Transactions on the Built Environment vol 64, © 2003 WIT Press, www.witpress.com, ISSN 1743-3509

The role of a feasibility study in planning a new LRT system

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Abstract

Light Rail Transit is applied into major suburban activity centers with concentrations of office complexes, shopping centers, and retail establishments. LRT can indeed improve access for many employees of these centers, particularly reverse commuters from lower income urban residential areas. This was the case of applying a brand new LRT system in the City of Athens in 2002. Following this, an increased interest was shown in mass transit investments for other Greek Cities, such as Patras ,Pireaus and Kalamata. The Greek Ministry of the Environment, Land Planning and Public Works has commissioned a feasibility study for an LRT system for the city of Patras, to the Transport Study Unit of the University of Patras. The emphasis of this study was in determining the feasibility of an LRT investment of planning engineering and environmental study funds.

The model process followed, is applicable on a broader scale to assist decision makers in prioritizing corridor LRT planning investments.

This paper describes the process and general findings of the specific study with respect to a set of discrete steps, which are applicable to other corridor transit investment planning efforts.

1 Background

Given the growing interest in LRT systems and mass transit investments in Greece during the last years, the Greek Ministry of the Environment, Land Planning and Public Works commissioned a feasibility study to the University of Patras[(1)], for the development of a new LRT system for the city of Patras – third in population city of the country.

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The emphasis of this study was not only to determine the feasibility of such an LRT system, but in general to identify the feasibility of investment of planning, engineering and environmental study funds in a specific corridor.

The model study process, drawn from the above study, is applicable on a broader scale and it can assist decision makers in prioritizing LRT planning investments. This paper describes the process and the general findings ,and assesses the role of such a feasibility study in planning a new LRT system – the process can be applied in all similar cases, following the discrete steps described here.

2 Setting the problem

The citizens of Patras (approx. 300,000) demand a new transport policy, which would improve their daily travel [(2)]. .

At present, the needs of the Patras' citizens mainly are served by private vehicles and – to a small percentage – by the mass transport system of the city (namely buses). The bus network is not dense and presents a number of severe deficiencies.

The daily difficulties to the citizen transfer can be devoted to:
- the concentration of moves to/from the city center
- the road network, which due to the overall morphology of the city's arrangement (: very lengthy, in the direction North/Northeast – South/Southwest) is extremely congested during most hours of the working day.
- the parking problem: roads in and around the city center cannot offer parking facilities to the numerous private vehicles which are directed there. Garages are missing.

The situation is further burdened by the significant number of vehicles which traverse the city, moving from/to the city's main port.

2.1. Buses and taxis

The bus network in Patras consists the unique mass transport system of the city. Buses operate in 6 lines, and serve approximately 40,000 passengers per day, which consists 10% of the total daily trips.

The rest 90% is served by private vehicles and taxis. As a consequence the traffic volumes in the road network are high, and result in traffic congestions; the overall passenger service is lowered to unacceptable levels.

Taxis are approximately 800 in number, and serve 7% of the total passenger trips.

It is clear that in order to improve the level of service, a new mass transport system is necessary which would undertake at least 25% of the total travel. A further increase in the number of moves by mass transport should then be pursued, which would lead to 100.000-150.000 passenger trips per day.

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2.2. The LRT

An LRT system has precisely the potential to serve such amounts of daily passenger trips and to offer a good level of service, without environmental pollution.

Supposing that an LRT corridor is established in the city serving 150.000 passenger-trips per day i.e. 54.750.000 per year, there is a potential to apply traffic measures which would easify traffic flows and reduce traffic congestion.

One main corridor for the Patras' LRT was suggested in the direction North/Northeast-South/Southwest connecting the suburbs to the city center (Fig. 1).

A simple study process was used to assess the feasibility of such a corridor. As illustrated in Fig. 2, and summarized below, the process involves a discrete set of participatory tasks, arrayed about four focus subjects. These are described below.

3 The study process

This was based on the approach described in [3] ,appropriately adjusted to meet present circumstances. The objective of the overall effort was to evaluate the general implication of an LRT corridor, rather than specific variations and tradeoffs. Nevertheless, a specific case-study alignment enhances the understanding of the problem. For the alignment concept three steps are involved:

Field trip. Field reconnaissance by the study team, which was conducted to identify potential alignments and respective issues.

Options. A concise working paper was prepared to qualify alignments and tradeoffs, and steer the technical and policy advisors toward a suitable case-study alignment. This working paper focused on a set of general criteria, including:

- physical requirements and impediments
- potential transportation impacts
- potential environmental impacts

Selection .The candidate case-study alignment was then chosen and discussed. This was further assessed.

For costs and patronage: discrete, single-value estimates of costs at such an early planning stage many times come back to cloud the credibility of the overall project – because the estimates can be "high" or "low" relative to current information [4], [5] . To realistically address the significant uncertainties that exist, ranges of potential costs and patronage can be developed and advanced into ranges of cost-effectiveness.

