

ROAD ASSET MANAGEMENT EVOLUTION AND TRENDS

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ABSTRACT

Climate change, awareness of energy efficiency, new trends in electricity markets, the obsolescence of the actual electricity model, and the gradual conversion of consumers to prosumer profiles are the main agents of progressive change in electricity systems towards the Smart Grid paradigm. The introduction of multiple distributed generation and storage resources, with a strong involvement of renewable energies, exposes the necessity of advanced metering or Smart Metering systems, able to manage and control those distributed resources. Due to the heterogeneity of the Smart Metering systems and the specific features of each grid, it is easy to find in the related literature a wide range of solutions with different features. This work describes the key elements in a Smart Metering system and compiles the most employed technologies and standards as well as their main features. Since Smart Metering systems can perform jointly with other activities, these growing initiatives are also addressed. Finally, a revision of the main trends in Smart Metering uses and deployments worldwide is included.

Introduction

India has one of the largest road networks in the world (over 3 million km at present). For the purpose of management and administration, roads in India are divided into the following five categories:

- National Highways (NH)
- State Highways (SH)
- Major District Roads (MDR)
- Other District Roads (ODR)
- Village Roads (VR)

The National Highways are intended to facilitate medium and long distance inter-city passenger and freight traffic across the country. The State Highways are supposed to carry the traffic along major centers within the State. Other District Roads and Village Roads provide villages accessibility to meet their social needs as also the means to transport agriculture produce from village to nearby markets. Major District Roads provide the secondary function of linkage between main roads and rural roads.

Trend in Road Traffic

Freight transport by road has risen from 6 billion tonne km (BTK) in 1951 to 400 BTK in 1995 and passenger traffic has risen from 23 billion-passenger km (BPK) to 1,500 BPK during the same period. Freight and

passenger traffic are expected to increase to 800 BTK and 3,000 BPK respectively by the year 2001. The annual growth of road traffic is expected to be 9 to 10%. Current boom in the automobile sector may even increase the future growth rate of road traffic. While the traffic has been growing at a fast pace, it has not been possible to provide matching investment in the road sector, due to the competing demands from other sectors, especially the social sectors, and this has led to a large number of deficiencies in the network.

Many sections of the highways are in need of capacity augmentation, pavement strengthening, rehabilitation of bridges, improvement of riding quality, provision of traffic safety measures, etc. There are congested road sections passing through

Towns where bypasses are required. Many old bridges are in need of rehabilitation/replacement along with capacity augmentation.

NHs are the main arterial roads which run through the length and breadth of the country connecting ports, state capitals, industrial and tourist centers and neighboring countries. NHs constitutes less than 2% of the total road network, but carries nearly 40% of the total road traffic.

The main roads have not kept pace with traffic in terms

of quality also. Out of the total 171,445 Km. Length of National and State Highways only 2 percent of their length is four-lane, 34% two-lane, and 64% single lane. As far as NHs are concerned, only 5% of their length is four-lane, 80% two-lane and the balance 15% continues to be single lane.

Thus the road sector, in spite of its high priority is adversely affected by the poor quality and service levels. The poor quality of Indian roads is highlighted by congestion, old fatigued bridges and culverts, railway crossings, low safety, no by-passes and slow traffic movement. The deficiencies in the road network is causing huge economic losses due to slow transportation and also contributing to high rate of road accidents.

In order to improve the road network on a country wide level, the National Highway Development Project was set up by the PMO. The project aims to develop the Golden Quadrilateral and the North south as well as the East West corridor as these are the high volume sectors carrying the substantial portion of the road traffic in India.

This report aims to study the NHDP with respect to the mandate that was given for the NHDP to the National Highways Authority of India (NHAI). The funding plan to fulfill the objectives of the NHDP is also discussed.

A host of financing mechanisms utilized in the NHDP is presented. In addition, the current status of the project in terms of the award of contracts, release of funds for the projects from various financing agencies etc along with the future completion dates are also discussed. The government's role in providing support to the project like policy incentives for promoting investments, increasing private sector participation in building infrastructure and financial support is also explored. The other road development projects carried out by the government are also looked at for comparison.

Frame work for Commercialization of Highways

In the context of the NHDP, the framework for commercialization of highways as proposed by Mr. Gajendra Haldea has been studied to evolve a comprehensive policy for improving the private sector participation in the Road sector. The Model Agreement, as proposed by him takes into account the deficiencies in the present framework of private participation. The

model attempts to address the concerns of all the stakeholders like the investor, lenders, the government and NHAI, with an emphatic orientation in favor of the user.

