

An Indian-Australian research partnership

Project Title:	Bus Route Design in an Integrated and Multimodal Transit System	
Project Number	IMURA0448	
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Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?

(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. Clean Energy
4. Water
5. Nanotechnology
6. Biotechnology and Stem Cell Research

The research problem

Define the problem

High traffic demand in urban cities has induced severe traffic congestion. In Australian urban areas, the avoidable costs of congestion in 2005 are approximately \$9.4 billion. The total kilometres travelled are estimated to increase by 37% from 2005 to 2020. Thus, if no effective solution is provided, the cost imposed by congestion will be higher than 12 billion by 2020 [1].

Promoting the public transport usage is well recognized to be a universal solution to congestion mitigation and consequently the sustainable and cost effective development of urban transport systems. Shifting from cars to public transport can deliver a 65 per cent emissions reduction during peak times and a 95 per cent reduction in emissions during off peak times from the commuters that make the shift [2]. The average fuel consumption of every 100 transit passengers per kilometres is 2.5 litres, which is 7 litres of car drivers. A

ten per cent shift to bus passenger transport from cars would reduce greenhouse gas emissions by more than 400,000 tonnes a year and every million passenger kilometres on public transport, instead of cars, saves 45,000 litres of fuel [3].

It is difficult to expand the train or tram network within a short time to cover the vast city area. Yet, the bus itineraries can be easily adjusted with little cost. The current bus networks in many cities are not well integrated with the train/tram networks, and the overlaps of their itineraries cause unnecessary competition and low utilization rates of many bus services. This project thus proposes a new idea of bus route/itinerary design, focusing on the integration of multimodal transit systems.

References

1. Bureau of Transport and Regional Economics, *Estimating urban traffic and congestion cost trends for Australian cities - working paper 71*, 2007, Department of Transport and Regional Services: Canberra.
2. Bureau of Infrastructure, T.a.R.E., *Long-term Projections of Australian Transport Emissions: Base Case 2010*, 2010, Department of Infrastructure and Transport.
3. International, C., *Impact on the Australian Economy of Increased Bus Patronage*, 2006: Kingston, ACT.

Project aims

Define the aims of the project

The objectives and contributions of this project include: (1) design a hub-and-spoke network framework of the multimodal transit system, taking train as the main lines and buses as the spoke lines, making the train/tram services more accessible to the commuters; (2) address the key factors to improve the seamless transfer, to reduce total trip time and prompt public transport usage; (3) systematic studies on the design and policies of transit-oriented-development in the context of the hub-and-spoke Multimodal Transit System; (4) build a transit assignment model for demand prediction, where bus travel time randomness and reliability is accounted for.

Expected outcomes

Highlight the expected outcomes of the project

3 journal papers on the main research objectives;
2 conference papers on the application side of this topic.

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

Urban Public Transport system itself is a big infrastructure system, and promoting public transport usage is also well recognized to be a universal solution to mitigate traffic congestion and eventually to the sustainable development of urban transport systems. This topic requires large-scale network optimisation and simulation.

Capabilities and Degrees Required

List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.

Aligned with the project objectives, the eligible candidate should have a relevant degree in Transport Engineering or Civil Engineering, with background knowledge/skills in Transport Planning, Transport System Optimization, Computer Programming, and Operations Research.

Potential Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.

Please provide a few key words relating to this project to make it easier for the students to apply.

Urban public transport systems, multimodal network, network design, bi-level modelling, hub-and-spoke network.