

GOVERNMENT OF PAKISTAN  
PLANNING COMMISSION  
NATIONAL TRANSPORT RESEARCH CENTRE

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PC-I  
ROAD RESEARCH WING IN  
NATIONAL TRANSPORT RESEARCH CENTRE

(Revised)

571  
NTRC-122

June, 1989

PART 'A'

PROJECT DIGEST

1. Name of Project: ROAD RESEARCH WING IN  
NATIONAL TRANSPORT RESEARCH CENTRE
2. Authorities responsible for:
  - (i) Sponsoring : PLANNING & DEVELOPMENT DIVISION
  - (ii) Execution : National Transport Research Centre
  - (iii) Operation & Maintenance : National Transport Research Centre
3. Time required for completion of Project: 48 Months
4. Plan Provision : Rs. 125 Million
5. Relationship of the Project with Objective of the Sector:

Road transport is regarded as a very major part of the socio-economic infrastructure of the country and socio-economic development of a nation is often measured in terms of size, density and quality of its road network. It is perhaps the only mode through which total integration of the country can be achieved. Therefore, the scale, capacity and technological level of the road transport network as well as its performance (quality of traffic service) are significant indicators of economic advancement of the country.

The growth of production, increase in per capita income and broadening of foreign trade relations alongwith specialization and concentration of production and consumption centres over past few decades has lead to a steady increase in the overall transportation demand. The traffic has increased from 24.3 billion metric ton km and 75.0 billion passenger km to 39.5 billion ton km and 130.0 billion passenger km between 1978-79 and 1987-88 i.e. 63% as regards freight traffic and 73% as regards passenger traffic. The traffic projected by the end of Seventh Five Year Plan i.e. 1992-93 is estimated at 48.0 billion ton km and 166 billion passenger km

i.e. an increase of 22% and 28%, respectively. The share of road freight traffic over the years has also been continually increasing i.e. from 51% in 1971-72 to 74% in 1982-83 and 80% in 1987-88. The share of road passenger traffic has, however, increased marginally from 78.8% in 1971-72 to 80% in 1982-83 and 85% in 1987-88.

Recognizing that in order to meet the transport requirements of the economy efficiently, the transport as a whole, and road transport in particular, need to be constantly improved, the allocation for transport as a whole and roads in particular has been increased manifold since 1970-71, inspite of great restraints on resources. The Seventh Five Year Plan (1988-93) envisages an investment of Rs. 81.957 billion in Transport including Rs. 39.130 billion in Public Sector, and Rs. 42.827 billion in the Private Sector. Out of this, a major part (75.6%) is earmarked for road transport (road infrastructure and motor vehicles) as per the following details:-

SEVENTH PLAN

( Rs. Billion )

Sl.No.	Private	Public	Total
1. Railways	8.485	-	8.485
2. Roads	18.293	9.147	27.440
3. Road Transport	2.277	32.240	34.517
4. Ports and Shipping	4.486	1.440	5.926
5. Air Transport	5.364	-	5.364
6. Others	0.225	-	0.225
TOTAL :	39.130	42.827	81.957

The existing road system was designed during first half of the century for small amount of slow moving traffic. The technological improvements over the years have greatly increased the speed and weight of the vehicles. The number of vehicles have also increased over time. This has brought new problems in its wake and has greatly increased the urgency of improving road standards, methods and materials, to bring it in line with the present day requirements.

The increased emphasis on the transport sector in general and road transport in particular in the face of limited resources warrant 'optimal utilization of investment' i.e. expended in manner which would yield highest return. The experience of other developed countries shows that this can only be done if extensive research is carried out to evolve the most economical design, execution, operation and maintenance of the transport infrastructure, as is evident from the profound impact which Transportation and Road Research Laboratory - U.K. had on various aspects of economical road planning, design, construction and maintenance of roads all over the world in general and in U.K. in particular. The administrative control of roads in Pakistan are divided among various agencies i.e. National Highways Board, four provincial highway departments, Azad Jammu and Kashmir, Northern Areas Works Organization, Frontier Works Organization, FATA-DC and a large number of local bodies. Two options are available to meet the research needs of these agencies. Either develop full-fledged research facilities in all the agencies or have one central facility at the federal level. Since this situation of fragmented administrative control is not unique to Pakistan alone, the common practice in most developed countries is that the research, which is of common interest to all agencies, is accepted a typical federal government

responsibility and carried out at a central place. The provincial Highway Departments concentrate on material testing, quality control, etc. The local governments, in view of their limited resources, do not undertake any research on their own.

6. Capital Cost of the Project:

	( Million Rs. )
Local Costs	32.613
Foreign Exchange Costs	19.132
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Total :	51.745
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7. Annual Recurring Expenditure after Completion

Local Costs	7.173
Foreign Exchange Costs	0.350
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Total ,:	7.523
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8. Objectives of the Project:

- (i) To provide research facilities in terms of manpower equipment and material to enable the Wing to develop a reliable and effective in-house expertise for research in roads.
- (ii) To fill-in the gap in R&D activities of various road research agencies i.e. Provincial Material Testing Laboratories to ensure adequate R&D support for their investment programme.
- (iii) To coordinate the research efforts taking place in the field of roads in the country to avoid un-necessary and wasteful duplication of research resources and efforts.
- (iv) To establish liaison with other institutions in the developed as well as developing countries in the Field of Research and Development in Roads.
- (v) To act as clearing house for all the research being undertaken in the country in the field of Road and project it among various international agencies.
- (vi) To help other insitutions develop indigenousexpertise and accelerate the pace of research and development in the field of Road Transport.

- (vii) To obtain sponsorship of international agencies for research in the areas of Road Transport where the Institute has built sufficient expertise to undertake research independently or to collaborate in areas of mutual interest.
- (viii) To disseminate results of research undertaken by the Institute and other national and international bodies in the field of Road Transport among various individuals and organizations both at the local and international level.
- (ix) To implement/execute experimental pilot projects on the basis of research carried out by Institute to establish viability of the research efforts and also to give it 'problem oriented outlook'.
- (x) To organize national and international seminars to discuss the problems facing the country in the field of Road Transport and make suitable recommendations to the Government.
- (xi) To arrange and organize training courses in road transport planning, appraisal, design, execution, monitoring, operation and maintenance.
- (xii) To undertake consultancy work in the field of transport.

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PART 'B'

PROJECT DESCRIPTION AND FINANCING

9. Location of Project: ISLAMABAD

10. Existing Facilities:

A brief description of the existing R and D facilities in the country in the field of transport is given below:-

(a) Road Research & Material Testing Institute, Lahore: The Institute was established in 1951 (previously it was named as Road Research Laboratory, but has recently been re-named as Road Research and Material Testing Institute). Originally, the Laboratory was entrusted with the work of carrying out research in buildings as well as in roads. This arrangement continued upto 1961 when it was bifurcated into two separate organizations one each for Buildings and Roads. Since then, the Institute is exclusively meant for research and testing in the field of roads and bridges.

The Institute has upto now devoted itself to routine work which includes site investigation, soils and materials testing, etc. Very little R&D work on other important problems related to roads has been done.

The Institute is organized into five sections covering : (i) Soils; (ii) Aggregates; (iii) Bitumen Materials; (iv) Cement Concrete; and (v) Chemicals.

The Institute has a total sanctioned staff of 126 out of which there are 8 officers including one Director (BPS-19), 3 Assistant Directors/Research Officers (BPS-18) and 4 Junior Research Officers (BPS-17). The technical support staff total 91 including



13 Research Assistants, 39 Laboratory Assistants, and 39 Laboratory Attendants. In addition, there are 27 clerical and service personnel including Clerks, Stenographers, Stenotypists, Drivers, Mali, Naib Qasid, etc.

The Budget of the Institute for 1988-89 amounts to Rs. 4.2 million including Rs. 3.5 million for establishment charges and Rs. 0.7 million for maintenance and repair of building, equipment, etc.

The Institute is spread over an area of about 24 acres with a built up area of 26,268 sq.ft. containing Administrative Block (15,612 sq.ft.), Laboratories (10,656 sq.ft.), Hostel for 34 trainees and residential accommodation for 34% of its employees.

- (b) Road Research & Material Testing Institute, Peshawar: The Institute consists of a small Laboratory containing four sections covering : (i) Soils, (ii) Concrete, (iii) Bitumen, and (iv) Chemicals.

The Institute has sanctioned strength of 20 persons including 3 officers (1 Research Officer, 1 Assistant Research Officer and 1 Assistant Engineer), 7 Junior Technical Staff including Laboratory Assistants/ Attendants, etc. and 10 clerical and service personnel. The Budget of the Institute for 1988-89 is Rs. 0.3 million. This covers mostly salaries of the staff and a nominal amount for the repair and maintenance of equipment.

The covered area occupied by the Institute is 1,044 sq.ft. including two Laboratory Halls of 1,020 sq.ft. and an office room of 224 sq.ft.

(c) The National Transport Research Centre: The Centre was set-up in 1974-75 under the Planning Commission as a development project to carry out operational research in all modes of transport. However, due to budgetary restraints, the Centre was able to concentrate on only the operational research in Transport Planning, Transport Economics and Highway Safety. A Data Bank for transport has also been developed. The sanctioned staff strength of the Centre is 62, out of which only 19 are professionals (16 in-position) and the remaining are complementary administrative and secretariat staff. Over the years, Centre also had the benefit of a number of foreign experts namely; one from Holland in Shipping and four from U.K. (one each in research organization, highway safety, rural roads and urban transport).

Beginning 1978-79, the staff salaries and other establishment charges was transferred to the Revenue Budget. The total expenditure upto 30-06-1989 amounts to Rs. 59.666 million, all in local currency, as per details given below:-

EXPENDITURE OF NTRC  
(ORW & RRW)

( RS. MILLION )

Y e a r	DEVELOPMENT BUDGET			NON-DEV.	TOTAL
	Staff	Studies	Total	Staff	Staff + Studies
1	2	3	4	5	6
1974-75	0.481	0.088	0.569	-	0.569
1975-76	0.311	0.026	0.337	-	0.337
1976-77	0.347	0.092	0.439	-	0.439
1977-78	0.454	0.165	0.619	-	0.619
1978-79	-	0.560	0.560	0.493	1.053
1979-80	-	0.682	0.682	0.575	1.257
1980-81	-	0.560	0.560	0.457	1.017
1981-82	-	0.447	0.447	0.617	1.064
1982-83	-	1.088	1.088	0.739	1.827
1983-84	-	2.892	2.892	0.913	3.805
1984-85	-	3.169	3.169	1.056	4.225
1985-86	-	6.889	6.889	1.414	8.303
1986-87	-	5.174	5.174	1.879	7.053
1987-88	-	11.973	11.973	2.198	14.171
1988-89*	-	11.544	11.544	2.383	13.927
Total :	1.593	45.349	46.942	12.724	59.666

\* Estimated.

The allocation for Seventh Plan amount to Rs. 125.00 million. As of 30.06.1989, the Centre has completed 126 studies, 17 are in-hand. The list of the studies may be seen at Annex-K. The Centre, at present, is housed in rented building.

Inadequacy of Existing Research Facilities:

The research facilities available in the country in the field of transport in general are totally inadequate to meet the requirement of development of the sector and far below the needs of development outlays as provided in various plans for transport sector. The inadequacy of proper R and D facilities in the field of transport has been repeatedly brought out by various expert groups appointed by the Government from time to time. Brief excerpts from some of the past studies are given below:

- (a) M/s Howard, Needle, Tammen and Bergendoff: The West Pakistan Communication and Works Department in 1962 appointed M/s Howard, Needle, Tammen and Bergendoff as General Highway Consultants. The terms of reference of the Consultants among other things also included evaluation of conditions and functional efficiency of the operation of Road Research Laboratory, Lahore. In their Stage-I Report on Appraisal of Existing Organizations, Facilities and Expansion Plans for the Road Research Laboratory concluded that "No fundamental research work in the true sense of the definition, is carried out by the Laboratory". They found that the Laboratory was greatly handicaped due to non-availability of staff, poorly trained research worker, low morale due

to lack of proper career planning, lack of adequate incentives and in-sufficient funds. An analysis of expenditure made by the Consultants indicated that expenditure on research was hardly 0.1% of total expenditure on road construction, in province of Punjab. The expenditure in other provinces was almost nil. The position today is not much different.

The Consultants stressed the need for the expansion of research facilities to meet increased responsibilities resulting from new high development programme. They recommended:-

- (i) Re-organization of Road Research Laboratory at Lahore and Organization of Regional Field Laboratories for material testing and quality control.
  - (ii) Acquisition of adequate laboratory equipment, supplies and facilities.
  - (iii) Training of personnel both within the country and abroad in all the important subjects connected with road research.
  - (iv) The organizational strength recommended by the Consultants consisted of 89 persons at the Central Road Research Laboratory and 28 persons each at five Regional Laboratories.
- (b) Fourth, Five Year Plan: The need for a transport research centre at the national level was also strongly stressed in the Fourth Five Year Plan in the following words:-

"Transport and Communications system have been changing rapidly in the past decade. Continuous research is essential if we are not to end up using methods which are crude and have become obsolete. To prevent this happening, the Transport Planning Cells in the provinces are being strengthened for proper coordination with the provincial and outside agencies and for the

sake of national perspective, a 'National Transport Research Centre' will be set up to undertake the much needed technical and economic research at the national level".

