CHAPTER 11 Transport Planning Directions

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11.1 Railway Productivity and Profitability

11.1.1 Introduction

Pakistan Railway's (PR) share of the transport market, for both passenger and freight movement, has been in steady decline since its creation, from the major part of the Western Railway of India, in 1947. There is considerable evidence to suggest that this decline is more rapid than the emergence of rival road and air transport services alone would have brought about - in other words PR is failing to carry all the traffic on offer to it, and potential rail traffic is being forced to use other modes or to not travel. This has a damaging effect on the economic performance of the whole nation. The financial performance had also been in decline for a number of years, ever larger losses being returned each year.

A number of studies of PR's operations and finances have been undertaken since the mid 1980's in an attempt to identify the causes of these failings, and to put forward corrective measures. The general conclusion is of a vicious circle of decline, in which PR has high costs and poor levels of service because of a lack of investment in recent years to replace old and obsolete equipment. As a result of the poor financial performance there is no money with which to replace these aging assets, and service levels and competitiveness continue to decline. This situation has been exacerbated by the allocation to rail of a declining share of the transport budget in successive Five Year Plans (FYP).

A number of other deficiencies were noted, however. Operating practices remained unaltered since the 1950's, as did the level of service operated, despite marked changes in the levels of demand for various services. Tariffs were not being set on a commercial basis, and a number of staff were being employed and branch line services run because of a reluctance on the part of Government to see them terminated.

A number of changes have been made since 1988 in the way PR is run and financed. This paper reviews the financial performance of the railway over the period 1980-81 to 1992-3 to see what changes (if any) there have been in financial viability and productivity in the last 5 years, and to assess what further changes need to be made to improve PR's operating and financial performance in addition to the investment in infrastructure and rolling stock proposed for the 8th FYP period and beyond.

11.1.2 Financial Performance

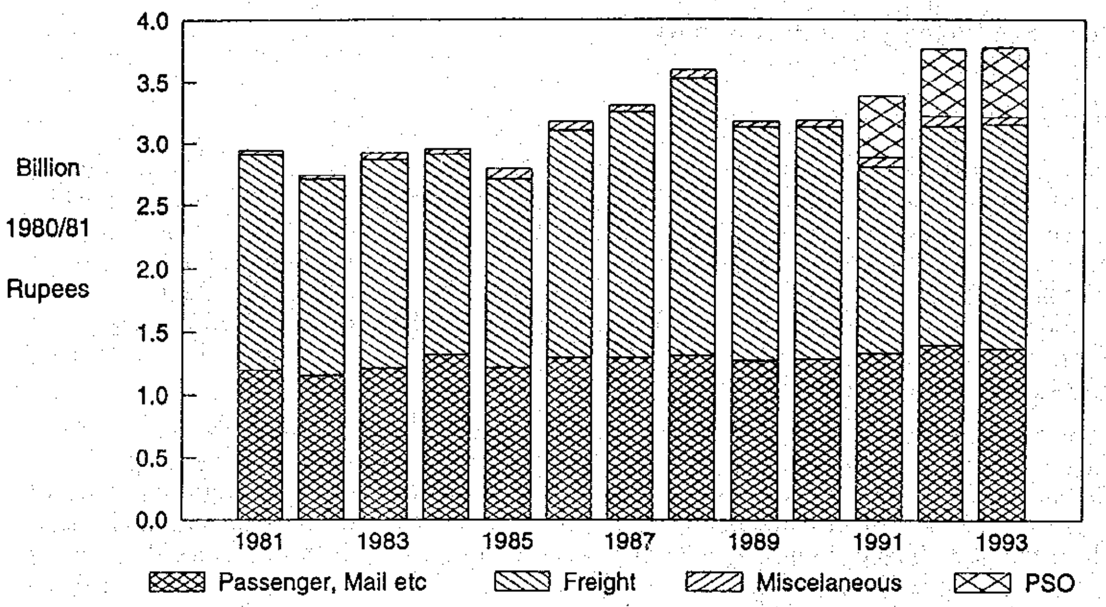
(1) General

The annual accounts, as presented in the PR annual Yearbook, show both revenue and expenditure on a steadily rising trend, with the difference between them declining sharply since 1987-8, suggesting that the recent reforms have been effective in turning the railway round financially. Forward projection of this trend suggests that break-even, or even a profit, on operations could be achieved by the end of the 8th FYP period.

In order to fully appreciate the level of change, the figures have been adjusted to eliminate the effect of inflation. Cost and revenue data were converted to constant ("real") value at the 1980-81 price level by factoring them by the ratio of the consumer price index in 1980-81 to the consumer price index in each year.

Figure 11.1.2.1 shows annual revenue in 1980-81 Rs, separated into: passenger; freight; miscellaneous; and, since 1990-91, Public Service Obligation (PSO). The last item represents payments made by the government in respect of the continued operation of certain branch lines and local passenger services which were identified in the mid 1980's as being hopelessly loss-making, and which would otherwise be withdrawn.

Figure 11.1.2.1 PR's Real Revenue at 1980-81 Constant Prices

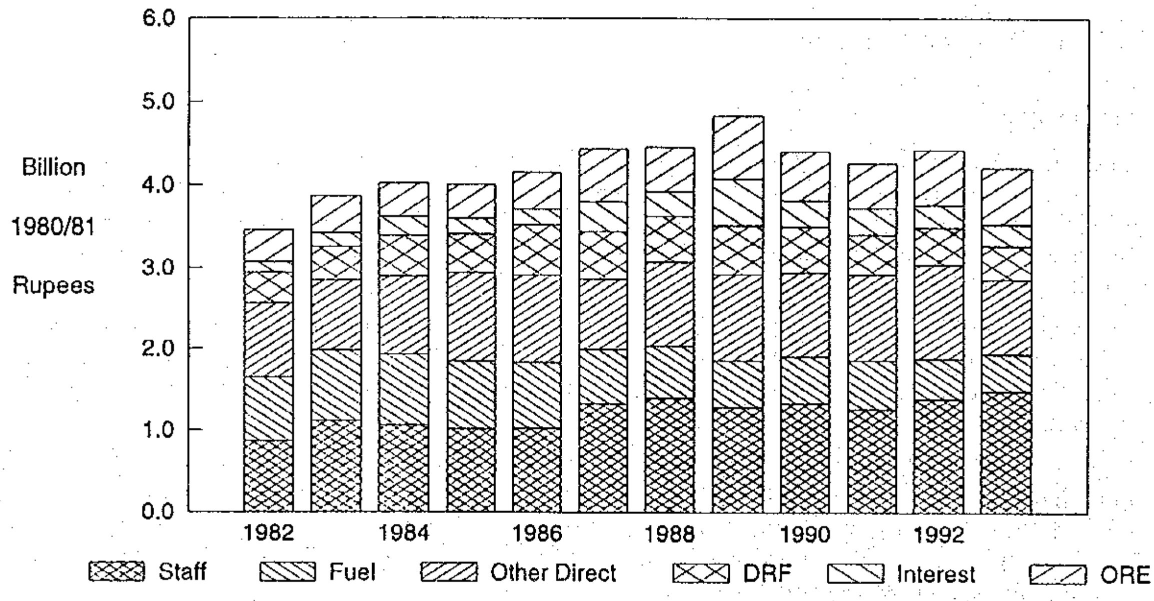


Source:
PR Yearbooks,
JICA analysis

It can be seen that direct revenue from passengers has remained remarkably steady throughout the period under review, rising slightly in recent years. Freight, and thus overall, revenue was on a rising trend to 1987-8, but fell sharply in 1988-9, since when (with the exception of 1990-91) it has also been steady. The introduction of PSO payments in 1990-91 has lifted income to an all time high in 1992-3.

Figure 11.1.2.2 repeats this analysis for expenditure. Costs are broken down into: staff; fuel; other direct costs; transfers to the Depreciation Reserve Fund (DRF); interest on borrowing; and Other Revenue Expenditure (ORE), which is mainly pension payments.

Figure 11.1.2.2 PR's Real Expenditure in 1980-81 Constant Prices

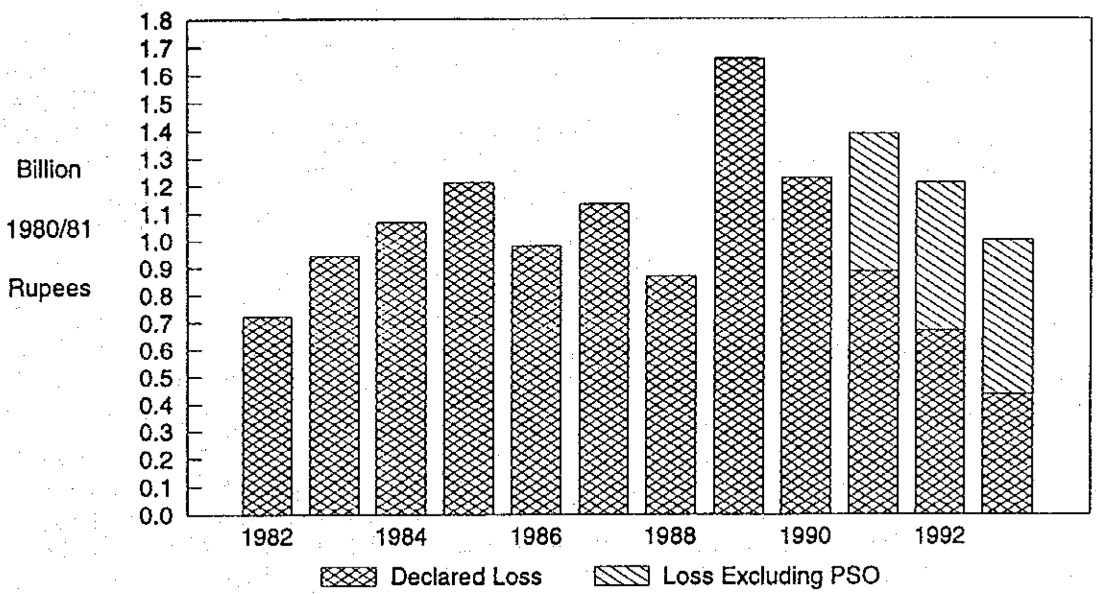


Source: PR Yearbooks, JICA analysis

Real costs rose steadily up to 1990-91, since when they have been in decline. Within these trends, fuel price has been declining since 1982-3 with the fall in world oil prices and the steady elimination of steam locomotives, but staff costs and ORE exhibit are on an increasing trend. Interest payments peaked in 1987-8, but the recent fall is more attributable to interest rate reductions than to a fall in the amount borrowed.

Figure 11.1.2.3 shows the annual loss in terms of 1980-81 Rs, with and without the PSO payment in recent years. This shows that losses peaked in 1988-9, the year the reforms started, but have only declined markedly due to the PSO payments - the underlying financial performance of PR has not improved noticeably.

Figure 11.1.2.3 PR's Operating Loss in 1980-81 Constant Prices



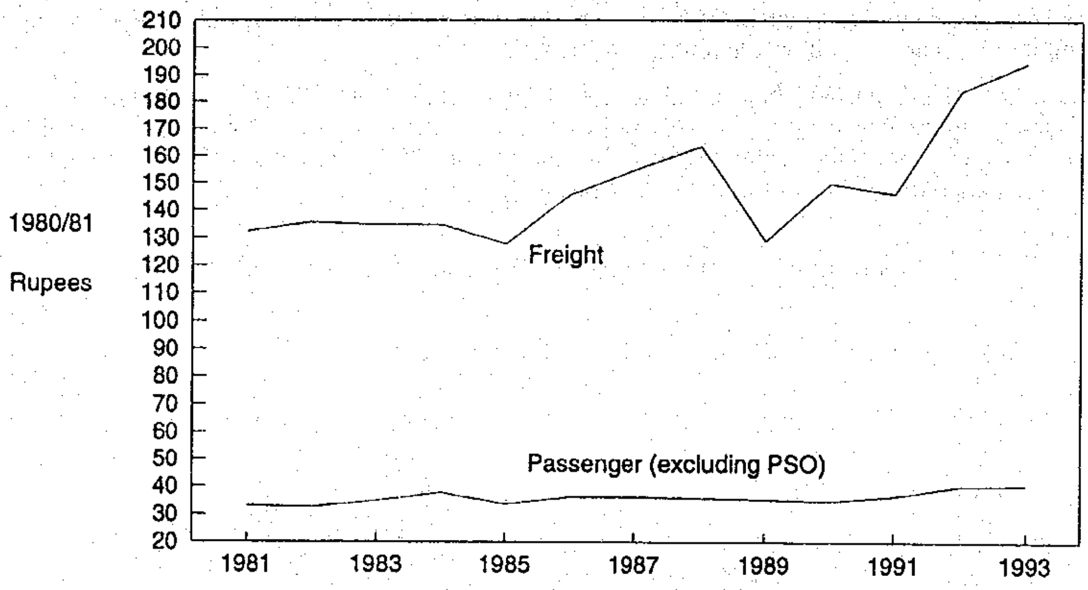
JICA analysis
Source:
PR Yearbooks,

(2) Relationship Between Revenue and Transport Task Performed

Figure 11.1.2.4 compares revenue and services provided, to see if the financial position would improve significantly if capacity constraints were relaxed and PR could offer more services where there was demand. There has been a slight increase in revenue-per-passenger-train-km since 1989-90. However, it is striking to note that revenue-per-freight-train-km is much higher than revenue-per-passenger-train-km. Further, it has been on a rising trend in recent years, particularly after 1988-9, since when it has increased from 3.6 times as much as passenger services-per-train-km run to nearly 5 times as much in 1992-3.

Insufficient data was available within the time available to repeat this analysis over the same period for the costs of running passenger and freight services to examine changes over time in the profitability of each type of service. There are also doubts about how accurately PR's current cost allocation methodology estimates the true costs of providing each type of service. Given these reservations, PR analysis presented in the annual Corporate Plan indicates that freight services as a whole are profitable (and some bulk/block services exceedingly so), whereas no group of passenger services covered their costs (and most did not even cover their direct, "variable", costs), although a few express trains did cover full costs.

Figure 11.1.2.4 Real Revenue per Train-km in 1980-81 Constant Prices

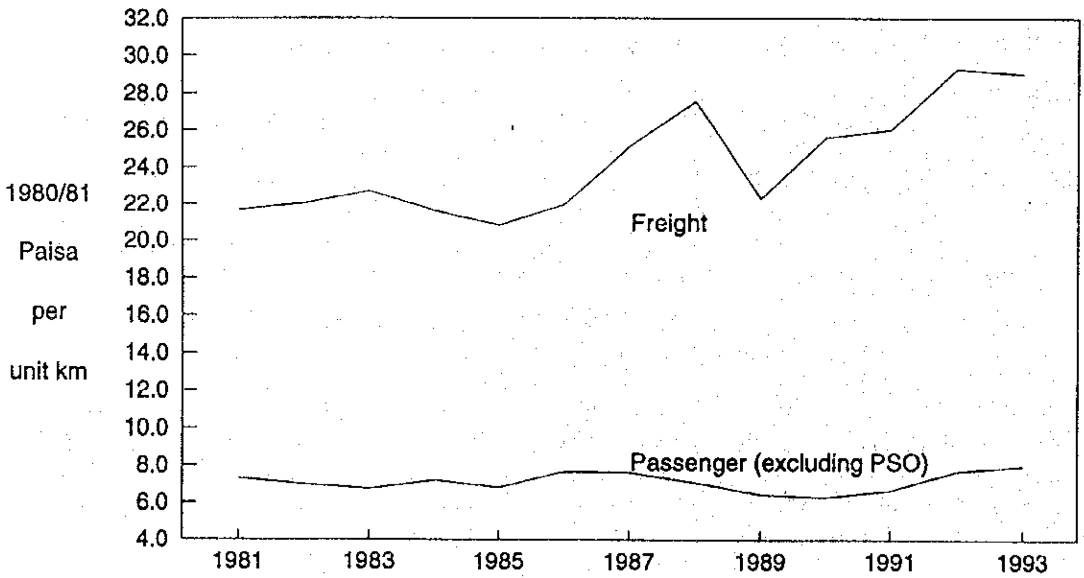


Source:
PR Yearbooks,
JICA analysis

Given a shortage of locomotives, and of track capacity in some parts of the network, where freight demand warrants and wagons are available, it would improve PR's finances to cancel passenger trains and run freight trains instead.

This is emphasised by Figure 11.1.2.5, which shows revenue per passenger km and tonne km. It can be seen that since the reforms started real freight-revenue-per-tonne-km has increased by over 30%, to record levels. For passenger traffic, the increase has been much less, merely returning revenue to 1985-87 levels, and is probably related to the introduction of Economy Class on express and Inter-City trains rather than to any real increase in fare levels.

Figure 11.1.2.5 Revenue per Ton-km and Passenger-km in 1980-81 Constant Prices



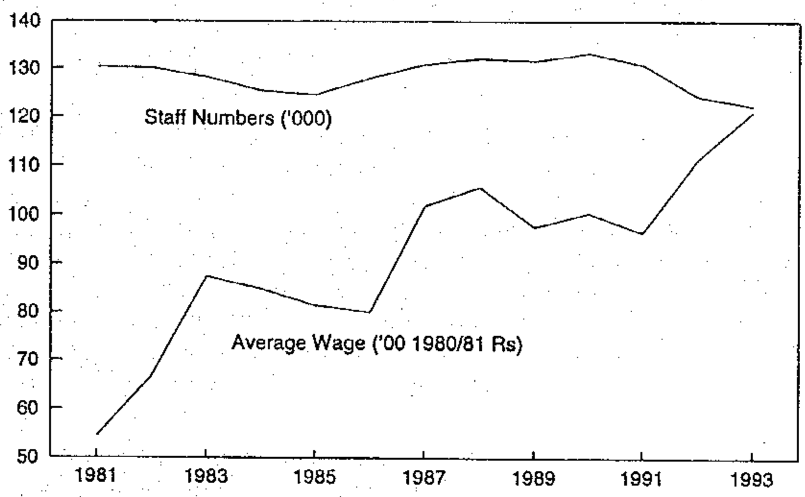
Source: PR Yearbooks, JICA analysis

The revenue potendtial between freight and passenger train services differ due to existing operational constraints. Most freight tranins that run south are empty, but a fully loaded freight train can carry over 1,300 tonnes which cannot be equated by passenger trains. The potential of revenue generation from freight transport is much heigher than that from the passenger trains.

(3) Staff Costs

As noted from Figure 11.1.2.2, staff costs form an ever increasing percentage of PR's total costs. Figure 11.1.2.6 shows staff numbers (in thousands) and average salary (in hundreds of 1980-81 Rs). Staff numbers have remained relatively constant over the period, despite the closure of some lines and the steady elimination of labour intensive steam locomotives. Numbers have declined since 1989-90, but the rate is little higher than natural wastage through retirement (2% a year) in a workforce of 130,000.

Figure 11.1.2.6 Staff Numbers and Average Wage in 1980-81 Constant Prices



Source: PR Yearbooks, JICA analysis

PR's inability to lay-off labour is highlighted by the costs assigned to operating staff in the 1992-3 budget estimates, in which the steam locomotives as a group cost more than diesel locomotives as a group, and much more per locomotive. Table 11.1.2.1 shows costs per locomotive allocated under a number of headings. These are in thousands of 1992-3 Rs.

The disparity in operations staff cost per operational locomotive is even greater, as about 80% of the diesel engines were available for use, whereas only between 50% and 65% of the steam locomotives were available (and an even lower percentage were actually used). While the higher costs to some extent reflect the high depot labour requirements of steam locomotives. They also suggest that staff are not being laid off or transferred when steam locomotives are withdrawn, and are even still being paid mileage allowance.

Table 11.1.2.1 Operations Staff Costs for Steam and Diesel Locomotives

	Steam		Diesel	
	Fleet	per loco.	Fleet	per loco.
Number of locomotives	125		549	
Crew wages (Rs 000)	44,995	360	50,153	91
Mileage, overtime etc. (Rs 000)	27,083	217	41,536	76
Shed staff wages (Rs 000)	30,912	241	6,524	12

Source: Fleet size - PR yearbook 1992/93
Staff costs - Railway Board, Details of Demands for Grants and Appropriations, 1992/93.

(4) Costing

The level of profitability of each type of service is assessed annually by PR as part of the drive to optimise financial performance and identify the costs of those services for which PSO is payable. While revenue allocation is relatively simple, the allocation of the high level of fixed and system costs to rail services has presented considerable problems to railway accountants over the years.

The procedure currently followed on PR, adapted from the Union International des Chemin de Fer (UIC) cost-allocation methodology, is "top down". Expenditure is first separated into "direct" - costs directly associated with the running of services such as maintenance, fuel, operations and maintenance staff etc. - and "general" - overhead items which do not vary directly with the level of traffic carried, such as administration, pensions, interest payments etc. Direct (or variable) costs are dis-aggregated into abstracts by broad type of expenditure: track maintenance; steam loco maintenance; diesel loco maintenance; traffic (operations) etc. These costs are then allocated to types of service on the basis of gross tonne km, train hours etc. The general costs are then added as a percentage mark-up to give "full" costs for each type of service.

The costs are thus averages over the whole system, and do not adequately identify the costs of individual sections of line or services. While the existing method may be adequate for a broad assessment of costs on a railway being run as a public service, where the transport task performed is the main criteria of success, it cannot estimate costs accurately enough for a commercial railway seeking to optimise financial performance.

PR is aware of this deficiency, and consultants from the Irish railway CIE are working with them to develop a "bottom up" cost allocation methodology to identify costs at a micro level.

A similar system is in use in the UK, which identifies resources used (spending on materials and spares, hours of labour for maintenance and operations, etc) at the level of each item of rolling stock, station, and section of track. In addition to identifying the costs of individual services more accurately than the top-down approach, this system also allows the comparison of the running costs of each type of locomotive, coach and wagon, and the identification of variations between costs for the same type of rolling stock or service in different parts of the system, so that justification can be sought from managers in high cost areas. Where there are regional variations in operating or maintenance method, it enables "best practice" to be identified and introduced in other parts of the system. For national and local authorities funding certain services via PSO payments, it allows accurate determination of the costs of the services they are paying for, and the true gap between the cost of the service and the revenue generated to be identified, enabling better value for money to be obtained from a limited public transport subsidy budget.

It is hoped that the new PR costing system will incorporate these features, allowing both PR and the government to optimise expenditure on the railway.

(5) Accounting

In addition to deficiencies in the current cost allocation methodology, there are also deficiencies in the calculation of some of the items included the accounts, which mean that the accounts (as published in the Yearbook) lead to a false picture of the financial health of PR. This means that the railway is much further from financial viability and potential privatisation (either whole or in parts) than the trend in declared losses over recent years would indicate.

Firstly there is a rebate of the payment of a return on government's past capital investment, with the implication that such payments should be made annually once PR is in declared profit. This payment was estimated at Rs902 million for 1992-3. At present this merely involves the cancellation of equal items in the annual revenue and expenditure balance. A more realistic picture would be given if this cancellation were not made, with the payment were shown in PR's expenditure and the rebate added to the PSO on the revenue side.

