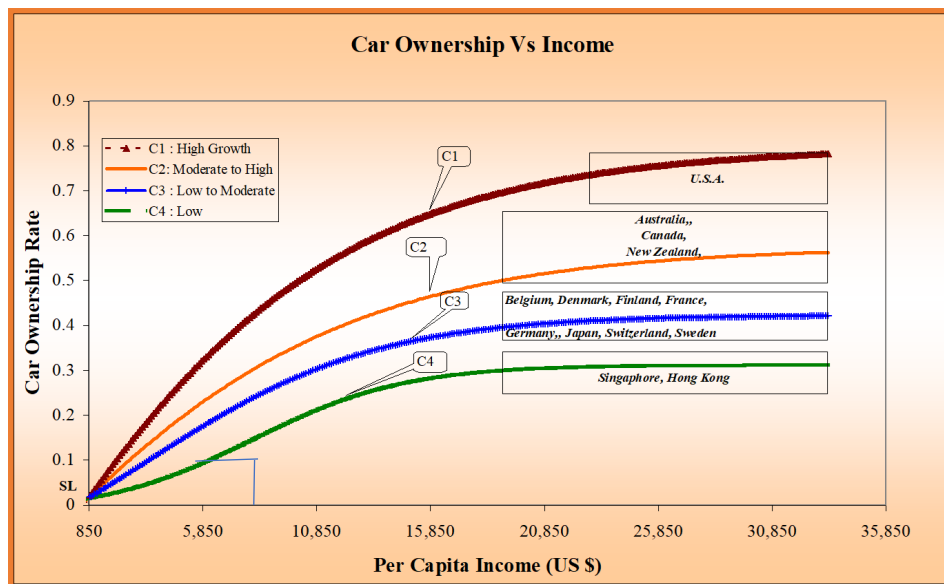


Figure 2: Car ownership and growth of per capita income

Source: Kumarage, A.S, 1998

Accordingly, for a given income level, countries like the USA that have achieved high incomes have maintained a higher vehicle ownership level when compared with countries like Singapore or Hong Kong. De Silva et al. (2022) argue that countries like the USA with low population density require higher private vehicle ownership

since providing public transport to serve a wider area may not be profitable. High-density countries like Singapore or Hong Kong manage lower vehicle ownership levels through strict ownership controls while maintaining high-quality public transport services to cater to people's mobility needs without feeling the absence of a car. To support sustainable vehicle ownership levels, Sri Lanka, the 38th most densely populated country in the world, should also exercise appropriate policy measures in line with its population density.

Figure 2, developed by Kumarage in 1998, shows the population density ranking of selected countries and their vehicle ownership at high-income levels. Sri Lanka is ranked 38th in population density; in a similar category to Germany or Japan. As per Figure 2, at the current per capita GDP of USD 4000, Sri Lanka should maintain a vehicle ownership level of 10%. However, the private vehicle ownership based on annual vehicle revenue license renewals is 28% (de Silva et al., 2022), closer to the profile for low-density countries such as the USA. Dilini et al. (2021) point out that the Western Province should maintain a 65% mode share for public transport to enable sustainable mobility.

In the event Sri Lanka reverses this trend and aligns its car ownership policy to maintain sustainable levels, it must adopt a suitable government intervention at the policy and planning level. This is imperative given the present economic crisis.

2.3. Disparities in sub-sectoral investment

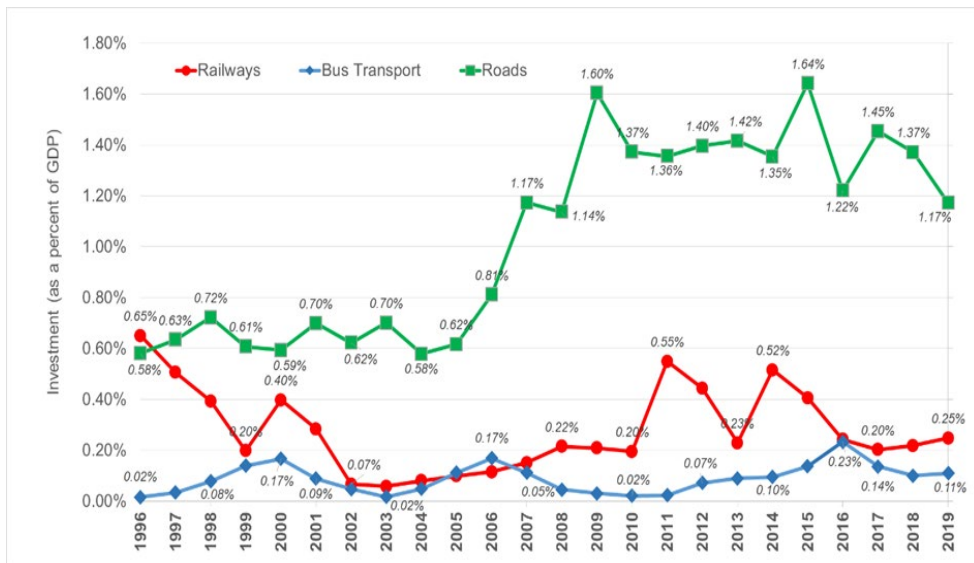


Figure 3: Investment in the transport sector as a percentage of GDP¹

¹ The source is based on Janaka Weerawadena's computations. It has yet to be published.