(c) Hashmi Committee: The Roadad Committee on Research and Development constituted in 1975, appointed a panel under the Chairmanship of Mr. T. H. Hashmi, an eminent Transportation Engineer to look into the state of the affairs in the field of transportation research. The observations and recommendations of the panel are as follows:-

- (i) The Research Institute in the field of Transportation are neither properly maintained nor adequately staffed.
- (ii) The number of Research Institutions in the country are very few. There is a positive need for creating more facilities.
- (iii) There is no coordination among existing research organizations with the result that there is complete lack of information about the research capabilities and research activities of various Institutions. There is urgent need for creating a central agency to work as clearing house of information regarding research activity in the various organizations.
- (iv) There are obvious gaps in the present research efforts which do not allow proper utilization of the existing facilities. There is also need for establishing new institutions as well as enlarging the scope of existing ones.
- (v) There is need for streamlining the procedure to ensure that the Government is kept fully informed of the research activity in various institutions.
- (iv) There is lack of accountability to ensure that the results achieved by research institutions are commensurate with the amount spent on them. This may, however, be viewed in the light of the fact that only token amount was spent in R and D in the past in the field of transportation. Research has not been taken very seriously and as a result not much was expected from these institutions to justify their existence.

(vii) The problems tackled by the existing institutions in the past were mostly local in nature and did not have wide spread impact.

(d) Roadad Committee: The Roadad Committee after thorough deliberations summarized their observations regarding R and D in the field of transport as follows:-

- (i) There are obvious gaps in the present research effort which does not allow proper utilization of the existing facilities.
- (ii) There is also need for establishing new institutions as well as enlarging the scope of the existing one.
- (iii) There is need for streamlining the procedure to ensure that the Government is kept fully informed of the research activity in various institutions.
- (iv) There is lack of accountability on the part of R and D institutions and it is imperative to ensure that the results achieved by research institutions are commensurate with the amount spent on them.

" The Committee further added that U.N. recommend that at least 5 per cent development budget may be spent on R and D. Whereas according to established standards, the minimum investment in the areas of project planning, design and execution to ensure optimum utilization of investment must be 1.5%. In contrast, the investment in Research and Development in Pakistan in the area of Transport in the past has averaged less than 0.05%. The allocation during Sixth Plan amount to only 0.24% of Public Sector expenditure. As a result, the benefits derived from the investment were far below the expectation and a substantial portion of the investment was wasted due to outmoded planning, design, appraisal, execution, monitoring and operation".

Types of Transport Research:

Research as a whole may be broadly categorized into two basic areas : (a) Basic Research, and (b) Adaptive Research. Basic research is the original work aimed at developing new relationships between the variables, invention of new theories, development of hardware as well as software. On the other hand, the adaptive research is carried out on the ways and means by which the technological know-how obtained in advanced countries could be applied to conditions prevalent in lesser developed countries. Most of the research being carried out in developing countries at present is adaptive research. Only when sufficient sophisticated institutions are developed, basic research can be undertaken.

In the field of road transport, research may be defined as not only getting the facts, experimentation, equipment development, although these may be indispensable, but also conception of new relationship between the variables entering into the problems and can be divided into three broad categories viz:

- i) Industrial Research: Industrial research can be defined as the research which is carried out for production and improvement of the basic transportation model. It involves research on the design of the components used for the production of transportation vehicles, fuel systems, types of motive units and other components, etc.



- ii) Structural Research: Structural research relates to the load carrying capability of the structures on which the vehicles ply i.e. road pavements, bridges, etc.
  
- iii) Operational Research: The operational research, though relatively a newer form of research is most important due to the fact that the optimal use of the facilities made available as a result of advancement in both the industrial and the structural standards are dependent upon the operational research.

There are two approaches to operational research.

- a) The Empirical Approach: The empirical approach represents the traditional approach. It has provided most of the present knowledge in the field of transportation engineering. The empirical approach primarily draw upon observations, measurements and statistical behaviour of the transportation phenomenon. The empirical approach has, however, failed to answer many questions about the behaviour of traffic, and optimization of infrastructure facilities and the stochastic occurrence of events in transportation.
  
- b) The Systems Approach: The latest approach adopted for operational research is called the systems approach. The system is defined as a set of objects and with relationship between the objects and between their attributee. In the case of road transport, the vehicle, the drivers, the road, may be defined as the objects, and driver's vision, reaction time, vehicle speed, accelerating and decelerating capability, head way, street width and traffic controls as the attributes.

A system therefore is a collection of diverse human - machine elements integrated to achieve a common desired objective by manipulation and control of materials, information, energy and human. The system approach involves formulation of the mathematical methods; analysis of sensitivity and stability of the system with respect to their elements; analysis of the compatibility of the various components and sub-systems.

The system's approach is especially suitable for tackling transport problems which are inherently very complex. Even on apparently single problem situations can seldom be corrected by changes in any one factor or by un-coordinated changes in several factors.

Inherent in the research process are theory formulation, experimentation and evaluation. Theory formulation, includes establishing the criteria for system optimization and formulating a mathematical model. Experiment can be of either controlled or an un-controlled nature. Controlled experiments may be either undertaken in the laboratory or in the field. Examples of the former are simulation, both analog and digital, examples of the latter are test tracks and to a certain extent tunnel and freeway control projects. The controlled field experiments are useful in evaluating theories, but actual validation must be based on real world situation i.e. the un-field test.

#### Road Transport Research Needs:

A brief statement indicating the need and relevance of various types of research in the context of the conditions prevailing in the country is given below:-

(a) Industrial Research: In the field of industrial research very little work has been done so far and at the present not much may be warranted because of the state of our manufacturing industry. This type of research would be needed only when our road transport industry become capable of producing automobiles and other transport vehicles. However, a start has been made by the Pakistan Automobile Corporation but the activity at present is assembly only. Therefore, large scale industrial research in this field is not warranted at the present moment or in the near future. In due course, there would be however be definite need to establish proper R&D facilities for automobile manufacture, etc.

(b) Structural Research: The main areas where such research could be carried out are:-

- Construction materials, i.e. Soil, Aggregates, Binders, Re-inforcement
- Design of pavements for various soil, water and climatological condition.
- Construction methods
- Drainage structures
- Design standards for low cost, intermediate and high speed roads.
- Traffic Engineering

Unfortunately, no real research is done in any of the above field. There is, therefore, clear and urgent need to develop these R&D facilities in these areas.

(c) Operational Research: The main areas where research of this type is required are as follows:-

- (i) Carrying out studies and research in economic forecasting and priority rating areas.

- (ii) Preparing long-term coordinated investment, operations, tax, subsidy and price plans embracing all modes of transport.
- (iii) Coordinating the research and planning work in the relevant agencies of the individual provinces and transport modes.
- (iv) Continuing and updating of research and studies done by TRACO and other Consultants in the past.
- (v) Formulation and review of "National Transport Policies", leading to the preparation of integrated plan for the development of a well-coordinated transport system.
- (vi) Providing consultancy services to provincial and modal planning agencies to evolve sound planning policies.
- (vii) Providing training and education in transport planning and project appraisal to ensure availability of trained staff for agencies concerned with planning, development, operation and maintenance of transport services and infrastructure.

Priority Areas:

The Working Group on Science and Technology for Seventh Five Year Plan consisting of eminent scientists have recommended the following thrust areas for Roads and Road Transport Research during Seventh Plan period:-

Roads:

- (1) Evolving a policy for the design of roads in Pakistan  
(warrants, geometric design, structural design, etc.)
- (2) Bridge Design Code
- (3) Low Cost Roads Design and Construction
- (4) New Construction Materials
- (5) Modern Road Construction Techniques
- (6) Soil stabilization techniques
- (7) Development of effective quality control mechanisms
- (8) Improvement of indigenous road construction tools
- (9) Optimum road mileage for Economic Development
- (10) Land Slides

Road Transport

- (1) Maximizing indigenous component in progressive  
manufacture of road vehicles.
- (2) Operational research
- (3) Highway Safety
- (4) Improvement in design of non-mechanized transport
- (5) Standardization and Role of Tractor Trolleys

11. Description of the Project:

The setting up of an institution for Road Research has been under the consideration of the Government of Pakistan for quite a long-time. A brief history of the same is given below:

Brief History:

To implement the recommendations of M/s Howard, Needle, Tammon and Bergandoff, Ministry of Communications prepared a Five Year Development Programme for Road Research (1970-75). The scheme envisaged upgradation of the existing Road Research Laboratory at Lahore and setting up of Regional Material Testing Laboratories at Peshawar, Hyderabad and Quetta. In addition, Field Control Laboratories at Bahawalpur, Multan, Faisalabad, Sargodha and Rawalpindi were also proposed. However, the implementation of the Plan could not materialize due to the break up of one Unit.

During Fifth Five Year Plan, the need for road research was again felt and provision was made for setting up of a 'National Road Research Institute' at an estimated cost of Rs. 25 million under the Ministry of Science and Technology. However, for a variety of reasons, the PC-I of the project could not be formulated. Finally, in April 1981, Ministry of Science and Technology suggested to the Planning

Commission that the National Transport Research Centre and National Institute of Road Research should be combined into one single organization and named as 'National Institute of Transport and Road Research' on the lines of Transport & Road Research Laboratory - London. It was proposed that for reasons of operational, administrative and financial advantages, the proposed Institute should be located under the Ministry of Science and Technology. The Planning Commission, however, did not agree to transfer of National Transport Research Centre to Ministry of Science and Technology on the grounds that the Centre carried out studies specifically required for the preparation of Five Year/Long-Term Development Plans by the Planning Commission.

Ministry of Science and Technology thereafter constituted a Committee under the Chairmanship of Director General, National Highways Board of Ministry of Communications to advise on the appropriate location of the proposed Road Research Institute viz-a-viz Ministry of Science & Technology, Ministry of Communications and Planning Commission. The Committee could not, however, make any headway, as a consequence, at the time of finalization of Sixth Five Year Plan, on the request of Secretary, Ministry of Communications, it was decided to transfer Road Research Institute to that Ministry and a provision of Rs.30 million was made in the Sixth Plan for this purpose. However, later on in a meeting between Secretary (Communications) and Secretary (Planning), it was decided that since the National Transport Research Centre was being made into an autonomous body and Ministry of Communications alongwith other concerned federal

Ministries and Provincial Highway Departments were fully represented on the governing board of the Centre, the interest of transport research would be better served if two institutes were combined. Consequently, Ministry of Communications agreed to transfer the Road Research Institute to Planning Commission. As a result, a PC-I was prepared in May 1984 for setting up a 'Road Research Wing' in the National Transport Research Centre at an estimated cost of Rs.29.8 million including an FEC of Rs.8.6 million. The project was approved by the CDWP in its meeting held on 23-09-1985 with the following conditions:-

- (1) Availability of foreign assistance; and
- (2) Clearance of posts by the Ministry of Finance.

Although the project was to be completed within a period of 48 months i.e. upto the end of Sixth Plan, the implementation did not proceed as per schedule because of delay in sanction of the staff by the Ministry of Finance and the lining-up of the foreign assistance.

The construction of the Laboratory and Workshop Blocks has been in-hand since November 1988 and are expected to be completed by the end of September 1989. The ODA have agreed to provide FEC amounting to £ 550,000 for purchase of equipment, staff training and technical support. The agreement to this effect was signed on 27th September 1987 and equipment is expected to arrive by last week of



September 1989. Ministry of Finance has also sanctioned 46 key posts of the staff. Arrangements are in-hand to get the staff on-board before September 1989 so that they are fully associated with the setting up and the commissioning of the equipment, and drawing-up research programme in collaboration with ODA experts.

### THE PROJECT

The proposed facility would be a part (Wing) of NTRC and would have the benefit of all the existing facilities in terms of manpower, equipment, etc. The Wing would be headed by a Chief (BPS-20) and shall have four sections headed by a Deputy Chief (BPS-19) with adequate supporting staff. A post of Senior Chief (BPS-21) is included to provide coordination between the three Wings of the Centre namely; Operational Research Wing, Road Research Wing and Urban Transport Wing. The organizational set-up of the Institute may be seen at Annex-L.