Secondly, and more seriously, the annual payment to the DRF is not calculated by reference to the value (either book or replacement) of PR's assets. Instead it is a fixed sum (revised every few years) based on a percentage of revenue. This was originally 4-6%, but (in partial recognition of the inadequacy of payments to the DRF to finance replacement of the railway's assets) was raised to 10-12% in the mid 1980's. It now stands at Rs993 million per year, but has not been raised since 1988-9, and is now lower in real terms than at any time since 1981-2.

That the annual payment falls far short of the annual sum required to adequately fund asset replacement is indicated by the need for almost all PR's track and rolling stock renewal in the last 15 years to be paid for from development plan budgets, rather than from the DRF.

PR's accounts do not therefore represent the railway as a "going concern", but one which is in terminal decline. The network will be closed down section by section as assets become worn out and are not replaced. This is already happening with the 2'6" gauge lines and steam locomotives.

(6) Depreciation

The correct amount to include each year for a dynamic business such as a railway will always be a matter of some debate. As the transport task to be met changes over time, some assets will become commercially redundant, and will not need to be replaced. It is thus correct that no depreciation allowance is made for them. Other assets will become technically obsolete, and will not be replaced on a "like-for-like" basis, the DRF would not need to be able to fund the whole cost of replacing these assets, as some upgrading (new capital investment) would be involved. It may thus be reasonable for the DRF to be unable to fund replacement of the railways assets.

However, an important consideration is the allowance to be made for inflation. While the useful life of the asset may not be in doubt (allowing a proportion of the cost of the asset to be set aside each year), the cost of the future replacement (even on like-for-like basis) is unknown. Basing depreciation allowances on historic cost will not set aside sufficient funds if the replacement is going to cost more than the original asset. This becomes a significant consideration if asset life is long (as it is with railway equipment) or if inflation is significant (as it has been in Pakistan). Under these circumstances accountants recommend the use of "current cost" accounting, in which DRF payments are based on the modern equivalent asset value (MEAV).

A detailed estimate of what PR's annual DRF payment has not been possible within the time available for this study. On a historic cost basis the payments would indeed be very low, as most assets were purchased many years ago at low prices and would, in any event, be fully depreciated by now (they would have been replaced many years ago had the DRF been adequately funded). A rough estimate of the annual payment under current cost accounting, at the 1993 price level, can be made, however. Table 11.1.2.2 below gives estimates for some assets based on costs of replacement assets from the 8th FYP.

Table 11.1.2.2 Required Depreciation Allowances at 1993 Prices

Type of Asset	Quantity Required	1993 Cost (Rs million)	Asset Life (years)	DRF Payment (each)	DRF Payment (system)
Diesel Locomotive	500	93.8a	30	3.13	1,567
		45.0b		1.50	750
Passenger Coach	2,000c	10.4d	30	0.35	693
Bogie Freight Wagon	10,000e	1.6f	40	0.04	400
Track km	8,000g	12.5h	50	0.25	2,000

Notes: a based on 1994/95 Corporate Plan, Appendix Figure, Rs6,000 million for 64 locomotives
b based on world market price of $1.5 million at Rs30=$1.
c based on commercial services only.
d based on 8th Plan allocation for AC coaches.
e based on 8th plan targets for wagons loaded per day and turnaround, factored by 0.5 for bogie wagons.
f based on 8th Plan allocation for 1367 high capacity wagons.
g excluding sidings and non - board gauge
h based on 8th Plan allocation for 800km of double tracking.

This suggests a 1993 DRF payment of between Rs3.8 and 4.7 billion, depending on the replacement value adopted for locomotives (the expected cost of producing locomotives at Risalpur is commented on further below). This considers only the replacement of assets needed for the future (PSO supported) railway, not the whole of PR's current operation. For the assets valued it may be considered an over-estimate, as the 8th Plan investments can be regarded as superior to (and thus more expensive than) existing assets. On the other hand it excludes stations and other buildings, sidings and yards, signalling (except to the extent that is has been included in the base cost estimate from the Lodhran - Peshawar double tracking), workshops and communications equipment. A realistic estimate of the DRF payment needed in 1993 under current cost accounting would thus be Rs4-5 billion, 3-4 billion higher than that actually made.

(7) Summary

Table 11.1.2.3 presents an alternative view of PR's 1992-3 Profit and Loss account, using current cost accounting and treating the business as a going concern.

Table 11.1.2.3 PR 1992-3 Profit and Loss Account Re-stated

		Rs (million)	
	Earnings (excluding PSO)	7,679	
less	Operating Expenses	6,846	
	Profit on Operation		833
less	Depreciation	4,500	
	Other Revenue Expenditure	1,617	
	Foreign interest changes	614	
	Returen on Government capital investment	902	
	Unsupported Loss		(6,800)
add	PSO	1,352	
	Rebate of return to Government	902	
	Annual Deficit		(4,546)

Source: PR yearbook 1992/93
Railway Board Budget,Estimates 1992/93 JICA analysis.

Assessed as a self-financing going concern, PR would have a loss of Rs6.8bn, operating revenues being only 56% of costs. This is reduced to Rs4.5bn by the explicit government grants of PSO and interest rebate. It is clear that, even with these explicit government support payments, PR is some way away from commercial viability, and that a considerable amount of work is needed if this is to be achieved.

The 8th FYP proposes a number of capital investments for PR, some of which will permit operations to continue at present levels (e.g. new and rehabilitated locomotives, track renewal), while others should permit enhanced services (e.g. double tracking, improved coaches and wagons). Both government and International donor agencies have shown a reluctance to support further investment in PR, in part because of the railway's poor use of its existing assets, slowness to change operating practices, and failure to achieve performance targets set in previous FYPs. Conversely it can be argued that some of PR's inefficiencies are forced on them by government restrictions on tariffs, employment and withdrawal from certain markets.

PR's productivity is reviewed below, identifying some possible reasons for the poor use of some assets, and possible means whereby productivity and revenue might be increased without major capital investment.

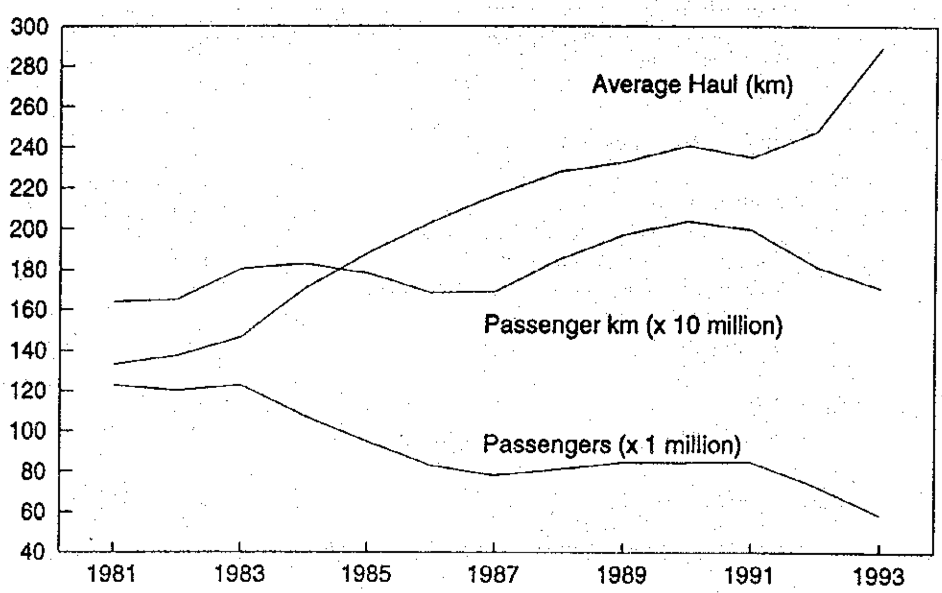
11.1.3 Productivity

(1) Transport Task Achieved

This is well documented in PR's annual yearbook. The data for the last 13 years are re-presented here graphically to illustrate the trends. Scales have been adjusted to fit units carried, unit km, and average haul onto the same graph.

Figure 11.1.3.1 shows the situation for passenger traffic. The significant features are that while passenger numbers have more than halved during the period, passenger km have gone up (although they were lower in 1992-3 than in recent years). Thus the average distance travelled has more than doubled, showing a particularly rapid increase since 1990. This indicates increasing demand for long distance travel, which PR has largely catered for by increasing long distance services, but falling demand for local travel (for which bus is a realistic option). The latter trend has been emphasised since 1990 as PR have cut back local and branch line services.

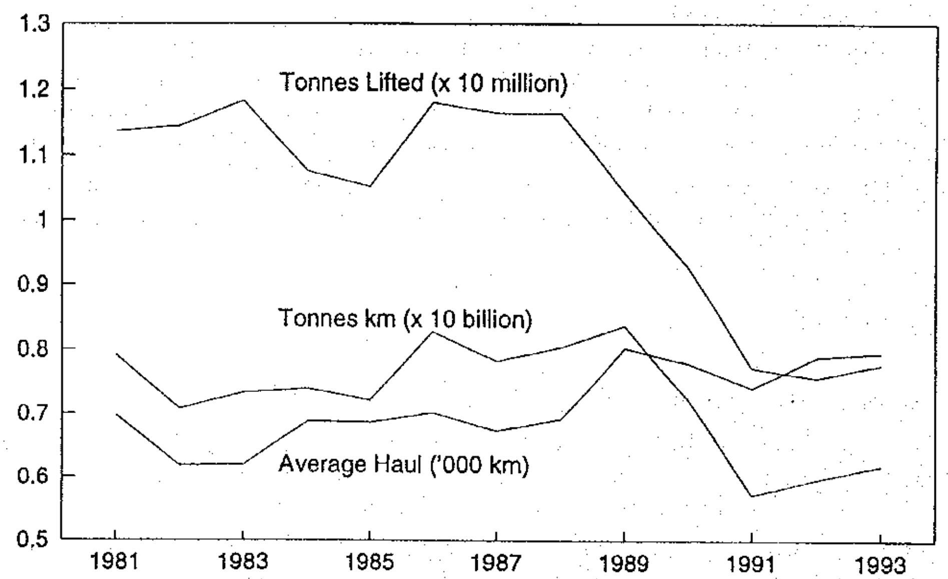
Figure 11.1.3.1 Passenger Transport Trends



Source:
PR Yearbooks,
JICA analysis

Figure 11.1.3.2 shows the situation for freight traffic. The main feature is a sharp decline in tonnes lifted between 1987 and 1991. Tonne km performed have not fallen to the same extent, and average haul has exhibited a rising trend, particularly since 1987. Thus it is mainly short distance freight traffic that has been transferred to road, rail retaining much of the long haul movement that it is best suited to carrying.

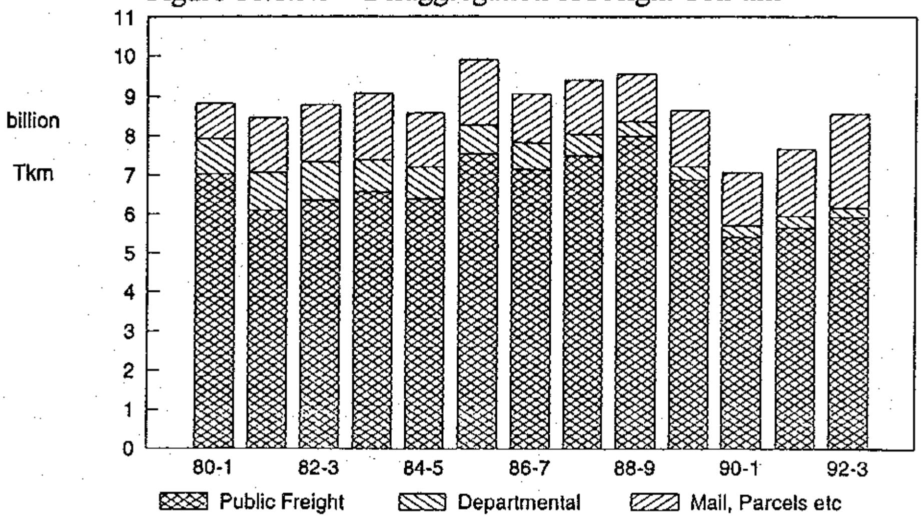
Figure 11.1.3.2 Freight Transport Trends



Source: PR Yearbooks, JICA analysis

Figure 11.1.3.3 shows non-passenger traffic dis-aggregated by type: public and government freight; departmental (PR's own goods); mail, and parcels etc. The last category mainly travels on long distance passenger trains, with only a few all freight coaching trains being run. There has been a sharp increase in mail and parcels carrying since 1990 following a marketing initiative to fill space on trains that would otherwise be empty.

Figure 11.1.3.3 Disaggregation of Freight Ton-km



(departmental Tkm est for 1986/7-1992/3)
Source: PR Yearbooks, JICA analysis

Transport of PR's own goods has declined steadily through the period, largely due to the elimination of steam and older diesel locomotives (which have high fuel and spares consumption). The rationalisation of spares and maintenance locations, and the opening of more sleeper factories. These have combined to reduce both the tonnage of railway goods to be carried and the distance over which they need to be moved.

This means that the decline in public freight carrying is not as severe as Figure 11.1.3.2 might indicate. Although there was a sharp fall between 1988 and 1991, this seems to have been arrested in recent years.

Overall the figures indicate that while traffic units of both types have fallen sharply in recent years, the transport task undertaken (unit km) has not fallen to the same extent, as PR concentrates its resources on the task to which it is best suited, long distance traffic. Experience worldwide indicates that such operations are usually profitable, however PR still returns a substantial loss each year.

(2) Staff

Further analysis has been undertaken of the relationship between staff levels on PR and the railway's operations.

Figure 11.1.3.4 relates the number of staff to the number of locomotives. Separate plots have been made for locomotives owned and locomotives actually in use. PR's fleet was still increasing in the early 1980's as new diesel locomotives were still being delivered, but since then it has been in decline as investment has ceased and older locomotives have been withdrawn. Staff numbers have not fallen to the same extent, and staff per locomotive has increased, even though the withdrawn locomotives have been steam and older diesels, which have high requirements for maintenance and depot labour. Thus as the task to be performed has declined; staff numbers have not.

Figure 11.1.3.4 Staff per Locomotive

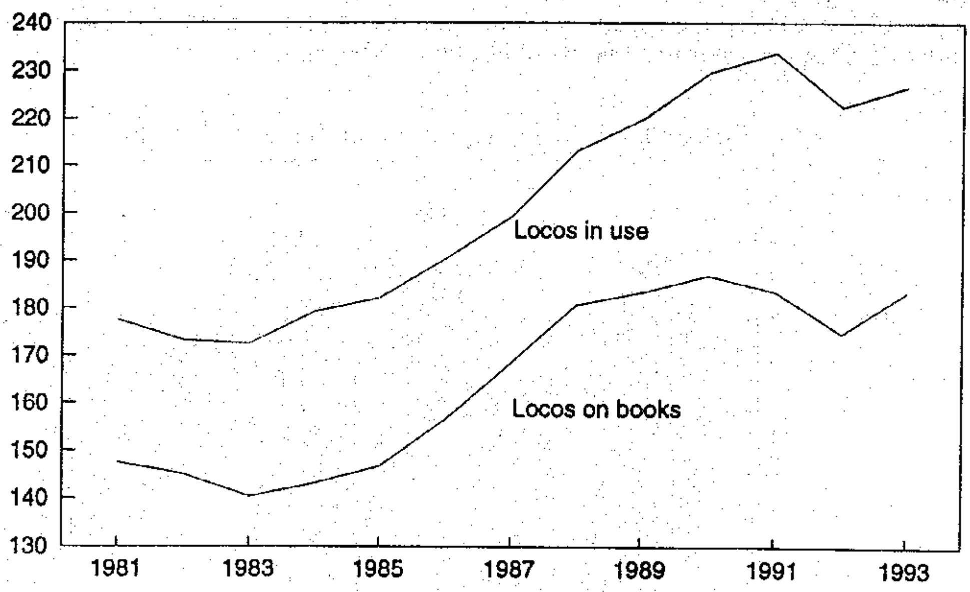
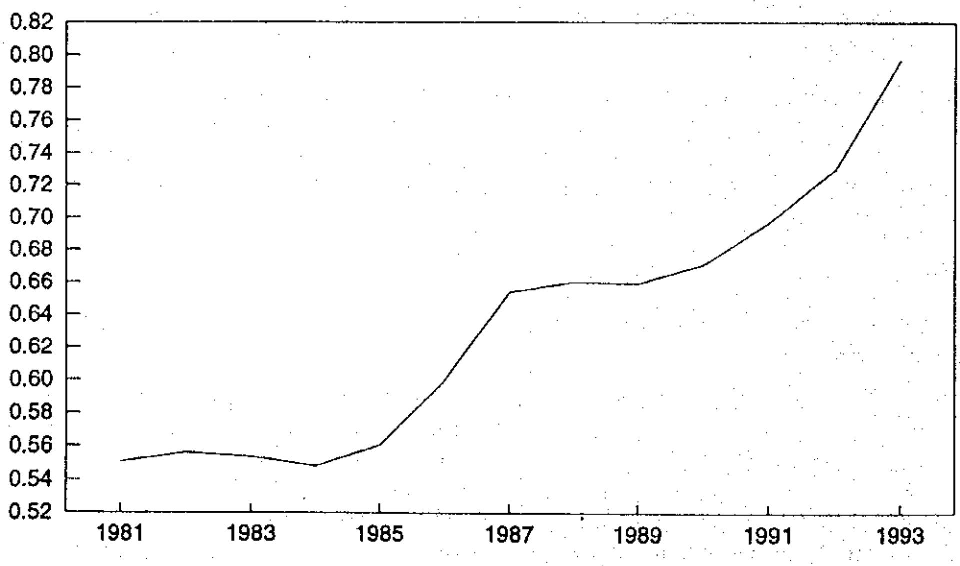


Figure 11.1.3.5 shows the number of staff per train run each year. Railcar services have been treated as 1/3 of a train, as they are in PR data. The ratio was stable up to 1985, since when it has risen steadily as the number of trains run has declined faster than the workforce. It is now 45% higher than it was in 1984. As the task to be performed has declined, staff numbers have not.

Figure 11.1.3.5 Staff per Train Run

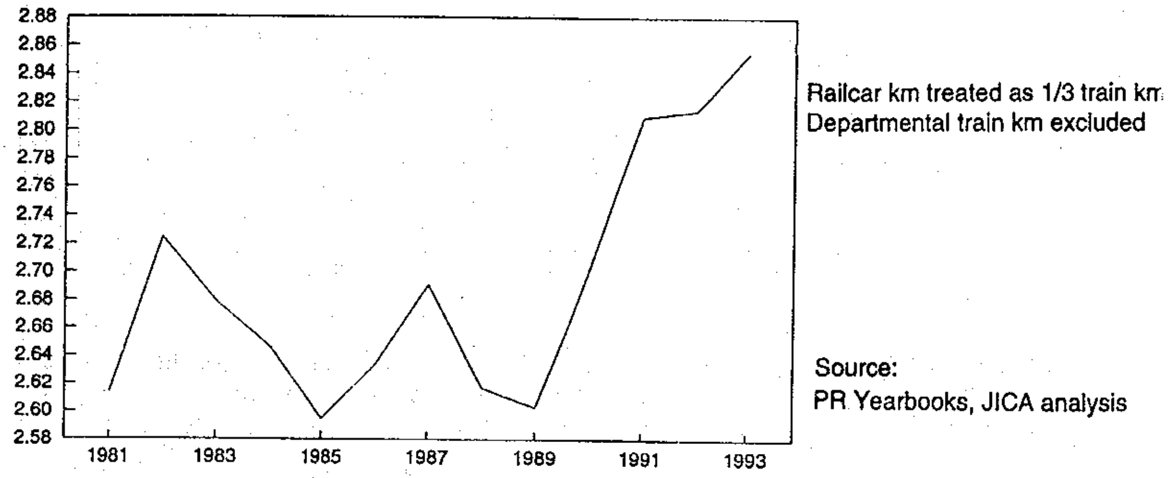


Source:
PR Yearbooks,
JICA analysis

(treating Railcars as 1/3 trains)

While the number of trains run has declined sharply in recent years, most of the withdrawals have been of short distance local workings. A similar analysis was therefore undertaken of staff-per-train-km run. This is presented in Figure 11.1.3.6. Here a falling trend is indicated up to 1988-9, when the commercial reforms started. Since then there has been a 10% increase in the ratio. Whenever the task to be performed has declined, staff numbers stayed on.

Figure 11.1.3.6 Staff per Thousand Train-kms

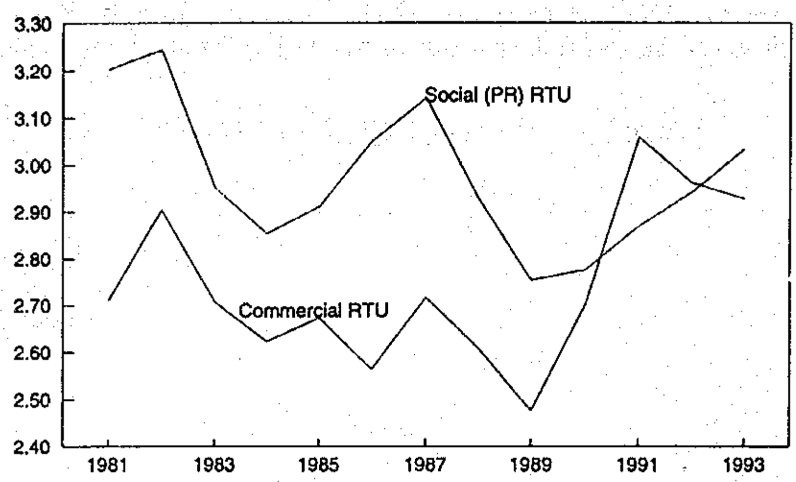


Finally Figure 11.1.3.7 shows the ratio of staff to Revenue Traffic Units (RTU). The PR concept of RTU is that:

- 1 passenger km = 2 RTU; and
- 1 tonne km = 1 RTU.

On this basis the number of staff per RTU is on a declining trend; i.e staff productivity is actually rising, despite the increasing ratio of staff to operations and equipment. There are sharp fluctuations, however, and the ratio has been rising since the reforms started, indicating that staff numbers are not falling as fast as the transport task handled.

Figure 11.1.3.7 Staff per Million Revenue Traffic Units



Source:
Railway Board Budget Estimates 1992/3, JICA analysis

PR's weighing of the value of passenger and freight traffic could be considered a social measure, placing great emphasis on the carriage of people. A more commercial approach could be based on the revenue rates per unit km shown in Figure 11.1.3.7 above, for example:

- 1 passenger km = 1 RTU; and
- 1 tonne km = 4 RTU.

The staff :commercial RTU ratio gives a rough estimate of staff per real Rupee earned. The plot also exhibits a falling trend to 1989, followed by a rapid increase to record numbers of staff per income unit in 1990-91. Since then the decrease in staff numbers, coupled with a recovery in freight traffic, has seen a resumption of the falling trend.

