NATIONAL TRANSPORT RESEARCH CENTRE
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RAILWAYS - TRANSPORT MODE OF 21ST CENTURY

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BY
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I - ADVENT OF RAILWAYS - NINETEENTH CENTURY TRANSPORT MIRACLE

1. The industrial revolution of Eighteenth century was brought about mainly due to the invention of steam power generation. Prior to the discovery of steam engine, the power to turn various sectors of the economy such as industry, agriculture and transport depended upon the animal and man power. Camels, horses, elephants and other such species were utilised to run the wheels of industry, ploughing of fields, extraction of water from the underground resources and haulage of men and materials across national and international frontiers. The land barrier in the transport sector was finally broken with the invention of Stevenson's steam railway locomotives. In line with the legendary opposition to all the major inventions in the history of mankind, opposition to the creation of steam locomotive was also extremely intense based on fallacious premises such as:

- Accidents causing loss of human life.
- Endangering the human and animal species habitating along the planned routes of the steam locomotives.
- Pollution of the environment along the planned routes of this earlier rudimentary type railway locomotive due to emission of heavy coal/oil smoke and extreme noise.
- Bursting of steam boilers and fire hazards will increase in the localities through which the steam locomotives will pass hauling the trains.

2. All the above misplaced premises have since been proved wrong. Instead the steam engine broke the DISTANCE BARRIER' on land and further imparted phenomenal 'Quantum Jump' to the overall scientific and technological discoveries especially that

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of internal combustion engine utilising fossil fuels such as petrol, diesel oil etc. ending with electric traction and Jet propulsion used extensively towards Railway, Road, Sea and Air transport. The latest technology being that of rocket propulsion using the compressed sophisticated liquid and solid fuels. So it is not exaggerated in any way to declare that the steam Railway engine of the late Eighteen and early Nineteen centuries proved 'Transport Miracle' within the national and across national borders especially in European, Asian and American continents.

2. The beginning of first commercial steam engine driven railway trains in the year 1945 in United Kingdom laid the solid foundation for the Railway revolution throughout the world. Immediately afterwards during the second half of the Nineteenth Century, Rail - Road started criss-corssisng the North American continent by laying such legendary Railways as Central Pacific and Union Pacific etc. not only from East to West but also from North to South. In Europe, the French, German and Russian nations started constructing their national Railways in a big way even crossing over the national frontiers. In Asia, the colonial powers such as British Raj in India, Burma, Srilanka, Middle East and Malaysia started constructing Railways in a massive way ostensibly on the plea of Military and Defence logistics to support their conquests of far away lands and to manage properly the occupied territories. In Nutshell by the close of Nineteenth Century, Railways throughout the world had come to stay as a viable transport mode within the national boundaries and along the international routes. The beginning of Twentieth Century witnessed the quality improvement in the Railway transport; the major being in realm of speed increases and comfort advancements prov rue to th ords of one of the legendary

founder of the British Railways 'Brunel' who had the foresight to remark as far back as 1840. "I shall not attempt to argue with those who consider any increase in speed unnecessary. The public will always prefer that conveyance which is most perfect and speedy, within the reasonable limits, is a material ingredient in perfection of traveling." These words uttered about a century and a half ago come from the generation which saw the Novel introduction of the Railway travel, to us, a generation that hears many suggestions for its winding up and consequent extinction.

No doubt Nineteenth Century can boast of rightly the century of 'Transport Miracle' due only to the advent of Railways.

II - HISTORICAL BACKGROUND - EVOLUTION/ REVOLUTION OF RAILWAY TECHNOLOGIES

1. Prior to the inauguration of first commercial Railway train in 1845 in the United Kingdom, it was ensured that the entire track structure and the rolling stock structure is based on definite design considerations and technological know-how upto that point of time round the world. It was safeguarded that the comfort of human-beings and safety of goods to be carried by the Railway train is maintained to the maximum without any compromise whatsoever.

2. In order to ensure the comfort of human-beings and safety of goods to be transported through rail transport, comfort and safety limits were prescribed based on actual research carried for this purposed. It is now common knowledge that human comfort during travel, irrespective of the mean and mode of travel that is rail, road, air, sea and now satellite is affected by the vibrations generated within

the vehicle in all directions. These vibrations are the major reasons to affect comfort and safety of human-beings and goods to be carried. While traveling by Railway trains or by any other mode of transport as described above, the human-beings and goods undergo serious and troublesome vibrations in all directions. In order to prescribe safe limits of these vibrations, the Railway Designers of Track Infrastructure and Rolling Stock Equipments categorized these vibrations into two type viz: vertical vibrations and lateral vibrations, the lateral vibrations being more harmful and injurious. During various conventions of the world Railways, it was prescribed that no Railway in the world will exceed the overall limit of vertical vibration as 0.5 g and lateral vibration 0.35 g including vibration while traversing over a curved track (g representing gravitational force of 32.2 ft per second per second).

3. After confirmation of these comfort and safety limits of accelerations and vibrations, the Railway Designers saw to it that the entire track structure comprising of steel rails laid over wooden, iron or concrete sleepers embeded in clean hard stone ballast duly inter-linked by fittings/fastenings such as fish plates, bearing plates and do spikes, etc. will be robust enough to withstand and contain the vibrations in the vertical as well as lateral directions within the limits prescribed above. Similarly, the rolling stock comprising of locomotives, passenger carriages and goods wagons alongwith wheels, axles, under-gears, suspension systems and vehicle bodies in such a way that the corresponding accelerations/vibrations do not exceed the joint limits prescribed above.

4. In order to measure and record these vibrations in two directions during the running state of each locomotive, passenger carriage and good wagon during its entire journey over the laid track

an instrument was designed, fabricated and manufactured to record these vibrations and accelerations in two directions viz: vertical and lateral and these instruments called 'Accelerometers' being handy could be placed in any part of the locomotive, passenger carriage and goods wagon enroute. No other transport system or mode has yet come till today to ensure the comfort and safety of human-beings and goods to be carried in the manner to be carried by the rail transport. Simultaneously, the Track Structure Designers have evolved and manufactured instruments duly fitted in proper track recording coaches which are periodically run over the entire track to record the state and limits of gauge, cross levels, longitudinal levels, versines, etc. so that the vibrational characteristics of the track do not exceed or contribute excessively towards the discomfort and endanger the safety of human-beings and goods to be carried. Similar precautions have been adopted by the rolling stock manufacturers to maintain locomotives and train vehicles to an extent that they also do not contribute their share of vibrations to an extent so as to break overall prescribed limits of vibrations.

5. In this connection, it will not out of the way to quote in verbatim the recommendations of an 'International Conference on Transport and Environment' held on 14th/15th October, 1996 at Rawalpindi under the aegis of Chartered Institute of Transport Pakistan.

> "Road transport cannot, however, compete with rail in either reducing transport related pollution or economizing in land occupation as well as energy consumption. Rail transport is also the only mode in which quantitative limits have been set for vertical and horizontal vibrations. Developing countries (with rapidly increasing urbanization as well as motorization) cannot

postpone action on reducing transport induced pollution which can be considerably reduced by rail. If indigenous hydro-electric power is available such pollution could even be virtually eliminated wherever rail replaces road."

III - GLOBAL ROLE OF RAILWAY - SOCIAL AND ECONOMIC BREAKTHROUGH

1. It hardly needs to be emphasized that the evolution of culture, society and economics owes in entirety to the gradual development of transport and communications since the pre-historic times throughout the world. The great historical cities of the world sprang up at the banks of big rivers only when rafters began means of conveyance for mutual contacts of mankind. The dynamic wheel invention brought in its wake the carts, chariots, buggies and the like which opened new inland vistas. More and more lands were brought under cultivation as a result and new dwellings mush-roomed away from the rivers' banks. There were beaten tracks then to cater for the transport needs. The civilization thereafter saw the dawn of steam propulsion. Then came the speedier and heavier road vehicles and to bear the impact of which mud-roads developed into paved streets and later on to make-shift metalled highways.

