KARACHI MASS TRANSIT PROGRAM (KMTP)

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1. INTRODUCTION

Karachi with its current population of about 8.5 million is 22nd largest city of the World. With an annual compound growth rate of 6%, almost double the national average, it's population is projected to reach 14 million by the end of the century. Apart from being the largest city of Pakistan, Karachi is the biggest industrial, commercial and financial centre of Pakistan and main port city located on major international air route between Europe and Asia Pacific rim. Inspite of Karachi's significance in national and regional context, the city is faced with serious inadequacies of civic necessities like transport, housing, water supply, sewerage and environmental requirements.

Mass public transport is provided by a publicly-owned fleet of single decker buses, operated by Karachi Transport Corporation; by a greater number of similar buses in diverse private ownership; and by many individually-owned minibuses. A small proportion of demand is served by infrequent suburban services on two Pakistan Railway lines. Fleets of taxis and autorickshaws provide a more personal and individual public service. Speeds are uniformly low in the main urban areas, vehicles are overloaded and the safety record is disappointing, although capacity is high in key corridors. From the operators viewpoint, fare levels (controlled by Government) are inadequate and profitability is marginal.

Lack of an appropriate transport system essential for the fastest growing urban centre of the Developing World, was creating major social unrest. Consequently, after a series of reports and recommendations for improvement of transport system of Karachi during the last two decades failed to produce positive results, Karachi Mass Transit Study was commissioned in 1987 with assistance of the World Bank.

The Study was undertaken for the purpose of defining a Mass Transit System appropriate for Karachi and to develop a programme by which needs for improved public transport in the city could be met.

Karachi Mass Transit Programme has been developed as a result of three years of comprehensive study and sound technical procedures. On implementation, the Mass Transit System of Karachi is expected to provide a model for the developing cities of the World.

1.1 TEST OF MASS TRANSIT ALTERNATIVES:

The screening of technologies reviewed all known mass transit vehicle systems and operating strategies, in the light of needs and conditions in Karachi, in order to dismiss from further consideration those technologies that would be least useful. Technologies withdrawn from further study at this stage were articulated buses, electric trolley buses, monorail systems, automated guideway transit systems, and guided buses.

The alternatives investigated, and Study findings regarding each, are summarized below. All the alternatives were compared with a base case (Alternative A) in which it was assumed, that there would be no substantive changes in policies or actions related to provision of mass transit services.

1.1.1. Alternative B - Improved Bus Service:

Policies designed to upgrade the quantity and quality of bus and minibus service would be instituted, routes would be redesigned, and a program of road and traffic management improvements related to bus operation would be implemented. This alternative was found to be worthwhile and necessary, but inadequate in view of the projected rapid increase in traffic and road congestion; it would leave mass transit at a disadvantage relative to other less efficient modes and accelerate the shift to those modes. The need for some form of transitway development (provision of separate alignments for mass transit) was indicated.

1.1.2. Alternative C - Improved Bus Service Integrated with Improved Commuter Rail:

The local suburban services and facilities of the Pakistan Railways main line and Karachi Circular Railway would be upgraded to provide faster and more frequent service, and wherever possible, convenient interchange between rail and bus. This alternative was found to gain very little in benefits, compared with Alternative B, while having significantly higher capital cost. The improved commuter rail services would carry less than five percent of total mass transit travel and would by themselves have a negative economic return.

1.1.3. Alternative D - Improved Bus Service and Busways:

In addition to alternative B-Type General improvements, there would be a network of busways (exclusive roadways, with stations, for bus service isolated from other road traffic). Bus routes were redesigned to integrate on-street and busway services. This alternative was found to have moderate cost and high benefits, reducing bus traffic on streets, and attracting a high proportion of major corridor travel onto the busways. Mass transit users would have large time savings and bus operators would achieve higher productivity and lower cost per kilometer of operation.

1.1.4. Alternative E - Improved bus service and Light Rail:

There would be a network of light rail routes and stations, integrated with improved bus service designed to complement the rail lines. Light rail would provide high speed, higher service frequency than commuter rail, and higher capacity than busways. This alternative was found to have high cost compared with busways, but with somewhat lower benefits due to the larger amount of passenger interchange required between bus and rail.