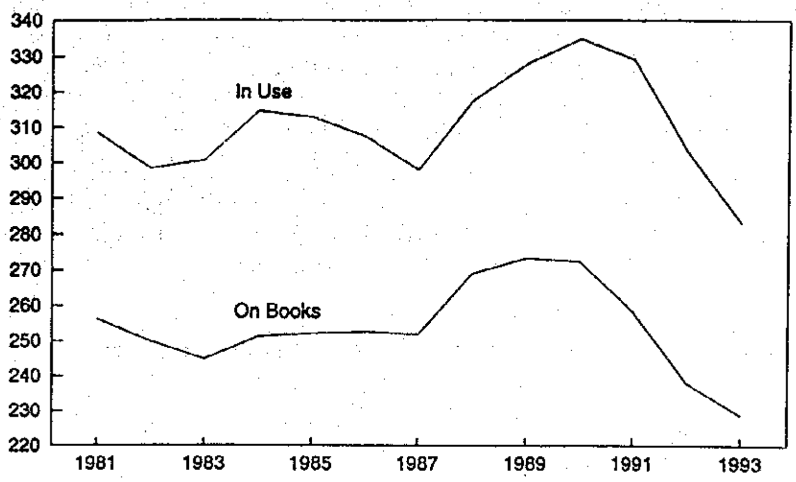
Overall the picture is not encouraging. A railway, which should be becoming more efficient year by year as labour intensive steam locomotives are phased out and little used services are withdrawn, has actually exhibited falling labour productivity over the last 13 years. Of particular concern is that the decline in labour productivity has accelerated in the last 5 years, i.e. since the operations reforms were introduced to make the railway more commercially oriented and efficient. A major contributory factor seems to be the inability of PR to lay off staff (particularly steam shed and operating staff) that it no longer needs..

(3) Train Productivity

PR operates a few passenger railcars, but they are old and their number is declining. All freight operations and almost all passenger operations are locomotive hauled. An analysis has been made of the relationship between the number of locomotives and the number of trains: train-km and RTU.

Figure 11.1.3.8 shows the number of trains (excluding railcars) run per year per locomotive. It can be seen that this was fairly constant, whether measured on the whole fleet or those in use, until 1987. There was then an increase to 1990, followed by a steep decline. At no time in the past 13 years has the number of trains run per locomotive reached one per day, despite many locomotives on branch lines running 4 or more trains per day. This is because a number of locomotives "available for use" each day are used for yard shunting (rather than running trains), and some freight trains take several days to complete their journey.

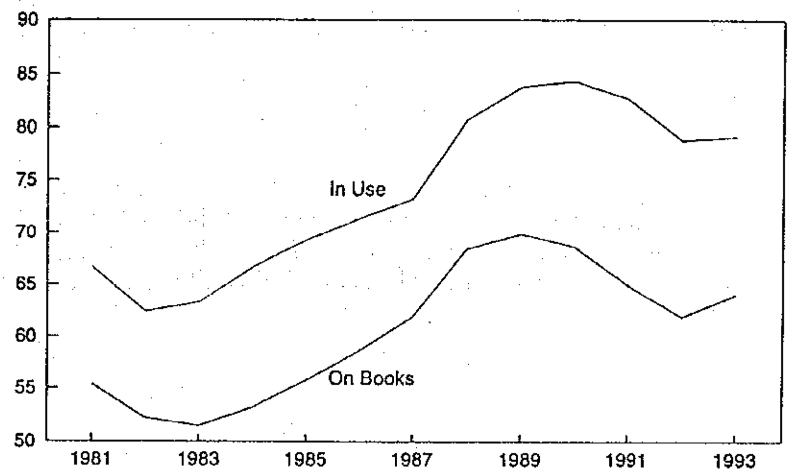
Figure 11.1.3.8 Trains Run per Locomotive



Source:
PR Yearbooks, JICA analysis

Figure 11.1.3.9 shows the number of train km (excluding railcars) run per year per locomotive. This shows a general rising trend, measured either on the whole fleet or locomotives in use, until 1989. Since then there has been some decline, despite the introduction, since 1989, of measures to improve the efficiency of PR. Annual train km per locomotive in use is currently around 80-85,000. As about 90 diesel and 30 steam locomotives are only used for shunting, the distance per locomotive on the line will be around 100,000km a year.

Figure 11.1.3.9 Train-kms Run per Locomotive (000)



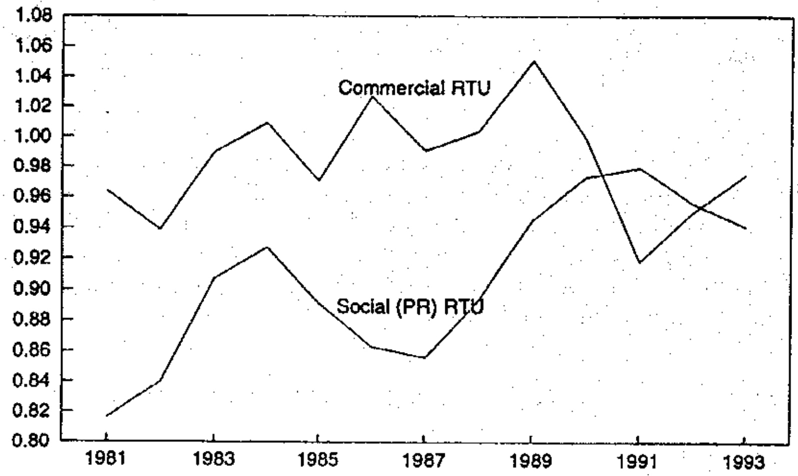
Source:
PR Yearbooks, JICA analysis

These distances can be compared with recent productivity on the railway in the UK. This has also suffered a severe cutback in investment (since 1976), with all new investment required to demonstrate an 8% financial rate of return over the "no investment" situation. The investment case for the replacement of 30 year old railcars on branch lines assumed that the new units would average 200,000km a year. The actual productivity of the new units has exceeded expectations, with some averaging over 300,000km a year. While the UK system is largely double track, avoiding the need for trains to wait for a service in the opposite direction to pass, it needs to be borne in mind that these railcars have a top speed of only 120km per hour, and that there is very limited operation of passenger services overnight in the UK.

Productivity of express passenger locomotives is even higher. Locomotives on the London - Birmingham/Liverpool/Manchester service average 300,000km a year even though the maximum haul is only 310km. On the longer London-Edinburgh- Aberdeen service units average 500,000km a year, with one unit scheduled to make a return trip (1,800km) 6 days a week, equivalent to over 650,000km a year per locomotive on the line. Comparability with PR productivity is limited, however, as these units run at much higher speeds (225km per hour) than is possible in Pakistan. It should be noted, however, that express passenger services in the UK are profitable, covering their full operating, depreciation and interest costs.

Figure 11.1.3.10 compares traffic carried (in terms of RTU) to train km run. Both social and commercial measures exhibit a rising trend to 1989, but have fallen from peak levels in the last few years. The commercial measure, biased towards remunerative freight traffic, is rising again as freight traffic increases, but the social measure is still declining.

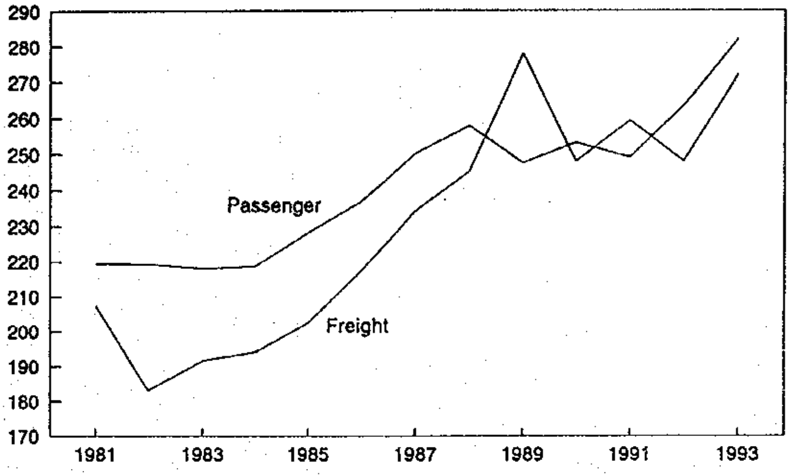
Figure 11.1.3.10 Revenue Traffic Units per Train-km (000)



Source:
PR Yearbooks,
Railway Board Budget Estimates 1992/3,
JICA analysis

Figure 11.1.3.11 shows the average distance run by freight and passenger trains. Both are rising steadily as short distance local and branch line services are withdrawn, although there has been little increase in the average distance for freight trains since 1989. Given the long hauls available in Pakistan, both distances are surprisingly short, indicating that a large number of short trips are still being operated.

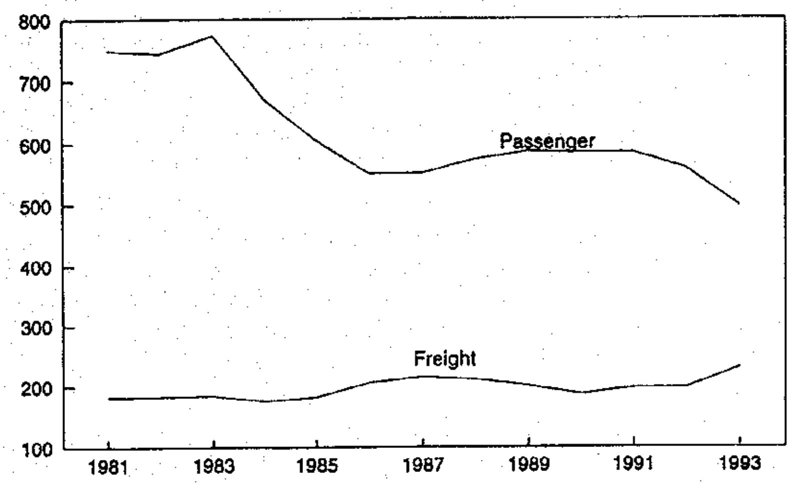
Figure 11.1.3.11 Average Distance Run per Train



Source:
PR Yearbooks, JICA analysis

Figure 11.1.3.12 shows the average load per train run. The trend is falling for passenger, but rising slightly for freight. The freight load is surprisingly low, given a potential train length of 70 (2-axle) wagons carrying 22 tonnes each - 1,540 tonnes. The figures indicate that a large number of relatively lightly loaded trains are still being run.

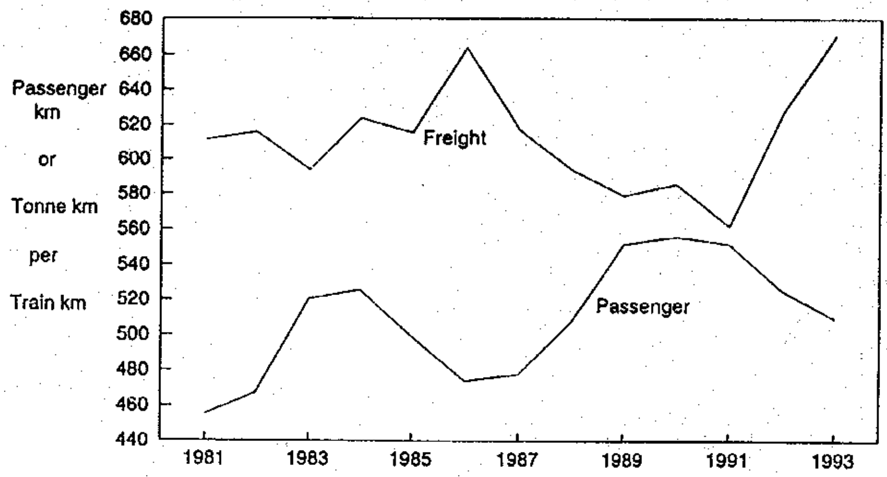
Figure 11.1.3.12 Average Load per Train Run



Source:
PR Yearbooks, JICA analysis

Figure 11.1.3.13 gives a more representative estimate of train load, on a unit km per train km basis. Heavily loaded long distance trains are given greater weight in this analysis. The average load of freight trains is nearly 700 tonnes in 1992-3, having risen from a low of 560 in 1990-1. This indicates that long distance trains are heavily loaded in one direction at least, and that the commercialisation of the last 5 years seems to be having an impact- average load during a freight train journey has risen significantly as more goods are carried on fewer trains. Comparison with the average load per train in Figure 11.1.3.12 suggests that satisfactory load levels are restricted to a few long distance trains, however, and that a large number of short distance freight workings run nearly empty.

Figure 11.1.3.13 Unit-km Carried per Train-km Run



Source:
PR Yearbooks, JICA analysis

Passenger km per train km had been on a rising trend up to 1989, but has since fallen (possibly due to the introduction of economy class, which has a lower capacity per coach than 2nd, on long distance services). It is noticeable that average load per train (Figure 11.1.3.12) is higher than average load per train km, possibly indicating that long distance trains are more lightly loaded than local trains, but also that there may be a high turnover of passengers during a long journey - those leaving the train at intermediate stations being replaced by others.

Similar analyses could be carried out on the level of utilisation of coaches and freight wagons, but many of these are specialised (e.g. AC, sleeper, oil tank), and detailed data on numbers and use of each type was not immediately available. It would appear however that passenger coaches are being intensively used, in terms of hours if not km. There are fewer than 2,000 main line coaches for over 100 main line trains per day. Many are deployed in 18 coach trains with 15-24 hour running times, indicating a high level of daily utilisation.

This is not the case with freight wagons. Most wagons are old 2-axle vehicles with an average capacity of around 22 tonnes. While there are some 4-axle bogie wagons, freight calculations are in terms of 2-axle wagon equivalents (i.e. 1 bogie wagon = 2 old wagons). Average loading in 1992-3 was only 1,178 wagons per day, with an average turnround time of 15.4 days on broad gauge lines. This means that on average, even at this low level of utilisation, only 18,141 wagons (out of 28,547 owned, around 33,000 in 2-axle equivalent wagons) were in regular use.

The 8th 5 FYP targets are 2,300 (2-axle) wagons loaded per day, with a turnround of only 7 days. This would require only 16,100 wagons in use, or a fleet of 19,000 allowing for 15% of the fleet under repair at any time. At 22 tonnes per wagon this gives a potential load of over 18 million tonnes and, at the 1992-3 average haul, 14.8 billion tonne km.

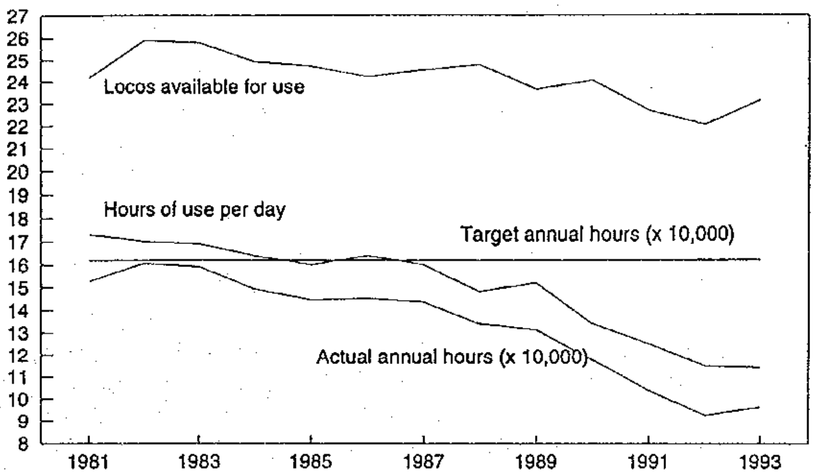
On either the current use or 8th FYP target basis over 10,000 wagons are redundant. Many wagons are small, old, of the wrong type (covered box cars with small loading doors) for the current - bulk load - transport task, and have ball bearings which need checking for overheating every 400km. The 8th FYP includes a provision for the continuation of a program to fit roller bearings to 14,000 older wagons. It would seem to be possible to withdraw all ball bearing wagons that are not going to be converted at once, as there would seem to be no need for them either at current or planned levels of productivity. This would immediately free up space in freight yards, allowing more efficient use of the yards and speeding the loading and unloading of those wagons which are needed.

One specialised type of rolling stock on which a wealth of data is available from the Yearbook is electric locomotives. The productivity of these has fallen sharply in recent years, as indicated in Figures 11.1.3.14 and 11.1.3.15.

Figure 11.1.3.14 shows availability. At a target 85% availability, an average 24.65 out of the 29 locomotives would be available for use, for an average 18 hours per day. This gives a potential 162,000 locomotive-hours per year. It can be seen that the electric locomotives fleet achieved this in the early 1980's, but that productivity has fallen well short of potential since 1989.

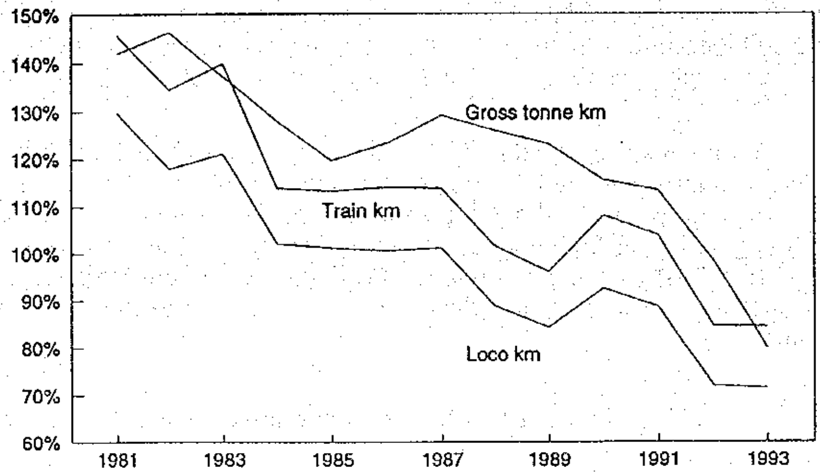
Figure 11.1.3.15 compares the performance of the average electric locomotive with that of the average diesel locomotive. Until 1983 it was significantly better, by 20% for locomotive-km and 40% for train-km and gross tonne-km (train-km performance is better than locomotive-km performance because diesel locomotives run more km in shunting yards or running light than electric locomotives do). Since 1990 relative productivity has fallen sharply, and is now only around 80% of that of diesel, despite electric locomotives only being used on full sized trains on the main line.

Figure 11.1.3.14 Electric Locomotive Availability



Source: PR Yearbook, JICA Analysis

Figure 11.1.3.15 Electric Locomotive Performance as % of Diesel



Source: PR Yearbook, JICA Analysis

This is not because of a fall in traffic on the electrified section, but more of not being used. Karachi- Lahore continues to be the main corridor for both passengers and freight. There are around 35 trains a day on the electrified section. In the early 1980's almost all were electrically hauled. In 1992-3, only an average of 17.7 per day were electric hauled.

The reasons for this are not known. Possibilities include: frequent breakdowns due to poor maintenance, resulting in locomotives not being available for the full working day; poor timekeeping of trains resulting in a locomotive not being available to take over from diesel at Lahore or Khanewal; incompatibility of the locomotives with modified air braked coaches and wagons; non-electrification of the approach lines to Lahore Dry Port; and a policy decision that it is not worth changing locomotives twice on trains working through between north of Lahore and south of Khanewal.

The possibility that there are a limited number of trains for which electric traction is now suitable is borne out by a proposal to extend the electrified section south to Samasata in order to fully utilise available loco hours on those trains for which they are suitable, but this has not been included in the 8th FYP programme. Instead the locomotives are to be re-built.

Poor maintenance and low availability seem to be a contributory factor in the recent low utilisation of electric locomotives, which has been attributed to their age (24 years). Annual distances run were nearly 140,000km in 1980-81, but had fallen to 68,000km by 1992-3. This needs to be compared with the 300,000km a year being run in the UK by locomotives built in 1966 (i.e. 5 years older) on the London-Manchester line, which have a similar maximum haul (298km) to those on PR (285km). Despite the introduction of two newer types of electric locomotive on the line, the 1966 type is still the most popular with traincrew and passengers as it is the most reliable.

Maintenance problems - shortage of spares, inadequacy of workshop equipment etc. - have been cited as a reason for low availability and productivity of other assets. There is a continuing programme of inventory build-up and up-grading of workshops, but this seems to be taking some time to take effect. Maintenance and availability problems with the 1966 UK locomotives in the late 1980's were resolved in less than 18 months, although it must be noted that there was considerable political pressure for this to be done, as nearly 1-3 of the Members of Parliament used the line regularly.

(4) Management

Management control of PR seems to be weak. There appears to be an inability to make even small changes in operating practice that would improve efficiency.

As an example, the 1992-3 Corporate Plan cited two improvements to freight operations that would save locomotive time - stabling of locomotives at Pipri Yard to save on light running between the yard and Karachi Cantt depot, and testing the brakes on freight trains before locomotives are attached (already being done at Keamari). The 1994-5 Corporate Plan mentions the same two improvements, as there had been a failure to implement them in the intervening 24 months. Shortage of funds, even for minor investments such as vacuum brake testing equipment at major marshalling yards, and unwillingness on the part of middle management and workers to accept changed working practices are cited as reasons for the lack of progress on these and other efficiency improvements.

Where there is general agreement to proceed, implementation is painfully slow. The Railway Board Budget Estimates for 1992-3 report that in 1991-2 the track re-habilitation programme achieved complete track renewal on just 56km, with rail renewals on another 3km and sleeper renewal on 24km. Despite a pressing need for re-habilitation of track, the target for 1992-3 was only 194km of renewal and 47 km of sleeper replacement. In the UK up-grading and electrification of over 1,000 track km of the London- Edinburgh line was completed in less than 3 years. In France over 600 track km of new high-speed line between Paris and the Channel Tunnel were designed and built in less than 5 years. Again lack of funds for PR is cited as a problem. The sleeper factories are operating below capacity because there are no funds to pay for their urgently needed products.

Even where overseas finance is available, progress is slow. Work on the OECF funded locomotive factory at Risalpur commenced in 1984, but the first locomotive was only produced in 1993, and work on the factory will continue into the 8th FYP period. Peak output will only be 48 locomotives a year. In the UK a plan to re-equip London's commuter railways with high technology electric railcars was announced in 1985. Financial approval and detailed design meant that the contract for construction was not awarded until the late 1980's. One of the contractors based their bid on the construction of a new factory in a disused carriage maintenance works. In less than 6 years this has been converted to a factory, produced trial units for testing, and then production unit. It may close due to lack of new orders next year after producing over 600 railcars.

In addition to the delay in opening and the low level of output, a further potential problem with the factory is the estimated cost of locomotive production there. Reports, both in Pakistan and in the international railway industry press, suggest that the first batch of 5 locomotives cost Rs120 million each. The budget allocated for 8th FYP production at the factory indicates a production run cost of around Rs94 million per unit. It is generally assumed that a basic 2,000HP diesel locomotive can be bought on the world market (dominated by US and Japanese manufacturers) for as little as $1.5 million, i.e. Rs45 million.

While PR might need to pay more than this for a relatively short production run of non standard gauge locomotives, production at Risalpur would appear to impose a rather high premium for self-sufficiency in locomotive manufacture and avoidance of expenditure of foreign exchange. A railway being run on commercial lines might consider writing off the factory without any further production and acquiring the urgently needed locomotives faster and cheaper from abroad.