2. It is at this point of time of history that Railway appeared on the global horizon in the mid-Nineteenth century. As a result, the life became speedier and the socio-economic growth started taking unprecedented strides. The inland dwellings exploded into big cities and metropolises. The movement of men and material from one place to the other gained tremendous proportion through the media of Railways which had criss-crossed practically all the continents by the end of the Nineteenth century as described earlier.

3. The slow sailing rafters, boats and barges began virtually extinct with the exception along the coastline and the entire land

surface traffic started to be carried by rail. In fact, the Nineteenth century can be very well described as the 'Century of Railways' which, in turn, brought about the socio-economic revolution across the variety of nations inhabiting our earth. The Railways were instrumental not only integrating different sections of society within the national borders but also created awareness of unity of human race across the national boundaries as a whole. It will not be exaggerated that the Railway acted as a major agent of change for universal unity of human race in the Nineteenth century and earlier part of Twentieth century that Europe and Asia intermingled with each other irrespective of their great differences of social and cultural background. Similarly, North American countries of Canada, United States and Mexico were connected by the prominent rail - road routes.

4. The beginning of civilization is rightly attributed to the birth of transport and amongst the transport means, Railway enjoyed the unique position of being first that intensified mutual contacts by mobility of human-beings and their goods which in turn made possible the socio-economic development of the mankind. No doubt all the civilized advanced countries have achieved their present status by development of their transport systems, Railway being the starting point of such a social and economic break-through.

IV - DESCENDENCY OF WORLD RAILWAYS - AFTERMATH OF ROAD AND AIR TRANSPORT ASCENDANCY IN THE TWENTIETH CENTURY

1. The first world war (1914 - 18) within the earlier part of Twentieth century, however, brought about phenomenal development in the Road and Air sectors as a spin-of, of Highway building and aircraft construction technologies which were developed at a rapid pace. Through the Railways were still the main stay for the transport needs of sustaining a global war or national civil wars or economic

development and carriage of passenger and goods. However, the Air transport and Highway transport started making inroads into the supremacy of the Railways. Railways having become stagnant in their outlook being the monopolists in transport sector at that point of time ignored the vital aspects of research and innovation to cater for higher and more mobility. The road sector having the inherent quality of door to door service became the biggest rival to the Railway. Development of cars and buses became the ideal of ordinary people in every country and throughout the world. The Air transport having the in-born quality of speedier movement within and across the national borders, continents and across seas and oceans revolutionized the transport sector beyond imagination. Thus towards the end of the Second World War and later on, the Railways started losing its ascendancy and preference in the global and national market of transport.

2. The major reason of this flop of Railways is attributed to the very, very conservative attitude of the Railway constructors, manufacturers of its various equipments, operators and managers towards research, innovation and achievement of higher speeds in the Railway operations.

3. The Second World War, in fact, witnessed the ruination of Railways not only within the national boundaries but also across the borders throughout the world on account of the fact of construction of sophisticated highways such as autobahns in Germany by Hitlar and in United States of America - the famous inter-state highways linking East to West and North to South. The development of internal combustion engine in a big way and bringing about its product as modern buses and cars gave practically a death blow to the Railways. The aircraft and air-liner dealt a final quo-degrace to the Railways. Railways being a monoply, its manufacturers and managers became so complacent that they saw the prevailing speed of 100 kmh as their

Ultimate goal and objective. Thus the world saw at the end of Second world War railways dying all over the world so much so that PEN Central Railways the biggest and Giant of world railways in the United States of America boasting of about 50,000 kilometerage got liquidated in the mid-Nineteen fifties inspite of the fact that United State Railways had too to their credit about a quarter million track kilometerage manned by 250 private companies. Thus the end of the Second World War saw the descendency of World Railways in the aftermath of road and air transport ascendancy. It was being proclaimed in the United States of America that the Railway is a 'DEAD HORSE' though the entire United of America was developed and built in the Nineteenth Century through the agency of Railways.

4. The United States of America having borne no direct scars of the Second World War gave rise to phenomenal development of Highway Transport and Air Transport. Major subarbias were built around the old towns and cities and cars became the status symbol of every family. Each family boasted of atleast three cars; one for the master of the house, the other for his spouse and the third for his children for travel across and within major cities or from East to West coast and North to South. Airlines were developed to carry people within hours instead of within days or months within national and international boundaries. Thus the world witnessed the progressive extinction of the Railways at the end of the Second World War where European Railways had already been destroyed through intensive War operations and aerial bombardment. In other parts of the world such as West Asia, South and East Asia, the Railways due to extensive use had degraded and ruined for want of timely replacement of infrastructure and vital equipments. There was no doubt that the witches in the transport sector forbade bad omens and ultimate death of the world Railways.

V. RENAISSANCE OF WORLD RAILWAYS - MIRACLE OF RESEARCH BASED MODERNIZATION IN THE WAKE OF WORLD WAR SECOND

1. The end of Second World War in 1945 witnessed the Europe including Russia completely ruined, its economy shattered. Millions of people starved of food, clothing and shelter. The entire infrastructure of Railways, roads, bridges, cities,

electricity and various other services stood completely destroyed. It was a Herculean task to re-build the Europe and re-juvenate its economy in the aftermath of Second World War. United States of America (USA) having remained safe from the direct effects of Second World War came in as a big donor and Messiah for the re-construction of ruined Europe. The famous 'MARSHAL PLAN' was launched for the re-construction of Europe and its economy.

2. The French nation had been able to save Paris and most of the Central and Southern France from the War destruction by surrendering to the German Army in time by Marshal PETIAN. The planners and top notchers of France controlling the French national economy came to the right conclusion that they should devote top most priority to the re-construction and development of 'Transport and Communication' sector to enable it to sustain the other sectors of economy such as industry, education, agriculture, etc.etc. France being a nation devoid of the natural resources of energy such as coal, fossil oil and hydle power generation, etc. adopted atomic electric power generation as main stay in the energy sector. The result is that France today tops the world nations in the production of atomic electric energy per capita.

3. Alongwith this decision, the French Planners under - took simultaneous decision as to which mode of transport should be given preference in their national planning policy keeping in view of the constraints of energy and power. They came to the conclusion that Railway is the only mode of transport which is capable to consume least energy per passenger kilometer and per tonne kilometer simultaneously capable of achieving the highest form of comfort and speed for the carriage of goods and passengers not only within the country but across their borders.

4. Towards this end, the French National Railways were given a go-ahead signal to embark upon full-fledged research activities to upgrade their Railway system with a view to achieve higher speeds on their existing infrastructure of railway track, signaling system and equipments including locomotives, rolling stock and traction. The speeds prevailing on the European Railway system and elsewhere in the world were mostly of the order of 100 kmh in respect of passenger as well as goods traffic. Since the world Railways considered this speed adequate and suitable for their purpose of

transportation and being monopolist they became complacent to the extent that they did not foresee the danger of their rivals such as Highway transportation and air transportation taking the lead in providing speedier transport facilities.

5. Keeping this panorama in view, the French National Railways undertook the basic technical research as well as operational research to modify their railway system without ploughing in major capital investment to upgrade the system for achieving higher speeds than the prevailing speed of 100 kmh.

6. Their extensive research for about 10 years since 1945 revealed that they could achieve much higher speed on the existing tracks by utilising existing signaling system and rolling stock equipment duly modified. The result was that by 1955 they achieved the break-through of attaining a speed of 331 kmh on existing tracks. After this break-through they went ahead to upgrade their main-line system connecting their major urban and industrial centres with the result that by the year 1980 they had upgraded their existing Railway infrastructure and equipment to such as extent that they were running passenger expresses with speed of 200 kmh on about 6000 kilometres main railway lines. In fact, this was nothing short of miracle in the world of Railways.