The Road Research Wing would carry out research into all aspects of road planning, structural design, materials for construction and maintenance, and the management and control of the processes involved. The aim would be to provide practical recommendations, bearing in mind economic and environmental factors, for the levels of services for which road should be constructed and maintained, and the means of achieving those levels and shall consist of the following sections:-

- (1) Pavement Design Section: Responsible for the development and improvement of structural design standards for new pavements and for the strengthening of existing pavements by overlaying to prolong their lives under traffic. Present standards are based on the experiments carried out by TRRL. A design method based on knowledge of the real stress-strain behaviour of the indigenous road materials need to be developed to check the validity of the existing standards and test the potential of new and improved paving materials in both new construction and strengthening. The programme would include laboratory studies of the behaviour of road pavement under repeated loading and pilot scale testing of completed pavements.
- (2) Materials Section: To carry out research in the properties of road building materials, including asphalt, soils, aggregates and other special materials. Also examine the economic and environmental problems involved in the production and use of quarried stone, gravel and sand and of possible alternatives such as industrial mineral wastes, etc. Factors affecting the resistance to skidding of roads including the polishing of road stones need to be studied so that realistic standards can be introduced. Tests for mixtures of stone and binders also to be developed to ensure that the optimum combination of available materials is used to withstand modern traffic stresses and weather for a long period.
- (3) Construction and Maintenance Section: This would be concerned with the management and control of the processes involved in the construction and maintenance of road pavements. The efficiency of the prevailing practices and existing processes would be studied to identify areas where they can be improved. Investigations shall also be made to examine the effects of surface

irregularity on riding quality and to produce new specifications for the control of surface regularity. In cooperation with federal and provincial highway engineers, management information systems shall be developed to ensure that maintenance is carried out in most cost-effective manner.

- (4) Traffic Engineering Section: The Traffic Engineering Section shall aim at reducing delays to vehicles and pedestrians, minimizing the interruptions to traffic flow and increasing traffic capacity of roads and junctions. It shall be concerned with methods of traffic control, with geometrical aspects of the design of roads and junctions, and with the best utilization of a given road network. Increasing attention is being given to the effects of traffic on the environment, on pedestrian movement and on business and social activities.

A very important function of the Traffic Engineering Section shall be to improve road safety by research in accident causation, accident prevention, and the mitigation of injuries. This would include collection and analysis of data, the study of human factors and the road environment, and the design and safety performance of vehicles.

Specific Areas of Research:

Some of the problems on which the Institute will concentrate its research efforts are enumerated below:-

- (a) Effect of Water Logging and Salinity, etc: In certain areas of NWFP, Punjab and Sind, the water table has risen to the surface level causing failure of existing road pavements and problems for new construction. Extensive research is called for to find economical materials and methods of maintenance and construction of roads in water logged areas.

- (b) Use of Local Aggregates for Road Construction: Good quality aggregates are not available in certain parts of the country. Transport costs of base and sub-base materials from distant quarries are quite high. Bricks can be readily available in all such areas. Studies are needed for using brick and other local aggregates as base and sub-base for roads.
- (c) Soil Stabilization: Quality of a road surface depends upon the stability of the soil. However, very limited work has been done on soil stabilization methods. Different combinations of various materials like cement, lime, bitumen, etc can be used with local soils for sub-grade stabilization. Investigations are needed for finding appropriate materials and methods for different areas in the country.
- (d) Construction of Low-Cost Roads: To improve communication between villages and market towns, low-cost roads need to be constructed. Research is to be carried out to find cheap materials and methods for the construction of such roads for light traffic.
- (e) Bituminous Carpets: So far very little mileage of our roads has been surfaced with bituminous concrete. Most of the black top roads are only surface treated. This method is sufficient for slow moving and light traffic. For present day, heavy and fast moving traffic, it is necessary to lay premix bituminous carpets on main roads. However, due to lack of experience in this field, extensive experimentation will be needed. Secondly, because of the fact that once the surface is laid, it would not be possible to strengthen the road with any material cheaper than asphaltic concrete to make up past deficiency. This would be rather unduly expensive method of improving and strengthening of roads. The design of pavements are therefore needed for their adequacy not only for the currently prevailing traffic but also for the anticipated traffic.

- (f) Cement Substitutes: Portland cement is usually used as a fine filler in bituminous carpetting. This is rather expensive. Research work has to be undertaken to find other suitable materials to be used as a filler.
- (g) Intermediate Technology: Riding quality has been not very good due to hand laid asphaltic concrete. Mechanical pavers have been used on large projects but these are expensive for small projects. Research is needed to develop alternate intermediate technology for making smooth pavements to improve riding quality of our roads.
- (h) Traffic Engineering: The traffic intensity on some of the main roads is fairly heavy and is increasing due to establishment of more industries. The pattern of traffic, among other things is determined by the lay out of existing roads. Our main roads have so far been constructed without any traffic studies. As a result, inspite of huge amount invested, the quality of service remain very low and can be improved very easily by carrying out the following needed Traffic Engineering Studies:-

1. Traffic Flow
2. Road Capacity
3. Vehicle equivalency
4. Road geometry
5. Quality of traffic service
6. Geometric standards

(i) Road Safety: Besides, the increase in traffic has brought with it progressively increasing rates of accidents. Some work has been done in the field of highway safety during past few years in the NTRC but there is still lot more to be done, in order to accurately diagnose the problem and try different remedial measures to alleviate the problem. The following investigations need to be initiated:-

1. Driver behaviour
2. Accident Black Spot
3. Driver Education
4. Road Safety Legislation
5. Vehicle fitness
6. Socio-economic factors
7. Psychological factors
8. Vehicle technology

(j) Photogrammetry: Aerial photography is now widely used for planning and location of road networks, traffic studies, determination of traffic density, location of materials, etc. It is, therefore, necessary to establish facilities for carrying out and interpretation of aerial photography.

(k) Cement and Concrete Research: All the major road bridges in the country are now being built in reinforced cement concrete. This costs less and saves foreign exchange as well. Prestressed concrete has become popular and all new bridges constructed recently are in prestress. As very high quality concrete is required in prestress work and all laboratories need to be equipped to investigate the best aggregate, and test the quality of cement. Facilities for prestress research work need to be provided urgently.

Strategy: The project has been designed with the economy as upper most factor and is borne out by comparison with other such institutions within and outside Pakistan, both in developed and developing countries.

- (a) Land: The TRRL (UK) occupies an area of 250 acres. The Road Research and Material Testing Institute, Lahore is spread over an area of 24 acres. In comparison, the land purchased for the combined requirements of the existing organization of the National Transport Research Centre and the proposed Road Research Wing is only 5 acres.
- (b) Building: The TRRL is housed in a very large building area consisting of a number of independent units. The Road Research and Material Testing Institute, Lahore occupies more than 49,000 sq.ft. (excluding residential colony) while the total area proposed for the combined requirement of existing Centre and the proposed Road Research Wing is 43,900 sq.ft. (Annex-B). This include provision for Offices, Laboratories, Workshops, Library, Record Room, Store, Conference Area, Study Staff.
- (c) Manpower: The total number of staff employed at the TRRL-UK is over 1,000. The staff strength at Road Research and Material Testing Institute, Lahore is 126. The Central Road Research Institute at Delhi has a staff of about 350. In comparison, the proposed strength of Road Research Wing is 82.
- (d) Training: In order to disseminate the benefit of research, training will be imparted to employees of Highway Departments and other road construction

and maintenance agencies on regular basis. Besides, a number of Post Graduate Students/Research Associates will carry out research assignments with the Road Research Wing. In addition, eminent engineers, professors and senior staff of Highway Departments will be invited for lectures, seminars, symposia, workshop at the Centre.

The Training Section will be responsible for arranging of courses, preparing of teaching materials, demonstration, seminars and symposia.

### 13. Give Summary of Capital Cost:

The summary for the capital costs for the original and the revised project are as follows:-

Sl. No.	I t e m s	As per Original PC-I			Revised			Re-marks
		Local	F.E.C.	Total	Local	F.E.C.	Total	
1	2	3	4	5	6	7	8	9
1.	Land	1.815	-	1.815	-	-	-	Annex-A
2.	Building	8.902	-	8.902	17.845	-	17.845	Annex-B
3.	Laboratory Equipment	0.500	8.000	8.500	-	9.391	9.391	Annex-C
4.	Office Machines	0.680	-	0.680	1.818	-	1.818	Annex-D
5.	Furniture & Fixture	0.418	-	0.418	0.664	-	0.664	Annex-E
6.	Air-conditioning	0.366	-	0.366	0.494	-	0.494	Annex-F
7.	Transport	1.100	-	1.100	0.750	1.740	2.490	Annex-G
8.	Estab. Charges	5.400	-	5.400	9.889	-	9.889	Annex-H
9.	Training & Technical Assistance	0.500	0.500	1.000	-	7.479	7.479	Annex-I
1.	Books & Periodicals	0.100	0.100	0.200	0.100	0.174	0.274	Lump-sum
Total :		19.781	8.600	28.381	31.060	784	49.844	
Contingencies:		1.419	-	1.419 <sup>a</sup>	1.553	0.348 <sup>c</sup>	1.901	
Grand Total :		21.200	8.600	29.800	32.613	19.132 <sup>d</sup>	51.745	

Note : a. 5% of the total,  
 b. 5% of the total,  
 c. as provided by ODA  
 d. details at Annex-J.



14. Basis of Revised Cost Estimates:

- (a) Building: Estimates of revised covered area are based on entitlement of different categories of staff according to scales laid down by the Government. Cost of construction has been worked out on the basis of costs estimates prepared by Pak-PWD, keeping in view the prevailing market rates. Details may be seen at Annex-B.
- (b) Equipment: The cost of equipment has been prepared by ODA experts.
- (c) Furniture and Fixture: The estimates are based on the requirement of the three laboratories, office space, hostel and other allied facilities as per current market prices. Details may be seen at Annex-E.
- (d) Establishment Charges: The estimates are based on present Pay Scales and other allowances for the proposed staff. Details may be seen at Annex-F.
- (e) Miscellaneous All other items are based on current market rates.

JUSTIFICATION

The original PC-I for the project was prepared in May 1984, and approved by the CDWP in September 1985 subject to availability of foreign exchange and clearance of posts by Ministry of Finance. Ministry of Finance when approached for sanction of staff, made it a condition that the FEC may be lined-up first. Since the project had been formulated in consultation with TRRL-London, who had assured prompt okay of the ODA. However, the actual agreement of ODA was received till September 1987 due to opposition from an un-expected quarter. This was made subject to completion of the building and provision of staff. After signing of the agreement with ODA, Ministry of Finance sanctioned only key posts of professional category during second half of 1988. Pak-PWD was entrusted the job of the construction of the building in January 1988, who as usual were very slow. Construction of Laboratory and Workshop Blocks was taken in hand in November 1988 which are expected to be ready by the end of September 1989. The Wing is likely to become fully operational by the end of 1989.

However, as expected, the inordinate delay in the implementation of the project has resulted in the inevitable increase of cost. Now that fairly firm estimates of various components have become available, the revised cost is expected to amount to Rs. 51.745 million with an FEC of Rs. 19.132 million. The increase is 74% in overall terms. The local cost, however, has escalated by 54% whereas FEC has gone up by 122%.

The increase in cost is primarily on account of :

- (a) increase in building area (75%);
- (b) increase in F.E.C. (122%);
- (c) increase in Establishment Charges (83%);
- (d) Omissions;
- (e) Other miscellaneous items as detailed below:-

(a) Increase in Building Area: The building area has increased from 26,300 sq.ft. to 39,000 sq.ft. for the reasons, namely:(1)addition in the staff strength of the Operational Research Wing; (2) enhanced sizes of the certain facilities, and (3) new items, as briefly

explained below:-

- (1) Operational Research Wing: At the time of the preparation of the original PC-I, the staff strength of the Operational Research Wing was only 28. Based on the Government approved scale of space entitlement, the building area requirements worked out to 26,300 sq.ft. However, since 1984-85, the staff strength of the Wing has increased from 28 to 62. As a result, the space requirement now amount to 6,000 sq.ft. Details may be seen at Annex-B.
- (2) Enhanced Sizes: The sizes of some of the facilities were increased on the advice of ODA experts, the Research Advisory Committee and Pak-PWD due to modular design of the buildings. The overall increase was from 15,600 sq.ft. to 19,910 sq.ft. The major items included Printing Room (400-500), Workshop (1,000-1,300), Library (600-1,000), Record Room (600-1,000), Store (600-1,500), Toilets (1,000-1,480) and Circulation Area (5,260-7,130).
- (3) New Items: The Centre employs about 100 persons in lower grades on contract for field surveys against various studies for which no provision was made in the original PC-I. Although every effort is made to keep them constantly deployed in the field but experience has shown that at any one time at least 50% of them attend office for various reasons namely; handing over the data collected by them, taking instructions for the next round and attending to other duties. A minimum area of 2,000 sq.ft. is required for this purpose which has now been included.

There were other omissions such as Committee Room (600 sq.ft.), Porch (450 sq.ft.), Drafting Room (650 sq.ft.), Model Room (200 sq.ft.).

Also, the original estimates was based on carpet area whereas the revised one is on Plinth Area basis as advised by Pak-PWD and include 2600 sq.ft. as walls.

The overall increase in building covered area is 12,700 sq.ft. i.e. from 26,300 sq.ft. to 39,000 sq.ft. resulting in increase in cost from Rs. 8.902 million to 17.845 million i.e. an increase of Rs.8.943 million. Out of which, Rs. 4.971 million is on account of building area and Rs. 3.972 million due to other omissions.