11.1.4 Possible Solutions

(1) General

PR thus has an urgent need to improve its operational efficiency and its financial performance in order to undertake its appropriate share of the transport task and reduce the burden it places on annual and development budgets. The charging of a more appropriate DRF sum in the accounts each year, allowing PR to fund renewal of assets from available funds would not, in the short term, solve any problems. While PR continues to run at loss it would merely transfer government expenditure from the capital account (5 Year Development Plan budget) to the current account (PSO, waiver of return on investment, annual loss).

In addition to the projects included in the 8th FYP, there is a need to:

- increase revenue;
- reduce costs; and
- work assets harder.

(2) Enhancing Income

This can be achieved by a combination of carrying more traffic for a given level of expenditure, concentrating on more remunerative traffic, and raising tariff levels in real terms. Additional traffic can be achieved by better marketing to fill unused capacity (e.g. mail coaches and southbound freight trains). PR has already implemented marketing initiatives and is concentrating on its more profitable operations. Providing additional capacity where demand exceeds supply will usually involve investment in additional or improved infrastructure or vehicles.

Raising tariff levels in real terms has often been put forward as a way for PR to reduce its deficit, as much traffic is carried at government controlled rates. Freight traffic is already being carried at commercially negotiated rates, as illustrated by the recent increase in revenue per tonne km shown in Figure 11.1.2.5. PR is still in the process of identifying the most remunerative and profitable freight traffic to pursue, and further improvements in real revenue per tonne km can be anticipated.

This is less simple for passenger traffic, as PR's long and middle distance fares already exceed rival bus fares by a considerable margin. Even with total freedom to set fares, PR would not be able to raise rates much without pricing traffic off the railway, especially as substantial improvement is being made to the parallel road network. The only realistic way in which PR can increase revenue per passenger km is to upgrade its services (as has already been done with the introduction of economy class on longer distance passenger services).

This requires a combination of greater comfort (which requires investment) and reduced journey times. Travel time can be reduced not only by higher line speed (requiring investment) but also by eliminating lightly used stops, rationalising the stopping pattern (and crossing pattern, on single track sections) of trains, and reducing the standing time at some stations.

Long distance services wait at major stations for as long as 35 minutes. Such stop-overs may have been useful historically as refreshment stops, but most trains now carry on-board catering, and a 10 minute stop-over has been found to be more than adequate on long distance services in Europe to allow for exchange of passengers with connecting services. This would lead to a reduction of 10 to 15% in long distance journey times. Such reductions would also lead to more intensive utilisation of rolling stock. Elimination of minor stops on express trains would also reduce travel time, particularly south of Lodhran.

The Shalimar express is typical. Conceived as a 15 hour, no station stop, express between Lahore and Karachi, it now has 10 intermediate stops and a running time of 16 hours 50 minutes. Only one stop is operationally necessary (at Khanewal, to change locomotives) and only one (at Multan) consistent with the train's original status. It is understood that many of the additional stops now made by the Shalimar Express (some of them at relatively minor towns) are due to political lobbying. In other countries fares vary by the speed of the train as well as distance and level of comfort provided. The freedom to run, and charge for, premium services could be a useful addition to PR's passenger income.

(3) Cost reduction

Major cost reduction for any given level of operation is not likely to be possible until a "bottom-up" cost allocation system is operating which will enable the actual cost of providing each service, and regional variations in that cost, to be identified. Steps which could be taken in advance toward such a system include removal of staff that are burdon to the railway's current and future level of operations and of old and un-necessary rolling stock.

Elimination of obsolete rolling stock leads to savings on maintenance and fuel (particularly for steam locomotives). Disposal of old freight wagons releases space in marshalling yards for more efficient use by remunerative activities, and may even allow entire yards to be sold off or converted to other uses (e.g. dry ports).

A thorough review, preferably by foreign management consultants, should be undertaken into the number and grade of staff PR actually needs for its current and projected future workload. Selection of individuals to fill the necessary positions identified by the review will, of course, be socially and politically difficult. It is, however, preferable for PR to choose the size and composition of its workforce rather than attempt to operate with those workers remaining after the current exercise of reducing the workforce via retirement/resignation. The railway is losing some of its better workers without replacement - while PR is still hugely overstaffed, shortages of skilled staff are developing in some disciplines.

If it proves politically or socially impossible to make staff redundant, those not actually needed to run the railway could be transferred to a labour reserve, with their cost added to the PSO request.

While government and labour organisations understandably wish to promote higher employment, overstaffed and inefficient PR is not the best way to achieve it, and may actually be counter-productive. Perpetuating a slower, less efficient and more expensive transport system than the country might otherwise have raises costs and limits the pace of development in the rest of the economy. This will have an adverse effect on the growth of employment opportunities in other sectors, as well as absorbing a significant proportion of the government's current and development budgets.

Costs can also be reduced by closing little used branch lines and withdrawing lightly used local services. For passenger services this would have little effect on PR's finances, as savings would be offset by a reduction in the PSO, but it would free locomotives for more important transport tasks. Freight services could be substantially rationalised by: concentrating resources on trains between a limited number of freight yards; local collection and delivery being by PR controlled road services rather than lightly used local freight services (discussed further below). In addition to reducing costs, this also releases assets for more remunerative main line services.

(4) Asset Utilisation

The results of railway capacity analysis (presented in Chapter 7) indicated that there is surplus track capacity in most parts of the system without double tracking or signal upgrading (although this may well be justified by allowing trains to run faster, making better use of rolling stock). Even where there are potential capacity constraints, for example Khanewal-Raiwind, there are under-utilised alternative routes (via Kasur or Faisalabad) that some freight trains could use. It is argued, however, that PR can only carry more traffic (and use that track capacity) with more locomotives, coaches and wagons.

Main line passenger services can only produce more with more equipment or by running faster, as indicated above. Given the locomotives, standardisation of trains would allow coaching sets arriving at a terminus to be used on the next departing express, without re-marshalling or a delay until the next return working of the incoming service, to increaseh utilisation. For example, trains from Paris arriving at London may then run to Brussels, rather than back to Paris, reducing time standing in London.

Where branch line services are to be retained, they could be cut back to a shuttle between the junction station and the branch line terminus, freeing track capacity on the main line and allowing a more frequent service on the branch with the same assets. For example, 3 return journeys a day between Taxila and Havelian, rather than 2 a day between Rawalpindi and Havelian.

As indicated above, freight locomotive and wagon productivity can be increased substantially by concentrating resources on scheduled non- (or limited-) stop block or bulk trains between major centres, coupled with road distribution. Operation of scheduled freight has been estimated to more than double the productivity of the locomotives and wagons involved. A scheduled container service between Keamari and Lahore Dry Port proposed in the 1992 UNCTAD Multi- modal Transport report would have almost doubled the capacity on offer while only using the same wagon resources, and fewer locomotive hours than the existing ad-hoc service. Similar increases in wagon and locomotive productivity are expected after the planned introduction of high capacity bogie wagons during the 8th FYP period.

These services would require termination of the current practice of only dispatching trains when all wagons are loaded. Initially trains would need to depart on schedule with empty wagons even in the peak direction until yard/loading efficiency and demand caught up with improvements in train operation efficiency. There would be problems of seasonal variation in demand for transport of certain goods, and of insufficient demand for daily, or even weekly, trains between certain points. However, there is no need for a scheduled freight train path to be occupied by the same type of train each day, or to use the whole length of the path. The train could be a wheat train one day, fuel oil or dry port cargo the next. Southbound return of empty wagons could be replaced by trains of rice for export during harvest seasons.

The fitting of roller bearings on existing stock and the introduction of new wagons under the 8th FYP will assist in increasing freight train productivity by reducing the need for mid journey axle-box inspections and raising maximum speeds. As noted above, if 8th FYP targets for wagons loaded per day and wagon turnround are met, freight capacity would more than double to over 14 billion tonne km, rather than the 9.25 billion envisaged in the plan. This could be achieved with existing locomotive resources if freight on main lines is scheduled and averages only 30km per hour (the UNCTAD Lahore container special would have averaged only 25.6km per hour, but would have doubled rolling stock utilisation).

Track utilisation by more remunerative long distance limited stop trains could be improved if services were withdrawn from lightly used intermediate stations, which would be retained only as places for trains to pass. Most local stations on main lines in the UK were closed a number of years ago to free track capacity for express services. There are only 11 stations, 7 of them at junctions and 5 with by-passes for through trains to avoid the station, on a 330km stretch of the London-Edinburgh line, compared to 50 km between Lahore and Multan, a similar distance.

(5) Labour Flexibility

The methods of increasing asset productivity and reducing the financial deficit outlined above require a number of changes in the way the railway, and particularly the freight business, is run. In the past changes in operating practice have proved difficult to implement, and it will be important that entrenched working practices are not allowed to stand in the way of reforms to increase the railway's capacity and efficiency. Senior management will need a clear mandate to implement reforms, and to take whatever steps they deem reasonable and necessary to achieve them. A "worst case" labour inflexibility scenario is possible in which it is better to hire new staff to run the railway efficiently while transferring those who will not adapt to changes in practice to the labour reserve suggested above. The increased wage bill could be more than off-set by the increases in productivity and revenues of the modernised railway.

11.1.5 Conclusion

PR seems to have been set conflicting targets - to be a commercial railway, covering its costs, and to be a social railway carrying planned allocations of traffic. It will be unable to achieve both targets without far greater investment than is likely to be forthcoming in the foreseeable future. The future role, as expressed in the 8th FYP and PR's annual Corporate Plans, appears to be as a commercial railway, yet a number of institutional barriers still seem to exist which prevent the achievement of this while retaining un- remunerative services and inefficient use of resources.

The role of PR therefore needs to be clarified, and accepted by all parties- policy makers, management, workers, and customers.

Implementation of the changes suggested above to promote the railway as a commercial organisation, with a view to eventual privatisation (either whole or in parts) could be assisted by a revision of PR's corporate structure along the lines of those adopted for the railway in the UK in the 1980's.

This divided the railway into a number of profit centres. The basic divisions were: civil engineers (track, signalling etc); mechanical engineers (rolling stock); and business sectors (who operated and marketed services using infrastructure and rolling stock supplied by the engineering departments). All manufacturing units were transferred to the private sector.

Business sectors were divided not only into passenger and freight, but into different types of service. For example, passenger was split into Inter-city, London commuter and other local services. Freight was separated into bulk/block services, multi-modal services and mail/parcels. Each business sector was set different commercial and performance targets, some with a commercial remit (Inter-city passenger, all freight), some with a social remit (to be achieved within an ever shrinking PSO grant). This set up an internal market for the railway's human and physical assets. Business sectors competed for rolling stock and track access, with the sector that can make the best use of scarce resources (e.g., in Pakistan, locomotives) being able to put in the highest bid. Engineering sectors needed to improve efficiency and rationalise resources in order to lower their costs and improve the quality of the product supplied to the business sectors.

This system was outstandingly successful in the UK, improving operating efficiency and standards of service, eliminating deficits on Inter-city passenger and bulk/block freight operations, enabling new investments to be financially justified and increasing the railway's share of traffic in some markets. It may well be suitable as an enabling environment for changes to the way the railway is run in Pakistan. A detailed study into the best corporate structure for PR is therefore recommended to establish the best organisation to implement transport policy towards railways and any necessary operational reforms.

11.2 Modal Split for Road and Railway

11.2.1 Introduction

It is generally accepted that a rail transport system has higher fixed costs associated with any movement of goods or people than a road based transport system, but lower movement costs per km. Thus road transport would, in general, use less resources (cheaper) for a short journey, and rail would use less resources for longer trips. For both freight and passenger transport there will be "break-even" distances at which the total cost of a journey by road or rail will be equal and, in an optimal use of transport resources, 50% of traffic would go by each mode (with road being the preferred mode for shorter trips and rail for longer).

This section explores a number of methods of estimating the current break-even distances for freight and passenger transport in Pakistan, and comments on variations in these distances in future with a more efficient use of resources in the transport sector.

11.2.2 Analysis of OD Data

An estimate of break-even distances for Pakistan can be made using actual mode choice behaviour, by deriving logit equations describing the relationship between the proportion of traffic using rail and the distance traveled from road and rail origin-destination demand matrices. Equations for passenger and freight movements in 1992-93 were presented in Chapter 3.

The equation for freight was:

$$P = \frac{1}{1 + \exp.(1.417 - 0.00075*D)}$$

where: P = share of rail
D = distance (km)

Solving this equation, P = 0.5 (traffic is equally distributed between road and rail) when D = 1,960km.
The equation for passenger travel was:

$$P = \frac{1}{1 + \exp.(0.840 - 0.00087*D)}$$

and P = 0.5 when D = 965.5km.

Both these estimates exceed the distance beyond which rail was previously assumed to have the cost advantage by a considerable margin. Reasons have been sought for these differences.

These higher than expected break-even distances indicate a high proportion of longer trips by road in the demand matrices, and these be seen in the summaries of passenger and freight transport by mode and distance traveled presented at Tables 3.5.3.1 and 3.5.3.2. These show the proportion using rail is highest between 600km and 1,300km, and falls sharply at longer distances.

Karachi-Peshawar, at 1,660km, is the longest distance it is practical to travel by rail in Pakistan. In fact, rail trips of more than 1,500km are rare, whereas road trips of over 2,100km between the ports and the Northern Areas are possible. The road demand matrices thus include long trips made by road because a rail option was not available.

The demand matrices have been adjusted to remove all trips between JICA zone pairs for which rail is not a practical option. This involved zones 5, 6, 7, 44, 46, 47 and 48. International trips (zones 49, 50, and 51) and intra-zonal trips were removed from the rail matrices as international and intra-zonal trips were not included in the road matrices. The equations were re-estimated using the new matrices, with the following results:

freight

$$P = \frac{1}{1 + \exp.(4.414 - 0.00306*D)}$$

P = 0.5 at D = 1,450km.

passenger

$$P = \frac{1}{1 + \exp.(2.617 - 0.00338*D)}$$

P = 0.5 at D = 775km.

Removing certain trips from the matrices has resulted in lower estimates of the break-even distance, but they are still well above the previous distances derived for Pakistan, of around 500km. A number of non-distance/cost related factors may also have a bearing on mode choice in Pakistan. This would mean that the behaviourial break-even distances derived above are not an accurate indication of the optimal economic break-even distances.

11.2.3 Problems With the Observed Mode Choice Data

The coarse zoning system means that, even with zones for which rail is not an option excluded, the road demand matrices still contain trips for which rail is not a practical option. The rail system is much more limited in its coverage of the country than the primary road network. Rail services in some zones are limited, either geographically or in service level. For example, rail only serves the northern tip of zone 43, the far south of zone 4, and the northern edge of zone 25. Some zones only have narrow gauge lines, meaning that longer trips must change trains at a junction - easy for passengers, but such a disincentive to freight that PR no longer offers freight services on these lines. Thus while some part of each zone in an O-D pair may be served by rail, it is not a practical option for trips between other parts of those zones, or even the rail served parts - zones 43 and 21 are adjacent and both have rail lines, but a trip by rail from Zhob to D.G. Khan must go via Quetta (40), Spezand (43), Sibi (45) and Jacobabad (28).

Even more trips could thus be removed from the matrices to improve their relevance to estimation of the break-even distance, but would involve arbitrary decisions on whether rail was an option. More dis-aggregate data would also help reduce the matrices to trips for which both road and rail were an option, but while rail data is on a station-station basis, road O-D data at this level of detail is not available.

Neither passenger nor freight trips are homogenous. For any length of trip road may appear the best mode for some traffic, while rail is preferred by others. Each mode has different characteristics. In Pakistan for most trips rail has the characteristics of being slow but cheap. Express passenger trains are as fast (or faster) than road, more comfortable, and safer, but more expensive. Block freight trains which can match or better road for speed of transit are now being introduced, but only for certain commodities. Choice of mode can thus be influenced for passengers by their value of time, willingness or ability to pay, and the level of service on offer on each mode. Similar considerations will apply to freight shippers.

Even taking this into account, some trips do not travel by the preferred mode due to lack of capacity. This is particularly true for bulk freight movements by rail and for some long distance rail passenger services, where demand exceeds the railway's current capacity to carry it. A similar distortion arises from allocation of certain imported cargoes to road by NLC when rail might be more appropriate.

Finally trips may not use the economically appropriate mode because the tariffs charged do not accurately reflect the cost of carrying the trip. Both modes are subject to government control of fares for basic passenger transport, and both modes use cross subsidy from profitable traffic to attract more demand than is economically sensible in other sectors (this is particularly true of south-bound freight movement, where there is excess capacity on both modes). Neither mode is covering its full costs. Rail makes financial losses despite receiving more than Rs 1bn in Public

Service Obligation payments and making inadequate provision for the depreciation of its assets. Diesel powered road vehicles are thought not to pay enough in road user charges to cover annual expenditure on the roads by NHA and the Provincial C+W Departments. Competitive road haulage rates may not fully take into account capital costs or owner-drivers' labour.

There are thus a number of reasons why choice of mode for travel in Pakistan may not involve an economically optimal use of resources, and an alternative to behaviourial analysis may give a better indication of the economic break- even distance for road and rail.

11.2.4 Alternative Approaches

(1) General

A comparison of the gradation of tariff rates with distance for the each mode might be expected to give an indication of the distance(s) at which rail becomes more efficient than road. However, this approach is not likely to yield useful results for Pakistan.

As noted above, total charges certainly do not cover fully allocated costs for rail, and probably not for road. Furthermore, there is subsidy of short trips by longer trips on stage bus services (where fares are set at a fixed rate per km by Provincial Transport Authorities), of southbound freight by northbound freight on both modes, of lower class passengers by upper class passengers on rail, and of lower class passengers by the government. Charges are thus unlikely to reflect the true costs of the mode, or to vary with trip length at the same rate as the cost of providing the transport service.

Another approach is to estimate the actual cost of providing transport services on each mode. PR's annual budget submission and corporate plan allocates a full and variable cost to each type of traffic. NTRC periodically derive detailed road vehicle operating costs. However, these estimates are derived in different ways, and are not strictly comparable. PR allocate all current expenditure (including some wholly unconnected with railway business) to various classes of train. The NTRC estimates allocate all vehicle costs to movement, infrastructure costs being represented by taxes on fuel, spares etc. Estimates of fixed and movement costs can, however, be made from the NTRC data to enable comparison with rail costs.

A number of different estimates can then made of the break-even point between the two modes. The distance can be derived by, among others: reference to 1992-3 costs and demand carried; 1992-3 costs and capacity offered; and optimal costs per trip (e.g. no overloading of trucks, marginal costs of an additional train). A range of estimates are presented below, along with the assumptions underlying them.

(2) Road Cost

Road cost was derived from the NTRC estimates. Depreciation, interest, crew and overheads were treated as standing costs and allocated on an hourly basis. Hours of use per year were estimated as:

Vehicle type	Hours moving	Hours standing	Total
Wagon	1,150	450	1,600
Mini/big bus	1,200	500	1,700
Truck	1,750	700	2,450

For periods spent moving, these time based costs were converted to distance based costs in proportion to the speed of travel.

Running costs per vehicle km were derived from NTRC operating costs for a range of speeds between 10 and 70 km per hour, weighted according to the proportion of time vehicles were assumed to spend traveling in each speed band. These costs for each vehicle type were then combined into a composite passenger vehicle (1/3 wagon, 1/3 minibus and 1/3 big bus) and a composite goods vehicle (60% 2 axle truck, 20% 3 axle truck and 20% tractor-trailer - the proportions of the larger vehicles have been set higher than their shares of the heavy goods vehicle fleet to reflect their greater use in long distance, inter-zonal, goods transport). For goods vehicles running costs when empty were estimated at 80% of running costs when loaded.

Standing time per long distance trip (loading, unloading, waiting for a return trip), was estimated at 4 hours for buses and 2 axle trucks, 5½ hours for a 3 axle truck and 8 hours for a tractor trailer. An addition of 25km (empty) running cost was made for positioning the empty vehicle for a loaded trip.

These costs per vehicle hour and km were converted to costs per passenger/tonne and passenger/tonne km on the basis of load levels as shown in Table 11.2.4.1. Passenger vehicles were assumed to have equal loads in both directions, but goods vehicles were assumed to only secure a backload 50% of the time (i.e. costs per km need to take account of 1 empty vehicle km for every 3 loaded vehicle km). Legal (no overloading) loads for goods vehicles were based on acceptable weights of 6 tonnes on the steering axle, 10 tonnes on the drive axle and 18 tonnes on a tandem axle. This gave the following vehicle weights:

Type	Gross weight	Net weight	Load
2 axle	6 + 10 = 16	7	9
3 axle	6 + 18 = 24	10	14
Tractor	6+10+18= 34	14	20

Costs were then calculated on 4 bases:

- average loads carried - for buses these are based on survey observations, for trucks there is less data, but it is understood that vehicles regularly exceed their permitted weight;
- capacity offered - seat km rather than passenger km for buses, 100% backload for trucks;
- no overloading of trucks, load carried basis (not applicable to buses); and
- no overloading of trucks, 100% backload basis (not applicable to buses).

These costs are presented in Table 11.2.4.1.

Economic costs, excluding all taxes paid on vehicles, spares, fuel etc. were also calculated, and are presented in Table 11.2.4.2.

(3) Rail Cost

PR distribute all current expenditure among various types of service, and also produce variable costs for each type. The 1992-93 allocated costs, in millions of Rs, are shown in Table 11.2.4.3, along with the level of traffic carried, in millions of units and unit km. Fixed costs per unit carried and running cost per unit km were derived from these and are also shown.

These fully allocated costs are not strictly comparable with road costs. They include items which will not vary with the amount of traffic carried, such as administration, pensions and interest on past borrowings, whereas all road costs presented in Tables 11.2.4.1 and 11.2.4.2 vary with the level of demand for transport. On the other hand, PR's costs probably under-allow for depreciation of assets. A second set of rail costs were derived by assuming that PR's variable traffic related costs comprise: operating costs (less administration); and double the actual depreciation allocation - about 75% of the full costs. Rail standing costs are usually greater than running costs, however, since PR allocate 70% to running costs the revised estimates were divided equally between standing and running costs. These costs are presented in Table 11.2.4.4.