1.1.5. Alternative F - Improved bus service and Heavy Rail (metro, or rapid transit):

The rail network would include more direct penetration of the Karachi Central Business District and other dense corridors and include underground construction in such locations. The system would provide higher capacity than light rail and produce benefits comparable to busways except in the area of mass transit operating and maintenance cost. Its capital cost would be very high.

These studies of alternatives explored the relevance of each of the above-mentioned mass transit modes in the context of Karachi's travel corridors and economic conditions within the forecast period. They also tested needs and benefits in approximately 190 kilometers of travel corridors, finding those most in need of transitway development.

The study concluded that the optimum long term provision should be based on bus services improved in capacity and quality with a network of convertible busways.

2. IMMEDIATE IMPROVEMENTS

2.1 Elements of Immediate Mass Transit Improvement

The primary objective is to improve the existing bus

services, which will always remain a major part of Karachi's mass transit system. The needed improvements include:

- o Revised policy on fares;
- o Improved loading standards for passenger safety and comfort;
- o Setting and enforcement of better vehicle design and maintenance standards;
- o Capital fund and process for bus financing;
- o Express service expansion;
- o Route rationalization;
- o Phased-in premium-quality air-conditioned bus service; Removal of encroachments and improvement of bus route road quality;
- o Better provision for bus stops and pedestrians; elected spot improvements to facilitate bus operation.

2.2 Vehicle Types and Standards

2.2.1. Buses:

The mass transit improvement program calls for introduction of new bus types to improve the comfort, convenience, and safety of ordinary bus services, to provide buses of higher capacity, and to offer premium-quality service at a higher fare.

Buses under new standards are to be maintained such that they can at any time meet the structural and mechanical standards for the vehicle type, and to be kept clean and in good repair and appearance inside and outside.

2.2.2. Transit Loading Standards:

Overcrowding is one of the most serious problems of the existing mass transit services in Karachi. Higher fares will help but not fully correct this problem. Enforced standards defining overloading for each type of mass transit vehicle will be set, based on not exceeding 5.0 standing passengers per square meter of space available for standees. Coordinated efforts in licensing, training, checking, and enforcement will be implemented to achieve standards.

2.2.3 Bus Stops and Their Use:

Buses of present stop almost at random, but the intention is to gain control over the placement and use of bus stops with the objective of improving bus running times and regularity, enhancing pedestrian safety and convenience, and reducing conflicts between buses and other road traffic.

3. TRANSITWAYS

3.1 Technology

Transitways provide a complete, separate facility for public transport, with not only the travelled way but also passenger stops or stations, and provisions for pedestrian access to the stations. This avoids conflict with other vehicular traffic and gives control over pedestrian access, with consequent safety and operational advantages. The transitways are to be at grade wherever crossing conflicts can be avoided; this is the least costly alignment choice. At major intersections or where road crossings are closely spaced or right of way limited, elevated alignments are chosen.

The Karachi transitway plan provides a network designed for initial use by buses, but with full provision for convenient conversion into light rail transit-ways, shown in Figure-1. The provisions include alignments suitable for light rail as well as bus, stations adaptable to use by trains or buses, structural strength adequate for either mode, and transitway width is suitable for both modes.

The rationale for convertible transitways is that light rail, while more expensive than buses on busway, can provide a higher passenger carrying capacity, conversion to light rail is one method by which additional mass transit capacity can be provided.

3.2 The Transitway Network and its Rationale

Transitways are costly, and therefore this solution is applied only in the most heavily-used and most congested corridors. These corridors comprise a large-scale network, overlaid on the finer-grained pattern of local bus routes. Almost half of all public transport passenger travel will be on transitways when the adopted network is complete.

The adopted transitway network for Karachi was developed by means of computerized network forecasts and their evaluation. Approximately 190 kilometers of possible transitway alignments were tested, in four alternative areawide networks. By a process of comparison and selection, an optimal network of transitways was identified. This network, shown in Figure 1, is approximately 87.4 km in total length, and has 68 passenger stations. For use as busways, provision is made at 15 locations for bus entry and exit, six at transitway ending points.