7. In 1960, the President of West German Railways paid a visit to the National French Railways and requested the French National Railways' President to cooperate for research and unification of European Railways cutting across the borders for running of passenger and goods railway expresses to which the French Railway President disclosed their break-through in achieving of 200 kmh and even higher commercial speeds on the existing Railway track. This phenomenon when realized by the West German Railway , they changed their design equation for manufacture and installation of their railway track.

8. Alongwith this break-through of railway speed on the existing tracks, the French National Railways simultaneously started technical research to plan, design, construct, operate and manage new railway lines with speed of more than 200 kmh. Their first target to achieve the speed of 300 kmh between Paris and Lyon and their

other various urban and industrial centers was to be achieved on newly constructed railway lines with least curvature, as the curvature is the major obstacle in the achievement of higher speeds not only in Railway technology but also in Highway technology.

9. French Railways keeping this in view selected two of their sections; one in the North from Strasbourg to South towards Layon where the speed of 300 kmh and above was planned to be achieved by using turbo diesel engine (Jet propulsion) and another electrified section was chosen near the border of France and Spain to attain this speed. The speeds of 300 kmh and above were duly achieved on these sections by the mid-seventies but due to oil crunch of late 1970's forced the French Railways to construct new line between Paris and Layon nicknamed TGV (Tres-Grand-Vitesse-very high speed) as an electrified Railway system than with turbo traction as turbo train consumes 40% more oil. Thus on February 6, 1981, the world speed record for a commercial train was attained between Paris and Layon on this newly constructed railway line.

10. The speed recorded and achieved was 380 kmh against the previous record of 331 kmh on existing track achieved also by SNCF by their two locomotives in 1955 (Refer Railway Gazette International June 1981 - (RGI). However, the French National Railways confined the TGV between Paris and Layon to a maximum speed of 300 kmh keeping in view the overall safety considerations of the passengers.

11. Following suit the Japanese national Railways in the East had also embarked on copying the French Railways' Model of TVG. The Japanese National Railways (JNR) instead of upgrading speed on their existing lines went for in a big way to build new lines with sophisticated track technology based on rails embedded in pre-stressed concrete girders and slabs erected on RCC concrete pillars. The new Takaido line was commissioned in 1964 and SANYO line in 1975 with speeds of 200 kmh and 250 kmh respectively. Since then the Japanese National Railways have nicknamed their high speed lines as Shinkanson Railways. Many other national Railways such as West German Railways, British Railways, Italian Railways and Indian Railways are vying desperately for achieving higher speed either on their existing lines or by building

new railway line on the lines of the breakthrough achieved by French National Railways and Japanese National Railways.

12. Against this background, the American Railways as already stated in this paper after having developed the United States of America through the agency of Railways declared their Railway as 'Dead Horse' due to aberration at their national Planning Policy giving preference to Airways and Highways as well as motorised transport. However, due to the oil crunch of late seventies and over congestion of their Airports and Highways, the USA have been forced to re-consider their view-point about the Railways. With this objective in view, the Federal Government of the United States of America awarded a consultancy contract each to a group of French experts and another to the Japanese Experts in the late seventies to prepare technical feasibility reports regarding the planning, designing, construction, operation and management of high speed railway lines connecting Newyork with Los Angles and sans Francisco i.e. East to West coast across the Mid-west on lines similar to TVG and Shinkanson. The period for the report was confined to be five years. However, both the Consultant Groups by mid-Eightles declared that USA though a super-power No.1 in the world has lagged behind in the understanding and attaining of requisite railway technologies and systems regarding planning, designing, construction, operation and management of railway systems like TVG and Shinkanson, they have recommended that the USA should go ahead by awarding construction contracts to French and Japanese and German firms who have achieved mastery in respect of building such high speed Railways for a couple of such sections of Railways upto 200 or 300 kms lengths each enabling the local Railway Experts of USA to get the experience and requisite knowledge for planning, designing, construction, operation and management of such high speed Railway systems.

13. A quote from the book 'RAILWAYS OF THE WORLD' by BRIAN HOLLINGSWORTH may be relevant in the context of magnitude of Railways the world over:

> 'In the world today there are more that three quarters of a million miles of railways blanketing the continents. Historically, railroads, although only 150 years old, have opened up continents, created trade routes and in

general provided national and international transportation services on a scale never before imagined. Today more than seventy percent of the world's freight is carried by rail.'

VI. SPACE ERA WORLD RAILWAYS - POISED/SET TO ACHIEVE JET/SATELLITE SPEEDS ON PLANET EARTH MINUS VIBRATIONAL DISCOMFORTS AND WEIGHTLESS DISORDERS OF AIR/SPACE TRAVEL.

Besides the above, the French and Japanese Railways have also gone ahead with the planning, designing, construction, operation and management of non-conventional Railway systems which have been nicknamed Maglev-Mono-Rail-Linear Motor or magnetic Afflux Railways which have the potential and capability to surpass the modern Jet Airliner speed and comfort in the near future but in the distant future "21st Century", this marvel and miracle of the Railway has the inherent potentiality to attain satellite speeds on the surface of the earth when tracked through big vacuum barrels and tunnels around the world minus of course the discomfort and weightlessness and other life dangers undergone by Astronauts in the satellite travel. Channel Tunnel Railway between U.K and France is just the fore-runner of such future railway systems.

2. The one billion dollar question is what else is expected from the poor world Railways declared as 'Dead Horse' by the sole Super Power USA after the World War Second inspite of the fact that USA was developed by Railways and it once boasted having the biggest kilometerage of the Railway in the world.3. A quote from U.I.C (International Union of Railways, Paris based) will not be out of the way to be described as under:

> "To ensure mass transport in densely populated areas of Europe, Japan and Eastern United States, the Railways possess two advantages which are no longer in dispute; it is the least polluting transport mode in addition to bring the most economical in terms of land occupation and energy consumption. It has been calculated that for the roads to cope

VII - ROAD TRANSPORT NEARER AT HOME - PAKISTAN RAILWAY AND ITS DOWNFALL

1. <u>Reasons and causes of downfall</u>

(I) The main cause and reasons for the catastrophic failure of Pakistan Railways Working Operational as well as Financial is its FAILURE to MODERNISE its operations, Infrastructure and equipment and financial working in time since Independence in August, 1947.

(ii) The down-slide is markedly visible since 1970 and onward.

(iii) Another cause is the astronomic Mis-management in its internal as well as external realms.

(iv) The modernisation and management Failures are attributable predominantly to lack of :

a) Adequate and updated IN-HOUSE Training Facilities and Human Resource Development.

b) Operation and Adaptive Research Institutional Facilities.

c) Objective and Comprehensive Transfer of Technology Facilities.

d) Coordination amongst the various disciplines.

2. <u>Mis-placed Notion of Inadequate Funding</u>

I. The P.R. Management has always been harping about the step-motherly treatment of the Government of Pakistan (GOP) regarding provision of funds and investments as demanded by it.

II. The fact of the matter is that since First Five Year Plan (1955 - 60) to Eighth Five Year Plan (1988-93), a sum of Rs.34 billions has been ploughed in the P.R. in the form of internal and external loans including foreign funding by Multi-national and international Donor agencies such as IMF/World Bank with eleven World Bank Railway loans and Railways' subsectoral portion of $ 105-M of First Transport Loan), Asian Development Bank, Islamic Development Bank, Kuwait Fund and host of bilateral loans such as YEN Loan, KFW Loan, CIDA and U.S. Aid Programmes.

III. All the above funding in rupee content and as well as in foreign exchange were used towards the acquisition and purchase of equipment, infrastructure and technologies as under:

a) Dieselisation since 1952 and purchase of diesel electric locomotives to replace the steam locomotives and setting up of diesel Electric Locomotive Factory at Risalpur.

b) Purchase of modern passenger coaches and setting up of passenger coaches Manufacturing Factory at Islamabad.

c) Installation of 100 lbs welded track on the main line between Karachi - Lahore and upto Lalamusa.

d) Introduction of electrical and electronic signaling including All - Relay Interlocking and CTC on the main line between Karachi, Lahore, Rawalpindi and Peshawar.

e) Setting up of five Concrete Sleeper Manufacturing Factories.

f) Purchase of various track machines for introduction of mechanised maintenance for the newly 100 lbs welded track.

g) Installation of Micro-wave communication technology.

h) Electric traction between Lahore - Khanewal on the main line.

i) Introduction of Air Brake.

