

**ROAD IMPROVEMENT
REQUIREMENTS IN KARNATAKA**

"ROADS FOR PROSPERITY"

**REPORT
OF
THE TASK FORCE
FOR
ROAD WORKS**

Submitted to

GOVERNMENT OF KARNATAKA

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TASK FORCE FOR ROAD WORKS

EXECUTIVE SUMMARY

ROAD STATISTICS

The major road network in Karnataka State consist of 3,497 km of National Highways (NH) including recently upgraded roads, 10,021 km of State Highways (SH) and 28,247 km of Major District Roads (MDR). This includes (i) 396 km of State Highways taken up for upgradation and 1027 km taken up for major maintenance under Phase - I of the Karnataka State Highway Improvement Project (KSHIP), with assistance from the World Bank and (ii) 618 km of State Highways taken up for improvement under Karnataka State Road Development Corporation Ltd. (KRDCL) (iii) 508 km of State Highways to be taken up during the second phase of KSHIP. The funds for the maintenance and improvement works of the NH are made available by the Ministry of Surface Transport (MOST) Govt. of India. Therefore the Task Force has attempted to review the present condition of the SH and MDR in the state and to work out a master plan with a feasible approach to upgrade and maintain the major state road network to a substantially higher standard, within the shortest possible time frame. At present, only about 10% of SH has two-lane carriage-way width of 7.0 m, 31% has intermediate lane width of 5.5 m and the remaining 59% has single lane width of 3.5 to 3.8 m. In the case of MDR, less than 1% percent consist of two-lane roads, 6% intermediate lane roads and about 93% single lane roads. The annual average growth rate of traffic intensity (load in metric tonnes per day) during the past five years has been 22.9% on SH and 18.42 % on MDR, in comparison to 17.0% on NH in Karnataka. 14 km of SH and 5597 km of MDR are yet to be provided asphalt surfacing. The riding quality of asphalted pavement surface of SH and MDR are by and large far from satisfactory.

CAUSES OF POOR ROAD CONDITION AND RAPID DETERIORATION

Due to the high growth rate of traffic loads moving along the state roads and inadequate maintenance and strengthening, the road pavements have become structurally inadequate, resulting in rapid rate of pavement deterioration. Added to this, the funds made available year after year to the state Public Works Department, Communications and Buildings (PWD-C&B) for road works has been at a shrinking rate with reference to the traffic growth and cost escalation of works. The inadequate and delayed maintenance of the state roads and movement of overloaded heavy commercial vehicles (HCV) has resulted in poor condition of road pavement, with lots of unfilled and improperly filled pot holes, considerable surface undulations, areas with wide cracks, longitudinal and cross ruts, broken pavement edges, unsafe shoulders and ineffective road drainage system. Providing a thin resurfacing course over structurally deficient road pavement is a wasteful exercise as this type of cosmetic treatment cannot withstand the present day traffic even for one monsoon season.

It may be emphasised that all flexible pavements are bound to deteriorate under the combined action of traffic, weathering of bituminous materials and other environmental and local factors. Therefore these roads will need maintenance from time to time, depending upon the rate of deterioration. The most essential day-to-day maintenance works include maintenance of road drains, shoulders and pavement surface. Thus it is obvious that it is not possible to achieve maintenance-free roads, particularly in the case of roads with flexible pavements.

It is to be noted that timely and required maintenance goes a long way in maintaining the design life of the pavement and riding quality. For a rupee not invested in the road maintenance, the road user ends up in wasting three rupees extra on the transportation cost. Assessed loss in transportation due to bad roads is Rs.200 billion per year in the country. (1995 base year).

BUDGET ALLOCATIONS

The budgetary allocations for Karnataka PWD (C&B) during the last three financial years, 1997-98, 1998-99 and 1999-2000 for plan works were Rs.44.49, 22.03 and 18.30 crores where as the actual amounts released during these three years were Rs.43.76, 18.65 and 13.72 crores respectively. The budget allocations for Non-plan or road maintenance works during the above three years were Rs.95.00, 118.00 and 147.83 crores respectively and the actual amounts released were Rs.74.66, 98.39 and 100.93 crores only. As the amounts released are generally lower than those sanctioned in the budget, the pending bills for the works executed keep increasing and the accumulated back-log in construction and maintenance works of the state roads continue to increase year after year.