Figure 3 shows investment in three key transport sub-sectors, each as a percentage of GDP. Over the years, investment in the road sector has increased while investment in railways has decreased after a few peaks in 2020, 2011 and 2014. The bus sector has been overlooked and has yet to receive substantial investment. These disparities in sectoral investment mean that the public transport sector in Sri Lanka is yet to be able to provide proper services. Standards and the regulatory interventions to provide high-quality public transport services to users are yet to be adopted. Regulations enabling more private investment and encouraging digitisation and modernisation are essential for Sri Lanka to move ahead with the rest of the world in the public transport sector.

According to (the Department of National Planning, 2021b), the Sectoral Composition of Public Investment indicates that transport-related infrastructure expenditure ranged between 25% to 35% in recent years. Regarding imports from 2015 to 2019, Kumarage (2022) states that approximately 8% of the total import bill is spent on road vehicles, while another 10% is used for fuel imports and another 3-4% to pay back loans for road construction. These figures indicate that Sri Lanka spends more of its budget on the transport sector.

3. TRANSPORT POLICIES AND PLANS FOR WESTERN PROVINCE

In any sector, 'policies' describe the concepts used to achieve intended objectives, while 'plans' detail methods of achieving such goals. Transport policies arise because of the importance of transport in virtually every aspect of nation-states' economic, social, and political activities. Such policies are related to developing a set of constructs and propositions to achieve specific objectives relating to social, economic, and environmental conditions and the functioning and performance of the transport system. On the other hand, transport plans involve preparing and implementing actions designed to address specific problems.

Effective decisions regarding transport resource allocation and managing and regulating existing transport activities are focused on policies. Governments are primarily involved in the policy process. They own, manage, or regulate many components of the transport systems. Public sector involvement is high regarding transport infrastructure provision, while private sector involvement is observed in providing and operating modes and terminals. (Jean-Paul Rodrigue, 2020).

3.1. Transport policies of economic development: Singapore and India

Considering the critical influence of transport on economic development, governments place higher importance on transport policies to ensure the sector contributes to planned economic development. The Government of Singapore

succeeded in having one of the most effective transport systems in the world because of a series of comprehensive transport policies covering five main areas. These include integrating town and transport planning, repair of road network and improvement of transport infrastructure, harnessing the latest network and traffic management technology, managing vehicle ownership and usage and improving public transport (Lam & Toan, 2006). Implementation measures included road pricing in the 1960s, the merger of bus companies and strong regulation therein in the 1970s, and investment in urban infrastructure, including Mass Rapid Transit (MRT) supported by a set of Light Rapid Transit (LRT) serving as feeders to MRT. Singapore continued to adopt a series of other transport policies such as Preferential Additional Registration Fee (PARF), Area Licencing Scheme (ALS), Vehicle Quota Systems (VQS) and Electronic Road Pricing System (ERP) (Santos et al., 2004). The integrated land use and transport plans featured by regional and subregional centres, TOD-based planning models and integrated transport hubs were developed to achieve the above transport policies (Diao, 2019). These have worked well for Singapore, one of the most densely populated countries in the world.

Poor mobility affects economic growth negatively and causes quality of life to deteriorate. Realising the importance of facilitating better mobility, India's transport policy for metropolitan urban areas also focused on integrating transport and urban planning, equitable allocation of road spaces having large populations, prioritising public transport, modernising technologies for public transportation, prioritising non-motorised transport, use of cleaner technologies and innovative finance mechanism using land as a resource (Ministry of Urban Development, 2014). After reviewing transport policies in India and worldwide, Verma et al., 2021 suggested that India has sustainable urban mobility, and should aim to improve safe, accessible, comfortable and affordable public transport systems, while reducing vehicle growth and pollution. The strategies towards Heavy Occupancy Vehicle (HOV) lanes, congestion pricing, shared mobility, MaaS, autonomous vehicles, and low and zero-emission vehicles have been proposed to realise these.

Policies adopted in Singapore and India highlight the importance of prioritisation and regulation of public transport, control of private vehicles using multiple measures including pricing, gradual introduction of rapid transport options, enabling non-motorised transportation options, integrated transport planning and utilisation of advanced technology in large and densely populated urban centres. Though the Western Province of Sri Lanka does not have the urban population mass as in Singapore and metropolitan regions of India, these policies are steps in the right direction.

3.2. Transport policies in Sri Lanka

If Sri Lanka is to get maximum benefits from investment in the transport sector, it is essential to adopt a proper transport policy and corresponding regulations, as done in Singapore. The transport policies that have been in use in the recent past are discussed below to examine if they support sustainable transport for economic development.