The steps involved refer to:

(i) unit construction costs. The initial step in developing order – of – magnitude construction costs is the development and documentation of appropriate unit cost values for construction, and contingencies based on current experience. In

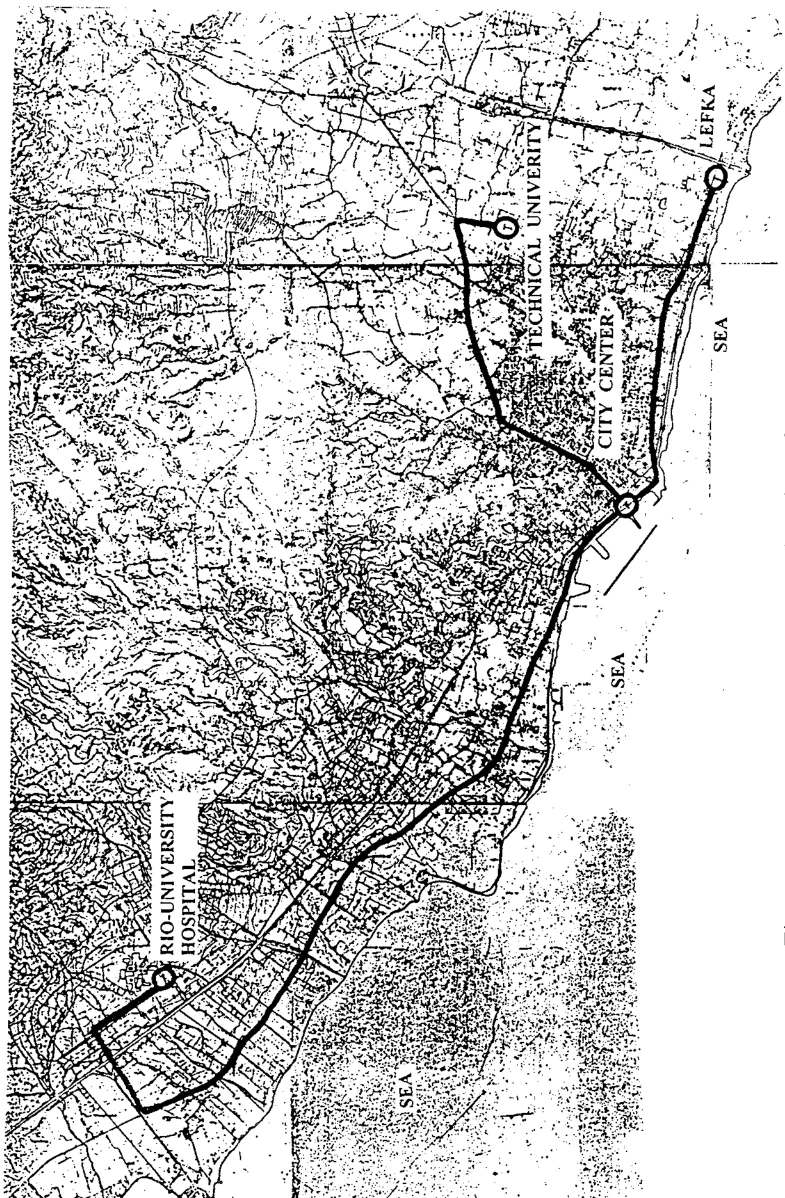

Figure 1: The LRT corridor for the city of Patras

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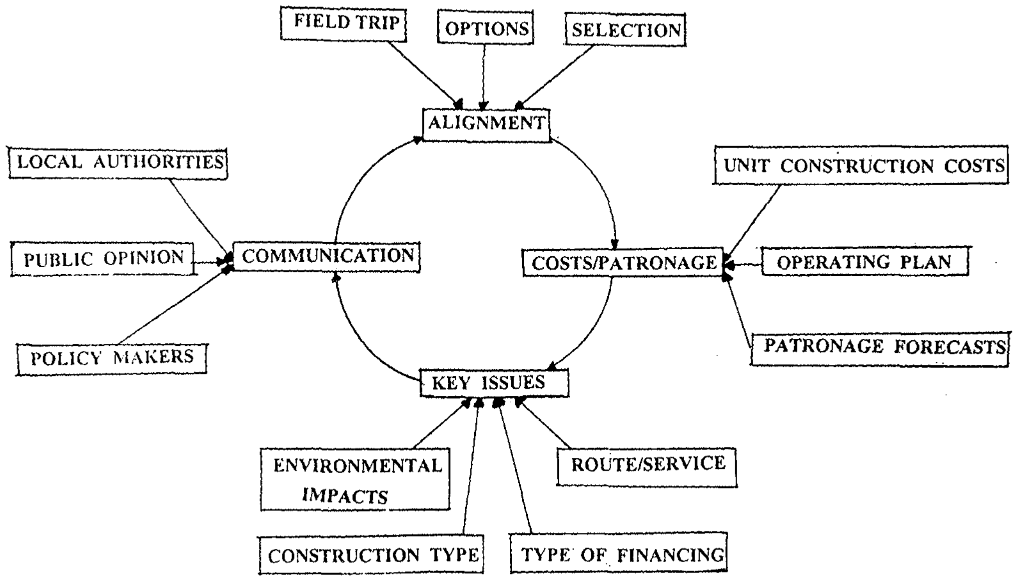