The study team of Karnataka PWD which visited Andhra Pradesh (AP) has reported that the grants sanctioned during the year 1999-2000 for the maintenance of SH and MDR in AP works out to Rs 12 lakh per km of road, whereas the amount sanctioned in Karnataka during the same year works out to less than a meagre 0.244 lakh per km of roads. The above facts indicate that road maintenance in this state has been receiving relatively very low priority. It may be mentioned here that essential road maintenance works such as improvement and maintenance of road drainage, shoulders and profile correction of road pavements get neglected year after year.

QUANTIFIED BENEFITS DUE TO ROAD IMPROVEMENT

The quantitative measure of riding quality of pavement surface is generally expressed in terms of unevenness or roughness index (RI) in mm per km. In the case of state roads, the mean RI value is estimated to be over 8000 mm per km, which is alarmingly high, resulting in considerable increase in vehicle operation cost (VOC) to road users due to increased rate of consumption of fuel, lubricating oil, etc. and enhanced tyre wear and vehicle maintenance cost. If the RI value of road surface is brought down from the present estimated average value

of about 8000 mm per km to 3000 mm per km by suitable road maintenance measures of the state roads, the total saving in consumption of diesel and petrol in the state is estimated to be about 687,523 and 163,008 kilo-litres respectively per year, which also results in substantial saving in foreign exchange to the nation. The average life of the automobile tyres is estimated to increase by about 6.1% due to the road improvement. The total saving in vehicle operation cost to the users of automobiles in the state due to the saving in the cost of fuel, tyres and vehicle spare parts, as a result of proposed improvement in maintenance level of existing state roads, works out to over Rs 2080 crores per year excluding the time cost of vehicles and road users. The assumptions made and the outline of calculations for working out the VOC and the annual savings to registered vehicles in the state are given in **Appendix - A**.

Due to the proposed upgradation of road pavement surface, there will also be considerable intangible benefits such as improvement of riding comfort to drivers and other travellers and reduction in pollution caused by road traffic. The Task Force proposes to give top priority for improvement in road maintenance standards in the state by making the required investments on one hand and to recover part of this saving in VOC from the beneficiaries or the road users, by charging special levy or cess on petroleum products, tyres and automobile parts, in order to create a dedicated fund, namely "**Karnataka Road Fund**". This is in tune with the present day concept of 'User or beneficiaries to pay for the services'

The next important task to be taken up is widening and upgradation of some of the selected stretches of existing roads with high traffic volume. There are several road stretches where the road-way width has remained narrow with reference to total traffic flow and its growth rate, expressed in terms of traffic volume in Passenger Car Units (PCU) per day. These narrow stretches have been causing traffic congestion, delays and higher accident rates. The road stretches with high traffic flow needing widening and upgradation have been identified (**vide Appendix - C**) and a prioritised list of road stretches is to be prepared after data collection, for being taken up for upgradation work during the subsequent phases. While fixing the priority of road stretches to be taken up for special maintenance or other upgradation works, factors such as existing condition of road, present traffic load intensity,

traffic volume and their growth rate, the importance of the road, etc. will be taken into account. Widening of these roads is also expected to result in considerable saving in VOC for the road users, in terms of saving in fuel and tyre cost. It is desirable to widen single-lane carriageways straight away to two-lane carriageway instead of in two stages, to intermediate lane and later to two lane road, in order to ensure better construction quality in the field. The proposed road improvement works also include improvement of road safety measures such as improvement of road intersections and of identified accident black spots, installation of traffic control and road safety devices, etc. However the savings due to possible reduction in road accidents have not been worked out.

BUDGET REQUIREMENTS

Due to paucity of funds, the state government has not been in a position to release sufficient amounts to make up the deficiencies of the existing roads and to maintain them in good condition, keeping pace with the deterioration caused by increasing traffic loads. Obviously it is not possible for the state government to arrange for funds to meet the expenditure involved for the special maintenance works on the existing roads and for the upgradation of the roads. The total cost of maintenance and upgradation of all the state roads during the road improvement plan period is estimated to be Rs.9,087 Crores as given in **Appendix – E**. It is proposed to raise funds and carryout the special maintenance works and the upgradation works in a phased manner in a period of five years, as per the proposed master plan. The estimation of cost for different categories of road maintenance and upgradation works and funds required as per these estimates such as improvement of road drainage system and patching of all pot holes given in **Appendix – E** are

- i) Rs. 856 crores for the top priority essential maintenance works of all state roads to be urgently completed excluding World Bank Assistance (WBA), Karnataka Road Development Corporation Ltd. (KRDC) roads.
- ii) Rs. 2,945 crores for upgradation of 8200 km of roads during first phase.