The model proposes a phased development of the Project Highway to avoid huge capital commitment and thus encourage private participation. The agreement also provides for strict definition of technical parameters from the users point of view. Issues such as risk allocation, concession period and concession fee are clearly dealt with special focus on encouraging private participation. It also provides for substantial flexibility to the concessionaire in terms of operation, construction and monitoring and supervision. The obligations of the concessionaire and the NHAI are clearly spelt out.

Thus the Model Agreement Framework has been well drafted and can be used as a foundation for developing policy initiatives for improving private participation in the roads sector.

Current Status of Road Network in India

The roads and highways in India account for about 80 per cent of the total passenger traffic and about 60 per cent of the total freight traffic in the country. Of the 49,585 km of National Highways in India about 33 per cent are single lane and only about 2 per cent of the total road network is four lane. The poor quality of Indian roads is highlighted by congestion, old fatigued bridges and culverts, railway crossings, low safety, no bypasses and slow traffic movement. Considering the importance of the road sector in the country, the government has embarked on the ambitious National Highway Development Project covering 13,000 km with a cost of Rs.54, 000 crore and the projects have already started rolling.

Comparison with Other Countries

The total road length in India is more than 2.25 million kilometers today (table 4), of which half is paved. This compares favorably with the U.S. that has 6.24 million km of total road length (3.63 million km paved). Compared to this, China has a total road length of 1.03 million km out of which only 170,000 km is paved. In terms of road length per square km, the connectivity in India (68.4 km per sq. km) is hence much higher than China (10.7) and comparable to the U.S. (66.5). However, most roads were built with the primary aim of moving passenger traffic. With demand outstripping the

supply and due to changes in nature of goods moved, the modal share of road transportation has increased substantially.

This has led to introduction of new, larger capacity, trucks. Most highways do not have the adequate bearing capacity for multi-axle and tandem trucks. This has led to rapid deterioration of road surface quality in many areas. A look at the levels of road traffic (table 5) indicates that there is a great potential for increase in this area, which is similar to the case of rail-based freight transportation.

Scope of the analysis:

Current trends

This part includes the understanding and analysis of trends affecting the functioning of the AM market, as well as the incentives governing AM firms. The aim is to identify distinct industry segments of the value chain in which changes might be occurring and the main features of these trends, and to provide an evidence-based assessment of whether they are likely to be permanent or transitory.

Treatment of risks

The systematic identification and evaluation of risks that can be found across the different segments of the value chain form another important objective for the study. The evaluation of these risks requires an assessment of their potential frequency, impact and allocation (ie, ultimate bearers). Based on these findings and on the identified industry trends, a further objective is to assess which of these risks are expected to grow in importance over time and which are likely to be of less concern. However, this study does not focus on market risks faced by clients when purchasing different products. Unless minimum investment returns have been guaranteed, or negligence by the asset manager can be demonstrated, no responsibility is to be borne by the AM firm, and the potential effect on the AM industry can in principle only be indirect, through reputation effects for example.

Impact of pension reforms

Pension reforms across Member States might have an impact on the development of the AM industry and could become a trigger for its accelerated transition. In this respect, it is necessary to consider the impact of the reforms on overall market size, and changes in the degree of competition, measured in terms of

concentration levels, fees, and cost efficiency, where relevant.

Treatment of product innovation

Examination of developments and trends in product innovation (rather than analysis of individual products per se) forms an important part of the analysis of trends in the AM industry insofar as they affect the evolution of the value chain, or their effect on operational and/or systemic risks in the industry can be identified. As an economic bottleneck impeding growth of both these industries.

Network Connectivity

Achievement of high network connectivity is usually the first step in infrastructure development. However, while this is a major problem in a number of other emerging economies such as China, it is not a factor in the Indian context. India already enjoys one of the highest rail and road connectivities in the world. The current Road Plan aims at achieving a level of around 80 km per square km by 2011, which is primarily to achieve social equity.