Included are 38.3 km at ground level, 29.8 km elevated,

and 19.3 km in transitional ramps between surface and elevated. Fifty of the 68 stations are elevated, with access for passengers by stairways and bridges which segregate these pedestrian movements from road traffic.

3.3 Designing and Building the Transitways

The staged introduction of transitway services should then continue through 2001. Staging is planned to place the highest-priority transitway segments first, and provide a logical sequence of transitway availability.

3.4 Projected Use of Transitways and Other Bus Routes

Travel forecasts prepared by means of computerized models predict future use of the mass transit system under projected conditions of population, employment, availability of motor vehicles, road conditions, and the mass transit facilities and services to be provided. These travel forecasts are a major measure of project justification and have been used in setting implementation priority. The Karachi area population totals used by KMTS are 7.4 million in 1987,9.9 million in 1993 14 million in the year 2000 and 21 million in 2010.

Numbers of trips are projected to increase more rapidly than population, because of rising affluence, as reflected in vehicle availability. If public transport is to retain or in crease its share of total trips,it must appeal to a growing proportion of the more affluent, to whon a motor vehicle is available.

From the KMTS traffic survey, at a particularly busy location in the principal network, M.A. Jinnah Road, 40,000 people travel to the city centre in the am peak hour. Figure 2 shows the distribution by mode at that location.

In 1987, excluding paratransit, the modal split was 57 percent public, 43 percent private. The forecasts indicate that in the absence of significant mass transit improvements, the public transport mode share, by the year 2000, will drop from 57 percent to 45 percent. The adopted mass transit improvements are projected to hold mass transit's share of choice riders constant. Further gains will be available through measures that promote transit or deter private vehicle or paratransit use. Example might include regulation and pricing of parking, assignment of priority to buses at selected on-street locations, increased motor vehicle and motor fuel taxes, use of auto-free zones or zones in which through-movement of traffic is prevented, and area pricing.

For the adopted transit improvement program, the year 2000 forecast predicts 5.55 million weekday passenger trips via mass transit, generating more than 46.3 million kilometers and 2.20 million hours of passenger travel each day. Of this total, 21.3 million (46 percent) of the passenger kilometers will be in buses on the transitway network, assuming it is completely in place. During year 2000 morning peak hours, there will be an estimated average transitway passenger loading, for both directions combined, of 25,000 per hour. Figure illustrates projected peak hour use of transitways at the year 2000 patronage level.

Average passenger speeds via bus are estimated to be 16 kph on-street and over 33 kph on-transitways. The predicted average speed on transitways is high compared with most busways, which typically have at-grade intersections and more closely-spaced stops. The system planned for Karachi is more akin to that now seen in Ottawa, Canada, where average speeds of 30 to 50 kph are reported.

4. CAPITAL COSTS OF MASS TRANSIT IMPROVEMENT

Capital costs of the recommended transit improvements have been estimated of the conceptual level of detail. Program expenditures provide for:

- o The 87.4 kilometer transitway network;
- o A central administration, operations, and maintenance facility for the transitway network and for mass transit administration;
- o Bus depots for maintenance and overnight bus parking;
- o Several bus terminals, at locations where large numbers of bus routes terminate;
- o Traffic - related projects to facilitate on-street bus operations;
- o The bus fleet itself, including replacements and capacity expansion; and
- o Maintenance and service vehicles for the transitway network.

4.1 Transitway Capital Costs

The adopted transitway program will cost Rs 13.88 billion, (at 1989 prices), expended over approximately a decade. The capital cost of the central administration, operations, and maintenance facility is included.

Transitway Construction Cost Estimate
(Rs. Millions, 1989 Prices)

Foreign Cost	2,948.9
Local Cost	9,453.2
Taxes and Duties	1,480.5
Total	13,882.6

5. ECONOMIC AND FINANCIAL RESULTS OF MASS TRANSIT IMPROVEMENT

5.1 Economic Evaluation

The adopted mass transit program includes many actions which together constitute an integrated program. The entire program is evaluated as a whole, demonstrating its economic viability, by comparing performance and cost result of the program with corresponding results in a "do minimum" case which represents the conditions in the absence of mass transit improvement.