Table 11.2.4.1 Road Vehicle Standing and Running Costs

Vehicle Type	Average Cost per '000 km	Average Cost per hour	weight	Payload Ave.	Payload Offer'd	Payload Legal	Standing Hours	Cost per Empty Veh km	Standing Cost per Unit Ave.	Standing Cost per Unit Offer'd	Standing Cost per Unit Legal	Running Cost per Unit km Current Ave.	Running Cost per Unit km Current Offer'd	Running Cost per Unit km Legal Ave.	Running Cost per Unit km Legal Offer'd
Wagon	3668.4	82.56	33%	10	14	14	4.00	3.67	42.20	30.14	30.14	0.367	0.262	n/a	n/a
Minibus	3479.5	90.99	33%	19	26	26	4.00	3.48	23.73	17.34	17.34	0.183	0.134	n/a	n/a
Big Bus	6121.0	110.42	33%	35	46	46	4.00	6.12	16.99	12.93	12.93	0.175	0.133	n/a	n/a
Composite Bus				21.33	28.67	28.67	4.00	4.42	27.64	20.14	20.14	0.242	0.176	n/a	n/a
2 axle Truck Loaded	6118.2	80.86	60%	15	15	9	4.00	4.75	29.48	29.48	49.14	0.513	0.408	0.856	0.680
Empty	4751.0														
3 axle Truck Loaded	7854.5	103.39	20%	20	20	14	5.34	6.13	35.27	35.27	50.38	0.495	0.393	0.707	0.561
Empty	6128.3														
Tractor-trailer Loaded	9443.4	118.38	20%	30	30	20	8.00	7.41	37.74	37.74	56.62	0.397	0.315	0.596	0.472
Empty	7410.9														
Composite Truck				19.00	19.00	12.20	5.07	5.56	32.29	32.29	50.88	0.486	0.386	0.774	0.615

Table 11.2.4.2 Road Vehicle Standing and Running Costs Excluding Taxes

Vehicle Type	Average Cost per '000 km	Average Cost per hour	weight	Payload Average	Payload Offered	Payload Legal	Standing Hours	Cost per Empty Veh km	Standing Cost per Unit Average	Standing Cost per Unit Offered	Standing Cost per Unit Legal	Running Cost per Unit km Current Average	Running Cost per Unit km Current Offered	Running Cost per Unit km Legal Average	Running Cost per Unit km Legal Offered
Wagon	2854.2	66.93	33%	10	14	14	4.00	2.85	33.91	24.22	24.22	0.285	0.204	n/a	n/a
Minibus	2620.8	72.00	33%	19	26	26	4.00	2.62	18.61	13.60	13.60	0.138	0.101	n/a	n/a
Big Bus	4664.0	86.27	33%	35	46	46	4.00	4.66	13.19	10.04	10.04	0.133	0.101	n/a	n/a
Composite Bus				21.33	28.67	28.67	4.00	3.38	21.90	15.95	15.95	0.186	0.135	n/a	n/a
2 axle Truck Loaded	4897.8	65.67	60%	15	15	9	4.00	3.78	23.81	23.81	39.69	0.411	0.327	0.684	0.544
Empty	3780.9	65.67													
3 axle Truck Loaded	6185.6	84.17	20%	20	20	14	5.34	4.79	28.46	28.46	40.66	0.389	0.309	0.556	0.442
Empty	4791.4	84.17													
Tractor-trailer Loaded	7471.3	98.91	20%	30	30	20	8.00	5.81	31.22	31.22	46.83	0.314	0.249	0.470	0.374
Empty	5810.3	98.91													
Composite Truck				19.00	19.00	12.20	5.07	4.39	26.22	26.22	41.31	0.387	0.308	0.616	0.490

Table 11.2.4.3 Rail Fixed and Running Costs - PR Cost Allocation

	Costs			Capacity				Fixed Cost per Unit		Running Cost per Unit km	
				Units		Unit km					
	Full	Variable	Fixed	Used	Offered	Used	Offered	Used	Offered	Used	Offered
Passenger											
Express	4028.40	2853.56	1174.84	23.055	29.942	15187.0	21985.0	50.958	39.238	0.188	0.130
Ordinary	1916.82	1461.31	455.52	35.984	89.960	1895.0	4737.5	12.659	5.064	0.771	0.308
Total	5945.23	4314.87	1630.35	59.039	119.902	17082.0	26722.5	27.615	13.597	0.253	0.161
Goods											
Block/Bulk	2632.96	1788.51	844.45	5.758	9.597	5251.5	8752.5	146.657	87.994	0.341	0.204
Other	708.32	530.21	178.10	1.991	3.318	928.8	1548.0	89.454	53.672	0.571	0.343
Total	3341.28	2318.72	1022.56	7.749	12.915	6180.3	10300.5	131.960	79.176	0.375	0.225

Table 11.2.4.4 Rail Fixed and Running Cost - Estimated Traffic Related Variable Costs

	Costs			Capacity				Fixed Cost per Unit		Running Cost per Unit km	
				Units		Unit km					
	Full	Variable	Fixed	Used	Offered	Used	Offered	Used	Offered	Used	Offered
Passenger											
Express	3021.30	1510.65	1510.65	23.055	29.942	15187.0	21985.0	65.524	50.453	0.099	0.069
Ordinary	1437.62	718.81	718.81	35.984	89.960	1895.0	4737.5	19.976	7.990	0.379	0.152
Total	4458.92	2229.46	2229.46	59.039	119.902	17082.0	26722.5	37.762	18.594	0.131	0.083
Goods											
Block/Bulk	1974.72	987.36	987.36	5.758	9.597	5251.5	8752.5	171.476	102.886	0.188	0.113
Other	531.24	265.62	265.62	1.991	3.318	928.8	1548.0	133.409	80.046	0.286	0.172
Total	2505.96	1252.98	1252.98	7.749	12.915	6180.3	10300.5	161.696	97.017	0.203	0.122

11.2.5 Break-Even Distances

The standing and running costs derived above produce linear estimates of the variation of the total cost of a journey with length. Comparison of costs for road and rail gives an indication of the break-even distance.

Comparing the PR allocated costs with road financial costs at 1992-93 demand levels indicates that road is cheaper than rail at all distances for both freight (Figure 11.2.5.1) and passenger (Figure 11.2.5.2). Comparison of the PR costs for express and inter-city trains (which are run on a commercial basis) also indicates that rail is more expensive than road at all distances (Figure 11.2.5.3).

Spreading the costs over the capacity on offer makes little difference to the relationship between express rail and road passenger costs, as surplus capacity is about 25% on both. Local (ordinary) rail is understood to have a lot of spare capacity on some services, if all seat km were used the fixed cost per passenger on rail would come down to below the fixed cost per passenger on road, but the (PR derived) variable cost per km would still be higher than for road. On the basis of this cost estimation, rail is cheaper than road for trips of less than 100km, but more expensive for longer trips. Figure 11.2.5.4 illustrates the relationships.

A similar comparison for freight indicates a break-even distance of around 650km. Both modes are fully utilised on journeys away from Karachi, but rail has more unused southbound and inter-regional capacity than road. Rail costs estimated on the basis of available capacity thus come down more than they do for road, Figure 11.2.5.5 shows the relationship. This is not a realistic comparison, however, as north- and south-bound freight flows are unbalanced, and capacity cannot be fully utilised.

Figures 11.2.5.6 (freight) and 11.2.5.7 (passenger) show the effect of substituting the estimated traffic-variable rail costs in Figures 11.2.5.1, 11.2.5.2 and 11.2.5.3. These indicate break-even distances of around 750km for freight and 275km for passenger. The break-even distance of 500km indicated for rail express services may be high, as these services offer a higher level of comfort, with air conditioning in many cars, and are really in competition with air conditioned "flying coach" services, which have higher operating costs than the vehicles included in NTRC's operating cost analysis.

The last two estimates of break-even distance, shown in Figures 11.2.5.8 and 11.2.5.9, compare costs of freight movement by road and rail if road vehicles were only loaded up to their approved gross vehicle weights. This indicates a break-even distance of under 400km on the basis of fully allocated rail costs and under 300km using the estimated variable rail costs.

These break-even distances are closer to those used in European transport planning, where rail is assumed to have a cost advantage on point to point bulk movements at distances above 200km. In the UK rail is the preferred mode for transporting coal from mine to power station over distances as short as 50km, due to very efficient operating methods. This gives some indication of what the break-even distance could be in Pakistan if PR improved its efficiency - 100-150% more freight tonne km could be carried with very little increase in expenditure or extra equipment if assets were better utilised.

Figure 11.2.5.1 Cost vs. Trip Length - Freight
- Full Rail Costs, Actual Road Costs and Actual Usage

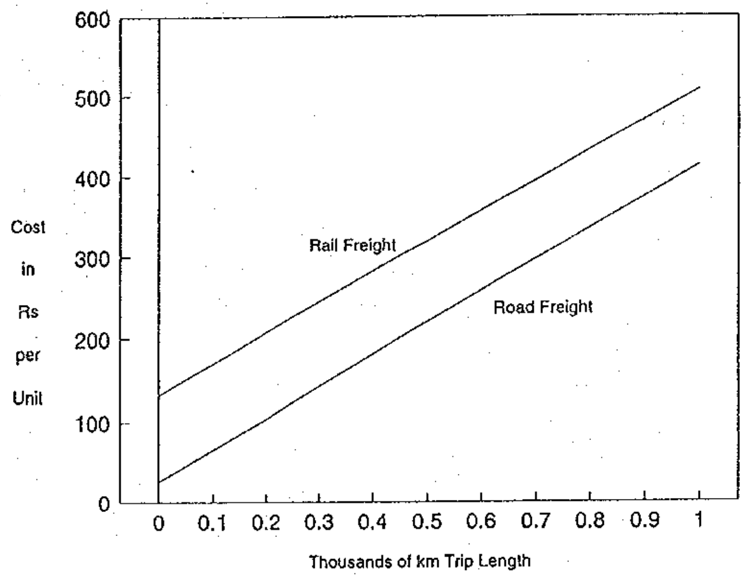


Figure 11.2.5.2 Cost vs. Trip Length - Passenger
- Full Rail Costs, Actual Road Costs and Actual Usage

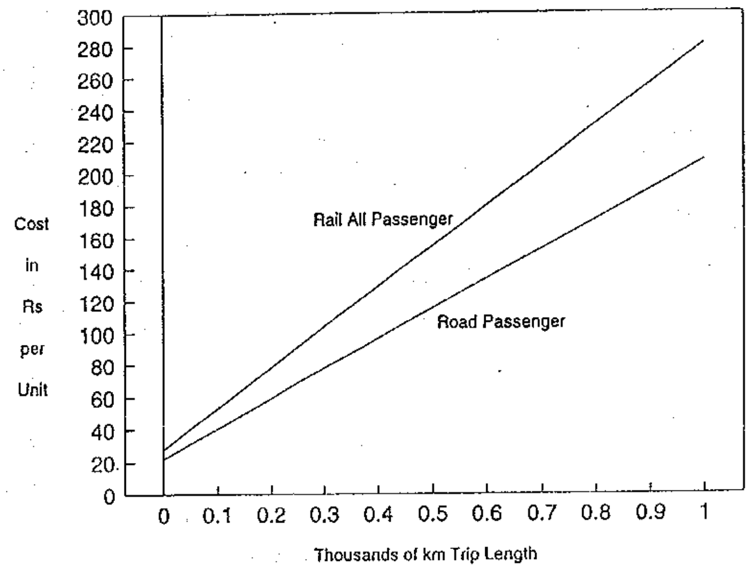


Figure 11.2.5.3 Cost vs. Trip Length - Passenger
- Full Rail Costs, Actual Road Costs and Actual Usage

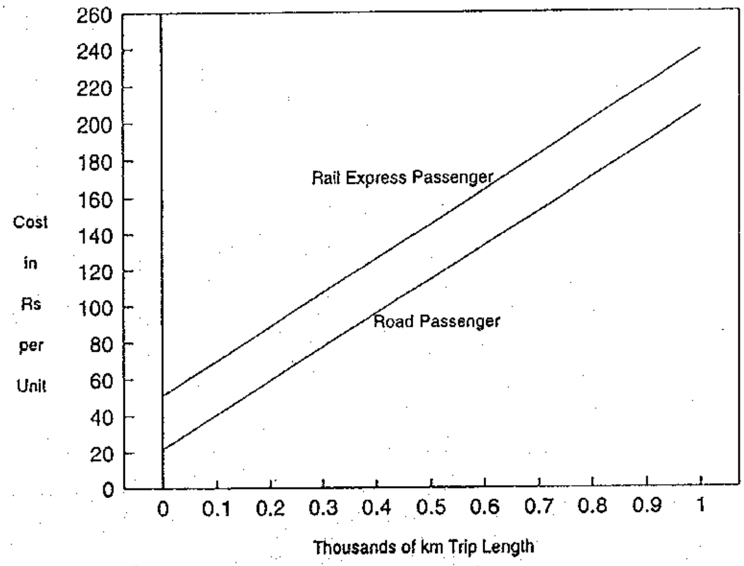


Figure 11.2.5.4 Cost vs. Trip Length - Passenger
- Full Rail Costs, Actual Road Costs and Capacity on Offer

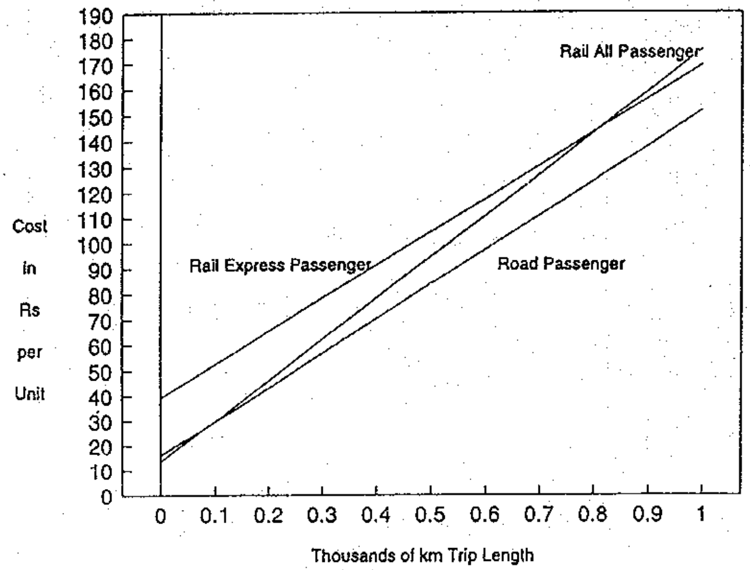


Figure 11.2.5.5 Cost vs. Trip Length - Freight
- Full Rail Costs, Actual Road Costs and Capacity on Offer

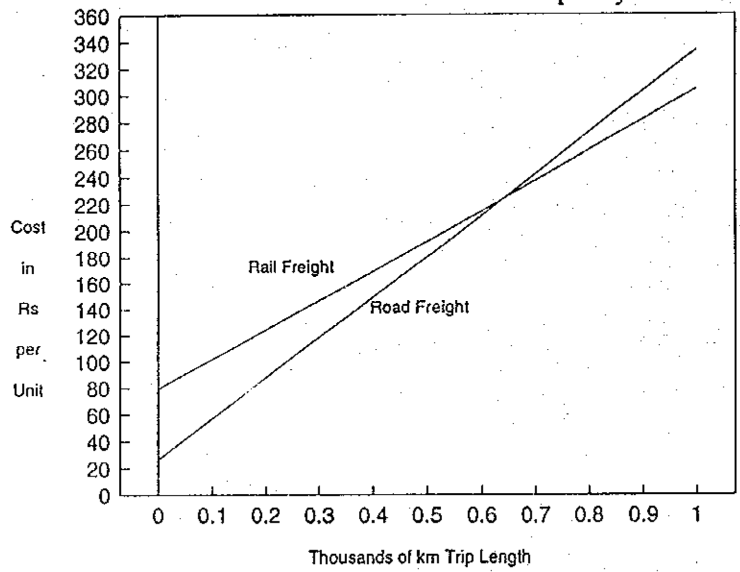


Figure 11.2.5.6 Cost vs. Trip Length - Freight
- Estimated Variable Rail Costs, Actual Road Costs and Actual Usage

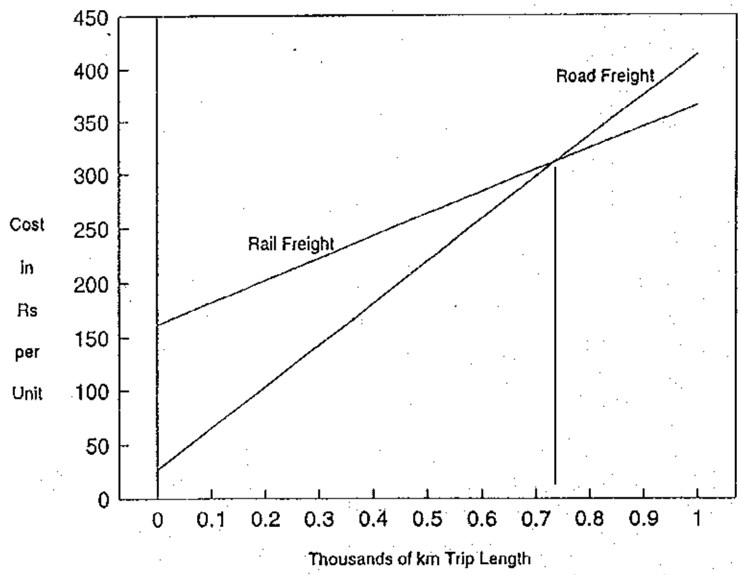


Figure 11.2.5.7 Cost vs. Trip Length - Passenger
- Estimated Variable Rail Costs, Actual Road Costs and Actual Usage

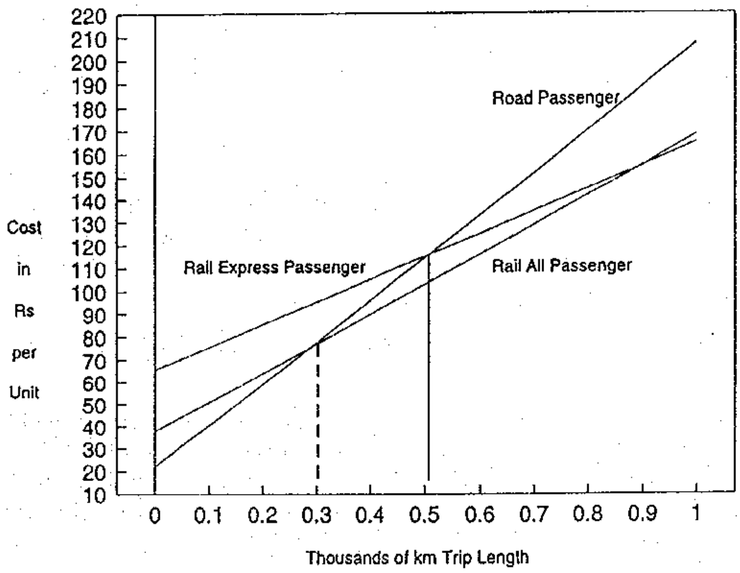


Figure 11.2.5.8 Cost vs. Trip Length - Freight
- Full Rail Costs, Road Costs without Overloading and Actual Usage

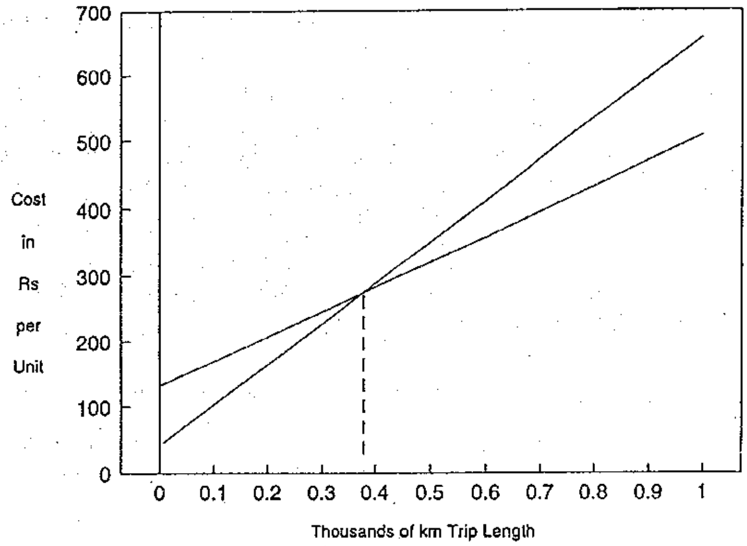
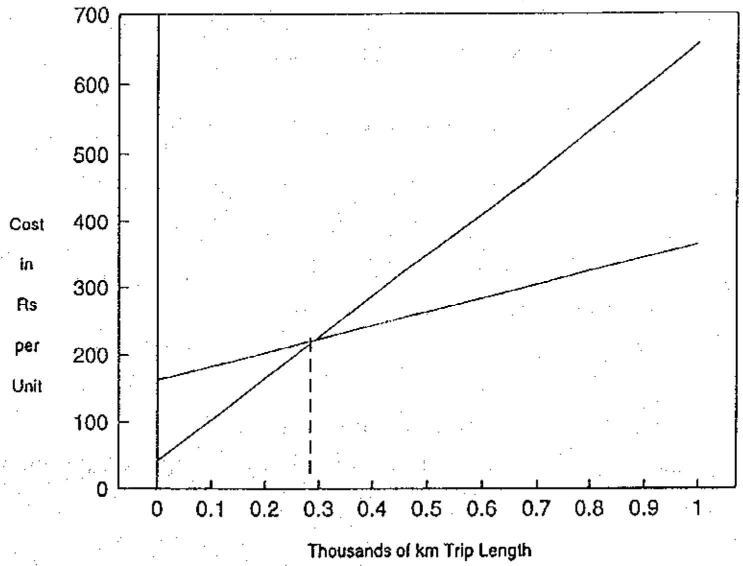


Figure 11.2.5.9 Cost vs. Trip Length - Freight
- Estimated Variable Rail Costs, Road Costs without Overloading and Actual Usage



11.3 Multi-Modal Transport

11.3.1 Introduction

The term "multi-modal transport" could be used to refer to any journey in which the passenger or goods being moved uses more than one mode of transport (road, rail, air or sea/water), and would thus be applicable to most journeys involving modes other than road, as road is almost invariably used for the first and last legs of a multi-leg journey.

More restrictively the UNCTAD Multimodal Transport Handbook (1992) defines it as:

> "The carriage of goods by at least two different modes of transport on the basis of a multimodal transport contract from a place in one country at which the goods are taken in charge by the multimodal transport operator to a place designated for delivery in a different country."

This paper also considers intra-national trips.

Multi-modal transport usually incorporates measures to facilitate the easy transfer of goods from one mode of transport to another. Two principal forms are practiced in various parts of the world:

- Containerisation - packing goods in standard sized containers for ease of transfer from one mode to another, e.g. International Standardization Organisation (ISO) approved containers, where the main haul is by sea; Unit Load Devices (ULD) where the main haul is by air; or swap-bodies for road/rail transfer; and
- Piggy-back - transporting the loaded vehicle of one mode on another mode for part of the journey, usually called roll on roll off (ro-ro) when the carrier mode is water.

Limited use is currently being made of multi-modal transport of containers in Pakistan.

This section reviews the circumstances under which various forms of multi-modal transport are used in other countries, and considers the prospects for greater use of multi-modal transport in Pakistan.

11.3.2 Containerisation

Standardised containers, also known as "boxes", have been used in international transport for over 30 years. The system has a number of advantages, which have contributed to the rapid expansion of use of containers for certain cargo movements. These include:

- rapid loading/unloading of vehicles, making the best use of vehicles and port facilities;
- safety of the goods in transit from damage or pilferage;
- safety of the vehicle, as loads are less likely to shift;
- administrative convenience of passing a sealed container through border checks; and
- ease of transfer to vehicles of other modes.

There are some limitations imposed by the nature of the container and the need for standardisation, among them:

- maximum weight of goods allowed in a container;
- minimum quantity of goods that would make the mode economical to use a whole

container for;

- the need for premises to load and empty containers; and
- the need for specialised vehicles and handling equipment.