Travel Time

The average speed on Indian highways is around 45 km/h, which is less than half of that on the U.S. Inter-State system. Coupled with this, there is a problem of low bearing capacities. Most road surfaces are flexible pavement bitumen, with bearing capacities one fourth of the U.S. Inter-State highways. There is a need for improvement in this area. However, it may not be desirable to go in for an intricate system of expressways for freight and passenger traffic. Due to a number of reasons mentioned earlier, it would be economically sound for the country to maintain a high share of railways in the overall surface transportation system. Also, construction and upgrading of roads requires major capital investments that may not be available. Hence, it might be better to go in for selective upgrading through identification of suitable higher priority corridors. The 2011 Road Plan proposes construction of about 12,000 km of expressways. Seven years after the plan commencement, India has yet to see this starting in any major way. A major factor hampering road construction is availability of funds.

Maintenance

The other major issue in freight transportation is increased use of containers. Larger sixteen wheel trucks and combination vehicles are replacing the old six wheel

trucks. These heavier vehicles need higher bearing capacity of the pavement. Most roads in India currently have a bitumen pavement. This was initially adopted over concrete because high bearing capacity was not needed for passenger movement. Most military equipment in India is transported on rail, unlike the U.S., where the Inter-State roads were constructed to enable movement of heavy tanks and artillery. Use of heavy axle-load trucks has led to rapid deterioration in surface quality. Since immediate upgrading of all the major highways is neither required nor economical, there is a need for evolution of an adequate maintenance and monitoring system. Use of heavy axle trucks would have to be restricted to certain roads, where alternate rail facilities are not available.

Model framework

Whatever be the nature and ownership of four-laning projects, the framework governing their operations would have to be uniform so as to provide an assured minimum level of service and safety to the users across the country. Ensuring a level playing field for all the investors would require that a common framework, whether owned by the government/NHAI or by private entities, govern all project companies. An appropriate framework would also virtually eliminate the scope for increasing the liabilities of NHAI as compared to the present arrangement where the gap between the tender price of highway projects and their out-turn price is very wide and unsustainable. Such a framework would also save on time and transaction costs, besides imparting transparency and fairness.

Rationale for phased development

The four critical elements that determine the financial viability of a highway project are traffic volumes, user fee, concession period and capital costs. As the existing highways have dedicated traffic and the government has prescribed the user fee for uniform application across the country, the revenue streams can be assessed with reasonable accuracy. The concession period on the other hand can be extended only for marginally improving project viability. As three of the above stated four parameter are pre-determined, capital costs is the only viable element for the bidders to determine the financial viability of a project, and they would seek an appropriate capital grant/subsidy (being offered by the authority in order to arrive at an acceptable rate or return.

In such a scenario, higher the capital costs, greater

would be the compulsion of project sponsors to seek larger grants from the government to leverage a larger pool of extra-budgetary resources, including private investment, resulting in a smaller programme of highway development. It is therefore important to reply on cost effective designs and to combine them with a phased investment programme to enable a more efficient and sustainable development to highways.

Technical Parameters

Presently, the focus is on construction specifications in the agreements. However, the model agreement proposes technical parameters based on output specifications having a direct effect on the level of service. The fundamental requirements for design, construction, operations and maintenance of the Project Highway should be identified so as to leave scope for innovation and value addition by the concessionaire.

This also provides for the concessionaire flexibility to develop and adopt cost effective designs without compromising on the quality of service for the users

Selection of Concessionaire

The selection would be based on open competitive bidding. All project parameters such as concession period, toll rates, price indexation and technical parameters would be frozen and short listed bidders would be required to specify the amount of grant required by them. The bidder seeking minimum grant would be awarded the contract.

Grant

According to the Model Agreement, the NHAI would provide the grant in the form of equity support and the concessionaire should be allowed to fund up to 50% of the project equity out of such grant. This would reduce the promoters' equity burden and facilitate leveraging of larger volumes of debt. Any grant in excess of equity support may be used for defraying O&M expenses in the initial phase.

Concession fee

In the initial years, the concessionaire has substantial outflows of capital due to debt service obligations. However, over the years, the cash flows increase due to increasing revenues and reduced interest payments. Therefore, the model agreement proposes that the concessionaire pays no concession fees in the initial years.

In the subsequent years, the concession fee is proposed to be levied on an ascending revenue sharing basis. Since the concession fee is to be paid in the later years, the present value of the fees is lower for the concessionaire.

Risk Allocation

The model agreement attempts to allocate risks to the parties who are best equipped to manage them. Project risks have been allocated to the private sector to the extent that it is capable of managing them. It also increases the scope of innovation and efficiencies in costs and services by the private sector.