Rs 272 crores for paving and surfacing of unsurfaced road stretches.

Rs 2,785 crores for resurfacing and improvement of rest of the roads of second priority.

- v) Rs.2,229 crores for widening and upgradation of the rest of second priority PWD roads including improvement of road safety.

Thus the total cost required for the five categories of road improvement works during the road improvement plan period is about Rs.9087 Crores.

While budgeting, provision should be so structured to complete the work in two years. No fresh work which cannot be adequately funded during the year is to be included in the budget. Cash flow/ cash releases should be as per the works programme/ action plan drawn at the beginning of the year and should avoid rush of expenditure at the end of the financial year.

KARNATAKA ROAD FUND

A campaign may be started in an appropriate way to convince the transport operators and other road users about the savings in transportation cost that will accrue to them due to the proposed improvement of roads, the cost of improvement works and the need to impose an additional cess or levy out of the saving in transportation cost. It may also be clarified that this cess will be deposited in a dedicated non lapsable fund called, '**Karnataka Road Fund**' (KRF) which will be exclusively utilised for road maintenance and upgradation works of the state roads. It is suggested that the implementation of the road upgradation programme as per the master plan and management of Karnataka Road Fund should be assigned to a newly created high powered body called **Karnataka Road Board**, consisting of stake holders, administrators, technocrats and experts.

By levying a cess of say Rs.0.50 per litre on fuel and 10% cess on automobile spares and tyres , an amount of about Rs.232 crores/year could be generated to the Karnataka Road Fund. A seed money of Rs.500 crore should be made available as KRF.

FINANCING

The required funds have to be raised by road bonds and by borrowing from organisations like HUDCO, financial Institutions and banks and the road maintenance works started off as per the master plan, and got completed in a period of five years. Simultaneously the additional cess should be levied as proposed towards "Karnataka Road Fund' and appropriate repayment details of the loans worked out with the help of experts.

ORGANISATIONAL CHANGES

a) RESTRUCTURING OF PWD

The PWD is to be restructured by creation of Karnataka Road Board on the lines of corporate functioning and to introduce accountability. In the mean time, separate identity of the PWD (C&B) is to be maintained by having separate seniority of the PWD (C&B) technical staff both for promotion and transfer in order to retain the proficiency developed within the department. No transfer either from or / to PWD (C&B) or Irrigation or other departments is to be effected.\ It is very much desirable to fully separate out the two departments of PWD (C&B) and Irrigation as early as possible and totally avoid inter-transfers.In order to develop the proficiency and encourage specialisation, restructure the PWD to segregate roads and buildings. A separate autonomous Building/ Authority be created that could cover the existing KHB, KSPMS and the construction and maintenance of existing buildings now under the jurisdiction of PWD.

The engineers with post graduate qualification in a particular area of specialisation are often not posted in the relevant departments; they are posted or transferred often to other departments where their specialised qualifications will not be useful. This practice also should be discontinued.

b) KARNATAKA ROAD BOARD

An independent, dedicated Road Board, functioning on the lines of a Corporate body (comprising of interested parties, lenders and stake holders as directors) to manage the Road Fund should be created to coordinate transport development, frame policies, plan and monitor the road development

INNOVATIVE CONTRACT PROCEDURES

In order to bring in qualitative and quantitative improvements in standards of the road works, several recommendations are being proposed. These include more innovative approaches of awarding contracts which impose more responsibility on the contracting agencies and upgradation of the equipment, techniques and materials used for road construction and where contractor maintains the road during the design life of road work.

ACCOUNTABILITY

The Task Force proposes to introduce accountability as part of the duties of each Executive Engineer and the various other engineers in the jurisdiction which include, maintenance and upkeep of the road drains, shoulders and pavement surface within the limits specified. For example no pot holes of even small size (0.1x0. m size) should remain unpatched for more than two days on the road pavement. The average RI value of pavement surface of the road stretches covered under the special maintenance work within the jurisdiction of each executive engineer initially should not exceed 3000 mm per km after the

special maintenance works and the RI value of these stretches should not exceed 4000 mm/km on SH and 4500 mm / km on MDR at any point of time within five years.