Like many other countries in the region, Sri Lanka has made several efforts to develop a proper transport policy. Three key transport policies have been formulated during the past two decades.

- **National Policy on Transport in Sri Lanka - 2009** (Ministry of Transport, 2008) - This policy was formulated by the Ministry of Transport and approved by the Cabinet of Ministers in 2009. It has addressed many essential aspects of transport and has comprehensively addressed issues in 10 key transport subsectors representing different modes, stakeholders, implementation agencies, regulation authorities, and safety. The prime attention has been to developing the Public Transport sector in terms of capacity and service upgradation, including ICT use. Specific awareness of environmental impacts and sustainability has been low. Although the Policy was comprehensive, only 3% of its policy recommendations were implemented due to a lack of instruments that require policy-based planning or investment (Kumarage, 2022).
- **Sustainable Sri Lanka 2030 Vision and Strategic Path - 2019** (Munasinghe et al., 2019) - This is a comprehensive national development policy comprising multiple sectors. It was developed by the President's Office and, though available to the public, was not formally approved. The Vision aimed to ensure that by 2030 Sri Lanka becomes a sustainable, upper middle-income country. Several transport policies and concepts have been recommended for implementation based on four policy pillars, namely Transport Demand Management (TDM), public transport improvement, road infrastructure development and environmental sustainability.
- **Draft National Land Transport Policy - 2020** (Ministry of Transport and Civil Aviation, 2020) – This policy has been formulated and reformulated through several discussions, including inviting public views and suggestions. However, it is yet to be finalised or approved. Its proposals are similar to the 2009 policy, and the primary focus is promoting multiple modes of public transport development.

All three policies have focused on improving and regulating public transport, especially bus transport. However, the policies show differences in priority to

facilitate private modes and measures to discourage private modes, such as through road pricing.

Although it has a set of transport policies that have addressed the critical transport issues, Sri Lanka is yet to implement them effectively. Presenting a different perspective, Ahmad & Chang (2020) who reviewed the effectiveness of India's transport policies suggest that the policies themselves are correct. Still, issues in implementation and integration, as well as inconsistent government policies such as the increase of bus fare, has led to failures. This shows the importance of establishing a transport policy aligned with a country's economic development policy and a firm government commitment to implement those policies or be policy-led rather than project investment-led.

The key directions have been evaluated based on six criteria to understand if they satisfy the success parameters. Van Wee & Mouter (2021) have suggested three criteria to assess the success of a transport policy: namely, effectiveness (policy interventions aimed to change the value of any indicator, such as the reduction of traffic fatalities), efficiency (ability to achieve aims with relatively low cost) and fairness (distribution of effects across a group of people). The success of such policies may depend on factors such as economic pricing, regulation mechanisms, addressing safety and how the health, environment and sustainability are considered. Tables 1A to 1C summarise the three recent policy directives of Sri Lanka in terms of whether these successful they have been in these respects (X indicates that the criterion has been addressed).

Table 1A: Assessment of the National Transport Policy, 2009

#	Policy directives/ Policy Key ideas presented in Sri Lankan Transport Policies interventions	Assessment of Policy Objective					
		Effectiveness	Efficiency	Fairness access	Economic pricing	Regulation	Safety
1	Rail transport -Increase modal share, Expand the network; Capacity and ICT improvements for existing suburban and long-distance trains, passenger comfort improvement, value-added services, fare rationalisation, subsidiaries for non-commercial ventures, develop non-fare-based revenue, Electrification, modernisation and integrated ticketing.	X	X	X	X		

2	Omnibus transport: restructure small operators; strengthen regulation (vehicle, operational staff, regulators); improve routing and scheduling; cost-based fare systems; regulator competency; enhance social standing.	X	X	X	X	X	X
3	Paratransit: Regulate standards, standard fare structure, public complaint system, Insurance for all passengers; issue registration for hiring vehicles.	X		X	X	X	X
4	Vehicle Administration: Streamline DMT operations.				X	X	X
	Private Vehicles: Cost recovery, taxation, road user charges, electronic tolls, fuel efficiency, park and ride, HoV concessions	X			X	X	X
5	Non-motorised vehicles: encourage cycling through bike financing, cycle lanes, park and ride, NMT facilities and safety improvement.		X	X			X
6	Goods transport and logistics: Rail-based logic centres, regulations for vehicles, operators, private sector investment, integrated efficiency improvements.	X	X	X	X	X	X
7	Urban Transport: Urban vehicle volume control, railway share improvement, HoC, NMT, promote PBL, reduce goods vehicles; road pricing, parking fee, integrate land used, preserve railway lands for future.	X	X	X	X	X	
	School transport: Concessionary rates, Sisu Seriya; bicycles for school transport.	X		X			X
8	Energy efficiency: Reduce fuel consumption through pricing, shift to public modes, and taxation for fuel inefficiency.			X	X	X	X
9	Safety and security in transport; reduce accidents; security of public transport users; accident covers, surveillance, testing and training.			X		X	X
10	Transport and environment: Control air pollution, noise pollution, visual pollution, and ecosystem impacts.						X
11	Planning and coordination	X	X				X
12	Research And Development	X	X	X			
13	Stakeholder participation			X			