- (b) Increase in FEC: While preparing the original PC-I, an amount of Rs. 8.6 million was tentatively proposed in foreign exchange for the equipment, etc. when the Sterling exchange rate was Rs. 22.00 i.e. equivalent to £390,000/-. However, the ODA on the advice of their own experts has agreed to provide an FEC of £550,000, which at present rate (1£=34.7855) is equivalent to Rs.19.132 million. thus, the FEC component to be provided by ODA in terms of Pakistani Rupees have increased from Rs.8.6 million to Rs.19.132 million i.e. an increase of Rs.10.532 million.
- (c) Increase in Establishment Charges: Because of increase in staff strength of the Operational Research Wing and the increase in salaries since 1984, the Establishment Charges have increased from Rs. 5.4 million to Rs.9.889 million i.e. an increase of Rs. 4.489 million. Details at Annex-H.
- (d) Omissions: This include underground and overhead tanks, car park, footpaths, compound wall, soil investigation, horticulture and connection charges, which were not included in the original estimates. The total cost on this account amount to Rs.3.972 million.
- (e) Miscellaneous: This include price increase on items such as office equipment, furniture and fixture, etc.

Against the original sanction of Rs.29.8 million with FEC of Rs. 8.6 million, the actual expenditure as of 30.6.1989 is expected to be Rs.13.348 million. Therefore, the proposed provision is timely.

15. Annual Recurring Expenditure after completion:

The annual recurring expenditure after completion of the project is estimated at Rs.7.523 million.

<u>Classification</u>	<u>Rs. Million</u>
011 Basic Salary of Officers	0.731
012 Basic Salary of Staff	0.776
010 <u>Basic Salary Total:</u>	1.507
020 Regular Allowances	2.622
000 <u>Establishment Charges Total:</u>	4.129
100 Purchase of Durable Goods	1.235
400 Repair and Maintenance of Durable Goods Total:	0.220
510 Transportation - Personnel TA and Running Cost of Transport	0.403
520 Communications - Postage, Telegraph and Telephone	0.221
530 Utilities -Gas, Water and Electricity	0.231
540 Stationery, Printing	0.200
550 <u>Printing and Publications</u>	0.052
560 Books and Periodicals	0.052
570 Uniform and Liveries	0.020
580 Rent of Office Building	0.325
590 Other Contingent Expenditure	0.065
500 <u>Total Commodities and Services</u>	1.569
600 Total Transfer Payments, Grants Entertainments and Gifts	0.020
900 Total Miscellaneous Expenditure	0.150
xxx Workshop, Supplies, Equipment & Maintenance	0.200
-----	
Total :	7.523
-----	

16. Unit Cost for each Category of Service or Output:

NOT APPLICABLE

17. Cash Flow for Next Five Years:

NOT APPLICABLE

<u>Sl. No.</u>	<u>I t e m s</u>	<u>1985-89</u>	<u>1989-90</u>	<u>1990-91</u>	<u>1991-92</u>	<u>1992-93</u>	<u>Total</u>
<b>A. <u>PHYSICAL</u></b>							
1.	Land	xx	-	-	-	-	-
2.	Building	xxx	xxx	-	-	-	-
3.	Machinery & Equipment	-	xxxx	-	xxxx	-	-
4.	Staff	xx	xxxx	xx	-	-	-
<hr/>							
Total							
<hr/>							
<b>B. <u>FINANCIAL</u></b>							
1.	Building	10.237	5.000	2.608	-	-	17.845
2.	Laboratory Equipment	-	4.626	-	4.765	-	9.391
3.	Office Machine	-	0.75	0.75	0.318	-	1.818
4.	Furniture & Fixture	-	0.264	0.2	0.20	-	0.664
5.	Air-Conditioning	-	0.194	0.15	0.15	-	0.494
6.	Transport	-	2.49	-	-	-	2.49
7.	Establishment	0.210	1.00	2.00	3.000	3.679	9.889
8.	Training & T.A	-	0.500	2.50	2.479	2.000	7.479
9.	Books & Periodicals	-	0.100	0.100	0.074	-	0.274
10.	Contingencies	-	0.650	0.450	0.50	0.301	1.901
<hr/>							
Total :		10.447	15.224	8.508	11.486	5.980	51.745
<hr/>							

**10. Manpower Requirement:**

(a) Execution: The construction of the building is being executed by Pak. Public Works Department while the equipment is to be purchased and installed under the supervision of the TRRL Experts of U.K. As such, there will be no direct manpower requirements for execution of the Project.

(b) Operation: Manpower requirements for operation of the Project are as follows. Details are attached at Annex-M.

(1) Professional and Managerial Staff (Grade 16 and above)

- Senior Chief (BPS-21)	1
- Chief (BPS-20)	1
- Deputy Chief (BPS-19)	4
- Asstt. Chief (BPS-18)	4
- Research Officer(BPS-17)	4
- Administration(BPS-17)	1
- Budget,Accounts,Library Printing & Drawing (BPS-16)	5

-----  
- Total : 21  
-----

(2) Support Staff (Grade 5 to 15) 40

(3) Other (Grade 1 to 04) 21

-----  
- Total : 82  
-----

(c) Likely shortage of Manpower by Occupation:

NIL

(d) Steps to be taken to assure availability of manpower:

- (i) The senior staff will be sent for short term on the job training abroad at the internationally recognized institutions like Transport and Road Research Laboratory and other such institutions in U.K., etc.
- (ii) For long-term training to Master/Ph.D. Degree facilities have been offered in ODA.
- (iii) Suppliers of the equipment etc will be required to provide training to the staff for the use of equipment.
- (iv) Regular training programme for junior staff of the Wing as also for the staff of Highway Departments etc will be provided at the Road Research Wing.

- (e) Approximate number of persons required to be trained per year (locally and abroad) and the kind of skills to be learned:

Three to four staff members will be sent for training abroad during early period. Subsequently, the number will be reduced to cover staff turn over only. The trainees will be imparted the skills for the use of specialized equipment, analysis and interpretation of results and research methods.

- (f) Give total capital outlay: Give capital cost of mobilization one worker for one shift:

- Not Applicable -

20. Physical and other facilities required for project:

- (a) Power supply : To be provided from public utility
- (b) Water and other Utilities: To be provided from public utility
- (c) Education Facilities by Type: To be provided from public utility
- (d) Housing by type: To be provided from Govt. Pool
- (e) Other: To be provided from public utility

21. Materials, Supplies and Equipment Required:

I. Minimum total requirements for execution:

- |                           |   |
|---------------------------|---|
| 1. Materials:             | Construction to be done by<br>Pak-PWD/CDA through<br>Contractors. |
| 2. Spares and Supplies:   |   |
| 3. Equipment & Machinery: |   |

II. Material : Spares and Supplies and Equipment for operation of Project:

	<u>Local</u>	<u>F.E.C.</u>	<u>Total</u>
Laboratory Supplies and Spares (5% of the total)	-	0.475	0.475



III. In the case of imported material and equipment for execution, indicate:

(a) Justification for imports

(b) Proposed Source/Sources  
of Supply

NOT APPLICABLE

LAND ACQUISITION

In the original PC-I an amount of Rs. 1.815 million was provided for acquiring five additional acres of land primarily for the test track of the Road Research Wing adjacent to the 5 acres land provided for the Operational Research Wing in H-8 Sector. However, inspite of best effort, CDA did not agree to allot the required land. As a result, on the advice of Inter-Ministerial Committee of the Centre, it was decided to accommodate the laboratories, workshop and office building of the Road Research Wing within the parcel of land already available and take up the Test Track on the outskirts of the city.

## REVISED ESTIMATES FOR BUILDING WORK

S.No	Item Description	As per P.C-I			Revised			
		Unit	Quantity	Rate	Total Amount	Quantity	Rate	Total Amount
1.	Building	Sq.ft.	26,000	250	6.500	39,000	250	9.750
2.	Internal Services <sup>1</sup>	10% of 1		-	0.650	17.5% of 1		1.737
3.	External Services <sup>2</sup>	15% of 1		-	0.975	12.5% of 1		1.241
4.	Connection Charges <sup>3</sup>	(L.S)	-	-	-	-	-	0.550
5.	Overhead Water Tank	Gallons	-	-	-	10,000	75	0.750
6.	Underground Water Tank	Gallons	-	-	-	30,000	10	0.300
7.	Road & Footpath	-	-	-	-	5% of 1		0.496
8.	Land Scaping	3% of 1	-	-	0.195	3% of 1		0.296
9.	Horticulture	-	-	-	-	2% of 1		0.199
10.	Car Parking Shed	Sq.ft.	-	-	-	6216	125	0.777
11.	Compound Wall	RFT	-	-	-	1995	310	0.619
12.	Soil Investigation	( L.S )	-	-	-	-	-	0.039
Total-A (1-12)		-	-	-	8.32	-	-	16.756
13.	Departmental Charges	7% of A	-	-	0.582	6.5% of A		1.089
G. Total (1-13)					8.902			17.845

Note:- (For Revised Estimates)

1. Internal Services:

- i) W/S and S/I @ 2.5% of building cost
- ii) Electrification @ 15% of building cost

2. External Services:

- i) W/S and S/I @ 2.5% of building cost
- ii) Electrification @ 5% of building cost
- iii) Sui Gas Installation (Internal & External) @ 5% of building cost

3. Connection Charges:

Connection charges for Electrification, Sui Gas and Water supply to be paid to WAPDA, Sui Northern & CDA.

OFFICE SPACE REQUIREMENTSA. OPERATIONAL RESEARCH WING:

S.NO	P o s t	B.P.S	As per P.C-I			Revised	
			Entitle- ment.	No.of Posts	Total Sq.ft	No.of Posts	Total Area
1.	Senior Chief	21	240	1	240	1	240
2.	Deputy Chief	19	240	4	960	7	1680
3.	Asstt. Chief	18	160	3	480	5	800
4.	Research Officer	17	160	3	480	5	800
5.	Superintendent	16	160	1	160	1	160
6.	Stenographer	15	80	4	320	8	640
7.	Stenotypist	12	80	5	400	5	400
8.	Assistant	11	80	2	160	3	240
9.	Draftsman	11	80	1	80	1	80
10.	U. D. C	7	80	2	160	2	160
11.	L. D. C	5	80	2	160	2	160
12.	D. M. O	4	-	-	-	1	80
13.	Section Officer	17	-	-	-	1	160
14.	Computer Programmer	17	-	-	-	1	160
15.	Librarian	17	-	-	-	1	160
16.	Despatch Rider	4	-	-	-	1	80
17.	Driver	4	-	-	-	3	-
18.	Naib Qasid	1	-	-	-	14	-
Total:-			-	28	3600	62	6000

(44)

B. ROAD RESEARCH WING

S.No.	Posts	AS PER PC-I			REVISED	
		No.	Entitle- ment	Total Sq.Ft	No.	Total Area Sq. Ft
1	2	3	4	5	6	7
1.	Senior Chief	1	240	240	1	240
2.	Chief	1	240	240	1	240
3.	Deputy Chief	4	240	960	4	960
4.	Assistant Chief	4	160	640	4	640
5.	Research Officer	4	160	640	4	640
6.	Admn.Tech.Officer	2	160	320	2	320
7.	Superintendent	6	160	960	2	320
8.	Stenographer	8	80	640	6	480
9.	Stenotypist	8	80	640	7	560
10.	Draftsman	1	160	160	1	160
11.	Tracer	2	80	160	2	160
12.	Assistant	2	80	160	3	240
13.	UDC	2	80	160	2	160
14.	LDC	2	80	160	2	160
15.	Librarian	1	160	160	1	160
16.	Telephone Operator	1	80	80	1	80
17.	Computer Operator	1	160	160	4	640
18.	Diarist	1	80	80	1	80
19.	Superintendent	1	160	160	1	160
20.	Lab. Tech.	4	80	320	8	640
Total:		56		7040	56	7040

C. COMMON SERVICES:

S.No.	Description	COVERED AREA (Sq.ft.)	
		As per P.C-I	Revised
1.	Laboratories	4,000	4,000
2.	Workshop	1,000	1,300
3.	Library	600	1,000
4.	Record Room	600	600
5.	Printing Room	400	500
6.	Canteen	200	400
7.	Store	600	1,500
8.	Security Room	200	200
9.	Reception	300	300
10.	Toilets	1,000	1,480
11.	Conference Room	1,500	1,500
12.	Circulation Area	5,260	7,130
Total-C		15,660	19,910

D. ADDITIONAL ITEMS:

1.	Study Staff	-	2,000
2.	Walls	-	2,600
3.	Committee Room	-	600
4.	Drafting Room	-	650
5.	Model Room	-	200
Total-D		-	6,050
Grand Total (A+B+C+D)		26,300	39,000

LABORATORY EQUIPMENT FOR ROAD RESEARCH  
WING IN NATIONAL TRANSPORT RESEARCH CENTRE  
ISLAMABAD

PHASE-I

GENERAL LABORATORY EQUIPMENT FOR SOILS, BITUMEN AND CONCRETE TESTING LABORATORIES

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
<u>A. GENERAL:</u>		
1	3	Large capacity oven. Approx 225 dm <sup>3</sup> with thermostatic control to approx 220°C and fan convected.
2	2	Large capacity oven. Approx 118 dm <sup>3</sup> . Thermostatically controlled to approx 200°C with fan convection.
3	2	Small fan-circulated oven. 68 dm <sup>3</sup> capacity. Thermostatically controlled to 300°C.
4	1	Laboratory oven. Thermostatically controlled with fan circulation. Capacity 720 dm <sup>3</sup> . Temperature range to 180°C.
5	3	Semi-automatic balance. Flat type. Capacity 25kg.
6	3	Electronic top-leading balance to weight up to 12 kg.
7	2	Top loading electronic balance to weight up to 1.5 kg. and accurate to 0.01g.
8	1	Analytical balance to weigh up to 150 g.
9	3	Riffle box 7mm.
10	3	Riffle box 15mm.
11	3	Riffle box 30mm.
12	3	Riffle box 50mm.
13	8	Mortars.
14	8	Pestles.
15	8	Rubber-headed pestles.