Inspite of induction of above mentioned new equipment, infrastructure and technologies, the working and operational results are extremely dismal and counter-productive, so much so that the loss/ deficit in the financial working is now touching the figure of Rs.5 billions per annum.

3. Comparison with Indian Railways

Pakistan Railway has been a part of the Indian North Western Railway. The comparison with Indian Railway for the year 1994-95 is given below for understanding the whole situation. The Indian Railway is also placed in the public sector (Please see Annexure I, II and III).

Principal/Key Statistics - 1994 - 95

	Pakistan Railway	Indian Railway	Remarks
- Route Length (Kms)	8,774.87	62,660	Includes all gauges
- No. of Railway stations.	808	7056	Includes all gauges.
- Passenger (kms in billion)	17.555387	319.365	
- Tonnes (kms in billion)	5.660993	252.967	
- Number of Employees	1,13, 186	16,20,000	
- Revenue Gross (in billion Rs.)	9.721623	201.010	
- Expenses in billion Rupees.	7.912502	165.901	

It may be noted from the above comparison that the operating expenses in the case of Pakistan Railways do not include:

I. Appropriation to DRF.

II. State Railway Interest on Debt.

III. Appropriation to improvement fund

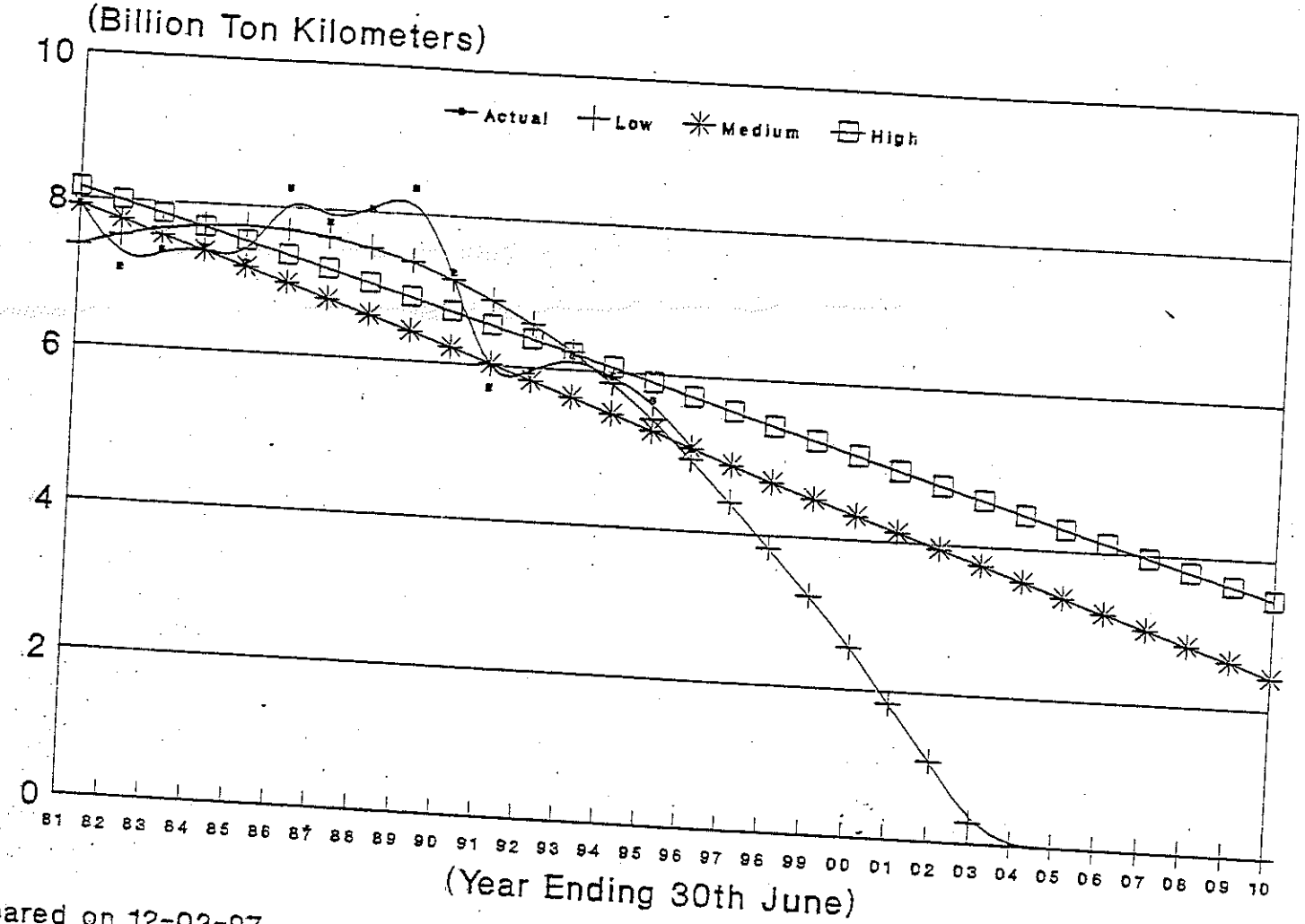
IV. Miscellaneous Railway Expenditure.

After catering for the above items, the deficit in case of Pakistan Railways is of the order of about three billion rupees which figure is now currently touching the limit of Rs. Five billions. In case of Indian Railways, after catering for all the above mentioned expenditure, the net revenue is of the order of 24.464 billion rupees which is a record in the World Railways as perhaps Indian Railway is the only Railway in the world which is in plus. It may be noted from Annexure-II that operating ratio on P.R. for the year 1995-96 has exceeded 100% for the first time in the history since Independence.

VII - PROSPECTS AND POTENTIAL OF RAILWAYS IN PAKISTAN

1. As per Railway Year Book for 1995-96, Pakistan Railways carried 5.077 billion tonne kilometres against 91.560 billion tonne kilometers carried by Road sector. Similarly, rail passenger kilometer achieved are 18.905 billions against the similar road