Table 1B: Assessment of the Transport Policies in the Sustainable Sri Lanka 2030 Vision and Strategic Path

#	Policy directives/ Policy interventions - Strategies	Assessment of policy objective					
		Effectiveness	Efficiency	Fairness access	Economic pricing	Regulation	Safety
1	Managing motorisation				X		X

2	Making bus transport the backbone of mobility			X		X
3	Getting the best out of the railways	X	X			
4	Building better highways and roads	X	X			
5	Providing seamless mobility	X	X			
6	Building better supply chains and logistics centres	X	X			
7	Improving Access and Making Mobility Affordable for All	X		X		
8	Protecting Lives					X
9	Building Sustainable Physical Environments					X
10	Protecting the Natural Environment					X
11	Improving Connections Nationally and with the World	X	X	X		
12	Making Employment Fulfilling and Productive					X

Table 1C: Assessment of the Draft National Transport Policy, 2020

#	Policy directives/ Policy interventions	Assessment of Policy Objective					
		Effectiveness	Efficiency	Fairness access	Economic pricing	Regulation	Safety
1	Improve the quality and reliability of public transport services and prioritise public transport use.	X	X				
2	Expand public transport network and increase the frequency of services; possible integration; quick adjustments for demand variations (peak-off peak); minimise transfers.	X	X	X			
3	Improve accessibility, equity and affordability of public transport services—Minimise walking distances to stops and terminals. Vehicles should be easily accessible to all users irrespective of age, gender or ability.		X	X			
4	Recognise the role of paratransit service and facilitate last-mile connectivity; deliver services to less-demand areas and last-mile connectivity with the help of ICT tools.		X	X			
5	Improve and expand inland water transport, coastal shipping and domestic air transport where appropriate.			X			
6	Improve and expand non-motorised transport (NMT) systems prioritise NMT improvements that provide access to public transport services. Provide information about the NMT routes and network.		X	X			
7	Use ICT to avoid or reduce passenger & freight movements and promote safe and effective use of transport services.	X	X				

8	Incorporate climate and disaster resilience into developing transport systems and related infrastructure.				X
9	Reduce transportation costs and travel time through better traffic and demand management mechanisms and ITS tools with the coordination of all stakeholders.		X		
10	Promote energy-efficient and less polluting vehicles with higher operation life.				X
11	Ensure adequate and effective enforcement of traffic rules for better compliance with laws and regulations and Use evidence-based enforcement.				
12	Ensure the transport needs of all, including children, women, sick, differently able and elderly, are adequately addressed; Set up effective pricing and identify any subsidy needs to targeted areas/groups.		X		
13	Ensure transport safety to minimise accidents, injuries and loss of lives.			X	X
14	Facilitate capacity building for skills development to achieve efficient transport service delivery.	X	X		
15	Develop institutional capacity to enhance the efficiency of transport sector operations and management through human resources development and provision of state-of-the-art tools and equipment.	X	X		
16	Integrate land use and transport planning to correct spatial imbalances so that demand for transport is minimised or trip lengths are reduced.		X		
17	Encourage and facilitate the involvement of the private sector in transport activities.				
18	Enhance research and development activities and disseminate knowledge related to the transport sector.	X	X		
19	Improve the quality and reliability of public transport services and prioritise public transport use.	X	X		
20	Expand public transport network and increase the frequency of services; possible integration; quick adjustments for demand variations (peak-off peak); minimise transfers.	X	X	X	

3.3. Transport Plans for Colombo Metropolitan Region/ Western Province (WP)

Transport plans are prepared to achieve objectives set in transport policies. Three different transport plans, developed after a series of studies and with the participation of many local and foreign experts, focused on the Western Province transport problems. The following is a review of these three plans.

3.3.1. CoMTrans Transport Plan (2014)

The CoMTrans Transport Plan (Oriental Consultants Co., 2014) was developed by the Urban Transport Development Project and funded by the Japan International Corporation Agency (JICA). Based on household survey data and transport demand modelling, the plan proposed a series of policy options and identified relevant projects based on four criteria: economic efficiency, environmental friendliness, equity in society and safety.

The study proposed reducing traffic flows in the city centre by promoting suburban centres by designing a transport system to decentralise activities to areas within the Colombo Metropolitan Region. Regarding transport modes, the study proposed to develop the monorail system with transport hubs, multimodal centres, and ride systems. To minimise the shift towards private modes, a higher level of public transport system was seen as an urgent need. The importance of developing the rail-based system, at least in the long run, was also recommended.