In order to efficiently manage the valuable assets of the state roads, it is necessary to give quasi-judicial powers and authority to the Executive Engineers of the PWD (C&B) and also to make each one of them alongwith all the concerned set of subordinate Engineers fully accountable for the entire road length in their jurisdiction. Some of the suggestions in this direction include authority to Executive Engineers to (i) (i) check the wheel/axle loads of commercial vehicles using portable weigh pads/bridges and to take authorised penal action and (ii) resurvey land to check suspected encroachments of road land and to take authorised steps to clear the encroachments.

LEGISLATIVE CHANGES

Highway Act and Rules, Motor Vehicle Act and rules need to be modified and amendments needed to be effected to the Statute are:

- i) empowering PWD officers to check overloading of commercial vehicles and to remove road encroachments
- ii) management/maintenance by privatization
- iii) enforcing the implementation of decisions of KRB
- iv) prohibiting ribbon development
- v) encourage introduction of multi-axled vehicles by extending fiscal incentives.

PRIVATE SECTOR PARTICIPATION

The Task Force proposes the construction of new road links such as bypass roads and new or missing road links through private sector participation. The stretches of SH and MDR,

which pass through congested towns and urban centres are to be identified. The conflicts between the through traffic and the local traffic cause undue delays and increase in VOC, pollution as well as road accidents, warranting construction of bypass roads to these towns. A few of the missing road links are also to be identified to provide direct access or improved connectivity to potential growth centres like tourist spots. Feasibility studies should be got conducted through competent professionals such that the economic viability of each proposed road link could be worked out and the possible sources of financing the project could be justified. Some of the bypasses and new road links, fresh or reconstruction of bridges could be developed as toll roads as Build Operate and Transfer (B.O.T). or Build Own Operate and Transfer (B.O.O.T). projects with total funding from private sources. Other alternative sources of raising funds could be worked out for the remaining bypasses and new road links. This item of work could be got done through Karnataka Road Development Corporation Ltd (KRDCL)

COMPUTERISED DATA BASE

One of the essential requirements envisaged for making qualitative improvement in road maintenance standards is collection of road-wise data base on each km length of the road in a professional manner and computerisation of the data. This work of data base collection has to be got done urgently on the first priority list of roads of about 8200 km length to be taken up for special road maintenance works, through competent professional consultants. The terms of reference for the professional consultants have been prepared (**Appendix – B**) which includes training of selected set of PWD engineers so that they could complete the preparation of data-base and computerisation of data for the rest of 78.5% of PWD roads, utilising their own man power and resources and help from the Bangalore University. Therefore some special funds have to be sanctioned for completing the preparation of data base on first priority roads of 8,200 km length (**Appendix - C**), within six months through professional consultants, for imparting training and for procurement of some essential equipment including computers, so as to enable PWD engineers to continue with the work.

It is essential to conduct pavement evaluation studies and to record all the particulars of drainage, shoulder and geometric details of the state roads. The data should be computerised such that all the technical details of any km stretch of all the state roads along with the particulars such as the date and type of maintenance work carried out, the construction agency that carried out the work and the names of concerned engineers responsible during execution are all available at the finger tips. This would introduce transparency in the works executed and also instill more responsibility in all those concerned with the works.

Some funds have to be ear-marked in the annual PWD budget for the preparation and computerisation of data base on the remaining 78.5% percent of the state roads on a continuing basis.

PRIORITISATION OF ROAD IMPROVEMENT

In view of the above facts, the Task Force is of the opinion that the maintenance and upgradation of existing PWD roads should be given the highest priority. Of this, the minimum essential maintenance works pertaining to road drainage, shoulders and pavement surface including patch repair and profile correction works should be assigned first priority and are to be carried out on the entire length of state roads on war footing, within the shortest possible period of time. The objective of the top priority essential maintenance programme is to temporarily achieve pot- hole-free roads in the state. The structural and functional upgradation of road pavements and shoulders and widening of carriageway and formation should be taken up immediately after that, in different phases after assigning priorities. The upgradation of the pavements should be carried out such that the riding quality of road surface is substantially improved with the average RI value less than 3000 mm per km and the design life of the pavement overlay is atleast five years. A qualitative improvement in road maintenance standards and increase in service life are expected, after the upgradation works under this scheme.