The most expensive component of the recommended program is the transitway network. The economic evaluation has also isolated the costs and benefits of the transitways alone.

The economic evaluation of the recommended transitway network has been developed from conceptual capital cost estimates of the recommended transitways; conceptual capital cost allowances for selected road improvements to facilitate bus operations, and for bus operating and maintenance depots; weekday, peak hour, and annual patronage estimates for the years 1990 through 2009; transit user time savings, valued at 40 percent of the estimated average wage in Karachi; mass transit operation analysis; road vehicle annual operating and maintenance costs; "congestion costs", estimated as the cost of road space used by projected road traffic in each year; and accident costs.

The above data provide cost and benefit streams for the 20-year economic evaluation period. The entire improvement program is conservatively estimated to have an internal rate of return (IRR) of 21.2 percent, and the 87.4-kilometer transitway network by itself generates an IRR of 19.8 percent.

5.2 Financial Results of Operation

The adopted mass transit improvement program is to be a joint undertaking of the public and private sectors. The

overall administration, management, and regulation of the program lie with government. The public sector (government) is to finance and build the transitway network, except as may be achieved for rail projects through Build-Operate-Transfer agreements.

The public sector also is to finance and build bus depots, bus terminals, and selected traffic improvement projects to ameliorate conditions of transit service problem areas.

The private sector is to own and operate buses, except those of the Karachi Transport Corporation (KTC), a public-sector company.

For private owners of buses and minibuses, reforms in fares, bus financing, and insurance will enable profitability levels adequate for expansion of service, improvement of loading standards, renewal of bus fleets with vehicles designed, built, and maintained to higher standards, and the hiring and training costs of drivers able to meet adequate standards. Private owners of buses will maintain and operate bus depots, which will be provided through the efforts and capital cost funding of government and handed over the associations such as the Karachi Bus Owners; Association under appropriate agreements.

6. CREATING THE KARACHI METROPOLITAN TRANSPORT AUTHORITY (KMTA)

Responsibility for transport in Karachi, including public transport, is diverse. Figure 3 shows the current institutional structure. It is shared between agencies of the Federal and Provincal Governments. Enforcement of standards and regulations is also not strong.

The primary legislative task to be accomplished is to create the KMTA, which will be the main vehicle for implementation of the mass transit program, and it should be functioning by the time the first transitway segment is placed in operation.

7. PRESENT STATUS

The following tasks are currently underway for the implementation of the program:

- Karachi Metropolitan Transport Authority has been established by the Government to provide an appropriate institutional arrangement.

- The Detailed Engineering and Implementation Work of the first priority 15.2 km Corridor and allied projects is being undertaken with World Bank finance.
- Another group of consultants led by M/S SOGELERG of France is preparing design and contract documents to bid stage for the 12 km priority-2 Corridor under a French Government Grant.
- Environmental Impact Study (EIS) of the overall network and the allied facilities.
- Build Operate Transfer (BOT) processing of Light Rail Transit implementation.

BIBLIOGRAPHY

1. Karachi Mass Transit Study; Reports and Technical Memos 1987 - 1990.
2. Karachi Development Authority. "The Karachi Development Plan", 1974 - 1985.
3. Rapid Transit Cell, Ministry of Communications, "Integrated Mass/Rapid Transit System Report", 1977.
4. Karachi Transport Commission "Karachi Transport Report", 1982.