The key proposals prioritised for the seven significant corridors reaching Colombo given by the CoMTrans plan are summarised in Table 2. Accordingly, around 100 transport projects were proposed for implementation in the Western Province in the short, medium, and long-term horizons.

Table 2: Development options for the seven critical corridors proposed by the CoMTrans plan

Selected Development Options			
Corridor	Railways	New Transit System	BRT/Bus/Road
Negombo Road	Modernised		Bus Priority
Kandy Road	Modernised		BRT
Low-level Road	Modernised		Bus Priority
Malabe Road		Monorail	
High-level Road		Monorail	
Horana Road			Bus Priority
Galle Road	Modernised		BRT Supported by Marine Drive Extensions

Source: CoMTrans study

The recommended transport options for the seven key corridors included Bus Priority Lanes (BPL), Bus Rapid Transit (BRT), Monorail, and Modernized Railway. Recommendations included railway improvements for three corridors, monorail only for two corridors, bus priority, or Bus Rapid Transit (BRT) systems for five corridors. Accordingly, the corridors Negambo, Kandy, Low Level and Galle were proposed with both railway and bus priority. The Horana corridor was presented with one option: bus priority. The monorail option was exclusively offered for the Malabe corridor and was the only option considered. The study used an International Monetary Fund-based predicted annual GDP growth rate of 4% by 2035 instead of the government forecast of an 8.3% growth rate. Further, the population growth rate was assumed at 1.425% p.a.

3.4. MoT/UoM- CMR Transport Master Plan (2015)

The Ministry of Transport (MoT), in 2015, started implement the next stage of the CoMTrans Master Plan by identifying options for investment prioritisation with a team of experts from the University of Moratuwa. The previous plan was slightly modified to determine the priority options given in Table 3. The railway and bus priority options which should have been considered in the CoMTrans Study were considered in this plan. Accordingly, Bus Priority was recommended as the best short-term option (with high private financing options), followed by a new railway line for the Malabe Corridor, leaving the monorail as the third, long-term, option. In identifying potential projects for investment, MoT obtained a technical feasibility study for rail for the Malabe corridor and found that to be a less costly solution and an option that would strengthen the existing railway network. A BRT on Galle Road was initiated by the MoT in August 2015, which completed a feasibility study after review by the International Finance Corporation (IFC) and was scheduled for design and investment.

Table 3: Priority Options in CMR Transport Master Plan (MoT/UoM- CMR Transport Masterplan)

	Railway	BRT	Bus Priority	Monorail	Road Widening
Galle Road	2	1			
Horana Road	2		1		3
High-level road	2		1		
Malabe Road	2	1	2	3	
Low-Level road	2		1	3	
Kandy Road	2	1		3	
Negombo road	1				

Excessive traffic accumulation within Colombo City, making it a monocentric city leading to a heavy burden on the road network, was a significant impediment to developing the peripheral cities and providing proper land-use transport facilities. Accordingly, six peripheral cities, Kadawatha, Piliyandala, Moratuwa, Kaduwela, Kadawatha and Ja Ela, were identified for development as satellite cities to reduce the traffic burden on Colombo City itself.

3.5. Transport Proposals for Megapolis Plan (2016)

The new government, in 2016, began making plans for high economic growth with a Megapolis Western Region Master Plan (Ministry of Megapolis and Western Development - Sri Lanka, 2016a). It envisaged the status of rapidly becoming a High

Income Developed Country through the spatial transformation of urban agglomerations in the Western Region. The transport plans provided a framework for urban development in the Western Region up to 2035. This plan has been prepared based on the urgency of the actions to resolve the critical urban transport problems and based on a logical sequence of implementation to maximise the outcomes in achieving the urban mobility objectives. Addressing issues of congestion as a critical goal and targeting high-income developed countries, a series of proposals were provided.

- **Transport Demand Management:** Flexible work hours, parking management, intersection control, traffic flow management, enforcement through CCTV, road pricing for entry to CBD
- **Public Transport Improvement:** Restructuring bus service, modernise busses and services, improvement of office and school service, regulating taxi service, railway electrification and modernisation, new Rapid Transit Systems (RTS) using LRT, paratransit regulation, and improvement to suburban terminals, new water transit systems.
- **Road Infrastructure Development:** capacity improvements by developing roadways, improved capacity of existing expressway network, improved walkability, intersection control and reduced vehicle emission, construction of new expressways.
- **Environment Sustainability:** Encourage bicycle use of electric vehicle rapid charging.

In proposing transport solutions for the WP, the Megapolis plan referred to the two earlier plans but reconsidered their transportation solutions as being inadequate as they used a higher population growth rate of 2.2% p.a. and a much higher GDP growth rate, leading to the estimate of much higher trip levels even by 2020. However, this has not occurred, with economic growth becoming negative due to multiple issues since 2019.