CONSTRUCTION PRACTICES

Some of the out-dated, primitive and unscientific construction specifications, techniques and practices, result in poor performance and inferior riding quality of road pavement, are to be identified. These are to be discontinued or be suitably modified at the earliest. Improved design, construction techniques and use of modern construction machinery/ equipment have been suggested so as to improve the quality of work, riding quality of finished surface and increase the service life of the road pavement. To cite some examples, specifications for soling course, drainage layer or the sub-base construction, application of prime coat and tack coat, some of the specifications for Water Bound Macadam (WBM) and bituminous construction techniques need drastic changes. It is essential to introduce construction machineries such as vibratory rollers, upgraded stone crushers and mixing plants, sprayers etc. The necessary changes/revisions in the specifications, execution details and the rates in the present specifications and PWD schedule of rates have been suggested so as to effect substantial upgradation in the quality of road works.

Some of the deficiencies in the existing, contract specifications and method of execution of road works are to be identified and appropriate changes such as performance based maintenance contract keeping in view the present trends elsewhere. Some changes in organisational set up have also been suggested in order to tone up the work culture in the state PWD.

KARNATAKA HIGHWAY RESEARCH AND TRAINING INSTITUTE

There is a need to start a Highway Research and Training Institute in order to carry out applied research studies and to suggest solutions to site specific problems on similar lines as the Highways Research Station, Chennai in Tamil Nadu. This Research Institute could also carry out data collection and computerisation of the data base on all the roads of the state and carry out required changes in the specifications etc. The Institute should also impart training

and expose the PWD Staff at various cadres to the latest trends in Engineering investigation, design & construction techniques and update the PWD staff on a regular periodical basis. However the functioning of such an institution could be effective and efficient only with a set of brilliant, qualified and experienced engineers and a set of supporting staff, who are interested to work continuously in such an institution. It is also necessary to provide special research cadre with incentives to the staff of this Research Institute, for example special pay, performance based promotions etc. in order to attract and retain capable dedicated staff of the institution. However as these types of incentives and special cadre are not easy to implement within the existing frame work of the PWD, it may be desirable to provide special grants to an autonomous organisation like Bangalore University to carryout the proposed applied research work of the PWD through a group of dedicated set of research staff appointed for this purpose.

The staff members of the Bangalore University have been providing help and guidance to Karnataka PWD since about 25 years now, to carryout several special studies and to suggest solutions to problems on road works from time to time. Therefore the Task Force recommends that the work of the proposed Karnataka Highway Research and Training Institute may be got done through a group of dedicated full time research staff specially appointed for this purpose, at Bangalore University. The staff of this research institution may consist of a Director, Deputy Director, Principal Research Officer, Senior Research Officer and Research Officers in the Scales of Professor, Reader, Selection Grade Lecturer, Senior Lecturer and Lecturer of the University, with a set of supporting staff to carryout field studies and laboratory studies. Provision may be made for a set of equipment for field studies and a mobile laboratory for quick testing of materials and facilities for transport/travel to all parts of the State. The detailed terms of reference outlining the scope of work, duties and the requirement of annual grant/ funds to be released to the University by the state PWD could be worked out jointly by the State PWD and Bangalore University. By this arrangement dependable applied research work of high quality could be got done at a relatively low cost

IMPLEMENTATION

The KRDCL has proposed to take up

- i) Reconstruction/Rehabilitation of 145 bridges at an estimated cost of Rs.100 crores. The work has begun
- ii) Improvement of 618 km under state highway, the detailed project reports are under preparation.

The Karnataka Government has proposed major maintenance for 1027 km, Upgradation of 396 km under World Bank Assistance. The final report of the KSHIP is under preparation by the Consultants . In the second phase, it is proposed to improve 508 km of state highway and MDR under Karnataka State Highway improvement programme.

RECOMMENDATIONS

Computerised data base on state roads and bridges are to be prepared such that all technical details of any km stretch of road along with particulars such as date and type of maintenance works done, names of concerned contractors and engineers responsible during execution, etc. are available on finger tips. The structural condition of the different links of the State Highways and Major District Roads as well as the riding quality of the different links can be visually seen using geographical information system so that need-based budget can be allotted on a scientific basis. The Government should take immediate steps for the formulation and adoption of Pavement Management System and Bridge Management System for maintenance programming in the State.

As the first step towards implementation of the proposed road improvement programme in the state, the suggested minimum set of maintenance works are to be carried out on top priority on all the existing SH and MDR so as to provide pot-hole-free roads with improved riding surface, within shortest possible period of three to four months. The funds required for this first stage i.e. top priority road maintenance works is about Rs.856 crores

- 3 Necessary approval be accorded and funds released urgently, to engage competent consultants and to get the necessary field studies conducted on the first priority roads of 8200 km, to prepare computerised data base and to work out design details and estimates for upgradation of these road stretches, within six months. The terms of reference for these consultancy firms have been given in this report at **Appendix – B** and these include imparting training to the PWD engineers to enable them to carryout similar studies and to prepare computerised data-base on the remaining roads in the state.