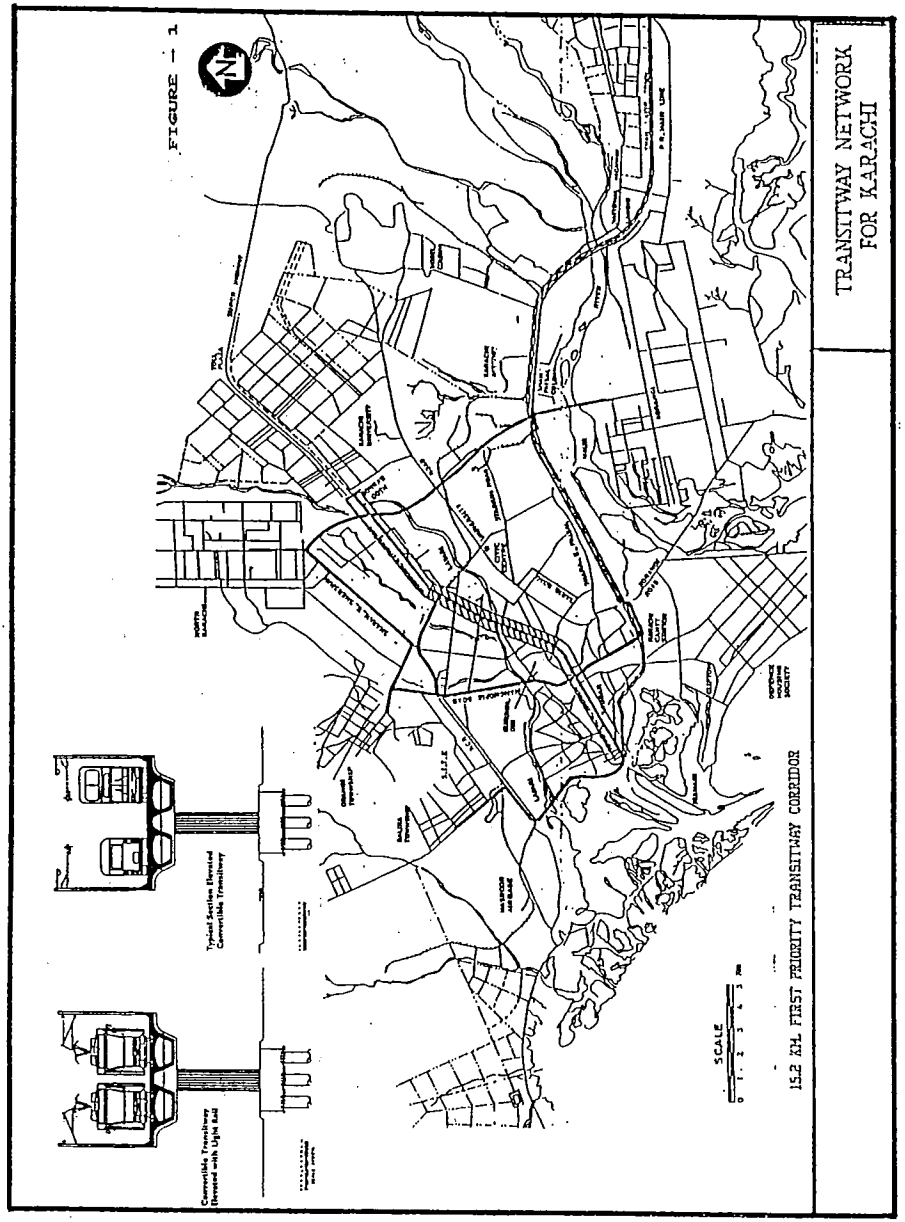
FIGURE – 1
TRANSITWAY NETWORK
FOR KARACHI
15.2 KM. FIRST PRIORITY TRANSITWAY CORRIDOR
SCALE
Tripod Section Elevated
Convertible Transitway
Convertible Transitway
Elevated with Light Rail