3.6. Way forward for WP with appropriate transport plans

Table 4 summarises how the three plans discussed above have treated critical public transport and other transport problems in the Western Province. Accordingly, the BRT was recommended as a short- or medium-term solution by the CoMTrans and MoT/UoM-CMR plan. However, the Megapolis plan has not considered BRT options, citing issues of expanding the network, the presence of an expressway network in some of the proposed corridors, its inability to cater to increased demand beyond the year 2025, issues to accommodate pedestrian and turning movements,

requirement of feeder services, issues to locate bus stops, etc. (Silva et al., 2016). All three plans have proposed bus sector improvements.

Table 4: Public transport options facilitated by the three key master plans for WP

	Time frame	CoMTrans	MoT/UoM- CMR Transport Master Plan	Megapolis
BRT	Short term	2 routes, 36 km	2 routes, 36 km	-
	Medium-term	3 routes, 63 km	2 routes, 40 km	-
	Long term		2 routes, 38 km	-
Bus Sector Improvement	Short term	Consider	Consider	-
	Medium-term	-	-	Consider
	Long term	-	-	Consider
Monorail/LRT	Short term	1 line, 23 km	1 line, 7 km	7 lines, 75 km
	Medium-term	2 lines, 31 km	1 line, 10 km	
Railway Electrification	Short term		3 lines, 91 km	4 lines, 196 km
	Medium-term	3 lines, 103 km	3 lines, 60 km	1 line, 22 km
	Long term		2 lines, 64 km	1 line, 30 km
New Urban Expressways	Short term	35 km	-	43 km
	Medium-term	26 km	-	-
	Long term	-	33 km	-
Inland Water Transport	Short term	-	-	3 routes

Substantial lengths of railway electrification have been identified in all three plans. While CoMTrans has identified this as a medium-term investment, the other two plans have identified the implementation starting immediately and running across more prolonged periods. CoMTrans and the Megapolis plan have prioritised the Monorail and LRT, whereas the MoT/UoM plan has identified only a limited length for immediate implementation. Urban expressways have been prioritised by the CoMTrans and Megapolis plan for quick adoption, whereas the MoT/UoM plan has proposed such only as a long-term investment. All three plans have covered different public transport options, assuming different growth scenarios. However, selecting a proper plan should consider the subsequent economic downturn, the lower mobility demand growth and the country's limited investment potential.

Sri Lanka has not achieved the envisaged economic growth and has been experiencing negative GDP growth since 2018. The population growth rate in Sri Lanka is also declining, only 0.28% in 2023. This indicates that the Megapolis plan

developed based on higher economic and population growth rates leading to higher levels of transport demand may need to be improved, and the investment in infrastructure to cater to higher capacities may not be justified. The status of Sri Lanka has mostly stayed the same from 2014-2015. CoMTrans and MoT/UoM plan proposals can be reviewed to identify feasible projects for implementation. Accordingly, the plans considered suitable for consideration in the different time frames are listed in Table 5.

Table 5: JICA/MOT/UOM Transport Plan Proposals revised for updated time frames.

	Short Term (2023-2027)	Medium Term (2023 – 2030)	Medium Term (2023 – 2040)
Galle Road	Bus Priority à BRT	Electrified Railway	
Horana Road	Bus Priority	Road widening	New Railway (via Padukka-Panadura link)
High-level road	Bus Priority	Electrified Railway	Road Widening
Malabe Road	Bus Priority	New Railway (via Dematagoda)	Rapid Rail
Low-Level road	Bus Priority	New Railway (via Kelaniya)	Road Widening
Kandy Road	Bus Priority à BRT	Electrified Railway	Rapid Rail
Negombo road	Bus Priority	Electrified Railway	

4. SECTOR-WISE REFORMS TO IMPROVE PUBLIC TRANSPORT

4.1. Recommendations for improving existing bus transport and moving towards BRT

The concept of BRT moves beyond that of just an attractive bus. Table 6 explains how BRT evolved by amalgamating the advantageous features of conventional bus and rail-based services (Sivakumar and Okamura, 2007).

Table 6: Comparison of different options

Conventional Bus CB)	BRT	Rail Based Service (RBS)
<ul style="list-style-type: none"> • Unreliable service • No clean buses • Badly conditioned bus • Not frequent service • Crowded buses • Cent war existence 	<ul style="list-style-type: none"> • Its enjoy by elimination (-) of CB and adding (+) of RBS • Higher speed • Higher capacity • Less costly • Quick implementation • Ideal ladder to go from CB to RBS 	<ul style="list-style-type: none"> • Excellent service but, • Extremely high cost • Purely Fixed route • Poor connectivity • Planning & implementation time is longer than a political cycle.

While the vehicle may be a modernised bus, integrating many other measures, such as digital connectivity, can make BRT more attractive and effective, especially since it is much cheaper than other forms of rapid transit and, therefore, ideal for consideration within the current economic context. A BRT could begin as a bus priority lane, followed by other bus priority measures, ultimately reaching the full-fledged BRT. Since the cost of most BRT measures is not very high, these measures may be open to both private and public sectors. BRT is considered an ideal ladder to move from the conventional bus system to a rail-based service. Figure 4 represents different measures that can be viewed and integrated to form a BRT system.