TON KILOMETERS BY RAIL



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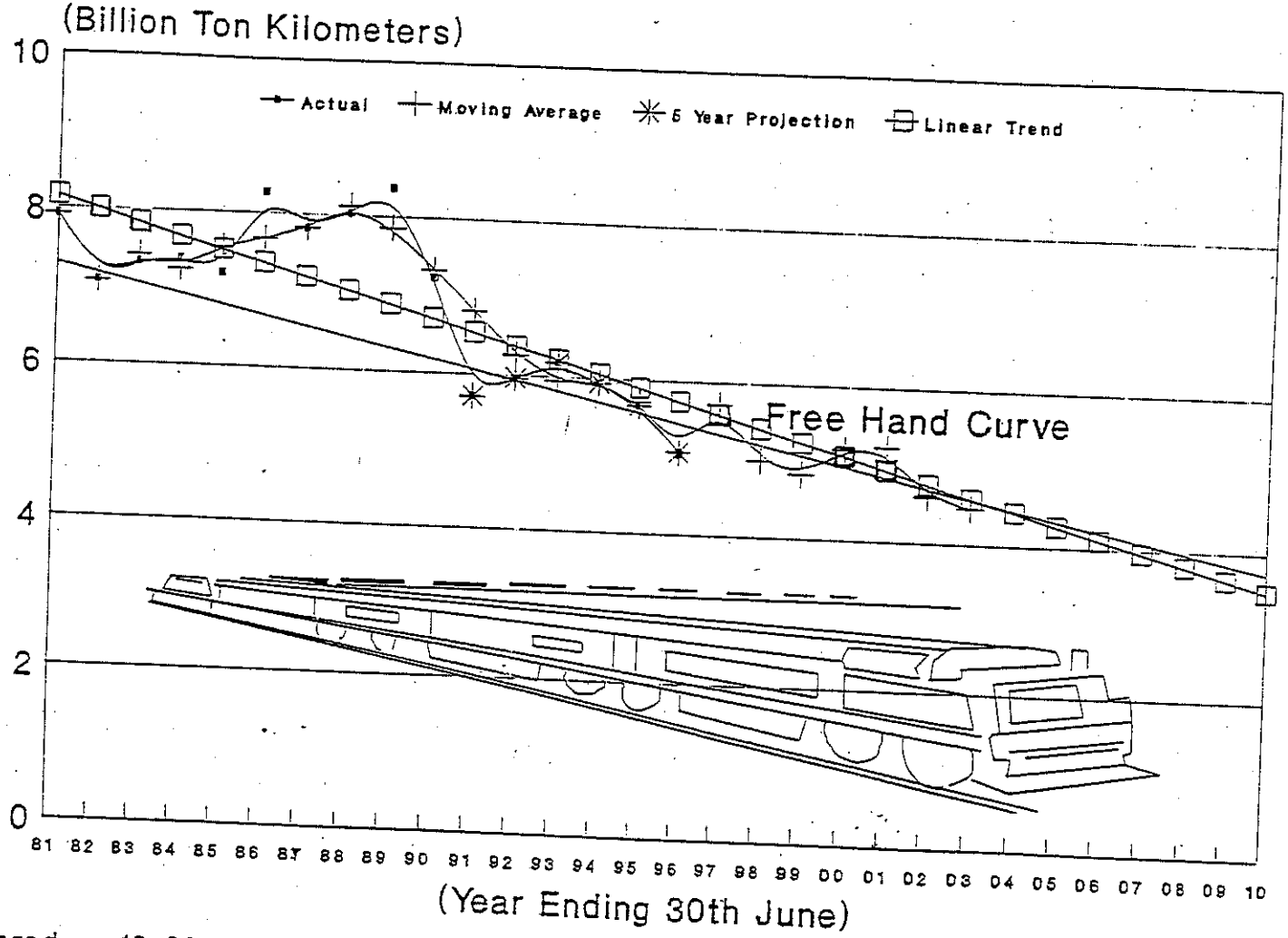
TON KILOMETERS BY RAIL
(FREE HAND PROJECTION)



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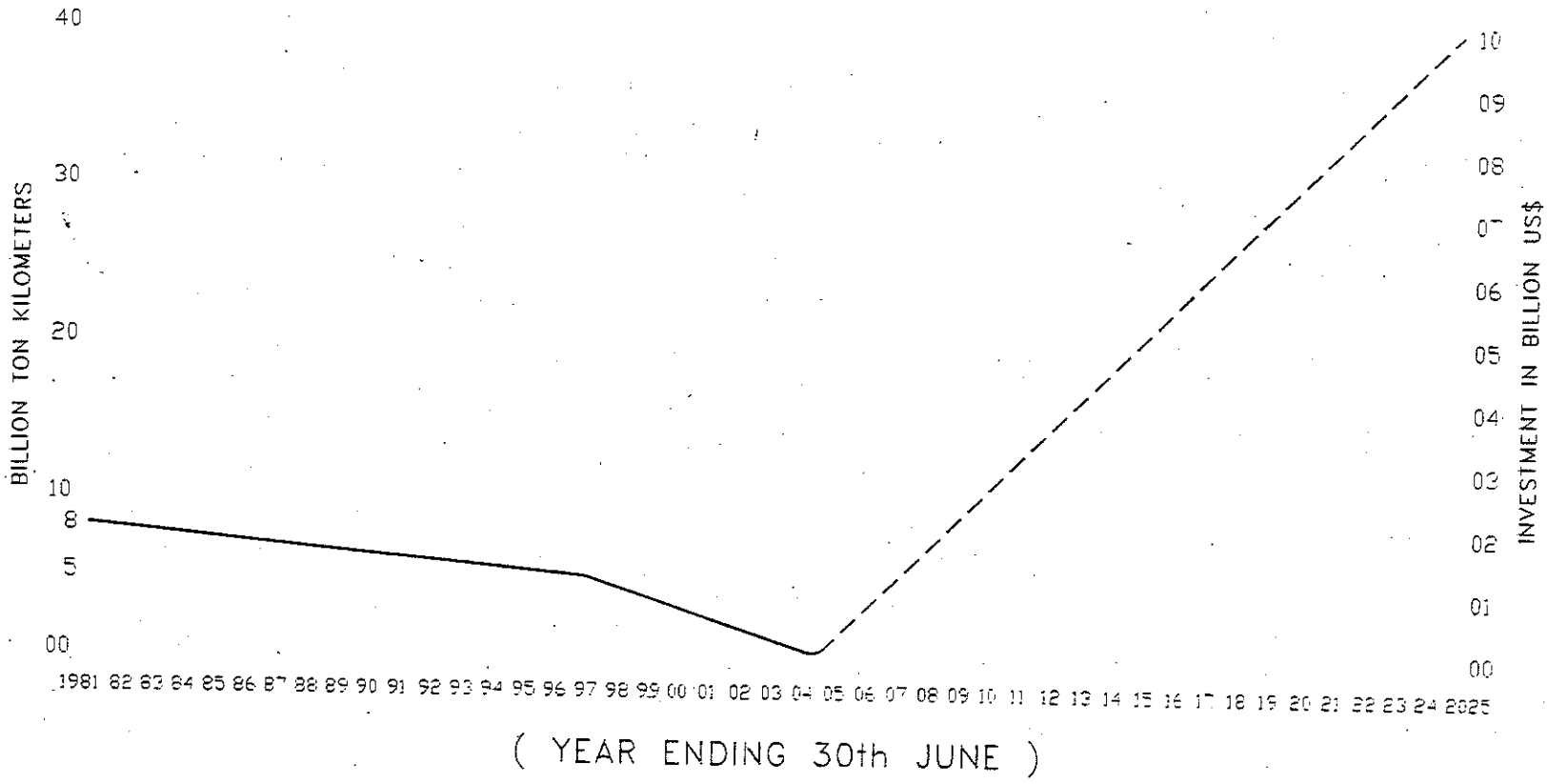
3. Future Strategy and Prospects

One thing is certain that the GOP is not in a position to make capital investments as required and demanded by the PR Management. In order to cater for the passenger as well as freight traffic during the next five to ten years as is being forecast by the concerned Sub-Working Transport Group of Planning Commission regarding forecast of transport projections for the 9th Plan and perspective plan, the foreign exchange investment involved is of the order of $ 1 5 billion which is next to impossible to be generated by the government of Pakistan through its own resources. Therefore, privatisation of various activities of Pakistan Railway is a Must. Privatisation will only be successful if total transparency is observed by the PR/GOP while offering contract, franchises, etc. to the foreign as well as local enterpreneurs. GOP has already approved its 'Open Access Policy' in respect of right traffic especially oil traffic for the newly private sector power plants. The World Bank has assisted PR/GOP in the formulation of various sets of conditions as required in different kinds of agreements to be entered by the GOP and Pakistan Railway with the private investors, operators and managers. Therefore, Pakistan Railway has to prepare its 9th Plan and perspective plan in the light of the above considerations.

IX RESURRECTION AND REJUVENATION OF PAKISTAN RAILWAYS - TO MEET TRANSPORT CHALLENGES OF 21ST CENTURY

1. Since the Railway infrastructure is available within Pakistan in the form of Pakistan Railways and major corridors of traffic have already been identified, the biggest transport corridor being along the main line i.e. Karachi to Peshawar via Lahore. Besides Pakistan Railway is connected with Iran and India at four points. Connection with Afghanistan by rail is also in the offing so as to reach the CIS states in the near future. Therefore, it is but obligatory and imperative that Pakistan Railways should be resurrected and rejuvenated to meet the transport challenges of 21st century. This challenge is not difficult to meet and compete with other world Railways such as French national Railways, Japanese National Railways and Indian Railways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(YEAR ENDING 30th JUNE)

IV. Introduction of high speed light weight passenger bogies and freight wagons replacing the entire existing ramshackled stock of railway passenger carriages and goods wagons.