The main use of containerisation is when the main mode of transport is by sea. ISO containers are mainly of two sizes: 20' (6.1m) or 40' (12.2m) long, 8' (2.45m) wide and 8'6" to 9'6" (2.6-2.9m) high. Containers are measured in Twentyfoot Equivalent Units - TEUs - thus a 40' box is 2 TEUs. There are also non-standard boxes: Chinese Railways have their own sizes that fit easily into their wagons; some shipping lines in the trans-Pacific trade use 45' containers, called long boxes (which are also counted as 2 TEU); and there are some 30' boxes.

ISO boxes are designed to stack up to 8 units. There are therefore limits on their weight. Approximate weights in tonnes are shown in Table 11.3.2.1. With a maximum permitted cargo density of 0.6 tonnes per m^3 they are not therefore suitable for carrying dense goods such as fertiliser or cement. However, ISO containers are seldom filled to their weight limit, the worldwide average for loaded boxes is only just over 10 tonnes per TEUs.

Table 11.3.2.1 Typical Container Loads

Length	Tare(average)	Gross	Net weight of goods
20'	3.5	24.5	21.0
40'	4.5	30.5	26.0
45'	5.5	34.0	29.5

ISO Containers have sockets at each corner via which they can be secured to vessels, vehicles or cranes. They are best carried on specialised vehicles and transferred by special cranes, but any vehicle or crane strong enough to take the load can be used provided the container is properly secured. The width and height of ISO containers means that there are few problems in carrying them inland by road or rail. Use of waterways is also possible if there are no height restrictions.

The convenience of carrying ISO containers on road and rail vehicles has increasingly led to their use for wholly inland transport, even for short trips such as the transport of containerised urban refuse to disposal sites by rail in Manchester, UK. However, their main use is still in trans-oceanic international trade in manufactured and semi-manufactured goods.

Liners with a capacity of 3.5 to 4.5 thousand TEUs operate between limited number of hub ports, the busiest of which are Hong Kong and Singapore, with turnover in excess of 7.5 million TEUs per annum. Local feeder shipping services connect these hubs to smaller regional ports, some handling only a few thousand TEUs a year.

In some countries there are limited facilities for handling ISO containers inland, and boxes are loaded ("stuffed") and emptied ("stripped") in specialised container freight stations (CFS) at the port, conventional road, rail or river transport being used for the collection or delivery leg of the journey. In the more developed economies most manufactured goods move between ports to/from ultimate origin/destination with container used for the sea leg of the journey. At an intermediate level inland CFS ("Dry Ports") are also used for stuffing and stripping boxes (with break-bulk collection and delivery by road).

Rail and/or road are most commonly used for inland distribution. Containerised goods tend to be of high value and the long transit times of inland waterways impose high stock-holding costs to shippers. Rail dominates for longer distances, or where a large number of TEUs are moving to or from a single location. In the US, rail can be particularly economical, due to lack of height restrictions, which permits the operation of trains with one container stacked on top of another, on the main trans-continental railways. This makes it cheaper, as well as quicker, to use rail and a West Coast port rather than ship throughout (via the Panama Canal) for trips between East Coast ports and Asia. Road is usually used for collection or delivery, so a trip will commonly involve three modes and 4 or 5 changes of vehicle.

Efficient container transport operations use specialised equipment at all stages except collection and delivery.

- Road transport is by tractor units hauling skeletal semi-trailers fitted with twistlocks to secure the container to the frame. This minimises the gross vehicle weight for any load, and increases the weight of container a vehicle can haul without exceeding axle weight restrictions. In most European countries vehicle weight limits are between 36 tonnes for a 4-axle combination (2-axle tractor, 2-axle trailer) and 44 tonnes for a 6-axle combination. Specialised units weigh as little as 10.5 tonnes, thus a fully laden 40' box can be carried by a 6-axle vehicle.
- Rail transport also uses skeletal wagons with twistlocks. In some countries wagons are of 2 TEU capacity, in the UK they are of 3 TEU capacity. Wagons are usually permanently linked in articulated units of 5 to 7 frames, with adjacent frames resting on a single bogie, reducing tare weight and train length for any given load.
- Feeder ships are either semi-container - standard cargo vessels adapted for stacking containers in the holds and on deck, with on-board cranes and thus able to serve ports with no specialised equipment - or fully cellular container (FCC), with specialised container holds and no masts or cranes (allowing port cranes unrestricted access to the ship). These can only use ports with their own container handling facilities.
- Liners are all FCC. They need specialised ports equipped with gantry cranes that can safely lift or drop a box on the far side of the ship. The largest are 280m long and need over 14 metres of water when fully loaded.
- Transfers are made by rail mounted gantry cranes fitted with spreader arms to grip boxes of different sizes. The spreader can be moved: laterally between road vehicles, rail vehicles, storage stacks, and FCC ships; or along a ship or a line of wagons and boxes. The best cranes are computer controlled and expensive (Hong Kong charges nearly $150 per lift), but have a theoretical capacity of 30 lifts per hour.

Shippers trade-off capital and operating cost against capacity. Large FCC liners are fast and offer the lowest cost per TEU-km at sea, but cost around $1,500 an hour in depreciation and interest. They are expensive assets to be idle and only call at well equipped, efficient, ports where turn-round time will be minimised. For trans-oceanic trade the overall cost equation therefore favours expensive ports and FCC liners over cheaper ports and less efficient semi-container vessels. Because of their cost, such cranes are usually worked 16 to 24 hours a day.

While the capital cost of an efficient container port is high, so is productivity. Hong Kong port planning guidelines assume 1,750 TEU per metre of quay per year, over 6 million tonnes per (320m) berth. This is about 10 times the productivity of traditional cargo handling methods for break-bulk goods. Average turnover for an FCC liner at Hong Kong exceeds 1,000 TEUs and is routinely achieved in only 15 hours. A 500m (75 TEUs) train can be unloaded and re-loaded in 4-6 hours, and a semi-trailer in 10 minutes.

Road tractors can be uncoupled from semi-trailers. If delivery is to a site without container handling equipment the tractor can thus leave the semi-trailer with the box and be available to pick up another, making the maximum use of expensive capital equipment - the vehicle is still working while the time consuming tasks of emptying or loading the container are taking place.

The container is usually sealed by customs at the point of export and can cross a number of frontiers with minimum delay before going through import formalities close to the final destination. Containers can therefore move through ports rapidly, easing port congestion, and be checked and loaded/unloaded at a more convenient site.

Air freight can also be containerised, but this is largely for the convenience of the airlines, ULDs making the best use of space in the aircraft and securing loads in flight. There is less standardisation than with ISO containers, as ULDs are designed to fit a particular type of aircraft.

While ULDs can be transferred to road (and even rail), they are usually loaded or unloaded inside the airport perimeter. There is a proposal to continue to use the existing air cargo terminal in Hong Kong, close to the manufacturing area, after the airport transfers to an offshore island in 1997, with ULDs being moved between terminal and airport on tractor-trailers.

Swap-bodies are similar to ISO containers, but are of lighter construction and cannot be crane lifted or stacked. They are intended for quick transfer between road and rail at remote sites without lifting gear. The system, which is still being developed, involves ramps, rollers or pivots on specialised vehicles. A number of different designs are being tested, most involve the transfer of cargo carrying bodies between skeletal wagons like those used for ISO containers. One involves mounting the whole road semi-trailer on rail bogies, but the structural strength needed to support the trailing weight of the rest of the train makes the semi-trailer undesirably heavy for road use, restricting the weight of goods that can be carried.

11.3.3 Piggy-Back

Trains, road vehicles and unaccompanied semi-trailers are carried across short stretches of water by ferries at a number of locations worldwide where the construction of a bridge or tunnel is not physically or economically feasible. Some vehicle ferries cover longer distances, e.g. England-Spain and Hong Kong-Taiwan, when alternative routes with shorter sea crossings are inconvenient or impossible.

This principle of "piggy-backing" one vehicle on another has been extended in the last 35 years to the carriage of road vehicles on rail, first cars, and more recently goods vehicles.

Generally piggy-back is similar to the use of swap-bodies, but the whole road semi-trailer is carried by rail. Road tractors deliver and collect semi-trailers at rail yards, leaving the most expensive part of the road vehicle free for other work during the rail journey, which may last several days.

The total height of a loaded semi-trailer on conventional rail flat wagon is about 5m. This mode of transport is only therefore possible if there is enough clearance above the rails for the combined height of the rail and road vehicles. Width is not usually a problem, road vehicles generally is restricted to a width of 2.5m whereas most rail vehicles are at least 2.8m wide.

Recently experimental rail wagons have been built in Europe and USA which hold the wheels of the road vehicle in a recess on the deck of the rail vehicle, reducing the overall height of the combination by up to 70cm. These wagons are being developed to permit combined road-rail-road transport of goods via the new Channel Tunnel between continental Europe and the UK, where rail loads can only be of a limited height.

On lines where height restrictions do not apply, complete trucks and tractor-trailer units are carried on specially adapted flat and drop-side wagons. This is seldom done to save vehicle operating costs, whole road vehicles are usually only carried by rail over a relatively short distance (less than 100km), through areas where the use of the road vehicle is impossible or undesirable.

Examples include:

- The Channel Tunnel, where trucks and buses are driven onto special rail wagons at one end of the tunnel and driven off at the other. The anticipated profitability of the Tunnel is based on the assumption that it will take less than 15 minutes to load up to 18 tractor-trailer units onto a train, and even less time to drive them off at the other end.
- Trips between Germany and Italy through the Alps. Switzerland and Austria have vehicle weight limits of 28 tonnes on their Alpine roads. However, European Union size tractor trailers (up to 44 tonnes) and truck-trailers (up to 56 tonnes) can be carried through these environmentally sensitive areas on rail wagons as there is adequate height clearance on some rail lines through the Alps.

11.3.4 Existing Multi-modal Transport in Pakistan

Currently, Pakistan's external trade is almost entirely conducted by sea through the ports of Karachi and Qasim. Imports dominate by both weight and value. However, most imports and about 50% of exports are bulk materials, unsuitable for containerisation. The flow of general cargoes and manufactured goods, which are suitable for containerisation, can be balanced. The 1992-3 port data is summarised in Table 11.3.4.1.

Table 11.3.4.1 1992-3 Trade through Karachi and Port Qasim

	Imports	Exports
Value (million US$)	4,875	3,284
Total Weight (000 tonnes)	24,755	5,476
General Cargo (000 tonnes)	4,187	2,987
Containerised Cargo (000 tonnes)	2,639	2,503
TEU (000)	255	252
General Cargo Containerised	63.9%	84.1%

Source: Karachi Port Trust, Port Qasim, JICA analysis.

For a country which currently has no specialised container handling equipment, a remarkably high percentage of potentially containerisable cargoes are actually containerised, exceeding 84% for exports. Karachi probably has the highest TEU turnover of any port without a dedicated container terminal. This is indicative of the dominance of containerisation for sea transport of certain cargoes. However, most of this containerised trade is not using multi-modal transport in Pakistan but is being stuffed or stripped at Karachi Port.

While detailed information is not available, the report of the 1992 UNCTAD Multi-modal Transport and Trade Facilitation Programme estimated that at least 50% of all containerised goods had an inland (north of Hyderabad) origin or destination and that up to 90% of this trade was stuffed or stripped in Karachi, traveling break-bulk in Pakistan. This means that in 1992-3 at least 250,000 TEUs had potential inland origins and destinations. In fact PR handled just over 20,000 TEUs, most of them to/from Lahore Dry Port (LDP), while the road network handled a smaller share.

The UNCTAD report identified a number of reasons shippers did not utilise the multi-modal transport potential of the ISO container in Pakistan. Among these were:

- unduly restrictive customs procedures, both at Karachi and inland dry ports;
- port congestion at Karachi and inland sites;
- a lack of suitable vehicles for the transport of containers; and
- slow transit times between inland cities and Karachi, particularly by rail.

There are relatively few multi-axle articulated cargo vehicles in Pakistan. There are even fewer specialised lightweight skeletal trailers of the type used for carrying ISO containers elsewhere. A typical 4-axle articulated vehicle in Pakistan weighs at least 15 tonnes unladen and can only carry 19 tonnes without exceeding the recommended maximum axle weight. The average weight of 2 loaded TEUs is 32 tonnes.

Most road transport of containers is thus by overloaded vehicles; some of them wholly unsuited to carry this type of load. The study team have seen 20' containers (average weight 13.5 tonnes, potential weight 24.5 tonnes) on Bedford trucks with a 15' platform designed to carry 9 tonnes of goods.

There are no specialised rail vehicles. Pakistan Rail (PR) mainly use drop-side bogie flat wagons (type BKF), with a capacity of 2 TEUs, and some 4-wheel 1 TEU wagons. 230 BKF have been modified for container use and are fitted with twistlocks, to secure the containers, and roller bearings with type MBKF. The length of passing loops limits trains to 35 bogies (70 TEUs).

Transit times are slow. For Keamari-Lahore (1,230km), NLC take 5 days (average 10.25 km per hour). Private trucking firms would take 2 days or less, but are restricted in the loads they can carry by customs bond requirements on goods clearing customs at inland dry ports. PR takes 2-4 days, depending on the number of stops a train has to make to allow higher priority trains to pass and on BKF wagons (which have ball bearings, which need to be checked every 400km) in the train included.

Given the difficulty in hiring a suitable vehicle for the inland transport of containers and the slow transit times, while private trucks can carry any un-bonded goods, it is understandable that many shippers find it preferable to use traditional break-bulk road transport and stuff/strip containers and deal with customs formalities at Karachi.

11.3.5 Future Prospects

(1) General

Forecasts of containerised traffic at the main ports of Pakistan in 1997-8 and 2005-6 are presented in Chapter 3. At current levels of port productivity this would require a trebling of the length of quay used for container handling by 2005. However, if the proposals for container terminals at both Karachi and Port Qasim are implemented the anticipated improvement in port efficiency would mean that the 2005-6 forecast could be handled at the same number of berths that are currently used.

Table 11.3.5.1 Potential Multi-modal Transport Demand at Dry Ports

			1992-93				1997-98			2005-06	
Total Goods (000 tonnes)			28,617				37,550			54,509	
Containerised (000 tonnes)			5,142				7,805			14,309	
Average load per TEU (tonnes)			10.0				9.4			9.0	
	Potential			Actual			Potential			Potential	
Dry Port	Total Freight (000 t)	Cont'd Freight (000 t)	TEU	Cont'd Freight (000 t)	TEU	Total Freight (000 t)	Cont'd Freight (000 t)	TEU	Total Freight (000 t)	Cont'd Freight (000 t)	TEU
Peshawar	543	49	4,878	7	700	816	85	9,022	1,306	171	19,046
Rawalpindi	372	33	3,342	10	1,000	589	61	6,512	1,008	132	14,700
Lahore	2,505	225	22,505	205	20,500	3,627	377	40,101	6,355	834	92,680
Sialkot	170	15	1,527	3	300	226	23	2,499	333	44	4,856
Multan	2,002	180	17,986	0	0	2,608	271	28,835	4,141	544	60,391
Quetta	951	85	8,544	0	0	1,316	137	14,550	2,059	270	30,028
Total	6,543	588	58,783	225	22,500	9,182	954	101,518	15,202	1,995	221,702

Source: 1992 - KPT data and NTRC surveys.
Other years - JICA analysis.

Adopting UNCTAD's estimate of at least 50% of containerised goods having a Pakistan origin/destination north of Hyderabad, potential long distance multi-modal flows are over 400,000 TEUs in 1997-8, and over 800,000 TEUs in 2005-6. Karachi area traffic is also potential multi-modal traffic over shorter distances if shippers choose to move goods through customs containerised.

By assuming the proportion of containerised to total freight transport demand is the same for all zones, the forecast freight O-D matrices can be factored to the potential demand for multi-modal transport, as shown in Table 11.3.5.1.

The columns headed "Total Freight" show the forecast total freight flow (actual for 1992-3) between zones with existing dry ports and Karachi port. "Potential Containerised Freight" is calculated by factoring total freight by one-half of the ratio of containerised trade to total trade for that year (as about 50% of containerised trade is believed to have an origin or destination in the Karachi area). Actual containerised freight is also shown for 1992-3.

Containerised freight is then converted to TEU by dividing by the average load per TEU (loaded and empty combined). The average weight per TEU for 1992-3 is based on data for the last 6 years from Karachi. This declines in future years as exports form an increasing proportion of containerised goods, requiring more empty containers to be imported for stuffing in Pakistan.

The forecasts of Table 11.3.5.1 may well be underestimated as:

- the proportion of containerisable general cargo is probably higher in the O-D matrix than it is in total goods as a high proportion of bulk imports (crude oil, coal, iron ore) are consumed at the ports, while some petroleum products are distributed by pipeline, and do not appear in the O-D matrix; and
- the catchment area of the dry ports may be larger than the NTPS zone, particularly for Quetta and Lahore.

If, via dedicated road feeder services, the dry ports were able to attract all potential inland containerised freight, the demand for inland transport of TEUs would be about four times higher than indicated in Table 11.3.5.1.

On the basis of these estimates, 90% of potential containerised freight for Lahore was already containerised in 1992-3. This indicates the success of the established LDP in attracting multi-modal transport, and shows the potential at the other sites. It should be noted that LDP has been open since 1974, but containerised traffic has only been significant since 1987.

It is clear that there is considerable untapped potential for multi-modal container transport in Pakistan, and that this will almost quadruple by 2005-6. What are changes needed to capture it? Are these changes desirable in the context of overall transport and trade policy?

(2) Facilitating Multi-modal Transport

The 1992 UNCTAD report made a number of suggestions for improving customs procedures, container yard efficiency and inland transport. The report concentrated on Karachi port, LDP and transport services between them, as this route exhibits the only significant use of multi-modal transport in Pakistan at present. There are a number of other rail-served-dry ports, with catchment areas covering the main manufacturing areas of the country, and comments made regarding LDP can be taken to apply to other dry ports as well.

Almost all improvements in inland container services will require some investment in new equipment - vehicles, cranes, CFS, improved dry ports etc. However, the UNCTAD report proposed a scheduled container rail service to LDP which would almost double the capacity as proposed without any investment in new equipment.

The proposed service uses the 230 MBKF wagons to form 5 sets of 35 wagons each, to run as a scheduled service between Keamari and LDP 5 days a week, requiring a 7 day turnround time. This would only use existing wagons and (assuming a locomotive is attached to the train for most of its current 50-80 hour transit) only use existing locomotives. It would roughly double productivity by operating the train to a timetable instead of the current practice of only dispatching trains when full which, as they are not scheduled, have low priority and spend most of their transit time standing in passing loops.

The UNCTAD plan would have a capacity of 36,400 TEUs a year, compared to the 19,000 operated on this route in 1992-3. A further proposal was for subsequent investment in European-style skeletal wagons, which would be lighter and faster than the existing rolling stock. Table 11.3.5.2 compares capacities and rolling stock requirements for the existing service, the UNCTAD proposal using the 230 MBKF wagons, and an equivalent skeletal wagon service.

Table 11.3.5.2 Requirements and Capacities of Container Trains

	Existing Service	UNCTAD No Investment	UNCTAD Investment
Type of wagon	MBKF	MBKF	Skeletal
Weight of wagon	21.5 tonnes	21.5 tonnes	16.0 tonnes
Length of wagon	48.0 feet	48.0 feet	63.0 feet
TEU/wagon	2	2	3
Speed	80 km/hr	80 km/hr	110 km/hr
Weight per TEU	14 tonnes	14 tonnes	14 tonnes
Weight per wagon	49.5 tonnes	49.5 tonnes	58.0 tonnes
Wagons per train	35	35	26
Length of train	1,680 feet	1,680 feet	1,638 feet
Weight of Train	1,733 tonnes	1,733 tonnes	1,508 tonnes
TEU per train	70	70	78
Transit hours	80 hrs	36 hrs	30 hrs
Loco hours per week	427 hrs	360 hrs	360 hrs
Turnround time	48 hrs	36 hrs	24 hrs
Round trip	280 hrs	168 hrs	132 hrs
Trains per week (1 way)	2.67	5	6
wagon sets needed	4.4	5.0	4.7
Wagon Needed	183	203	144
TEU per year (2 way)	19,413	36,400	48,672
Revenue per TEU	5,433	5,433	5,433
Revenue per year (000)	105,479	197,773	264,451

Source: UNCTAD Multi-modal Transport and Trade Facilitation Report(1992)
JICA analysis.
1 Includes 24 hours per round trip for re-marshalling and replacement of wagons needing repair.
2 Includes allowance of 15% for wagons in maintanance workshop.

Significant points are that:

- both MBKF services could be run with the existing wagons (indeed conversion of another 18 BKF would permit the formation of a 6th train);
- the scheduled MBKF service would use less locomotive hours than the existing service, yet offers 88% more capacity;
- six skeletal services could be run with the same locomotive resources as the scheduled MBKF service, due to their higher top speed; and
- a skeletal train is lighter than an MBKF train, despite carrying 8 more TEUs.

If the additional capacity were fully utilised at the (1992) rates quoted in the UNCTAD report, a scheduled MBKF service would generate over Rs90 million more revenue for almost no increase in operating costs (only fuel, distance related maintenance and mileage allowance). The skeletal wagon service could generate a further Rs67 million.

Initially, as indicated above, 5 trains per week may offer excess capacity to LDP. It is important, while shipper confidence in the new service is developing, that the train should run on schedule, whether it is full or not. Spare capacity to and from LDP could be utilised by offering capacity to other dry ports on the same service. For example, if Multan boxes were loaded at the rear of the train at Karachi a detour could be made (if track capacity between Lodhran and Shershah permits) to detach wagons at Multan (picking up on the southbound trip). Sialkot, Rawalpindi and Peshawar boxes could, as now, use ordinary freight trains to and from LDP.

PR can thus test the market for multi-modal services with a minimum of capital investment by changing its operating and marketing practices in respect of container specials. If this is successful, the Multan/Lahore service could be further upgraded with a fleet of skeletal wagons, and the MBKF re-deployed to introductory (scheduled) specials to Quetta and Rawalpindi/ Peshawar. Further new wagons could be introduced to phase out the MBKF and increase frequency.

Improved rail services would need to be complemented by improvements in road haulage facilities for containers. These would be needed both for local collection and delivery of containers at the dry ports and Karachi, and also for longer distance road services to areas not served by rail and to operate services rival to rail to promote competition and efficiency.

The vehicle favoured for this purpose elsewhere in the world is a tractor and skeletal semi trailer combination, with a vehicle weight of 10.5 (4-axle) to 13.5 (6-axle) tonnes. These lightweight vehicles can carry one 40' or 45' box or two 20' boxes, with a payload of between 22.5 tonnes (4-axle) to over 30 tonnes (6-axle) within existing recommended axle weight limits. Two loaded TEUs, at the average for recent year's imports, would weigh 32.4 tonnes. The 6-axle combination (3-axle tractor, 3-axle semi-trailer) is recommended. It is used increasingly in other countries, and is the preferred vehicle type for multi-modal feeder services to rail depots in the UK.