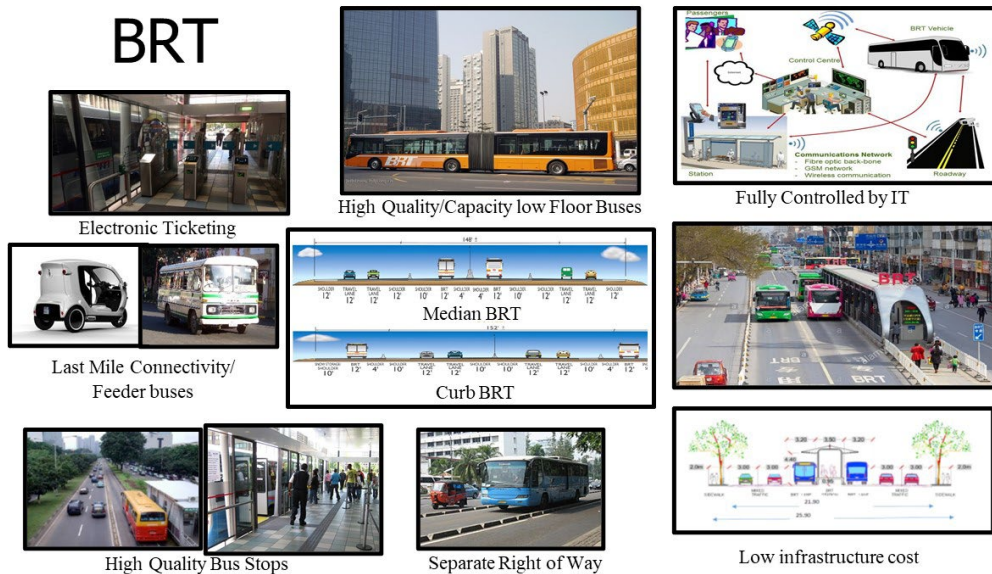


Figure 4: Possible BRT measures for integration

Though urban centres must move from conventional buses towards more railway options, this should be done with the economic costs in mind since railways, and especially rail rapid transit such as MRT, Metros, or even LRT, have higher initial costs and operating costs, that can make it unaffordable for a medium-sized middle-income city like Sri Lanka. In terms of implementation, the BRT requires only 1-2 years, as done in Jakarta, while an MRT/ LRT takes much longer, more than six years at minimum. As shown in Figure 4 (Kumarage, 2012), the corridor demand in the Western Province is around 10,000 passengers per hour in the peak direction. Double the current demand may be served if a single-lane BRT is implemented, at an average cost of USD 1-10 million per km. This option is much cheaper than the LRT and MRT, which, as shown below, are around twenty times as costly than a BRT. The estimated Galle Road Corridor demand for 2035 is still 50% of the carrying capacity of a well-planned BRT system.

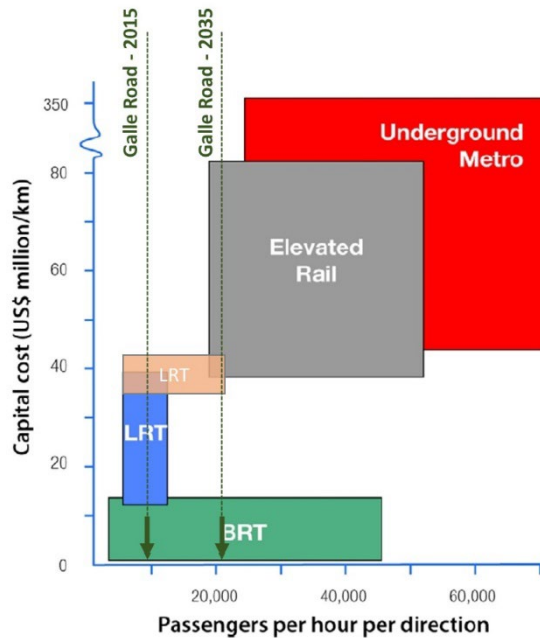


Figure 4: Passenger Demand in Transport Corridors in Western Province compared against urban transport options and costs

A BRT system with one lane for buses can carry up to 10,000 passengers per hour, whereas the same lane with mixed traffic carries only 2,000, and a regular bus lane has only 9,000 passengers per hour. Thus, a BRT is a cost-effective solution to increase road throughput without expensive road widening and/or high-cost RBS.

Many other systems go hand in hand with the public transport development to utilise the maximum benefits: Feeder systems, congestion charging, on-street parking restriction, off-street parking provision, park-n-ride system, modal integration, passenger information systems, etc.

4.2. Bus reform

A bus reform piloted in Kandy for modernising the bus sector with GPS tracking and a cashless fare collection system, called SAHASARA, can be considered a realistic means of improving bus transport in Sri Lanka, which has the following advantages over other modes (Ministry of Megapolis and Urban Development, 2019).