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
16	3	Sieves 37.5mm.
17	3	Sieves 5.0mm
18	1	Sieve 20.0mm.

B. FOR MOISTURE CONTENT DETERMINATION - OVEN METHOD:

19	100	Moisture content tins 90g capacity
20	12	Spatula, 100mm blade.
21	6	Scoops.
22	30	Sample containers, lever lid.
23	6	Oven trays.
24	4	Weighing bottles (pack of 5).
25	3	Desiccators
26	6	Silica gel 500g.

C. FOR DETERMINATION OF LIQUID LIMIT:

27	2	Liquid limit device ASTM method.
28	2	Grooving tool. ASTM.
29	2	Grooving tool and guage BS.
30	2	Revolution counter kit.
31	100	Test forms.
32	6	Glass plates.
33	12	Spatulas 200mm blade.
34	12	Evaporating dishes 150mm.
35	30	Sample container tins, lever lid.
36	6	Polythene wash bottles.



<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
<u>D. DETERMINATION OF LIQUID LIMIT, PENETROMETER METHOD:</u>		
37	2	Cone Penetrometers.
38	2	Test gauges for checking cone.
39	6	Penetration test cups.
40	2	Metal straight edge 100mm.
<u>E. DETERMINATION OF LINEAR SHRINKAGE:</u>		
41	8	Shrinkage moulds.
42	2	Vernier calipers.
43	3	silicone lubricant.
<u>F. SAND EQUIVALENT VALUE:</u>		
44	1	Sand equivalent apparatus.
45	1	Syphon assembly.
46	20	Test forms.
47	1	Calcium chloride.
48	1	Glycerol-Analar.
49	1	Formaldehyde.
50	1	Mechanical shaker.
51	1	Stopclock.
<u>G. SPECIFIC GRAVITY OF SOILS, FINE-GRAINED SOILS:</u>		
52	10	Density bottles, 50ml.
53	4	Volumetric flasks 100ml.
<u>H. DETERMINATION OF SPECIFIC GRAVITY, FINE TO MEDIUM AND COARSE-GRAINED SOILS:</u>		
54	4	Gas jars.
55	1	Mechanical end over end shaker.

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
56	20	Test forms.
57	6	Thermometers - 10°C to 100°C

I. GRAIN SIZE ANALYSIS OF SOILS:

58	1	Constant temperature water bath. 480mmx 240mmx 400mm
59	1	High speed stirrer.
60	4	Soil hydrometer.
61	4	Glass cylinder, 1000ml.
62	4	Sieve 4.75mm mesh.
63	4	Sieve 2.00mm mesh.
64	4	Sieve 850µm mesh.
65	4	Sieve 425µm mesh.
66	4	Sieve 250µm mesh.
67	4	106µm mesh
68	6	75µm mesh.
69	4	Lid.
70	4	Receiver.
71	4	Sieve 9.5mm mesh.
72	4	Sieve 19.0mm mesh.
73	4	Sieve 37.5mm mesh.
74	4	Sieve 50.0mm mesh.
75	4	Sieve 75.0mm mesh.
76	6	Sieve brush.
77	6	Beaker 250ml.
78	4	Measuring cylinder 2000ml.
79	3	Thermometer - 10°C to 50°C.
80	3	Sodium hexametaphosphate 500g.

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
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J. DETERMINATION OF PH VALUE:

81	1	Laboratory PH meter.
82	3	Beffer tablets 4 pH.
83	3	Buffer tablets 9.2 PH.
84	6	Beaker 100ml.
85	6	Beaker cover.
86	6	Volumetric flasks 500ml.
87	1	Glass stirring rods (pack of 10)
88	1	Magnetic stirrer.
89	1	BDH soil testing outfits.

K. MOISTURE-DENSITY RELATION OF SOILS. ASTM D1557, AASHTO T180:

90	3	Proctor mould.
91	3	Straight edge.
92	3	ASTM compaction mould.
93	2	Compaction rammer 4.5kg.
94	20	Test form.
95	1	CBR extruder.
96	2	Proctor compaction rammer (ASTM D698, AASHTO).
97	1	Automatic soil compactor ASTM with ASTM rammer and moulds.

L. DENSITY OF SOIL IN PLACE, SAND CONE METHOD (ASTM D1556, AASHTO T191).

98	1	Test sand 600/300mm.
99	6	6 in sand core.
100	6	Plastic container, 5 litre.
101	6	Density plate.
102	2	200°C general purpose oven.

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
103	1	Harvard trip balance.
104	1	Set of weights.
105	1	Scoop.
106	1	Field and laboratory scales(1 of each).
107	12	Density spoon.
108	12	Rubber-headed mallet.
109	12	Density chisel.
110	12	Density pick.
111	24	Sample containers 10 dm <sup>3</sup> .
112	10	Sample tray 254 x 254mm

M. DENSITY OF SOIL IN PLACE BY RUBBER BALLOON METHOD ASTM D216T AASHTO T205.

113	40	Moisture content tin.
114	1	Balloon density apparatus.
115	1	Density plate.
116	10	Sample container 0.5 dm <sup>3</sup> .
117	20	Rubber balloon.
118	100	Polythene bag 760 x 508mm.
119	3	Thermometer - 10°C to 110°C.

N. CALIFORNIA BEARING RATIO, IN SITU:

120	1	28KN load ring.
121	1	Penetration piston.
122	1	Mechanical jack.
123	1	Ball seating attachment.
124	1	Set of extension rods.
125	1	Datum bar assembly.

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
126	1	Penetration dial gauge.
127	1	Mounting bracket.
128	1	Annular surcharge weight, 4.5kg.
129	1	Slotted surcharge weight, 4.5kg.
130	10	Test form.
<u>O. CALIFORNIA BEARING RATIO, LABORATORY METHOD, (ASTM D1883, AASHTO T193).</u>		
131	1	28KN load ring.
132	1	50KN load frame with 5 speed drive.
133	3	Straight edge.
134	12	Mould body.
135	12	Extension collar.
136	12	Perforated base plate.
137	4	Spacing disc.
138	12	Swell plate.
139	8	Swell tripod.
140	8	Swell gauge.
141	10	Filter papers, whatman No.5
142	12	Filter screen.
143	1	Penetration piston.
144	1	Penetration dial gauge.
145	1	Bracket for mounting dial gauge
146	12	Annular surcharge weight.
147	12	Split surcharge weight.
148	1	Stabilising bar for load frame.
149	1	Soaking tank.

ITEM NO.      QUANTITY      DESCRIPTION  
P. STRENGTH OF STABILISED SOILS, MEDIUM-COARSE GRAINED. (BS 1924, TEST II).

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
150	2	Vibrating hammer.
151	1	Support frame.
152	1	Set of 3 tamping feet.
153	4	150mm cube mould.
154	4	Steel capping plate.
155	3	Steel float, plasterer's type.
156	20	Sample container (curing tin).

Q. GENERAL GLASS AND PLASTIC WARE:

157	12	Beaker 100ml.
158	10	Beaker 250ml.
159	10	Beaker 500ml.
160	5	Beaker 1000ml.
161	2	Beaker 2000ml
162	10	Beaker covers 100mm diam.
163	5	Measuring cylinder 50ml.
164	5	measuring cylinder 100ml.
165	10	"      "      150ml.
166	5	"      "      500ml.
167	5	"      "      1000ml.
168	6	Volumetric flasks 100ml.
169	6	"      "      250ml.
170	3	"      "      500ml.
171	3	"      "      1000ml.
172	3	Conical flasks 500ml.
173	6	"      "      250ml.

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
174	3	Graduated pipettes 5ml.
175	3	" " 10ml.
176	3	" " 25ml.
177	3	Bulb pipette 50ml.
178	3	Burette 25ml.
179	3	" 50ml.
180	2	Weighing bottles 25mm diam x 50mm ht (pack of 5).
181	6	Evaporating dishes, porcelain 120mm x 48.
182	6	Evaporating dishes, porcelain 120mm x 55.
183	6	Glass funnels 50mm diam.
184	6	" " 110mm diam.
185	2	Desiccator, non-vacuum type 200mm int. diam.
186	1	desiccator, vacuum type.
187	1	Desiccator safety cage.
188	6	Wash bottle polythene 500ml.
189	2	Desiccator cages (for item 185 above).
190	100	Test tubes 100x2mm Pyrex glass.
191	5	Test tube holders.
192	3	Crucible tongs, nickel
193	1	Truck, hand drawn, platform size 950x500mm approx with rubber cushion tyres.
194	1	Sack truck, capacity 100-150kg with rubber cushion tyres.
195	2	Burette stands, double, hardwood.
196	2	Pipette stands, hardwood.
197	2	Pipette stands, hardwood.

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
198	3	Tripod stands, triangular top.
199	3	Retort stand bases, rectangular.
200	3	Bossheads, for rods up to 15mm.
201	3	Retort clamps, 3 prong.
202	1	Sieve shaker, for 200mm and 300mm diam. sieves.

R. AGGREGATE TESTING EQUIPMENT:

203	2	Thickness gauge.
204	2	Flakiness sieve 10 to 6.3mm.
205	2	" " 14 to 10.
206	2	" " 20 to 14.
207	2	" " 28 to 20
208	2	" " 27.5 to 28.
209	2	" " 50 to 37.5.
210	2	" " 63 to 50.
211	2	Length gauge.
212	4	Pyonometers.
213	1	Los Angeles abrasion machine for 220 - 240V.
214	1	Set abrasive charges for LAA test.
215	1	Aggregate impact value apparatus - complete with cylindrical measure and tamping rod.
216	1	Aggregate crushing value apparatus comprising 75mm diam. steel cylinder, plunger and base plate.
217	1	Metal measure 57mm diam. x 90mm deep for ACV test.
218	1	Tamping rod for ACV test.
219	2	Wire baskets for magnesium sulphate soundness test.



<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
220	4	100ml beakers.
221	1	Water bath 16 litre capacity.
222	10	Magnesium sulphate 2kg.
223	1	Bulk density measure 15dm <sup>3</sup> .
224	1	Bulk density measure 10dm <sup>3</sup> .
225	1	Bulk density measure 7dm <sup>3</sup> .

S. BITUMINOUS MATERIALS TESTING EQUIPMENT

226	1	Mixer, bench-mounted 5dm <sup>3</sup> capacity.
227	1	Mixer, bench-mounted 10dm <sup>3</sup> capacity.
228	1	Auto compactor (for Marshall test).
229	3	Compaction moulds ASTM.
230	1	Compaction pedestal.
231	1	Compaction pedestal.
232	1	Compaction hammer.
233	1	Compaction mould body. ASTM.
234	1	Sample extruder comprising frame, jack extraction collar and plunger.
235	1	Hotplate 200mm diam. 2kw simmerstat.
236	1	Hotplate, Rectangular 460mm x 300mm 2kw simmerstat.
237	1	Marshall load frame 25kN semi automatic with digital read out.
238	1	Chart recorder for use with load frame above.
239	1	Core penetrometer.
240	1	Compaction mould for use with core penetrometer.
241	1	Muffle furnace 1200°C.
242	6	Silica crucibles 25ml squat form.
243	6	Porcelain crucibles size 1, 25ml with lids.

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
244	6	Heat resistant gloves with gauntlet.
245	1	Ring and ball apparatus.
246	2	Rings, shouldered pattern.
247	1	Steel balls, pack of 10.
248	2	Ball contring guides.
249	1	Stirrer, electric, high-speed.
250	1	Immersion heater.
251	1	Bosshead.
252	1	Clamp.
253	1	Thermometer IP60C - 2°C to +80.
254	1	Thermometer IP61C 30°C to 200°C.
255	1	Thermometer IP89C-1°C to +175°C.
256	3	Metal tripod stands.
257	8	Metal gauges.
258	1	Standard penetrometer.
259	6	Penetration needles (pack of 3).
260	1	Automatic controller for the penetrometer.
261	1	Transfer dish for use with the penetrometer.
262	24	Penetration tin. 70mm diam by 45mm deep.
263	1	Standard tar viscometer.
264	12	STV cup. 10mm diam, complete with ball valve.
265	12	STV cup 4mm diam. complete with ball valve.
266	2	Gauge for checking 10mm orifice.
267	2	Gauge for checking 4mm orifice.
268	4	Thermometer IB8C 65mm immersion 0°C to 44°C.
269	2	Apparatus for rate of spread of chippings. (300mm square tray, chains and spring balance).