Use of the (expensive) tractor units can be maximised if semi-trailers are detached on delivery to a site, leaving the tractor free to collect another semi-trailer at the same (or a nearby) site while the container is being loaded/stripped/stuffed etc. This may require some changes in vehicle registration procedures, with separate registration of tractors and semi-trailers. In Hong Kong it is common for semi-trailers to be owned by different companies to the tractors, and there are about 50% more semi-trailers than tractors serving the container port.

To cope with increased demand, port facilities will need to be improved. The UNCTAD report described a suitable sea-port rail facility at Southampton (UK) where the container throughput is similar to that forecast for Karachi by the end of the 8th FYP. Similar but smaller facilities are recommended for inland sites, with overhead cranes to transfer boxes direct between rail and road vehicles or a storage stack. Boxes in the stack can be for indirect road vehicle collection/delivery or an on-site CFS where boxes are stuffed or stripped, with break-bulk road transport used for collection/delivery. Indonesian Railways have such a facility at Bandung in Jawa, with two sidings capable of accommodating a full length container train, a substantial concrete area for road vehicle circulation, and an on-site CFS.

There is also a potential for inland transport of air freight in ULDs, as International flights are currently concentrated at just three sites - Karachi, Lahore and Islamabad. Road transport would seem to be the most suitable, as none of the airports is rail connected and demand will be much lower. Any medium to large cargo vehicle could carry ULDs, but van-bodied semi-trailers with roller-bearing platforms and tailgate lifts (to ease loading and unloading) are preferred in other countries. Modifications to customs procedures to allow ULDs out of airport secure areas would also be needed.

The long distances covered by some freight movements in Pakistan suggest that there is potential for road on rail piggy-back services where road collection/delivery is needed at both ends of the rail haul. This means that import and export traffic is not a potential piggy-back market, as rail can serve the port direct. Nor is the transport of traditional 2 and 3 axle trucks, whose height would foul bridges and electrification equipment when mounted on a rail wagon.

The extent of the market is thus limited and unknown, but it is likely that substantial improvements in PR transit times and efficiency would be needed before shippers would consider it worthwhile to send loaded semi-trailers by rail. Some investment in new wagons would also be needed, as PR has very few flat wagons long enough to accommodate semi-trailers, and none is long enough to accommodate a tractor-trailer combination.

A potential future multi-modal market is transit traffic between the ports and Central Asia. This could move by road throughout, but would be ideal rail traffic, either in ISO containers or piggy back, between the ports and suitable railheads at Taxila (KKH), Nowshera (Lowari-Chitral-Tajikistan route), and Peshawar (Khyber Pass-Kabul route). Restoration of through-rail services to Kabul is also a longer term possibility.

(3) Desirability of Multi-modal Transport

Previous studies, and the foregoing sections of this paper, have examined the potential for multi-modal transport in Pakistan and the measures needed to accommodate it. Consideration also needs to be given to the desirability of multi-modal transport on a congested transport network.

Multi-modal transport is ideal for the transport operator. There is usually a balanced flow of traffic in each direction, as even if trade flows are un-balanced, there will always be movements of empty containers or piggy-back vehicles in the off-peak direction for loading.

However, having a large number of specialised vehicles (skeletal wagons can only be used for multi-modal operations) moving empty boxes and semi-trailers across the country might not be the best use for a limited transport network capacity.

For example, a conventional 6-axle tractor semi-trailer unit can carry over 30 tonnes without causing undue damage to the roads, but is limited to 2 TEUs. While the average weight of this load would be 25-27 tonnes, the actual goods carried will only average 18-20 tonnes, the balance of the weight being the containers themselves. Thus the same vehicle trip could carry 50% more goods break-bulk than containerised.

This disparity is even greater on rail, where higher permitted axle loads mean that up to 60 tonnes can be carried in modern bogie hopper wagons. A 35 wagon train can thus carry a payload of 1,800 tonnes, whereas a container special will average 650-700 tonnes. Chinese transport planners have considered directing all overland container movement to road (even over distances greater than 3,000km) to preserve rail track capacity for coal, oil, grain and mineral trains.

Meeting the possible 2005-6 inland container movement demand of 800,000 TEUs a year would require at least 15 trains per day each way and a fleet of over 2,700 skeletal wagons. Additional investment would thus be needed in locomotives, signalling and double tracking to cope with this demand as well as PR's existing passenger and bulk freight markets. Allowing for the additional needs of peaks in demand, Central Asian traffic and road-on-rail piggy back, a huge investment in transport infrastructure and vehicles would be needed to handle this traffic.

Before embarking on major investments in multi-modal transport facilities, a detailed study needs to be made of whether, within the current planning horizon, multi-modal transport is desirable in Pakistan. That is, will the benefits arising from greater trade (because of the convenience to importers and exporters of quick, safe and secure transfer of goods between modes) and more efficient use of land round sea-ports made possible by transferring certain activities inland outweigh the dis-benefits of a relatively inefficient use of road and rail freight capacity?

The following issues should be investigated in detail:

- the Pakistan origin or destination of goods currently moving through the ports containerised, to determine the main corridors of demand for multi-modal transport and the likely division between road and rail;
- the future potential for other multi-modal traffic, e.g. diversion of intra-Pakistan long haul road freight to piggy-back on rail, Central Asian transit traffic etc.;
- the preferences of shippers, importers and exporters for multi-modal transport;
- the difficulties and benefits to the customs service of having a larger number of inland import and export points, with goods moving in bond between them;
- the likely impact on prices, reliability of delivery time, the level of trade and Pakistan's competitiveness in World markets;
- the employment and land use impacts of moving much freight handling and customs processing away from the sea-port areas;
- the overall effect on transport costs per tonne-km of moving goods break-bulk or pre-packed, by road or rail (separating out the effects of a general shift of freight to rail from the effects on the utilisation of all freight vehicles, including bulk and break-bulk, from a shift to containers); and
- the investment implications (infrastructure and vehicles) of a move from the status-quo (mainly break-bulk by road) to multi-modal transport due to changes in the level of trade and changes in the efficiency of utilisation of road/track space.

11.4 Opportunities for Private Sector Involvement in Transport in Pakistan

11.4.1 Introduction

The 8th FYP envisages much of the future investment in industry and infrastructure in Pakistan to come from the private sector, and incorporates strategies to support such investment, particularly foreign investment.

Within the 8th FYP period such investment in transport is expected to be limited to road vehicles, air transport and sea transport, but in the longer term private sector involvement in all aspects of transport is possible.

This section briefly reviews current and potential future private sector initiatives in Pakistan's transport industry and infrastructure in the light of experience in the UK and southern Asia.

In the last 15 years, the UK has moved from having a transport sector dominated by public ownership to private sector domination of the provision of services and increasing private sector involvement in the ownership and management of infrastructure. Countries in southern Asia have been at the forefront of the worldwide movement to private sector provision of transport infrastructure.

These changes are the result of altered perceptions of the role that the private sector can usefully play in the provision of transport facilities, and particularly in public transport.

Reasons advanced for increasing the involvement of the private sector, and possible mechanisms to achieve this, are assessed below. The main modes:

- road;
- rail;
- sea; and
- air

are then reviewed. Examples of private sector participation, concentrating on recent initiatives, in other countries in transport infrastructure and transport services are given. Actual and potential private sector involvement in transport in Pakistan is considered.

11.4.2 Rationale and Mechanisms for Private Sector Participation

(1) Why?

In the past it was considered necessary for the public sector to play the main role in the provision of transport because of economic factors. Land transport infrastructure exhibits economies of scale, each mode is best served by having only one network, rather than rival networks (some countries developed rival rail networks in the 19th Century, with disastrous financial and economic consequences). Transport networks are thus natural monopolies, and public ownership or regulation was advocated to protect consumers' interests.

Transport services were also argued to benefit from economies of scale (size of vehicle, frequency of service), as well as featuring externalities (costs and benefits accruing to parties who are neither the users nor providers of the service), particularly in connection with road transport, which cannot easily be taken into account in free market economy. Because of these features it was argued that the government needed to determine the optimal level of service to be provided, from which it is only a short step to argue that the government should be the provider of the service.

A further reason for public sector provision of transport services is strategic. Import and distribution of certain goods, or of people, particularly in times of crisis or war, is essential for the continued functioning of society. Governments seek to ensure some control over transport in periods of emergency, and many consider that this is best achieved by having ownership, and thus control, of transport services at all times. This reason for the public ownership of the means of service provision is frequently used regarding railways and ocean shipping.

While all the above reasons for public control may still be valid, the view has gained ground in recent years that the private sector is much better at managing major construction projects and mobilising resources for the provision of services. Providing the public sector can retain overall legal and regulatory control, it might be preferable for day to day management and even ownership of vehicles, vessels and infrastructure to be in private hands.

Perceived strengths of the private sector include:

- tighter control of costs, both in construction projects and in service provision;
- a more dynamic management style, leading to the private sector being;
- more responsive to changes in technology, levels of demand and the needs of shippers/travellers; and
- the ability to mobilise private capital for investment in transport projects.

Although governments can generally raise investment funds more cheaply than the private sector, the use of alternative sources of funding is seen as very important, particularly in developing countries with limited current budgets and large existing loan commitments outstanding.

A further advantage seen for private sector ownership of transport facilities is the transfer of some risk that the project will not perform as forecast to the private sector. This relates particularly to major construction projects. If these remain in private ownership, the consequences of cost over-runs or poor quality work remains with the private sector.

(2) How?

In addition to encouraging further participation in those areas that have traditionally been dominated by the private sector (e.g. road transport of goods), a number of mechanisms for increasing the involvement of the private sector in transport are being used by governments in different parts of the world. Among them are:

- outright privatisation - sale of existing public sector owned infrastructure or transport operations, either to an existing company or by corporatisation of the public sector body accompanied by floatation on the stock market;
- private sector provision of new infrastructure (and any associated transport services) under franchise, either in perpetuity or for a concession period;
- changing laws to permit private sector participation in activities previously restricted to the public sector;
- leasing assets or letting management contracts to the private sector, with the public sector retaining ownership; and
- inviting private sector operators to tender to operate services in place of or alongside services operated by the public sector.

11.4.3 Road

(1) Infrastructure

There are very few privately owned and operated roads available for use by the general public anywhere in the world. Considerable interest has been shown recently, however, in commissioning new roads from private sector construction consortiums, with the private sector funding the construction and retaining ownership or management of the road after completion.

The private investors recover their investment (and any return on it) by payments based on the number of vehicles using the new facility. In some instances these payments come direct from the public sector body commissioning the road ("shadow tolls"). An example of this method of provision is a tunnel under the dock area in Amsterdam. Under this system the public sector body postpones payment for the new road, and transfers some risk - that the road is well built and well maintained, that demand for the new road meets expectations - to the private sector.

It is more normal, however, for the investors to recover their investment direct from the road users via tolls, under Build-Operate-Transfer (BOT) concessions. Under this system construction companies are invited to build the road in exchange for the right to operate it as a toll road for a number of years, the concession period, after which the infrastructure is handed over to the public highway authority. Such roads need to be high quality, limited access, expressways in order to attract sufficient traffic willing to pay a high enough price to repay the investment.

A number of BOT highways, bridges and tunnels have already been built, and more are being commissioned. Existing examples are: the second Thames crossing at Dartford and second Severn crossing near Bristol in the UK; urban expressways in Jakarta and Bangkok; tunnels under the harbour and through mountains in Hong Kong; and the Hong Kong - Guangzhou "super-highway" system. Further BOT highways are being commissioned in all these countries, in Malaysia, and elsewhere.

None has been open long enough to judge whether the system is achieving the forecast benefits for the public sector, road users or the concessionaires. Problems have already arisen in Thailand, with disputes over interpretation of contracts, the concessionaire's freedom to set commercial charges, and subsequent construction of rival roads not considered at the time of bidding. Concessionaires in Hong Kong also complain of loss of traffic and revenue because tolls on earlier public sector tunnels have not been raised as promised.

Very few schemes to date have been forecast to be financially viable, some degree of public sector subsidy or contribution (land purchase and clearance, feeder roads, tax holidays) has been required to attract investor interest. In the UK the existing public sector crossings (and their toll income) have been handed over to the concessionaires as an inducement to build the additional capacity now needed.

In other countries, e.g. France, motorways are tolled, and operated by public- private joint ventures (JV), set up as commercial corporations and able to raise capital on financial markets with the advantage of government guarantees. It is not known how much public sector investment went into the establishment of these JVs, but it is understood that they are generating substantial cash surpluses and are seeking opportunities to invest new projects both in France and abroad (expressions of interest have been made in potential BOT concessions in the UK).

A new route to bringing private sector financial discipline to highway provision being proposed is the letting of maintenance and management contracts for particular roads, areas or the whole network. Whether this is practical, i.e. whether suitable contract terms can be drawn up to relate public sector payment to the performance of the contractor, has yet to be established.

World Bank highway sector studies in developing countries are increasingly recommending the creation of "Road Funds", independent of general taxation, to provide an adequate flow of income for highway construction, maintenance, and management in countries with persistent central budget deficits. It is envisaged that the income of the road fund would come from existing sources of road user taxation such as fuel taxes, license and registration fees. This may create administrative difficulties with Treasury departments which currently receive such income. There will also be problems with accountability - a road fund financed highway authority would have a fair degree of autonomy and (in theory) freedom to levy whatever charges were needed to fund the expenditure if deemed necessary.

However, given adequate public sector controls on the fiscal and spending policies of the semi-independent highway authority, there is no reason why it should not be a JV or wholly private sector. It should be noted, however, that there are no operating examples of this kind of private sector involvement in highways, nor are there yet any firm plans for one.

There are no private sector roads in Pakistan, and none are currently planned. There are a number of examples of private sector management contracts, but these are restricted to the collection of tolls on certain bridges and roads. There are plans to toll new and upgraded sections of the national highway network, but NHA would retain ownership and control of the roads.

BOT toll roads could be considered in the future as the need for a high grade motorway system becomes greater, and even self-funding highway authorities. There are, however, a number of potential problems.

BOT concessionaires are unlikely to be prepared to take on the maintenance and accident liabilities imposed by current driver behaviour in Pakistan, particularly in connection with the overloading of cargo vehicles. They may wish to protect their roads with weighbridges at all entry points, and use their own traffic police to enforce driving standards.

Self-funded highway agencies would need revised rates of vehicle taxation. Most of the taxes paid by road users in Pakistan are import duties on vehicle and spares, strictly an instrument of trade policy and trade balance management. World Bank assessments of the adequacy of road user charges no longer include such taxes, and without them road users, and particularly owners of heavy, diesel powered, vehicles are not paying as much as is being spent on constructing, upgrading, maintaining and administering the highway network on their behalf.

A further disadvantage is that there are currently five major public sector highway authorities (NHA and the four provincial C+W departments), as well as districts and municipal authorities concerned with the provision of local roads. Arranging adequate and equitable autonomous funding for all these agencies could prove difficult, and considerable further study would be needed before recommending such a system in Pakistan.

(2) Services

Road transport services worldwide are already overwhelmingly provided by the private sector, particularly freight transport services. Current opinion is that there are no major economies of scale in road transport, and therefore no justification for large, centrally controlled, fleets of vehicles.

Bus services are still provided by publicly owned and managed companies in a number of countries in order to ensure an adequate supply of transport to all sections of the community, but the trend is increasingly towards private sector provision, with the public transport authorities inviting tenders from bus operators for the provision of a specified level of service in areas in which it is felt that services provided by the free market are inadequate.

There are two main approaches to securing adequate service levels. The market based approach, being followed in most areas of the UK, is to allow private sector bus operators to choose, in competition with other bus operators, the level of service and route network they are willing to supply on a commercial basis (usually without any imposed control on fares), and then seek tenders for the operation of additional services to areas or at times that the free market is not prepared to serve. A problem with this system is that it can result in over-provision of services where there is high demand and under-provision where there is low demand as the threat of competition from rival operators prevents any cross subsidy (between profitable services and un-profitable ones) across services or through time (i.e. too many buses during the day, but none early, late or on holidays).

An alternative is for public specification of the required level of service (and also possibly of fare levels) across a network, with private sector operators being invited to tender for the right to operate all or part of the network. Bids can be positive (operators pay the authority for the right to operate profitable services) or negative (payment is required to operate the specified service at the fare level proposed). By this method, used in London, major German cities, and rural France, among other areas, the public sector retains control of the level of service while reaping the benefits of private sector management discipline and efficiency.

These methods are usually appropriate only in developed economies in which high levels of car ownership mean that there is a small market for local bus services, and public sector interference in the market is justified in order to ensure mobility to all sections of the community. It can also be applied to cargo transport services in remote areas in which market prices for transport would make the shipment of goods in or out of the area prohibitively expensive.

Where there is adequate demand for transport services for the private sector to be prepared to undertake all transport services required, the correct role of the public sector is considered to be one of quality regulation, rather than quantity or price control. Areas of legitimate concern include ensuring fair competition, adequate safety standards and maintenance of vehicles, use of suitably qualified staff, and protection of other road users and society from dangerous practices such as overloading, speeding and blocking the path of rival vehicles.

Most road transport in Pakistan is already provided by the private sector, and the government is currently pursuing fiscal policies to encourage further participation. There are a number of public sector bus companies in Sindh, Punjab, NWFP, and Northern Areas, and road freight transport services are provided by NLC. All the bus companies operate at a loss, and NLC, previously declaring profits, are understood to have made a loss in 1992-3. The financial status of the private sector operators is unknown. They would appear to be profitable, as there is a constant stream of new entrants into the business, but many owner-operators probably do not make sufficient allowance for depreciation of vehicles, own labour or the cost of capital in setting their rates. Licence fees and fuel taxes for diesel vehicles are also too low to cover the costs that they impose on society.

Given the generally healthy state of the private sector, there seems to be little justification for public ownership of any fleets. Tenders are being sought for sale of some of the bus companies. There may be some case for the retention of public control of NATCO's services, in view of the social service nature of its operations, but this could probably be undertaken more efficiently by buying in services operated by the private sector. The presence of NLC in the freight haulage sector could be a major distortion on the free market, given their potential for cross-subsidisation from military resources and influence on the allocation of certain movements of strategic goods. Careful consideration therefore needs to be given to the future role of NLC in freight transport now that the transportation crisis it was created to deal with is over.

11.4.4 Rail

Recent development in economic theory advocates separation of ownership of rail infrastructure and services on it, to make the structure of rail services similar to road services, with a number of competing operators offering transport services on a network owned and maintained by a separate organisation. It is however the norm for railway infrastructure and the transport services operated on it to be in common ownership.

There are a number of profitable privately owned railways in the world. Most specialise in heavy freight haulage, examples being the major US rail-roads and mineral railways in Australia. The majority of railways offering passenger transport services are in public ownership and require substantial annual capital or revenue subsidy.

Separation of infrastructure and services is designed to identify those areas of railway operation that are profitable, which can be easily privatised, and those areas which are not, and which will need public sector support. This general approach has recently been adopted in Sweden and the UK, and is under consideration in Germany, but these examples differ in detail.

In Sweden the infrastructure is expected to remain in public ownership, while private operators, as well as the existing public sector operator, offer services.

In the US a public sector operating and rolling stock owning company, AMTRAK, has been created to run long distance passenger services across the tracks of the freight railways.

In the UK, it is the infrastructure which will be privatised first, along with ownership of the rolling stock. Services will be operated by a number of regional and national competing operating companies, leasing rolling stock and track access. The pricing structure has been set so that the asset owning companies are profitable, as are some (freight) operating companies, but passenger service operators may require substantial subsidy to be able to continue to provide the current level of service. It is intended that the private sector will bid for franchises to run the operating companies for concession periods.

It is hoped that this will bring private sector cost control and initiative into what is already one of the most cost effective mixed railways in the world. It remains to be seen whether the change of ownership will improve on the previous structure of a single publicly owned corporation structured into divisions so as to create an internal market in which business sectors competed for the best allocation of rolling stock and journey times for their chosen marketing strategies.

Prior to the privatisation exercise, there was already substantial private sector participation in rail operation in the UK. Major freight shippers were encouraged to supply their own fleets of specialised wagons, with the railway providing haulage. Some shippers also made arrangements to supply their own locomotives, with the role of the public sector reduced to providing the infrastructure and operating staff. Historic locomotive preservation societies were even allowed to use their own train-crew.

Such private sector initiatives are not confined to the experiment in introducing free market economy to the public sector in the UK in the last 15 years. A number of fringe railway activities are undertaken by the private sector in association with railway operators. Examples include on-train catering (the Pullman company owned no railways and ran no trains, but arranged to add its dining cars to operator's services), sleeping cars, and luxury tour trains (e.g. the Orient Express).

Rolling stock manufacture is predominantly in the private sector, and maintenance increasingly so. Ticket sales, cleaning and publicity are other areas of railway operation that have been passed to the private sector while still retaining overall control of the railway in the public sector.

Even in the UK, where the intention is to have all aspects of railway ownership and operation in the private sector by 1998, the minimum level of service will still be specified by a public sector body, which will have an allocation of the annual transport budget to purchase social services the market is not willing to supply.

The Channel Tunnel is an example of a BOT rail project. It is connected at each end to the national networks of the UK and France, but controls the track in between. It runs its own services as well as charging for international passenger and freight services to use its track. The concession period, originally 55 years, has recently been extended as compensation for additional safety costs imposed on the concessionaire by the governments of UK and France, who commissioned the project.

BOT urban mass transit systems are proposed in a number of cities (including Bangkok and Jakarta), but there have been delays in awarding the contracts or starting work due to the inherent lack of financial viability of such ventures and a reluctance on the part of the host municipalities to meet the required public sector input. Urban BOT systems which are running in Manchester and Sheffield in the UK have involved transfer of existing public assets and substantial capital inputs by the public sector to create systems which can cover depreciation and generate a return on the limited capital input of the private sector.

All rail infrastructure and services in Pakistan are in public ownership, Pakistan Railways effectively operating as a branch of the Civil Service. The largely single track system has suffered from a lack of investment in recent years, and is running with increasingly old and dilapidated equipment, as well as using outdated and inefficient operating methods.

It would undoubtedly benefit from an injection of private sector dynamism and capital, but made an estimated loss on a current cost asset replacement basis, before explicit government subsidy, of Rs6.8 billion. It is doubtful that any aspect of PR's activities is profitable, even bulk freight haulage (which is extremely profitable with the cost allocation and depreciation regime adopted by PR), and it is difficult to see where any private sector interest is going to come from.

Areas already explored include privatisation of ticket sales on some sections (it is understood that this has not been successful), and on-train catering. Other potential areas of involvement include provision of modern and reliable specialised freight wagons by some shippers (e.g. container wagons, oil tanks), but this would also require changes to PR's current practice of running freight trains on an ad-hoc basis, with no guarantee of departure or transit times.

Manufacturing operations (locomotives, carriages, wagons, concrete sleepers) could be sold off as viable industrial concerns, and some aspects of maintenance bought from private sector suppliers. Some of the other areas of private sector involvement in public sector railways identified above could also be considered.