V. Introduction of CTC and continuous train control system with signal control stations/sections, one kilometer apart. These signals, if not physically put on the line even then their aspects will be visible within the locomotive cab. Automatic braking in case Driver is inattentive, sleepy or drugged, the train will come to stop automatically if it is disregarding the signal. So these will be almost driverless trains. However, to cover the psychological aspect of the passenger, an Engineer Driver will always be available within the locomotive cab.

VI. Fibre optic telecommunication will be introduced on this main corridor either independently or in collaboration with Pakistan Telecommunication Corporation.

VII. Modern freight handling and terminal facilities will be introduced at all the major yards and stations.

VIII. All the major yards right from Karachi to Peshawar will be made automatic.

IX. Last but not least, human resource will be developed to plan, design, construct, operate and manage this modern Pakistan Railways locally in the form of tradesmen, technicians, technologists, engineers, experts and overall managers.

Concluding it can be reasonably surmised that the commissioning of a new Pakistan Railways on the lines mentioned above is not something unachievable. Rather it is the order of the day to avoid the dooms-day scenario as predicted earlier if Pakistan tries to meet its transport needs through Highways and Airways. It is yet not everything lost provided we as a nation rise and understand, build, operate and manage a modern Railway system.

ANNEXURE - I

PAKISTAN RAILWAYS
YEAR BOOK 1995 - 96
PRINCIPAL STATISTICS

PLANT & EQUIPMENT	UNIT	1994 - 95	1995 - 96
Route - Kilometers	Kms.	8,774.87	8,774.87
Track - Kilometres	Kms.	12,624,73	12,624,73
Locomotives	No.	676	652
Coaching Vehicles	No.	2,343	2,862
Other Coaching Vehicles	No.	401	384
Freight Wagons	No.	29,228	28,561
Railway Stations	No.	815	808
OPERATIONS			
Passenger, Mixed & Other Coaching Trains Run.	No.	119,331	111,968
Train Kilometers, Passenger Mixed and Other Coaching	Thousand	32,928	32,782
Coaching Vehicle-Kilometres	Thousand	583,774	576,271
Freight Train run	No.	34,620	33,347
Freight Train-Kilometres (Freight & Mixed Trains)	Thousand	9,392	9,433
Other Coaching freight Tonne-Kilometres	Thousand	486,740	498,633
		2,518,517	2,618,904
VOLUME OF TRAFFIC			
Passengers Carried	Thousand	61,717	66,465
Passenger Kilometres	Thousand	16,385,132	17,555,387
Tonnes of Freight Carried	Thousand	8,036	7,356
Tonne - Kilometres	Thousand	5,938,756	5,660,993
Tonne - Kilometres Freight & Coaching Combined.	Thousand	8,457,273	8,279,897
Freight Wagons Loaded	No.	427,174	389,439
FUEL CONSUMPTION			
Furnace Oil	Tonnes	42,490	40,893
H.S.D. Oil	Tonnes	150,614	147,784
Electric Energy	KWH	28,256,700	22,394,700
Coal	Tonnes	1,091	1, 089
EMPLOYMENT & WAGES			
Persons Employed	No.	116,026	113,186
cost of Employees	Thousand	3,664,772	4,307,502*
FINANCIAL RESULTS			
Gross Earnings	Thousand	9,134,023	9,721,623*
Total Ordinary Working Expenses	Thousand	7,801,274	7,912,052*
Operating Ratio	Percent	85,4	81.4*
	*Provisional		

CONSULT MAPS OF P.R ANNEXURE IV & V

ANNEXURE - II

PAKISTAN RAILWAYS
YEAR BOOK 1995 - 96
PRINCIPAL STATISTICS

PLANT & EQUIPMENT	UNIT	1994 - 95	1995 - 96
Route - Kilometers	Kms.	8,774.87	8,774.87
Track - Kilometres	Kms.	12,624,73	12,624,73
Locomotives	No.	652	638
Coaching Vehicles	No.	2,041	1,862
Other Coaching Vehicles	No.	384	384
Freight Wagons	No.	28,561	26,755
Railway Stations	No.	808	781
OPERATIONS			
Passenger, Mixed & Other Coaching Trains Run.	No.	111,968	111,418
Train Kilometers, Passenger Mixed and Other Coaching	Thousand	32,782	34,186
Coaching Vehicle-Kilometres	Thousand	576,271	610,025
Freight Train run	No.	33,347	26,021
Freight Train-Kilometres (Freight & Mixed Trains)	Thousand	9,433	8,188
Other Coaching freight Tonne-Kilometres	Thousand	498,633	430,165
		2,618,904	2,501,859
VOLUME OF TRAFFIC			
Passengers Carried	Thousand	66,465	73,652
Passenger Kilometres	Thousand	17,555,387	18,904,765
Tonnes of Freight Carried	Thousand	7,356	6,854
Tonne - Kilometres	Thousand	5,660,993	5,077,363
Tonne - Kilometres Freight & Coaching Combined.	Thousand	8,279,897	7,579,225
Freight Wagons Loaded	No.	389,439	383,122
FUEL CONSUMPTION			
Furnace Oil	Tonnes	40,893	32,248
H.S.D. Oil	Tonnes	147,786	145,508
Electric Energy	KWH	22,394,700	20,439,300
Coal	Tonnes	1,089	680
EMPLOYMENT & WAGES			
Persons Employed	No.	113,186	104,281
cost of Employees	Thousand	4,307,502	4,590,696*
FINANCIAL RESULTS			
Gross Earnings	Thousand	9,721,623	8,362,822*
Total Ordinary Working Expenses	Thousand	8,702,387	9,242,052*
Operating Ratio	Percent	89,5	101.5*
	*Provisional		