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
292	3	Volumetric flask 250ml.
293	3	Volumetric flask 500ml.
294	3	Volumetric flask 1000ml.
295	8	Volumetric flask 2500ml.
296	8	Polypropylene tubes 50ml with caps, for use with centrifuge item 290.
297	2	Carbon dioxide boiling flask 250ml with rubber bung.
298	2	Vacuum reservoir 2000ml capacity.
299	2	Conical filter flask, with bung and glass tube.
300	2	Sets glass tubes, elbows and taps.
301	1	Vacuum pump.
302	1	Masonry saw, electric driving 110C 60Hz 1ph.
303	3	Diamond blades 355mm diam.
304	3	Diamond blades 475mm diam.
305	1	Road breaking hammer, petrol engine. Complete with compaction foot and chisels.
306	1	Elgastat de-ioniser.
307	10	Replacement cartridges for de-ioniser, item 306.
308	1	Manesty still.
309	1	Water bath, 16 l capacity, 0-95°C.
310	1	Solvent recovery still.
311	6	Dichloromethane 275kg drum.
312	1	Bottle roller (for extraction of binder).
313	2	Steel bottle 600ml with 49mm rubber stopper.
314	2	Steel bottle 2,500ml capacity with 71mm rubber stopper.

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
315	2	Steel bottle 7,000ml. capacity with 71mm rubber stopper.
316	3	Flask funnel for fitting 7000ml steel bottle.

T. FIELD SAMPLING AND BORING EQUIPMENT:

317	3	Soil auger, steel handle and T-piece.
318	10	Soil auger extension rods, 1m long.
319	3	Soil auger head, 100mm diameter.
320	2	Soil auger head, 150mm diameter.
321	2	Gravel auger head 150mm diameter.
322	2	Stillson wrench size 14
323	3	Chisel to fit standard extension rod

U. SITE INVESTIGATION EQUIPMENT:

324	1	Mackintosh probe, suitable for 10m depth
325	1	Munsel soil colour chart
326	1	Conductivity meter for soil salinity
327	3	Geological hammers (Estwing)
328	4	Dynamic cone penetrometers
329	2	Prismatic compass
330	2	Measuring tapes 30m
331	1	Hygrometer
332	2	Abney levels
333	1	Optical level
334	1	Kango hammer with accessories
335	1	Portable generator 1500 watts 110 volts and 220 volts.

ITEMS TO BE PURCHASED IN SECOND PHASE

(After completion of laboratories and dependent on staff employed)

Triaxial testing equipment

Shearbox testing equipment

Consolidation testing equipment

Permeability apparatus

Nuclear density gauge

Concrete testing equipment to include:-

1 Mixer 56l capacity

Moulds, (cube moulds, beams)

Rapid analysis machine

Vibration compaction equipment

Compression/Flexural testing machine 1000KN

Slump test apparatus

Air entrainment meter

Curing tank 610mm square x 508mm deep

Concrete test hammer, normal

Pluse velcocity measurement, Pundit apparatus

Setting time (Vicat apparatus)

1 Mobile minuteman drill

2 Benkelman beams and calibration equipment

2 Bump integrators

2 Portable weighbridges and calibration equipment

1 Jaw crusher suitable for laboratory use

Laboratory safety equipment eg fire extinguishers

Laboratory first aid equipment

OFFICE MACHINES

Sl. No.	I t e m	Qty.	(Rupees)			
			As per Rate	PC-I Amount	Revised Rate	Revised Amount
1	2	3	4	5	6	7
1.	Typewriters	6	15,000	90,000	20,000	120,000
2.	Typewriters	14	5,000	70,000	10,000	140,000
3.	Composer	1	56,000	56,000	-	-
4.	Calculators	20	400	8,000	400	8,000
5.	Photocopying Machine	1	60,000	60,000	-	-
6.	Duplicating Machine	1	50,000	50,000	-	-
7.	Amonia Printing Machine	1	20,000	20,000	-	-
8.	Micro Computer	1	300,000	300,000	500,000	500,000
9.	PABX	1	-	-	350,000	350,000
10.	Audio/Video aids	(L.S)	-	-	150,000	150,000
1 .	Miscellaneous	(L.S)	-	26,000	50,000	50,000
T o t a l :-		-	-	680,000	-	1,318,000

## CALCULATIONS OF FURNITURE/FIXTURE COSTS

As per original PC-I

Sl. No.	Post	TABLE					CHAIR					RACK					BOOK SHELF					ALMIRAH					FILE CAB.					VISITORS CHAIR				
		Rate	Req.	Amount	Rate	Req.	Amount	Rate	Req.	Amount	Rate	Req.	Amount	Rate	Req.	Amount	Rate	Req.	Amount	Rate	Req.	Amount	Rate	Req.	Amount	Rate	Req.	Amount	Rate	Req.	Amount	Rate	Req.	Amount		
1.	Sr.Chief	2,000	1	2,000	1,500	1	1,500	600	1	600	1	600	800	1	800	800	1	800	800	1	800	700	1	700	700	1	700	400	400	400	10	4,000				
2.	Chief	2,000	1	2,000	1,500	1	1,500	600	1	600	1	600	800	1	800	800	1	800	800	1	800	700	1	700	700	1	700	400	400	400	8	3,200				
3.	Dy.Chief	2,000	4	8,000	1,500	4	6,000	600	4	2,400	4	2,400	800	4	3,200	800	4	3,200	800	4	3,200	700	4	2,800	700	4	2,800	400	400	400	20	8,000				
4.	A.C.	1,500	4	6,000	1,000	4	4,000	600	4	2,400	4	2,400	800	4	3,200	800	4	3,200	800	4	3,200	700	4	2,800	700	4	2,800	400	400	400	12	4,800				
5.	R.O.	1,500	4	6,000	1,000	4	4,000	600	4	2,400	4	2,400	800	4	3,200	800	4	3,200	800	4	3,200	700	4	2,800	700	4	2,800	400	400	400	8	3,200				
6.	A.O.	1,500	1	1,500	1,000	1	1,000	600	1	600	1	600	800	1	800	800	1	800	800	1	800	700	1	700	700	1	700	400	400	400	3	1,200				
7.	Supdt.	1,500	1	1,500	1,000	1	1,000	600	1	600	1	600	800	1	800	800	1	800	800	1	800	700	1	700	700	1	700	400	400	400	2	800				
8.	P.S.	1,500	1	1,500	1,000	1	1,000	600	1	600	1	600	800	1	800	800	1	800	800	1	800	700	1	700	700	1	700	400	400	400	2	800				
9.	SS/G	1,500	1	1,500	1,000	1	1,000	600	1	600	1	600	800	1	800	800	1	800	800	1	800	700	1	700	700	1	700	400	400	400	2	800				
10.	D/Man	2,000	1	2,000	1,000	1	1,000	600	1	600	1	600	800	1	800	800	1	800	800	1	800	700	1	700	700	1	700	400	400	400	2	800				
11.	Comp.Op.	2,000	1	2,000	1,000	1	1,000	600	1	600	1	600	800	1	800	800	2	1,600	800	2	1,600	700	2	1,400	700	2	1,400	400	400	400	8	3,200				
12.	Lib.	1,500	1	1,500	1,000	1	1,000	600	1	600	1	600	800	4	3,200	800	4	3,200	800	2	1,600	700	2	1,400	700	2	1,400	400	400	400	4	1,600				
13.	S/G	1,200	4	4,800	1,000	4	4,000	600	4	2,400	2	1,200	800	2	1,600	800	2	1,600	800	2	1,600	700	2	1,400	700	2	1,400	400	400	400	2	800				
14.	Asstt.	900	2	1,800	800	2	1,600	600	2	1,200	2	1,200	800	2	1,600	800	2	1,600	800	2	1,600	700	2	1,400	700	2	1,400	400	400	400	2	800				
15.	T.Opt.	900	1	900	800	1	800	600	1	600	1	600	800	1	800	800	1	800	800	1	800	700	1	700	700	1	700	400	400	400	1	400				
16.	Lab.Tech.	900	8	7,200	800	8	6,400	600	8	4,800	2	1,200	800	2	1,600	800	2	1,600	800	2	1,600	700	2	1,400	700	2	1,400	400	400	400	8	3,200				
17.	U.D.C.	900	2	1,800	800	2	1,600	600	2	1,200	2	1,200	800	2	1,600	800	2	1,600	800	2	1,600	700	2	1,400	700	2	1,400	400	400	400	1	400				
18.	L.D.C.	900	3	2,700	800	3	2,400	600	3	1,800	3	1,800	800	3	2,400	800	3	2,400	800	3	2,400	700	3	2,100	700	3	2,100	400	400	400	8	3,200				
19.	Tracer	900	2	1,800	800	2	1,600	600	2	1,200	2	1,200	800	2	1,600	800	2	1,600	800	2	1,600	700	2	1,400	700	2	1,400	400	400	400	2	800				
20.	S/T	900	8	7,200	800	8	6,400	600	8	4,800	2	1,200	800	2	1,600	800	2	1,600	800	2	1,600	700	2	1,400	700	2	1,400	400	400	400	4	1,600				
21.	Supt W/S	1,500	1	1,500	1,000	1	1,000	600	1	600	1	600	800	1	800	800	1	800	800	1	800	700	1	700	700	1	700	400	400	400	1	400				
22.	Mech.	900	4	3,600	800	4	3,200	600	4	2,400	4	2,400	800	4	3,200	800	4	3,200	800	4	3,200	700	4	2,800	700	4	2,800	400	400	400	8	3,200				
23.	S/Keeper	1,500	1	1,500	1,000	1	1,000	600	1	600	1	600	800	1	800	800	1	800	800	1	800	700	1	700	700	1	700	400	400	400	2	800				
24.	N/Qasid	-	-	-	300	17	5,100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
TOTAL :		70,300		70,300	59,100		59,100	24,600		24,600	12,000		12,000	36,800		36,800	16,100		16,100	38,400		38,400														

TOTAL : 70,300

TOTAL : 59,100

TOTAL : 24,600

TOTAL : 12,000

TOTAL : 36,800

TOTAL : 16,100

TOTAL : 38,400

TOTAL A = 257,300

TOTAL B = 89,000

TOTAL C = 71,700

G.TOTAL = 413,000

TOTAL A = 257,300

TOTAL B = 89,000

TOTAL C = 71,700

G.TOTAL = 413,000

TOTAL A = 257,300

TOTAL B = 89,000

TOTAL C = 71,700

G.TOTAL = 413,000

TOTAL A = 257,300

TOTAL B = 89,000

TOTAL C = 71,700

G.TOTAL = 413,000

TOTAL A = 257,300

TOTAL B = 89,000

TOTAL C = 71,700

G.TOTAL = 413,000

TOTAL A = 257,300

TOTAL B = 89,000

TOTAL C = 71,700

G.TOTAL = 413,000

**CALCULATIONS OF FURNITURE/FIXTURE COSTS**

( REVISED )