Figure 2: Layout of the study process

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this case, the Athens corridor LRT system provided the model design concepts although variations were considered [6]

(ii) operating plan. Ideally an LRT operating plan would be identified in a long-range planning document. With this information available, the integration of planned LRT line is considered and reasonable operational assumptions, including reasonable headways, would have to be identified. The operational plan has to be consistent with the transport computer modelling.
The patronage assessment begins with definition of a discrete operating plan (speeds, stations, distances, frequencies) which is translated into a network for modelling purpose.
Since a model for patronage estimation was not pre-existent, manual estimation was substituted here, based on approximations of total trip making and transit model-share, by focusing on corridor population and employment characteristics, and transit usage.

(iii) patronage forecasts. These were prepared for the study and then were translated into ranges based upon review of variables to which patronage is sensitive, such as household income, availability of transit links etc. The resulting values were presented with respect to appropriate measures of effectiveness, such as daily passengers per km, to allow for order of – magnitude comparisons with performance measures of existing similar systems.

Future issues: these refer to :Route service. The specific routing and service assumptions set forth in the case study will need to be scrutinized very carefully with respect to an overall plan for implementation of public transport services.

Construction. The type and configuration of construction will require segment by segment consideration.

Environmental impacts. I.e. traffic impacts at intersections and along street segments, and at proposed station locations; property access; land use compatibility; noise and air quality; construction impacts; vehicular and pedestrian safety.

Type of financing
A public-private partnership was suggested in the case-study, as it seemed to be the best option for the specific application.
Finally, it is critical to involve the local authorities, the decision makers and the public opinion in the whole process, even at these early stages of the project; this may prove necessary to secure their consensus regarding the prospects of the LRT implementation.

4 The effects on traffic congestion

On a regional level as it is e.g. the wider Patras area, the LRT implementation can reduce traffic congestion to the degree that they divert auto users to transit. While a number of factors contribute to a commuter's decision on whether to use auto or transit, a major one is the relative travel-time and convenience of using transit over auto.

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The LRT line should have an operating environment that allows high average operating speeds – exclusive or semi-exclusive rights-of-way, generously spaced stations, and few if any features that would slow the trains and park-and-ride-stations should be convenient for commuters, especially with good roadway access. For a new LRT line, many of the park-and-ride commuters will come from other transit and - specifically for Patras – from bus services.

Once of the characteristics of light rail transit is its ability to operate in a variety of modes, including in street, in mixed traffic, and/or with at-grade street crossings. This ability enables LRT to provide better service by locating stations close to the markets, and avoiding cost and certain types of environmental/community impacts, but it can come at a "cost", because local traffic circulation and parking can be disrupted. At intersections, depending on the configuration of the crossing, LRT can affect the level of service. Modification to traffic signals, such as adding an exclusive or semi-exclusive phase for the LRT move, or introducing turning prohibitions, can adversely affect vehicles using the intersection, particularly when light rail vehicles are present. Mid-block crossing, though, protected with traffic signals or gates and flashers, introduce potential delay for traffic. In-street running in mixed traffic will affect traffic levels of service, while taking one or more street lanes for the exclusive use of the LRT will reduce the capacity of the street. Converting a street to a transit mail for LRT will alter traffic patterns and divert traffic onto other streets.

These impacts are part of the trade off between proving better service, station locations, and/or avoiding costs or more severe impacts.

In serving some special trip generators, such as stadium, university, general hospital that are subject to surge discharge of attendees following conclusion of an event, LRT should be isolated from the traffic access routes that will experience back ups and delays. Otherwise, LRT can get caught up in the same traffic congestion as the other traffic.

Property Access and Driveway Protection. Suburban centers often have numerous commercial driveways and private roads providing access from public roads to individual parcels or developments. These driveways and roads can be affected by LRT running along a street, as entering or exiting traffic could be delayed when the trains are approaching and crossing the drives. This can be especially troublesome when the traffic is associated with a work shift change or other surges of traffic than can be blocked by the trains. When the LRT is operating in a street median, turning movements into or out of driveways can be restricted and require some circuitous routings. One remedy is to put breaks in the median opposite the driveways to allow traffic to cross the tracks, although some type of crossing protection or warning device is necessary. Because a large number of these median breaks would adversely affect the operating speed of the trains, a compromise is to consolidate the driveways where possible to minimize the number of breaks to be provided, although this may require the cooperation of a number of adjacent property owners.

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5 Conclusion

Light Rail offers a unique blend of cost effectiveness, environmental benefit and regeneration support. These benefits have been proven in many places around the world.

A feasibility study for a new LRT implementation is obviously necessary, but it gives only a general, and not a specific level of detail. The main outcomes of such a study are a range of benefit/cost measures for the corridor, and not an alignment selection.

The role of the feasibility study is to answer basic questions regarding the desirability of investment and of planning a LRT system.

The general process described in this paper, which came out of the LRT feasibility study for the city of Patras, can be applied to virtually any problem, and it consists a good guide for similar applications.

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