- The only available option for the short term, with private investment capacity as high as 80%.
- With only \$250 million in state funding, all 10,000 buses in the WP can be converted to a quality comparable to those in Japan, Korea, Singapore or Hong Kong.

- Current bus owners (including SLTB) can be retained, though reformed.
- Live digital connectivity between passengers, operators and buses can be established.
- Accurate bus operational data (speed, travel time, etc.) is readily available (Fernando et al. 2021)

4.3. Railway development proposals

Sri Lanka Railways own its right of way. Therefore, trains can move much faster during peak times than vehicles plying congested roads. Low utility cost associated with railways has led many people to use railways during the pandemic and economic crisis. The fare for travelling by train is often half the bus fare. Further, many railway users can travel using concessionary season tickets. This financing model needs to be changed while the government supports its enormous economic contribution to averting congestion costs. The Colombo Suburban Railway Projects plans to have an electrified, efficient suburban transport system in the Western Province for which the designs and the cost estimates are ready to cover areas including Kalutara South, Avissawella, Negambo, and Polgahawela. The project cost is estimated and has been justified. This can be the gateway for modern technology to reach the railways. IT-based passenger information systems, ticketing machines, and more performance monitoring can improve services.

4.4. Usage of Modern IT Technology to improve public transport sector

Like any other sector, transport can harness the benefits of recent Information Technology (IT) developments. In the digital age, a range of IT tools can be used to generate solutions that effectively utilise existing capacities while giving improved choices to the users in the system. The transport sector, including autonomous vehicles, can be digitised in the long-term using computer vision and AI-based dynamic traffic controls. Short-term applications can be included using IoT and sensor-based passenger information of buses and trains, associated AI-based analytical tools, sensor-based parking, demand-based scheduling of public and paratransit supply, AI-based dynamic traffic control, optimised bus scheduling, and peer-to-peer (P2P) ride-sharing.

As a mode of public transport, hired three-wheelers in Sri Lanka had the reputation of being unprofessional in behaviour, unfair and not predictable in pricing, and untrustworthy. By introducing vehicles employing apps such as PickMe and Uber, the three-wheeler sector has been transformed into a fair, trusted, safe, secure, professional, and traceable mode of transport with multiple payment methods, etc. The process was facilitated by having an appropriate app and a set of mobile phones

with service providers and users. The following key technologies can be used to improve the transport sector.

- Tracking system for all vehicles of the transport sector (for all buses, trains, and even public transport vehicles)
- Digital payment system for transportation
- Portals like bus management systems or railway or integrated solutions
- A range of passenger apps for users of public transport

One adequately developed solution is the SAHASARA digitisation project, where a range of IT-based tools were used to provide integrated solutions. The pilot project was launched in Central Province, and it includes means of GPS tracking, IT-based scheduling, electronic travel cards, electronic ticketing, service extensions, and centralised operation control (Ministry of Megapolis and Urban Development, 2019).

4.4.1. Changes in land use policy to facilitate a better public transport system

Integration between transport as well as land use is a pre-requisite. If the transport system is changed, so too will accessibility and in turn land use. This emphasises the need for transport planners, engineers, and urban planners to work together in finding sustainable solutions towards issues emerging from inevitable urban development trends in the Western Province.

The plans for the Western Province (or any other province) need to be aligned with national and regional level land use policies and particular strategies. Such integration will ensure the development goals are realised, as many conflicts, incompatibilities and misfits will arise in land use, population distribution, and employment opportunities due to changes in mobility patterns led by transport development. In this regard, the National Physical Plan highlights the high-growth areas in the Western Province to guide the decisions related to transport development plans and projects.

5. CONCLUSIONS

To progress towards sustainable development, Sri Lanka must invest more in public transport and focus on updated transport plans, especially in the Western Province. Key measures to move forward can be summarised below.

1. Adopting the JICA CoMTrans/UoM/MOT plan for Western Province is recommended.
2. Transport Pricing Reform. Implement Road User Charges, Revise Vehicle Import Duties, and Commence a Road Maintenance Fund and a PT Subsidy Fund.

3. Rescheduling of the LRT developments as medium to long-term private investment.
4. Negotiate with JICA to divert LRT financing to Railway electrification/modernisation and bus infrastructure development.
5. Change of the Bus Regulations to private investment to modernise and deliver higher service quality.
6. Setting up an AI-based traffic management system to streamline parking, intersection control and road conditions to eliminate bottlenecks.
7. Engineering and related professional inputs in planning and feasibility studies in transport should be realigned to undertake projects as a team in data-led realigned multisector transport investments.

Measures to improve the bus sector, including bus priority lanes, could be adopted in a few years. During this period, the work for railway electrification can be started parallelly to ensure that it can be implemented within a 5 to 10-year time frame. The rapid transit measures could be taken up in the long run after raising the required capital through public or private investments.

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