Sl. No.	Post	TABLE				CHAIR				RACK				BOOK SHELF				ALMIRAH				FILE CAB.				VISITORS CHAIR					
		Rate	Req.	Amount		Rate	Req.	Amount		Rate	Req.	Amount		Rate	Req.	Amount		Rate	Req.	Amount		Rate	Req.	Amount		Rate	Req.	Amount		Rate	Req.
1.	Sr.Chief	3,000	1	3,000	2,500	1	2,500	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,700	1	1,700	1,700	1	1,700	1,700	1	1,700	400	10	4,000	400	10	4,000
2.	Chief	3,000	1	3,000	2,500	1	2,500	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,700	1	1,700	1,700	1	1,700	1,700	1	1,700	400	8	3,200	400	8	3,200
3.	D.C.	2,500	4	10,000	2,000	4	8,000	1,000	4	4,000	1,000	4	4,000	1,000	4	4,000	1,700	4	6,800	1,700	4	6,800	1,700	4	6,800	400	20	8,000	400	20	8,000
4.	A.C.	2,000	4	8,000	1,000	4	4,000	1,000	4	4,000	1,000	4	4,000	1,000	4	4,000	1,700	4	6,800	1,700	4	6,800	1,700	4	6,800	400	12	4,800	400	12	4,800
5.	R.O.	2,000	4	8,000	1,000	4	4,000	1,000	4	4,000	1,000	4	4,000	1,000	4	4,000	1,700	4	6,800	1,700	4	6,800	1,700	4	6,800	400	8	3,200	400	8	3,200
6.	A.O.	2,000	1	2,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,700	1	1,700	1,700	1	1,700	1,700	1	1,700	400	3	1,200	400	3	1,200
7.	Supdt.	2,000	1	2,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,700	1	1,700	1,700	1	1,700	1,700	1	1,700	400	2	800	400	2	800
8.	P.S.	2,000	1	2,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,700	1	1,700	1,700	1	1,700	1,700	1	1,700	400	2	800	400	2	800
9.	SS/G	2,000	1	2,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,700	1	1,700	1,700	1	1,700	1,700	1	1,700	400	2	800	400	2	800
10.	D/Man	2,000	1	2,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,700	1	1,700	1,700	1	1,700	1,700	1	1,700	400	2	800	400	2	800
11.	Comp.Opt.	2,000	1	2,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,700	1	1,700	1,700	1	1,700	1,700	1	1,700	400	2	800	400	2	800
12.	Lib.	1,500	1	1,500	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,700	1	1,700	1,700	1	1,700	1,700	1	1,700	400	2	800	400	2	800
13.	S/G	1,200	4	4,800	1,000	4	4,000	1,000	4	4,000	1,000	4	4,000	1,000	4	4,000	1,700	4	6,800	1,700	4	6,800	1,700	4	6,800	400	8	3,200	400	8	3,200
14.	Asstt.	900	2	1,800	800	2	1,600	1,000	2	2,000	1,000	2	2,000	1,000	2	2,000	1,700	2	3,400	1,700	2	3,400	1,700	2	3,400	400	4	1,600	400	4	1,600
15.	T.Opt.	900	1	900	800	1	800	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,700	1	1,700	1,700	1	1,700	1,700	1	1,700	400	2	800	400	2	800
16.	Lab.Tech.	900	8	7,200	800	8	6,400	1,000	8	8,000	1,000	8	8,000	1,000	8	8,000	1,700	8	13,600	1,700	8	13,600	1,700	8	13,600	400	8	3,200	400	8	3,200
17.	U.D.C.	900	2	1,800	800	2	1,600	1,000	2	2,000	1,000	2	2,000	1,000	2	2,000	1,700	2	3,400	1,700	2	3,400	1,700	2	3,400	400	2	800	400	2	800
18.	L.D.C.	900	3	2,700	800	3	2,400	1,000	3	3,000	1,000	3	3,000	1,000	3	3,000	1,700	3	5,100	1,700	3	5,100	1,700	3	5,100	400	6	2,400	400	6	2,400
19.	Tracer	900	2	1,800	800	2	1,600	1,000	2	2,000	1,000	2	2,000	1,000	2	2,000	1,700	2	3,400	1,700	2	3,400	1,700	2	3,400	400	2	800	400	2	800
20.	S/T	900	8	7,200	800	8	6,400	1,000	8	8,000	1,000	8	8,000	1,000	8	8,000	1,700	8	13,600	1,700	8	13,600	1,700	8	13,600	400	8	3,200	400	8	3,200
21.	Supdt.W/S	1,500	1	1,500	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,700	1	1,700	1,700	1	1,700	1,700	1	1,700	400	2	800	400	2	800
22.	Mechanic	900	4	3,600	800	4	3,200	1,000	4	4,000	1,000	4	4,000	1,000	4	4,000	1,700	4	6,800	1,700	4	6,800	1,700	4	6,800	400	4	1,600	400	4	1,600
23.	S/Keeper	1,500	1	1,500	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,700	1	1,700	1,700	1	1,700	1,700	1	1,700	400	2	800	400	2	800
24.	N/Qasid	-	-	-	800	17	5,100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL :		80,300		80,300	63,100		63,100	41,000		41,000	15,000		15,000	78,200		78,200	37,400		37,400	38,400		38,400	38,400		38,400	400	10	4,000	400	10	4,000
A. TOTAL COST 5 TO 23 (A) = 353,400																															
B. COMMON SERVICE																															
1. Conference Room Table x 2 = 10,000																															
2. Conference Room Chair x50 = 25,000																															
3. Printing Room Table x 4 = 4,000																															
4. Laboratories Furniture =100,000																															
5. Workshop Furniture =100,000																															
Total (B): =239,000																															
C. CANTEN AND LIBRARY																															
1. Add. Staff (Sr.Chief) = 20,700																															
2. Canteen Furniture, 16 Chair, 4 Table and Other = 11,000																															
3. Reading Table, Book Racks Almira, Cabinet, etc. = 40,000																															
TOTAL (C) : =71,700																															
G. TOTAL = 664,100																															



FIXTURES

Sl. No.	Description	As per PC-I			Revised		
		Qty.	Rate	Amount	Qty.	Rate	Amount
<u>1. Airconditioners</u>							
	- Senior Staff	11			14		
	- Laboratories	10			10		
	- Library	01			02		
	- Conference Room	02			02		
	- Total	24			28		
	- Less Available	1			6		
	- Net Required	23	12,500	287,500	22	18,000	396,000
<u>2. Gas Heaters:</u>							
	- Staff Rooms	50			50		
	- Laboratories	15			15		
	- Common Places	10			10		
	- Total	75			75		
	- Less Available	10			10		
	- Net Required	65	1,200	78,000	65	1,500	97,500
	- Grand Total			365,500			493,500

REQUIREMENT OF TRANSPORT VEHICLES

S.No	I t e m	As per P.C-I			R e v i s e d				
		Qty.	Local	FEC	Total	Qty.	Local	FEC	Total
1.	Survey Vehicles	2	0.300	-	0.300	2 <sup>1</sup>	-	1.183	1.813
2.	Personnel Carrier	1	0.15	-	0.150	1 <sup>2</sup>	-	0.557	0.557
3.	B u s	1	0.650	-	0.650	-	0.750	-	0.750
Total:-			1.100	-	1.100		0.750	1.740	2.490

## Note:-

1. Truck for deflection measurement - 1 No. (Provided by ODA)  
    Saloon car for B.I unit - 1 No. ( " " " )
2. 8-10 Seater Ford Transit - 1 No. ( " " " )

ESTABLISHMENT CHARGES ( AS PER ORIGINAL P.C-1)

Sl. No.	Designation	EPS	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
			No. of posts	Basic Pay	S.P. Allow.	H.R. Ceiling	Convey. Allow.	Ent. Allow.	Spl. Res. Allow.	Total Per Month	Man-Months	Total Costs	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	
1.	Sr. Chief	21	1	4,200	400	3,000	285	500	2,000	10,485	80	314,550	
2.	Chief	20	1	3,800	200	2,500	285	400	1,500	8,585	42	364,770	
3.	Deputy Chief	19	4	3,200	-	2,000	285	-	1,000	6,485	102	661,470	
4.	Asstt. Chief	18	4	2,100	-	1,500	235	-	700	4,585	102	467,670	
5.	R.O.	17	2	1,600	-	1,500	100	-	500	3,700	102	377,400	
6.	A.O./Teh. Offrs.	17	2	1,600	-	1,500	100	-	-	3,200	94	268,800	
7.	Supdt.	16	5	1,050	-	1,150	100	-	-	2,300	168	487,500	
8.	S/ grapher	15	6	1,050	-	1,150	100	-	-	2,300	174	400,200	
9.	S/ typist	12	7	750	-	900	100	-	-	1,750	195	341,250	
10.	D/Man	16	1	1,050	-	1,150	100	-	-	2,300	24	56,160	
11.	Tracer	8	2	590	-	600	70	-	-	1,260	42	60,450	
12.	Asstt.	11	3	850	-	1,150	70	-	-	2,070	108	223,560	
13.	U.D.C.	7	2	530	-	600	70	-	-	1,200	60	73,920	
14.	L.D.C.	5	3	520	-	400	70	-	-	990	90	91,080	
15.	Librarian	16	1	1,050	-	1,150	100	-	-	2,300	42	91,000	
16.	Tel. Opert.	11	1	700	-	900	70	-	-	1,670	18	30,270	
17.	Com. Opert.	16	1	1,050	-	1,150	100	-	-	2,300	42	99,050	
18.	Lab. Tech.	11	8	700	-	900	70	-	-	1,670	144	240,480	
19.	Mechanics	11	5	700	-	900	100	-	-	1,700	138	234,270	
20.	S/keeper	11	2	700	-	900	100	-	-	1,700	50	102,300	
21.	Driver	4	3	500	-	400	70	-	-	970	90	87,360	
22.	N/Qasid	1	16	440	-	250	70	-	-	760	400	319,560	
TOTAL :												5,400,560	

82

OR SAY: 5.400 Million

## ESTABLISHMENT CHARGES ( Revised )

Sl. No.	POST	BPS	No. of Posts	Basic Pay	H.R. Ceiling	A l l o w a n c e s										Total P.M.	Man-Month	Total Cost
						7	8	9	10	11	12	13	14	15	16			
1	SR.CHIEF	21	1	5420	5900	305	800	800	1160	1084	400	-	15,869	30	476,070			
2	CHIEF	20	1	4900	5000	305	800	700	940	980	400	-	14,025	30	420,750			
3	D.C.	19	4	4130	4000	305	800	600	820	820	-	-	11,450	141	1,617,975			
4	A.C.	18	4	2710	3000	305	542	500	780	780	-	-	8,617	129	1,111,593			
5	R.O.	17	4	2065	3000	305	413	400	620	620	-	-	7,423	156	1,157,988			
6	A.O./T.O.	17	2	2065	3000	305	-	-	-	620	-	-	5,990	54	323,460			
7	SUPDT.	16	2	1350	2250	76	-	-	-	270	-	-	3,946	60	236,760			
8	S/G	15	6	1165	2250	76	-	-	-	233	-	50	3,774	177	667,998			
9	S/T	12	7	970	1800	76	-	-	-	194	-	50	3,090	201	621,090			
10	D/MAN	16	1	1350	2250	76	-	-	-	270	-	-	3,946	24	94,704			
11	TRACER	08	2	790	1200	76	-	-	-	158	-	50	2,274	48	109,152			
12	ASST.	11	3	910	1800	76	-	-	-	182	-	50	3,018	78	235,404			
13	U.D.C	07	2	750	1200	76	-	-	-	150	-	50	2,226	78	173,628			
14	L.D.C.	05	3	700	800	76	-	-	-	140	-	50	1,766	72	127,152			
15	LIB.	16	1	1350	2250	76	-	-	-	270	-	-	3,946	30	118,380			
16	T.OPT.	11	1	910	1800	76	-	-	-	182	-	50	3,018	24	72,432			
17	COM.OPT.	16	4	1350	2250	76	-	-	-	270	-	-	3,946	108	426,168			
18	LAB.TECH	11	8	910	1800	76	-	-	-	182	-	50	3,018	192	579,456			
19	MECHANIC	11	5	910	1800	76	-	-	-	182	-	50	3,018	114	344,052			
20	S/KEEPER	11	2	910	1800	76	-	-	-	182	-	50	3,018	54	162,972			
21	DRIVER	04	3	675	800	76	-	-	-	135	-	50	1,736	96	166,656			
22	N/Q-HELPER	01	16	600	500	76	-	-	-	189	-	50	1,415	456	645,240			

9,889,080

OR SAY : 9.889 MILLION

TRAINING AND TECHNICAL ASSISTANCE

S.No.	I t e m	Qty.	Cost (Rs.Million)					
			As per PC-I			Revised		
			Local	FEC	Total	Local	FEC	Total
1.	Air tickets for short term trainign @ Rs.15,000 each.	13	0.195	-	0.195	-	-	-
2.	Local expenses of Foreign experts short term visits for training of staff.	L.S	0.275	-	0.275	-	-	-
3.	Travel and daily expenses of training abroad.	L.S	-	0.500	0.500	-	-	-
4.	Other expenses.	L.S	0.030	-	0.030	-	-	-
5.	<u>Training:</u>							
	a) 1 yr. M.Sc Course	4	-	-	-	-	1.739	1.739
	b) 3 months technician course	6	-	-	-	-	1.566	1.566
	c) 1 week course at TRRL	6	-	-	-	-	0.104	0.104
	d) 3 months specialist visits from U.K	2	-	-	-	-	0.696	0.696
6.	Technical cooperation for collaborative research	L.S	-	-	-	-	2.435	2.435
7.	TRRL Input 2 visits per year for 5 years	L.S	-	-	-	-	0.939	0.939
Total:-			0.500	0.500	1.000	-	7.479	7.479

(70)  
FOREIGN EXCHANGE COMPONENT  
 (To be provided by ODA)

ANNEXURE-J

I t e m	AMOUNT		
	£ (Sterling Pounds)	Rs. Mill.	
<b><u>I. LABORATORY EQUIPMENT:</u></b>			
(i) Equipment	Phase 1	£121,000	
	Phase 2	£132,000	
	Photocopying equipment	£7,000	
	Specialist visits to install equipment	£10,000	
(ii) Vehicle	1 Personal Carrier or Land-Rover	£15,000	
	1 Truck (for deflection measurements)	£18,000	
	1 Vehicle - Estate car (for B.I measurements)	£12,000	
	Shipping etc.	£5,000	
	Sub - Total (I)	£320,000	11.131
<b><u>II. TRAINING/TECHNICAL ASSISTANCE:</u></b>			
(i) Trainig	4 x 1yr Msc. Course	£50,000	
	6 x 3 month Technicians course	£45,000	
	6 at TRRL 1 week course	£3,000	
	2 x 3 month Specialist from U.K	£20,000	
(ii) Technical Cooperation for collaborative research		£70,000	
(iii) TRRL Input (TC) 2 visits/yr for 5 years		£27,000	
	Sub- Total (II)	£215,000	7.479
<b><u>III. BOOKS AND PERIODICALS:</u></b>			
		£5,000	
	Sub- Total (III)	£5,000	0.174
	Total I + II + III	£540,000	18.784
	Contingencies	£10,000	0.348
	Total FEC	£550,000	19.132

Note:- ( 1£ = Rs.34.7855)