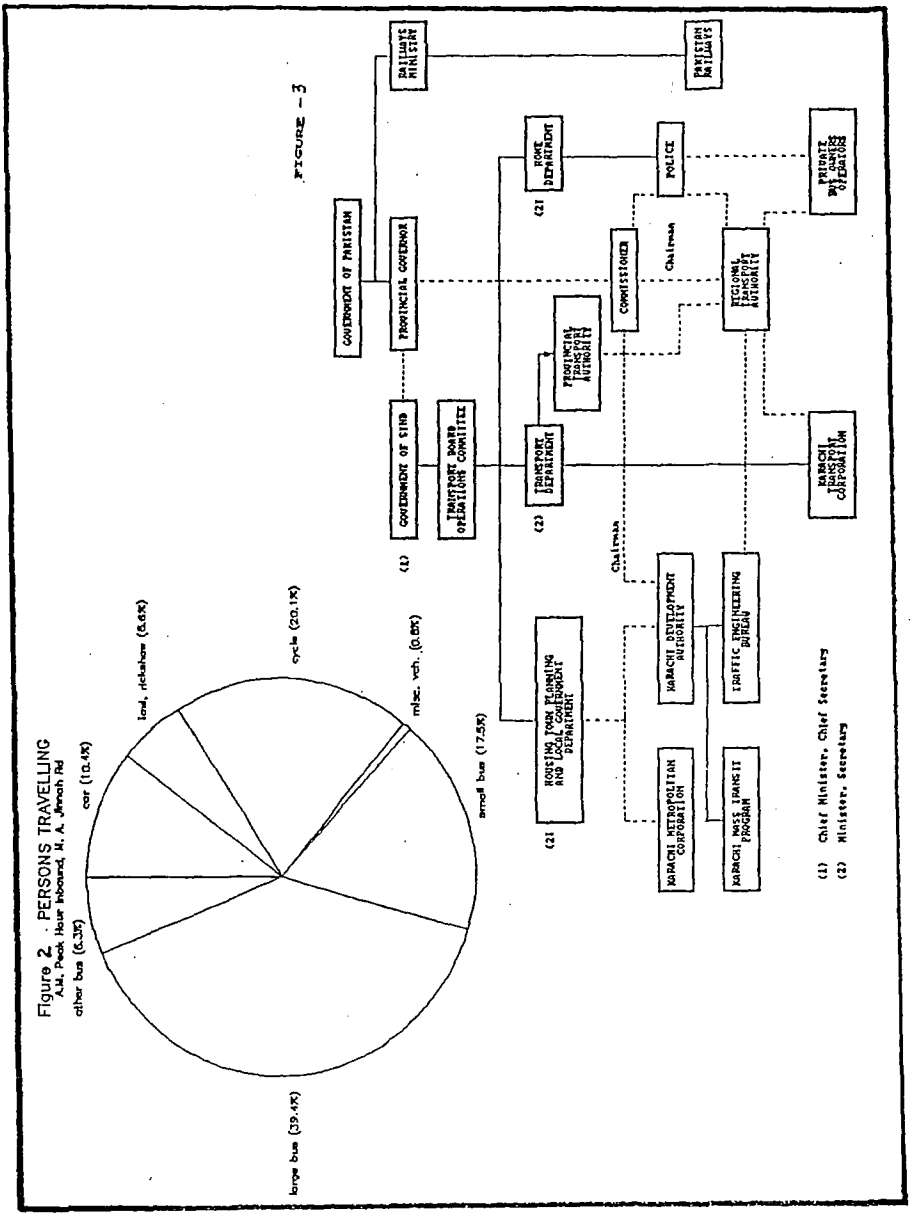
Figure 2 - PERSONS TRAVELLING
A.M. Peak Hour Inbound, M. A. Jinnah Rd
cycle (20.1%)
misc. veh. (0.8%)
smcd bus (17.5%)
large bus (39.4%)
other bus (6.3%)
car (10.4%)
ind. rickshaw (5.6%)
FIGURE - 3
GOVERNOR OF PAKISTAN
PROVINCIAL GOVERNOR
GOVERNMENT OF SIND
TRANSPORT BOARD OPERATIONS COMMITTEE
RAILWAYS MINISTER
PAKISTAN RAILWAYS
HOME DEPARTMENT
POLICE
PRIVATE BUS OPERATORS
TRANSPORT DEPARTMENT
PROVINCIAL PUBLIC WORKS AUTHORITY
COMMISSIONER
REGIONAL TRANSPORT AUTHORITY
KARACHI DEVELOPMENT AUTHORITY
TRAFFIC ENGINEERING BUREAU
KARACHI METROPOLITAN CORPORATION
KARACHI MASS TRANSIT PROGRAM
HOUSING TOWN PLANNING AND LOCAL GOVERNMENT DEPARTMENT
KARACHI PUBLIC WORKS CORPORATION
(1) Chief Minister, Chief Secretary
(2) Minister, Secretary