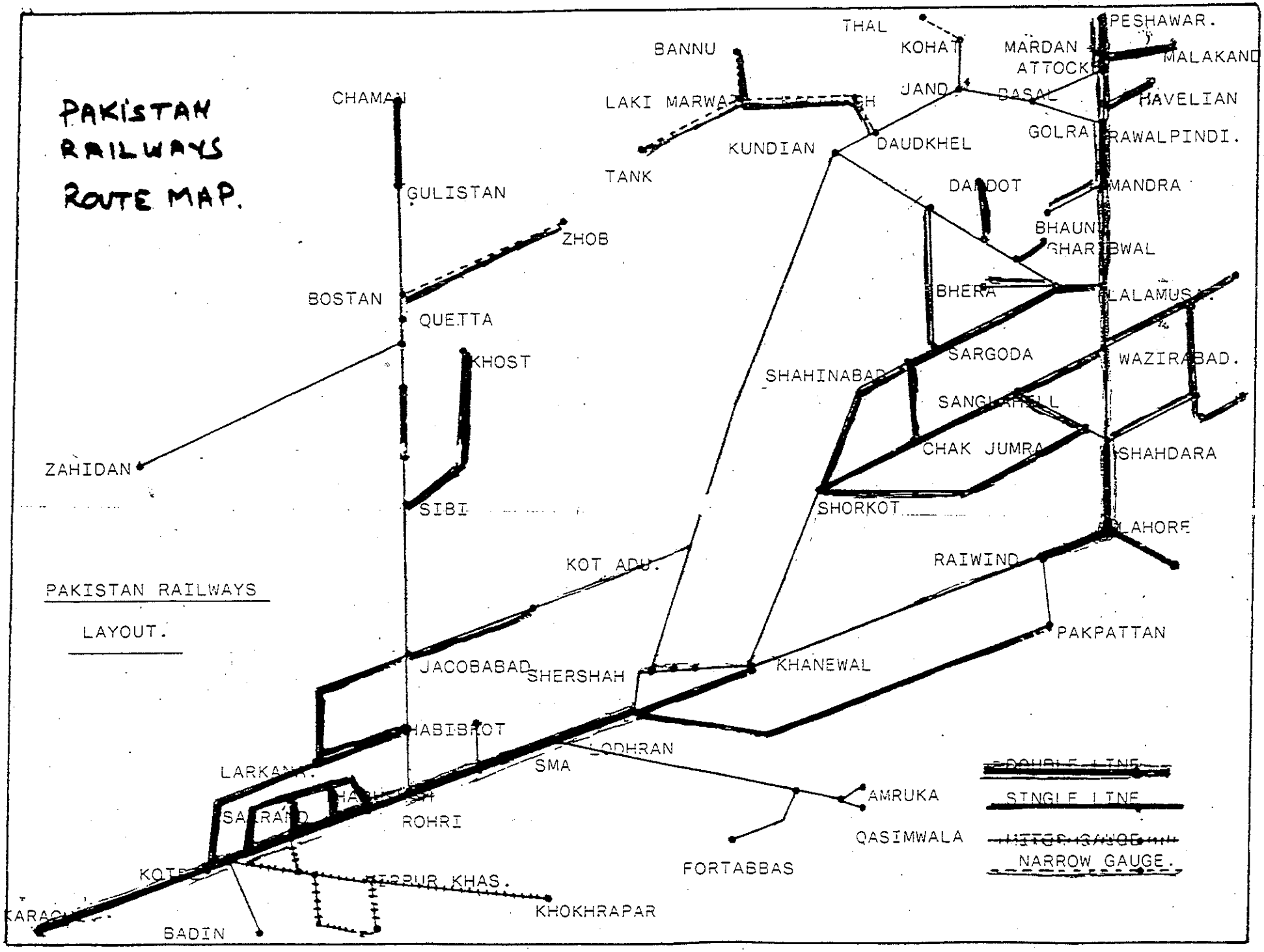
ANNEXURE - III

INDIAN RAILWAYS
YEAR BOOK 1994 - 95

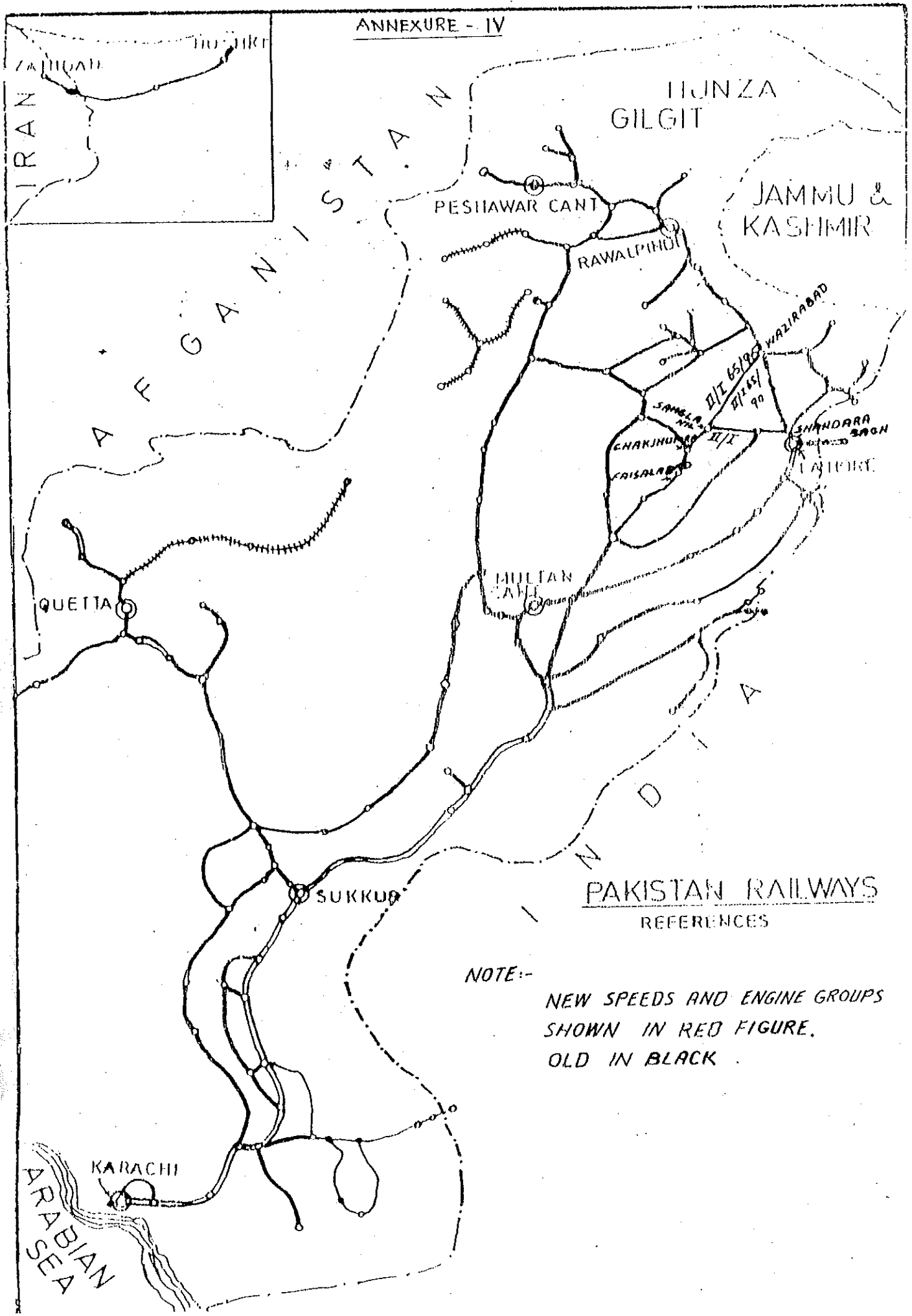
KEY STATISTICS - 1994 - 95

1.	Route Length (Kms)	Broad Gauge Metre Gauge Narrow Gauge TOTAL	39,612 19,210 3,838 62,660
2.	Double and Multiple Track (Route Kms)	Broad Gauge Metre Gauge TOTAL	14,995 94 15,089
3.	Electrified Track (route Kms) (Opened to traffic)	Broad Gauge Metre Gauge TOTAL	11,606 166 11,7722
4.	Number of Railway Stations		7,056
5.	Number of Railway Bridges		117,869
6.	Traffic volume (Millions) Passengers Originating Tonnes Originating Passenger Kms. Tonne Kms.		 3,915 381,55 319,365
7.	Number of employees (Thousands)		252,967
8.	Revenue (Rs. in Millions)		1,602
9.	Expenses (Rs. in Millions)		201,010
10.	Rolling Stock		165,901
		Locomotives: Steam Diesel Electric TOTAL Passenger Carriages Freight Cars	 347 4,259 2,302 6,908 33,678 291,360

ANNEXURE V


PAKISTAN RAILWAYS ROUTE MAP.
PAKISTAN RAILWAYS
LAYOUT.
THAL
KOHAT
PESHAWAR.
MARDAN
ATTOCK
MALAKAND
BANNU
LAKI MARWAT
JAND
DASAL
HAVELIAN
CHAMAN
KUNDIAN
DAUDKHEL
GOLRA
RAWALPINDI.
TANK
GULISTAN
DANDOT
MANDRA
ZHOB
BHAUN
GHARIBWAL
BOSTAN
BHERA
LALAMUSA
QUETTA
KHOST
SARGODA
WAZIRABAD.
SHAHINABAD
SANGLAHILL
CHAK JUMRA
SHAHDARA
ZAHIDAN
SIBI
SHORKOT
LAHORE
KOT ADU.
RAIWIND
PAKPATTAN
JACOBABAD
SHERSHAH
KHANEWAL
HABIBKOT
ODHRAN
LARKANA
SMA
AMRUKA
SAKRAND
ROHRI
QASIMWALA
KOTRI
MIRPUR KHAS.
FORTABBAS
KHOKHRAPAR
KARACHI
BADIN
DOUBLE LINE
SINGLE LINE
METER GAUGE
NARROW GAUGE.