LIST OF RESEARCH STUDIES

# RESEARCH STUDIES

## COMPLETED

1. Economics of Electrification -- Khanewal - Samasatta Section of Pakistan Railways	February, 1975	32. National Port Policy	May, 1979
2. Inland Water Route-Port Qasim-Sukkur	May, 1975	33. A Survey of Intercity Bus Operations	May, 1979
3. Highway Improvement Priority Criteria	January, 1976	34. Motor Vehicle Ordinance-Working Paper	June, 1979
4. Pilot Origin & Destination Survey	January, 1976	35. Canal Roads for Public Use (Feasibility Study)	July, 1979
5. Inland Traffic Forecast 1980-81	February, 1976	36. Choice of Mode for Journey to work (For Government Employees)	August, 1979
6. Port Cargo Traffic Forecast for Pakistan (1974-75 to 1989-90)	February, 1976	37. Traffic Enforcement Plan for Rawalpindi	November, 1979
7. Organization of NTRC Interim Report	April, 1976	38. 4th Course on Transportation Projects Planning	November, 1979
8. Effects of Highway Design Elements on the Capacity of Two-Lane Roads	August, 1976	39. Psychological Attitudes Towards Highway Safety	January, 1980
9. Farm-to-Market Roads Survey	November, 1976	40. Bus Make Study	March, 1980
10. Pakistan Maritime Transport Study	January, 1977	41. Abstract of Research Studies (1st Issue)	March, 1980
11. Lowari Ropeway Study	February, 1977	42. Computerized Reservation of PIAC	June, 1980
12. A Note on Petrol Versus Diesel Transport	August, 1977	43. Five Year Plan for F.W.O.	June, 1980
13. Re-organization of Administrative Control of Transport	October, 1977	44. Establishment of NTRC Phase-I, (Revised) PC-II.	July, 1980
14. Change of Passenger Class Structure of Pakistan Railways-Effect on Revenues	November, 1977	45. Role of Transportation in Development	July, 1980
15. Containerization in Pakistan	November, 1977	46. Real Problem of Highway Safety in Pakistan	July, 1980
16. Economics of Pipeline Versus Rail	December, 1977	47. Investment Programme and Development Projects of PIAC	July, 1980
17. Pakistan Highway Code	December, 1977	48. Review of Port Traffic Forecasts	August, 1980
18. Re-Organization of Traffic Police	January, 1978	49. Effectiveness of Traffic Police Training	September, 1980
19. Draft Motor Vehicle Ordinance, 1978	January, 1978	50. Road Safety Ordinance, 1980	October, 1980
20. Traffic Survey of Islamabad Highway	June, 1978	51. Transport Bulletin	November, 1980
21. Organization of NTRC Final Report	July, 1978	52. Highway Speed Survey	November, 1980
22. Effect of Increase in Bus Fares on Common Man's Budget	July, 1978	53. Energy Use in Transport	February, 1981
23. Highway Operating Speeds of Government & Private Bus Drivers	August, 1978	54. Utilization of Technical Manpower in IVDs	February, 1981
24. Transport Requirements - Shortage of Buses	October, 1978	55. Effect of Enforcement on Road User's Behaviour	March, 1981
25. Modern Transportation	December, 1978	56. Manual of Uniform Traffic Control Devices	July, 1981
26. Survey of Bus Services for Islamabad Secretariat	December, 1978	57. Fuel Consumption Study	July, 1981
27. Accident Study for Punjab	December, 1978	58. Inland Water Transport in Pakistan	September, 1981
28. Containerization in Pakistan Final Report	January, 1979	59. Transport Research & Development in Pakistan	October, 1981
29. Feasibility Study for the Operation of a Passenger/Ro-Ro-Ferry Service to the Gulf by P.N.S.C.	March, 1979	60. Transport Bulletin (Supplementary No. B)	November, 1981
30. Transport Data Collection, Storage & Retrieval System	March, 1979	61. Bus Driver Training Pilot Study	December, 1981
31. Highway Transportation Studies and Surveys	April, 1979	62. Traffic Factors for Pakistan	March, 1982
		63. Multi Axle Vehicle Survey	October, 1982
		64. Axle Load Survey	October, 1982



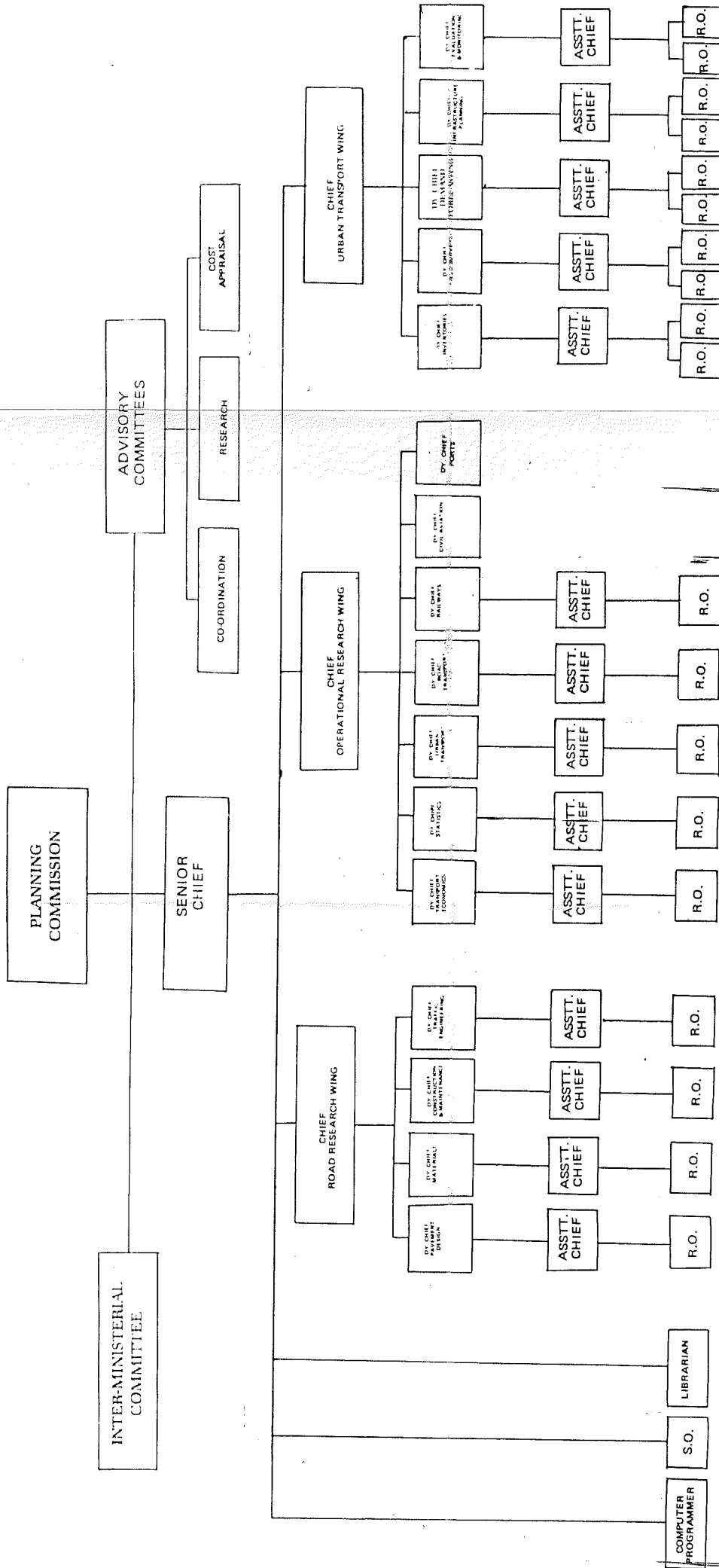
65. Road Accidents in Pakistan	January, 1983	94. 8th Course on Transportation Projects Planning	December, 1986
66. Establishment of NTRC PC-II, Phase-III	March, 1983	95. Survey of Road Construction Machinery	January, 1987
67. Economic Implication of Vehicle Over-loading	April, 1983	96. Improvement in Taxi Services Rawalpindi-Islamabad Vol. I&II	February, 1987
68. Road Development Plan Azad Jammu & Kashmir (1983-88)	April, 1983	97. Economics of Taxi Operation	March, 1987
69. National Transport Plan Study	May, 1983	98. Procedures Manual for Evaluation of Farm-to-Market Roads	June, 1987
70. Road Traffic Origin-Destination Survey (1979-80)	June, 1983	99. Effectiveness of Bus Driver Training Course	June, 1987
71. Transport Alternatives for Sixth Plan	August, 1983	100. Battery Powered Electric Vehicle	October, 1987
72. Review of Vehicle Operating Equipment and Inventory in Pakistan	November, 1983	101. Pilot Urban Bus Project (Preliminary Evaluation)	December, 1987
73. Survey of Skidding Resistance Values on Main Roads in Pakistan	December, 1983	102. Analytical Review of Road and Road Transport Statistics (1947-86)	December, 1987
74. 5th Course on Transportation Projects Planning	December, 1983	103. 9th Course on Transportation Projects Planning	December, 1987
75. A Review of Design Standards for Tertiary Rural Roads	November, 1984	104. Transport Bulletin	January, 1988
76. Intermodal Choice Motivation	December, 1984	105. PC-II, NTRC Phase-III	January, 1988
77. 6th Course on Transportation Projects Planning	December, 1984	106. Road Freight Transport	February, 1988
78. Vehicle Operating Cost Study	January, 1985	107. Road Freight Industry Survey	February, 1988
79. The Volume and Composition of Traffic on Tertiary Rural Roads	January, 1985	108. Taxi Survey (Peshawar)	June, 1988
80. A Study of Design Standard for Surface Width and Design Speed on Tertiary Rural Roads	February, 1985	109. Un-Remunerative Rail Lines	June, 1988
81. Transport Statistics, 1984	April, 1985	110. Unit Cost of Road Construction	July, 1988
82. Motor Vehicle Utilization Survey	June, 1985	111. Inland Water Transport (Review)	August, 1988
83. Road Accidents Counter Measures in Pakistan	June, 1985	112. Abbottabad Murree Road Traffic Count Study	October, 1988
84. Transport Demand for Major Commodities	June, 1985	113. Taxi Survey (Lahore)	November, 1988
85. O.D. Survey for Rail	June, 1985	114. Indus River Expedition (1987-88)	November, 1988
86. Public Service Vehicle Survey	June, 1985	115. Abstract of Research Studies (Third Issue)	December, 1988
87. 7th Course on Transportation Projects Planning	December, 1985	116. International Seminar on Highway Safety	March, 1989
88. Survival Rate of Motor Vehicles	December, 1985	117. Inland Water Transport (Canal Reconnaissance)	April, 1989
89. Origin Destination Survey for the Link Road between Super Highway and PQA	March, 1986	118. Installation of Standard Traffic Signs on National Highway N-5 Lahore-Gujranwala Section	April, 1989
90. PC-I, Urban Transport Wing in NTRC	April, 1986	119. Taxi Survey (Quetta)	May, 1989
91. Abstract of Research Studies (Second Issue)	June, 1986	120. Taxi Survey (Karachi)	May, 1989
92. The Effect of Road Work Signs on Driver Behaviour	October, 1986	121. Peshawar Ring Road (Alignment)	May, 1989
93. The Effect of Road Markings on Drivers Behaviour	December, 1986	122. Quality Control of Road Construction	June, 1989
		123. Role of Tractor Trolleys in Transportation	June, 1989
		124. Link Node Directory	June, 1989

125. Traffic Factors for Pakistan June, 1989  
126. Traffic Count Programme (Phase-IV) June, 1989

## ON-GOING

127. Urban Bus Train.  
128. Accelerated Rural Development Programme  
129. Demonstration Projects.  
— Dial a Taxi Project.  
— Lahore Canal Bank Road.  
— Low Cost Roads.  
— Parking Meter.  
— Chip Spreader.  
— Fixed Time Traffic Signal.  
— Traffic Actuated Signal.
130. Intersection Improvement at Peshawar.  
131. PCU Equivalency Factors.  
132. Economics of Mini-Bus Operations.  
133. Truck Industry Survey.  
134. Economics of Truck Sizes.  
135. Effect of Road Roughness on Freight Tariffs.  
136. Role of Improved Communication on Truck Utilization.  
137. Two Tier Urban Bus Service - Karachi.

# ORGANISATION CHART



STAFF FOR ROAD RESEARCH WING IN THE  
NATIONAL TRANSPORT RESEARCH CENTRE

Sl. No.	Designation	BPS	No. of Staff
1.	Senior Chief	21	1
2.	Chief	20	1
3.	Deputy Chief	19	4
4.	Assistant Chief	18	4
5.	Research Officer	17	4
6.	A.O/Transport Officer	17	2
7.	Superintendent	16	2
8.	Stenographer	15	6
9.	Stenotypist	12	7
10.	Draftsman	11	1
11.	Tracer	8	2
12.	Assistant	11	3
13.	U.D.C.	7	2
14.	L.D.C.	5	3
15.	Librarian	16	1
16.	Telephone Operator	11	1
17.	Computer Operator	16	4
18.	Lab. Technician	11	8
19.	Mechanic	11	5
20.	Store Keeper	11	2
21.	Driver	4	3
22.	Niab Qasid	1	16
Total :			82