4. Upgradation of identified 8200 km of higher traffic volume estimated at Rs.2945 crore should be taken up.
5. The field studies, data collection and computerisation of data-base should be continued and completed on the remaining 78.50% of the SH and MDR by the PWD engineers and the Bangalore University. With these data, the actual maintenance and upgrading requirements for different items of works for the PWD roads, could be worked out and also the priorities for taking up different road stretches in phases could be decided. It is suggested that the special maintenance and upgradation works of all SH and MDR should be completed in a period of five years. The total cost of upgradation and improvement of all the state roads including the road safety level, during the five year period is likely to be of the order of Rs. 9087 crores.
6. A dedicated non-lapsable 'Karnataka Road Fund' is to be created by levying a special cess on petrol, diesel and lubricating oil at a suitable rate per litre and appropriate cess on sale price of automobile tyres and spares. The additional cess imposed will form only a part of the benefits to road user in terms of their Vehicle Operation Cost (VOC).
7. The Karnataka Road Fund is to be operated by a newly created autonomous Karnataka Road Board and the fund exclusively be utilised for maintenance and upgradation of the state roads as per the master plan and for repayment of loan instalments.
8. The PWD is to be restructured by creation of Karnataka Road Board on the lines of corporate functioning and to introduce accountability. In the mean time, separate identity of the PWD (C&B) is to be maintained by having separate seniority of the PWD (C&B) technical staff both for promotion and transfer in order to retain the proficiency developed within the department. No transfer either from or / to PWD (C&B) or Irrigation or other departments is to be effected.
9. Construction of bypass roads to towns, some new road links to connect potential growth centres and tourist spots are to be identified to relieve traffic congestion, improve the accessibility and help rapid development of these centres. Private

investment for some of these projects to be taken up as B.O.T. or B.O.O.T. to be explored. These projects may be implemented through Karnataka Road Development Corporation Ltd.

10. Some of the outdated and unscientific construction techniques, equipment and specifications which are still in practice, are to be discontinued. Improved techniques and equipment are to be adopted without delay. Also necessary changes in specifications, execution details and the rates in the present Schedule of Rates (SR) are to be suggested, by the proposed Highway Research and Training Institute of Bangalore University so as to improve the quality of work.
11. In order to efficiently manage the valuable assets of the state roads, the Executive Engineers should be given quasi-judicial powers and they should be made accountable for effective management. The upkeep and maintenance of every km length of road should be the responsibility of a set of PWD engineers.
12. Contractors should be prequalified and short listed in the fields of their activity – roads and bridge works.
13. Road improvement and maintenance works are to be awarded on contract basis for a period of five years, indicating the various threshold levels for maintenance and the penal provisions in case of failure to comply-with during the contract period. Performance based contract system is to be introduced with a commitment of the contractor to maintain the road during the designed life cycle. Works may be grouped to make them viable for induction of latest machinery and modern techniques.
14. While budgeting, provision should be so structured to complete the work in two years. No fresh work which cannot be adequately funded during the year is to be included in the budget. Cash flow/ cash releases should be as per the works programme/ action plan drawn at the beginning of the year and should avoid rush of expenditure at the end of the financial year.

5. Weigh-in-motion system with facilities to record classified flow of vehicles, speeds and axle loads (developed by the Central Road Research Institute, New Delhi in collaboration with other labs.) be installed in a few strategic locations in the state
16. Ammendments to the statute are needed to be effected to empower PWD officers to check overloadings, removal of encroachments Ribbon development to be prohibited, management of state roads by privatization, encouragement of introduction of Multi Axle Vehicles by offering fiscal incentives and enforcing the implementation of the decisions of KRB
17. A Karnataka Highway Research and Training Institute should be established at Bangalore University, funded by the Govt. of Karnataka to carryout applied research studies, to suggest solutions to site specific problems and to impart training to PWD staff at various levels. It is necessary to provide special research grants to cadres with incentives such as special pay, performance based promotion to the staff of this research institute in order to attract and retain capable and dedicated staff of the institution. The work of the proposed Highway Research and Training Institute may be got done through a group of dedicated full time research staff specially appointed for this purpose at Bangalore University.