ANNEXURE - IV



PAKISTAN RAILWAYS

REFERENCES

NOTE:-

NEW SPEEDS AND ENGINE GROUPS SHOWN IN RED FIGURE.
OLD IN BLACK.

traffic of 153,874 billions. Based on the fast dwindling freight traffic as represented by above figures, two Graphs placed as Figure - 1 and figure - 2 may be consulted. In accordance with the trend, if persisted, the Pakistan Railways will be out of freight traffic by the year 2005-2006. In the second Graph, a free hand curve plotted stipulates downward trend yet it maintains some position of the Railway within the freight market up to the year 2010 subject to modest investment in the equipment and infrastructure sectors. The ministry of Railways has, however, planned an optimistic estimated forecast for passenger kilometer traffic as 22 billions by the year 2002-03, with 3.3% annual increase against the road sector increase of 5.32%. Similarly, in the respect of optimistic estimated forecast for rail freight traffic is 12,00 billion tonne kilometres with a 20.62% increase annually by the year 2003 starting from base year 1997 against the Road sector increase of 8.5% annually for the corresponding period. From the above latest forecast gathered by the transport sub-group deputed for this purpose by the Planning Commission, it is absolutely clear that if Railways are starved for funds and investments in the equipment and infrastructure sector then the entire burden of freight as well as passenger traffic will fall on the road sector especially along the major corridor i.e. Karachi, Hyderabad, Sukkur, Multan, Lahore, Rawalpindi and Peshawar

Figure 1

Figure 2

which corridor is catered for both the Pakistan Railways and the Road sector. The road infrastructure will definitely collapse if further burdened with the traffic which is presently being carried by Railways and also due to the growth rate of 10% per annum on national level. The movement of freight and passengers by road from Karachi to upcountry in this corridor will portray a dooms-day scenario spelling out an environmental disaster even if one can tolerate the pollution and the resultant traffic hazards that this colossal movement will bring about and the road infrastructure will collapse beyond redemption.

2. Consequently the solution lies in moving these large long haul bulk quantities of freight and large number of human-beings by Railways, the capacity of whose existing infrastructure is grossly under-utilised.

just across the border are doing yeoman service in respect of transport needs of th countries and nations.

2. In order to do justice to the above stated challenges, two Graphs have been evolved taking into consideration all the factors mentioned especially in paras VII & VIII above which depict the planned productivity level of the PR in respect of passenger kilometers and tonne kilometers by the year 2025 (Consult Figures 3 & 4). According to

Figure 3

Figure 4

Figure - 3, passenger kilometrage i.e. proposed to be achieved is 50 billions. Similarly tonne kilometers are planned to be achieved is 40 billions. However, these figures can be achieved only by ploughing in major investments of the order of dollars 10 billions as shown on the two Graphs (Figure 3 & Figure - 4). It is reasonably assessed from the technical point of view that the Railway infrastructure especially that of track in the major corridor viz: Karachi to Peshawar via Lahore can be made fit to run 200 trains per 24 hours out of which 125 or so can be passenger trains and 75 freight trains.

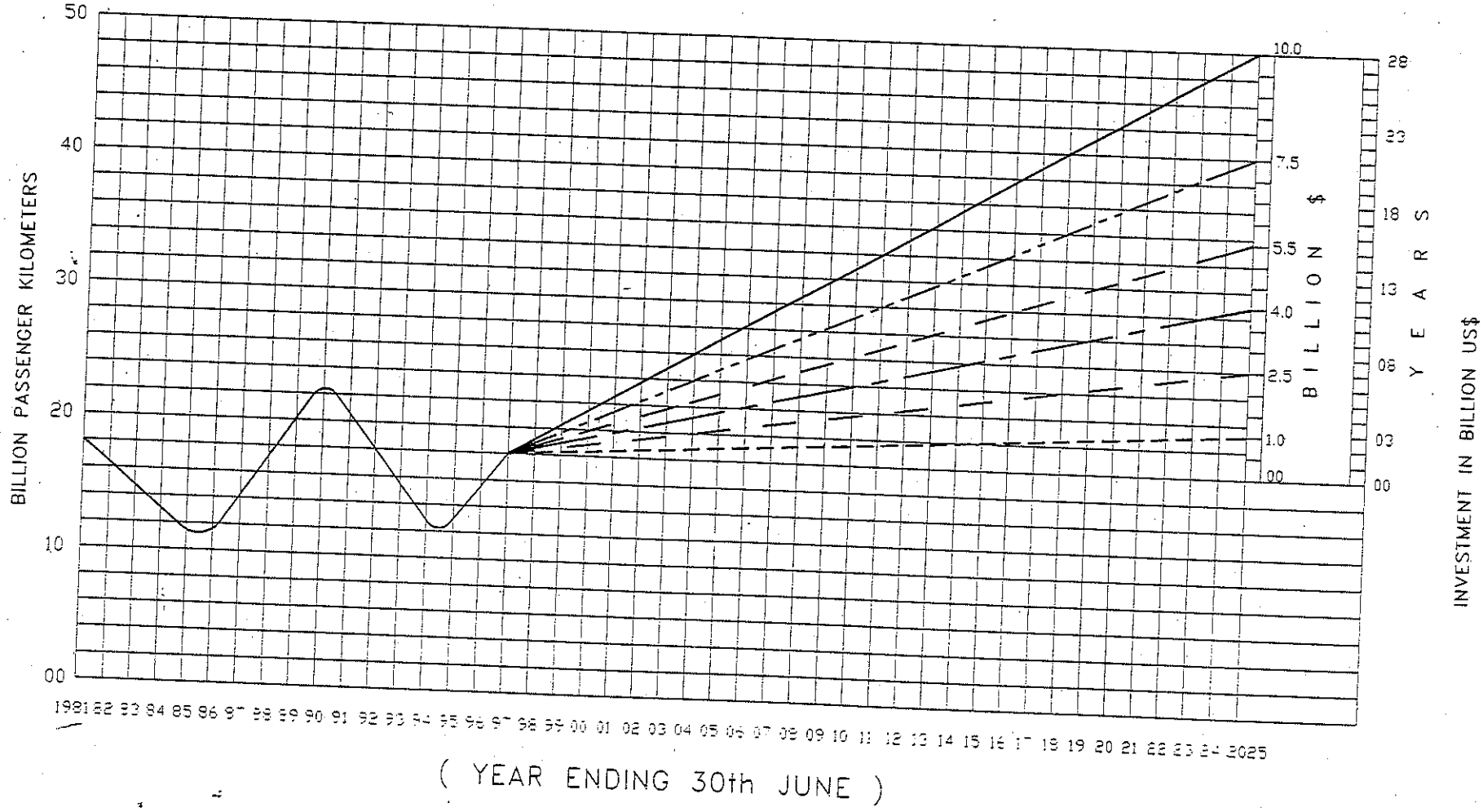
The projects, works, technologies and systems that will have to be inducted in this main corridor which carries about 80% of the total traffic at the moment are indicated as under:

I. The entire mainline between Karachi and Peshawar via Lahore will be a double line without any gap whatsoever.

II. The track structure alongwith re-construction and strengthening of bridges will be undertaken. The present track structure consists of 46 kg. rail over pre-stressed concrete sleepers with 12" ballast cushion. This will have to be upgraded to 50kg. rail with concrete sleepers having 25% more section Modulus (strength) over 18" cushion of well compacted ballast.

III. Electric traction will have to be introduced on this main line.

PROPOSED PLANNED INCREASE IN PRODUCTIVITY OF PASSENGER KILOMETERS TO BE CARRIED BY PAKISTAN RAILWAYS.



(YEAR ENDING 30th JUNE)

PROPOSED PLANNED INCREASE IN PRODUCTIVITY OF GOOD TONS KILOMETERS TO BE CARRIED BY PAKISTAN RAILWAYS.