Little interest, or change in PR's fortunes, seems likely with the present institutional set-up. PR should initially be moved towards the commercial railway that the 8th FYP envisages by giving it the status of a public corporation, similar to that of PIA, and an internal structure, on the lines of that adopted in the UK from 1984 to 1994, that will promote a commercial, profit or efficiency based culture within the railway systems. The physical and social geography of Pakistan is favourable to rail transport, and forecast levels of demand would appear to support elements of a profitable (and privatisable) railway if present operating efficiencies can be overcome and new capital investment attracted.

11.4.5 Sea

(1) Infrastructure

Many ports world-wide are in private ownership, while in other countries ownership is public, either by the state or the city or province in which the port is located. A halfway house found in some ports is public ownership and control, with stevedoring, lighterage, dredging and pilotage services contracted in from the private sector.

Ports in the UK were in mixed ownership. Some were privately owned (e.g. by the main user of the port's facilities, such as a shipping line). Some were in indirect public ownership, being built by public sector bodies such as power stations or steel mills. Others, taken into public ownership as a strategic measure during a period of national emergency, have recently been given corporate status as "British Ports", and have been sold off individually, usually to their management and staff. Ownership is now overwhelmingly private, although the busiest port, Dover, is effectively run by the municipality.

There are a number of competing ports in the UK, and privatisation has led to modernisation, increased efficiency, and profitability for most ports. Those which have not been particularly successful as ports, e.g. Dartford, have found other uses for their assets, using port land for industrial estates (also bringing traffic to the waterfront).

Ownership structure at Hong Kong is mixed. While some waterfront is in private ownership and some is publicly owned and managed, the major port facility and the container terminals, have been built by rival private consortia under Port Development Board franchise. There are proposals to improve the efficiency of the public waterfront by letting management contracts to the private sector (who are achieving better through put at their own wharves despite having facilities nominally inferior to the public wharves.

There are only two major ports in Pakistan, at Karachi and Port Qasim, with relatively little competition between them, as Qasim is a specialised bulk cargo port. While they are both constituted as public sector port trusts, there is already some use of private sector contractors and management.

There are considerable further opportunities for the introduction of private services and management into these ports. In particular, container shipping lines are expressing interest in taking over the management of several berths and constructing modern dedicated container terminals there. Competition, and therefore efficiency, would be enhanced if more than one operator were involved, as at Hong Kong.

(2) Services

Most shipping services worldwide are operated by private companies. Ships are frequently registered in countries with particularly lax safety regulations (known as "flags of convenience"), even if this is not the country of the owner of the ship. As noted above, some countries maintain state owned shipping lines for reasons of security of supply. State fleets are also maintained to enforce higher safety standards on shipping carrying the country's essential imports and exports, and to provide better working conditions for the nation's sailors.

Pakistan falls into the latter category, with a national carrier, PNSC. There are also some locally owned private sector shipping services. However, the bulk of cargo moving through Pakistan's ports are delivered or collected by non-Pakistan registered ships.

PNSC has made limited investment in new vessels in recent years, and now suffers from having an aging fleet not well suited to the transport task it faces. It is not competing well for cargoes, even to or from Pakistan. Outright privatisation is a possibility, but the line probably needs a fresh injection of public sector capital to modernise its fleet, and a management overhaul, before serious interest from the private sector would be forthcoming.

11.4.6 Air

(1) Infrastructure

The great majority of public "commercial" airports world-wide are in public ownership, and many of them are in joint civil/military use. In some places the runway and air-side facilities are provided by the military or another state body (often called the Civil Aviation Authority - CAA), while terminal buildings and passenger and freight handling services are provided by other organisations, which are sometimes private sector, but usually also public sector. At all international airports customs and immigration facilities are state run.

In developed countries civil airports are usually in public ownership, either by the state or by the local authority for the city they serve. This was the case in the UK until recently, when the state owned airports were developed into a profitable state owned corporation, British Airports Authority, and then privatised as a group, BAA Plc, via floatation on the stock market with the former management structure intact.

Sales as a group was pursued in order to retain airport facilities at remote Scottish without explicit public sector subsidy, the whole, seven airport, group being extremely profitable, and able to carry the losses on the outlying area airfields from profits made at the main London gateways of Heathrow and Gatwick. It also permitted construction of a third London airport, at Stanstead, without public sector funding, finance being raised on the capital markets by BAA on the basis of their profitability.

Although there is excess demand for landing and take-off slots at Heathrow, BAA's franchise does not allow revenue maximising auctions of slots, allocation being made by the CAA and BAA receiving agreed rates. However, BAA earns more than 55% of its income from land-side activities, particularly retail and catering concessions at Heathrow and Gatwick.

Most other airports in the UK are in local authority ownership. Some are profitable, e.g. Manchester, while others are not, but continue to be subsidised by the local authority in order to have facilities for air transport near their town.

All commercial airports in Pakistan are in the public sector. Eight are jointly operated by the CAA and the Air Force, the others are solely operated by the CAA.

CAA's accounts show it to be profitable, but there is concern that there is insufficient maintenance expenditure. Income is largely (85%) from air-side activities, mainly landing fees. Only three airports have any significant amount of traffic, Karachi, Lahore and Islamabad. No breakdown of income and expenditure on an airport by airport basis has been seen, but it is likely that these three airports are profitable, while all the others sustain substantial losses.

CAA is anxious to reduce the net cost of maintaining the outlying airfields, either by increasing their income or reducing their cost. Outright privatisation as a group, with a commercial management approach achieving the desired results, is not a realistic option given the joint military use of 8 of the fields.

Options include:

- transfer of the ownership/management of some of the fields to the province or districts that they serve, particularly those which only have flights one or two days a week - airport staff could then be employed on other civic duties on days of the week when the airfield did not need to be open to reduce running costs;
- letting of airport terminal management to private consortia skilled at maximising retail and catering revenue - this would seem to have limited application in Pakistan as only the three main airports have any significant international traffic, and it is international passengers who spend most at airports. Furthermore, it is estimated that 20% of BAA's income (and a similar percentage at other large European airports) is derived from the sale of duty free alcohol products;
- increased landing fees, which would be resisted by CAA's main customer, PIA; and
- closure of some airfields, with withdrawal of air services to those areas, which would not accord with regional development policy.

The best short term options seem to be transfer of the management of some airfields to the local authority (with safety standards still set by CAA) and introduction of private sector management (e.g. BOT terminal concessions at Lahore and Islamabad, where facilities fall well short of international standards) at those airports where there is the potential for increased commercial activity.

(2) Services

Airline ownership is mixed. Many countries have a state owned "flagship" carriers. In some countries there are also small private sector airlines filling niche roles. In some countries all airlines are privately owned (e.g. USA, UK). Scandinavian Airlines System is in effect a joint venture, being nominally a private carrier, but with significant shareholding by the governments of the three countries it mainly serves.

In the UK, the state-owned flagship airline, British Airways (BA), has recently followed the same path of re-structuring as a profitable state owned corporation followed by floatation intact on the stock market that was pursued for BAA. Thus the only state involvement in civil aviation now is the regulatory function of CAA.

BA appears to be profitable, as does another private sector international carrier, Cathay Pacific of Hong Kong. Most international airlines are not profitable, however, and it is estimated that world airlines, as a group, lost more than $1 billion last year.

A number of governments are understood to be preparing their state airlines for privatisation, primarily as a source of cash for the government, including the Philippines. This would also be a possibility for PIA, which has been encouraged to become more commercial in recent years.

It is understood that PIA is now profitable on a commercial accounting basis, and is expected to be able to fund its own fleet renewal programme during the 8th FYP period without the need for any injection of government funds. Outright sale or floatation on the stock market is thus a possibility.

Encouragement has recently been given to the private sector to enter the internal air transport market on a limited scale, but it is understood that early experiences have not been successful. New entrants have had difficulty in getting certification for their planes and pilots from CAA, and have withdrawn (possibly temporarily) from the market, alleging CAA bias against the private sector.

It is possible that these small private operators will return to the market if clear standards and guidelines on their participation are given by government and CAA.

11.5 Trade and Communications with Central Asian States

11.5.1 General

After the cold war, the international communication network is required its complete change, linking not only to its previous friendship countries but also to the world, especially among Central Asian Republics/CIS. These countries, during the USSR period, had the rail/road transport system which linked the countries in the west with the ports at Black Sea, in the east with Nakhodka and Vladivostok and in the north with Leningrad. Now these routes could provide not enough safe/reliable transport services. These countries, therefore, are in search for the best trade and transit route for their international trade.

Since Pakistan locates exactly south of these states, such as Tadzhikistan, Uzbekistan, Kirghistan, Kazakhstan, Kirgistan, Turkmenistan, etc., it is expected to solve the transport problems of the Central Asian States by opening all its transport links passing through Iran, Xinjiang (China), Afghanistan and by offering the Karachi Port to CAS' trade.

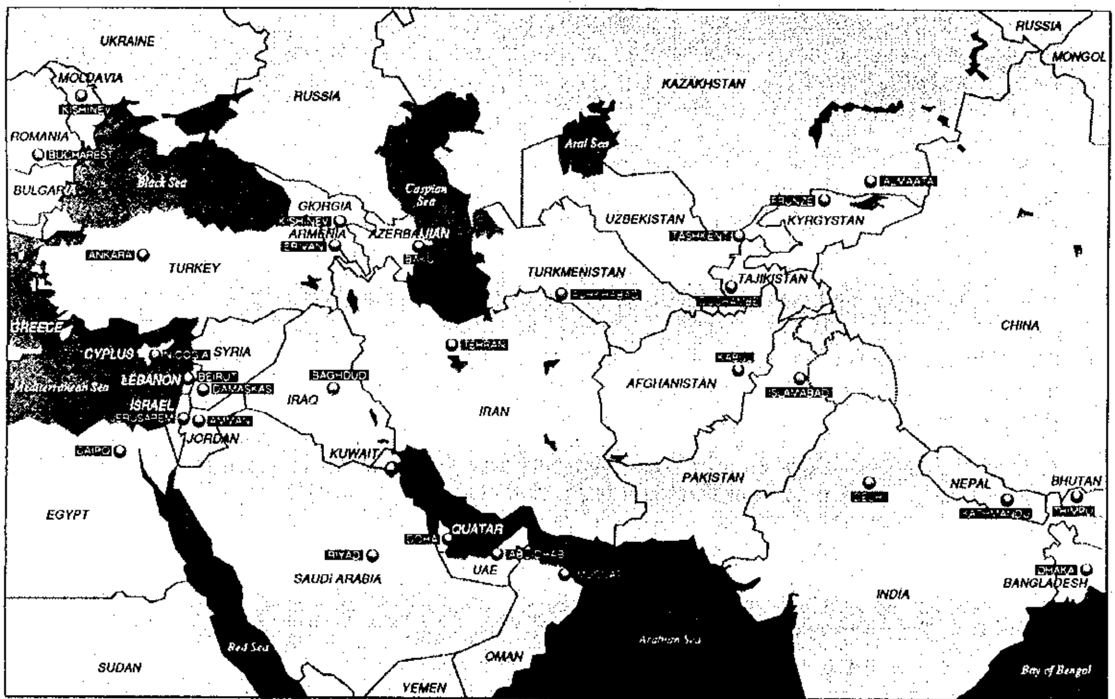
11.5.2 The Economic Cooperation Organization (ECO)

The Regional Cooperation for Development (RCD), the today's ECONOMIC COOPERATION ORGANIZATION, was set up in Istanbul, Turkey, in July 1964, recognizing the importance of the economic cooperation for the regional/international development among the neighbouring countries.

Pakistan, Iran and Turkey are the three founder member countries of the ECO, and now the following seven countries have also become the members of the ECO.

- Turkmenistan,
- Tajikistan,
- Uzbekistan,
- Kazakhstan,
- Kyrghistan,
- Azerbaijan, and
- Afghanistan

Figure 11.5.2.1 Location Map of ECO Countries



The Major characteristics of the ECO Region are briefly summarized as follows;

- the area covers more than 600 million square kilometers, with a population of more than 300 million,
- the region is rich in various natural resources,
- the climatic condition is suitable to agricultural products, not only for domestic consumption but for export.

Table 11.5.2.1 GNP and Population in ECO Countries, 1991

	Per Capita GNP (US$)	Population Growth (% in annum)	Population (thousand)
Afghanistan	n.a.	2.58	(16,100)
Azerbaijan	1,670	0.45	7,219
Iran	2,170	3.43	57,764
Kazakhstan	2,470	0.61	16,899
Kyrgyzstan	1,550	1.33	4,448
Pakistan	400	3.06	115,588
Tajikistan	1,050	3.01	5,412
Turkey	1,780	2.17	57,237
Turkmenistan	1,700	2.37	3,748
Uzbekistan	1,350	1.71	20,955

Source: Economic Review Karachi, 5/1993

And the ECO region considers the plans, in order to improve the quality of life and to contribute to the world prosperity;

- Boost the inter-regional trade,
- Pool its market resources for export/import requirements from the international markets,
- Improve its TRANSPORT INFRASTRUCTURE (Land, Sea, Air) enabling THROUGH TRANSPORT and encouraging the MULTI-MODAL TRANSPORT SYSTEM for the inter-regional and the international transport and trade purposes.

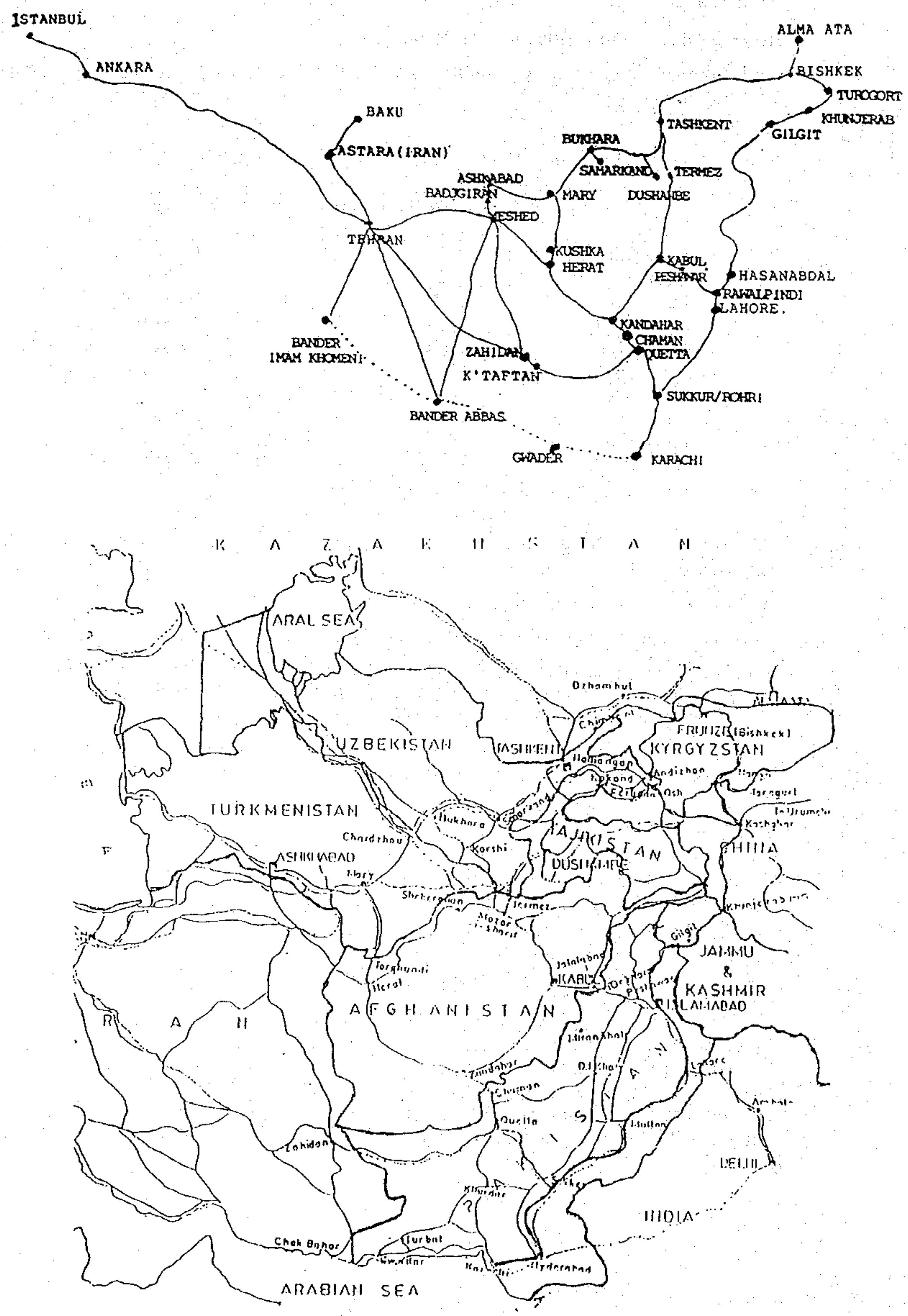
Pakistan, on account of its geophysical location, is expected to offer its "Gateway Services" through Port Karachi and Qasim with its roads/railway links to the ECO/Central Asian Region.

11.5.3 Possible Routes

The possible transport routings through Pakistan to Central Asian/ECO Countries are;

1. Karachi - Chaman - Kandahar - Herat - Kushka (Turkmenistan)
2. Karachi - Chaman - Kandahar -Kabul - Termez (Uzbekistan)
3. Karachi - Peshawar - Kabul - Termez (Uzbekistan)
4. Karachi - Rawalpindi - Gilgit - Khunjerab - Torgurt - (Xinjiang/China) - Georgijevka - Irkestam - Bishkek (Kyrghistan)
5. Karachi - Rawalpindi - Gilgit - Khunjerab - Torgurt - (Xinjiang/China) - Georgijevka - Khorgos - Almatoy (Kazakhstan)
6. Karachi - Quetta - Kohitaftan - Zahidan - Meshed - Ashkabad (Turkmenistan)
7. Karachi - Quetta - Kohitaftan - Zahidan - Astra (Iran) - Baku (Azerbaijan)
8. Karachi - Quetta - Kohitaftan - Tehran (Iran) ------ to Istanbul (Turkey)
9. Karachi - Chaman - Kandahar - Herat - Meshad - Tehran (Iran) ------ to Istanbul (Turkey)

Figure 11.5.3.1 Overland Transport Routes, via Pakistan to Central Asian States

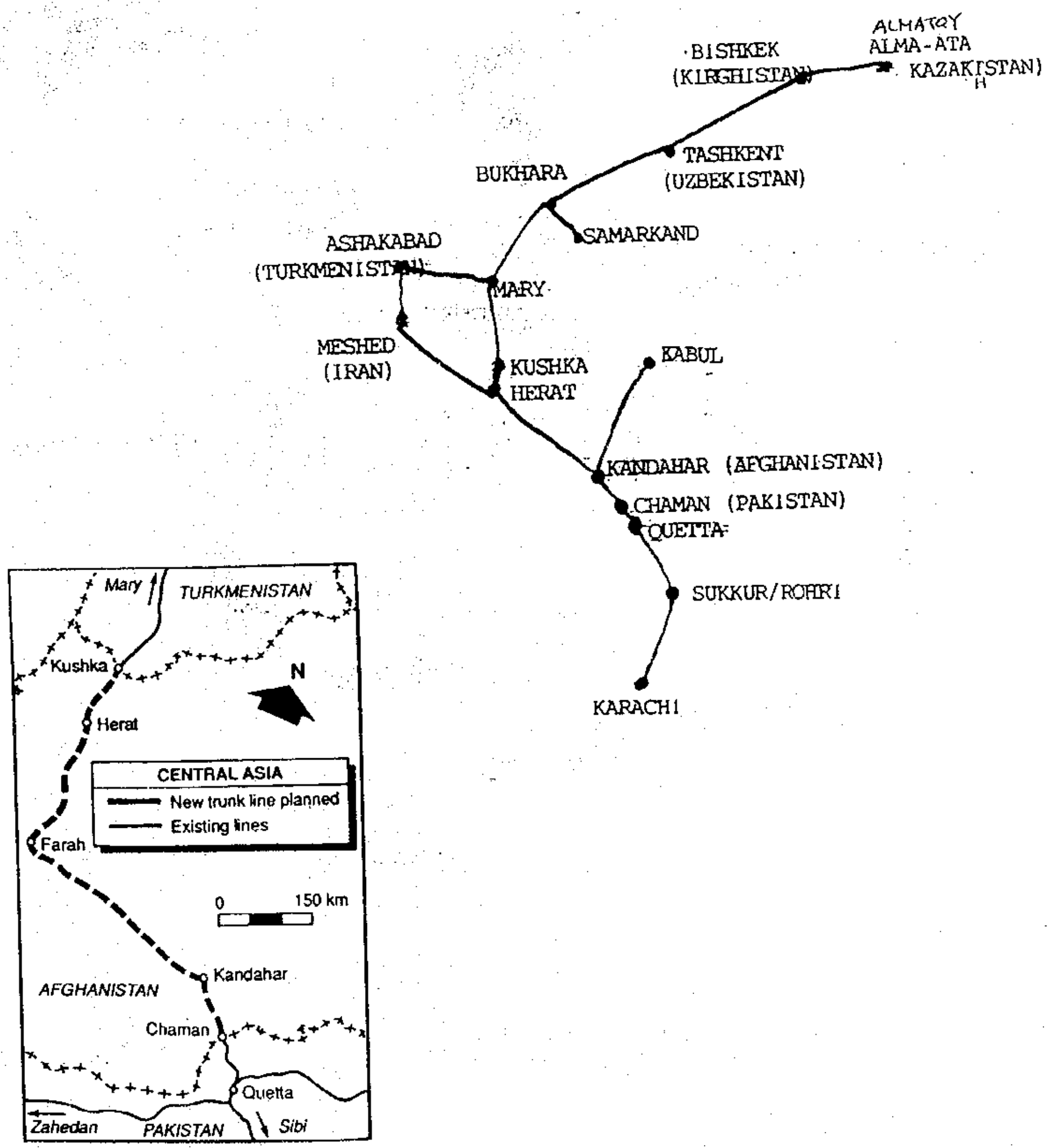


In addition to the road network mentioned above, the importance of a rail transport system, which has certain advantages especially for the long-haul transport of bulk commodities, is also inevitable.

The railway network linking the ECO Region, Karachi - Chaman - Kandahar (through Afghanistan) Herat - Kushka (Turkmenistan), is considered as a top long-term priority. A preliminary feasibility study has been completed for the route. There is an existing railway link between Karachi and Chaman section, 838 kms, while a new extension of railway line is proposed between Chaman and Kushka. The project costs US$ 600 million, plus US$ 100 million for upgrading PR's Quetta - Chaman branch section.

The Central Asian trunk line would run through the Afghan provinces of Kandhar and Herat, skirting the mountainous region west of Kabul. The route is seen as a vital trade corridor to connect the Muslim states of the former Soviet Union with the Indian Ocean.

Figure 11.5.3.2 Proposed Railway Links



11.5.4 Trade Potential

Since there is very few available statistical data on the international trades of the Central Asia States between/through Pakistan, it is impossible to analyze correctly these international trade potential, both in terms of quality and quantity. Therefore, two completely opposite opinions are observed: one is optimistic and another is pessimistic.

Figure 11.5.4.1 Conceived Transport Routes