The commercial and technical risks relating to construction, operation and maintenance are allocated to the concessionaire, as it is best suited to manage them. Other commercial risks, like rate of growth of traffic are being allocated to the concessionaire. The traffic risk is mitigated, as Project Highway is a monopoly where existing traffic volumes can be measured precisely. All direct and indirect political risks are being allocated to NHAI.

Financial Close

The agreement stipulates a time limit of 240 days (extendable to 360 days) failing which the bid security amount shall be forfeited. This is possible if all the parameters are well defined and all the requisite preparatory work has been undertaken. The model agreement provides the framework for obtaining the financial closure within the stipulated time. It will result in substantial cost reduction.

User Fee

The agreement provides for indexation of user fees to the extent of 30% linked to WPI and exchange rate variations (20% indexed to WPI and 10% to exchange rate variations). A higher level of indexation is not being favored due to the following reasons:

It would require users to pay more for a declining (more congested) level of service when they should be receiving the benefit of a depreciated fee. A higher indexation would also add to uncertainties in the financial projections.

Local traffic

It is proposed that the highway should be used by local residents without any payment of tolls until free service lanes are provided. It would improve the local support

for the project and avoid any legal or political opposition. Frequent travelers would be allowed at a concessional rate based on daily or monthly passes.

Construction

Handing over the possession of the required land and obtaining all environmental clearances are being proposed as conditions precedent to be satisfied by the Authority.

The agreement defines the scope of the project with precision and predictability in order for the concessionaire to determine his costs and obligations.

Before the commencement of the collection of user fee, the concessionaire will be required to subject the highway to specified tests for ensuring compliance with the output specifications relating to the level and safety of service for the users.

Operation

Operational performance would be the most important test of the service delivery. The agreement provides for an elaborate mechanism to evaluate and upgrade safety requirements on a continuing basis. A dedicated Safety Reserve has been proposed for meeting the additional cost relating to up gradation of safety measures. The agreement also provides for traffic regulation, police assistance, emergency medical services and rescue operations.

Right of Substitution

The lenders in the highways sector require assignment and substitution rights so that the concession can be transferred to another company in the event of failure of the concessionaire to operate the project successfully.

Termination

In the event of termination, the Agreement provides for a compulsory buyout by the NHAI. Termination payments have been quantified precisely in the agreement. Political force majeure and NHAI default are proposed to qualify for adequate compensatory payments to the concessionaire and thus guard against any discriminatory action by NHAI or government.

Debt will be fully protected by NHAI in the event of termination, except for two situations: When termination occurs as a result of default by the concessionaire, 90% of the debt will be protected

In the event of non-political force majeure, 90% of the debt beyond insurance cover will be protected

Monitoring and Supervision

The agreement specifies a 'hands-off' approach with respect to monitoring and supervision and the NHAI is entitled to intervene only in case of default.

Monitoring and supervision of construction, operation and maintenance is proposed to be undertaken through an Independent Consultant to be selected by NHAI through a rigorous and transparent process. The independence would add to the efficiency of the operations.

The agreement also provides for a transparent procedure to select well-reputed statutory auditors to enforce financial discipline. In addition, all the financial inflows and outflows of the project are proposed to be routed through an escrow account.

Government Support and Guarantees

Loan assistance from NHAI has been stipulated for supporting debt service obligations in the event of revenue shortfall resulting from political force majeure or Authority default. The agreement provides for a sovereign guarantee to secure the repayment of debt. This would result in lowering of interest rates and thus reduction in grants from govt./Authority.

A state support agreement has been contemplated to provide the sponsors and lenders with support from State Governments in respect of law and order, traffic regulations, land laws, local bodies etc.

Miscellaneous

A regular traffic census and annual survey has been stipulated for keeping track of traffic growth. Sample checks by the Authority would also be carried out.

Applicability to State Highways

Though the agreement has been drafted for national highways, it can easily be adapted to state highways with marginal modifications. To implement it, the states would also need to undertake reform and restructuring of their road sector.

Conclusion

Asset management basically means systematic way of maintaining, upgrading and operating physical assets in order to meet public expectations. I have taken a portion of Rourkela road for my project area. Then I collected 33 points around the road and collected data's of the points. I collected their positions and corresponding elevations. Then I got the map of the road with all data. Using those data's I found out the super elevation, coefficient of friction, ESWL, flow capacity of the road. Then I analyzed the results and predicted the reasons behind the failure of the road. The main reason for the failure of the road is due to heavy application of repeated loads . It can be prevented by creating alternate routes for heavy vehicles.

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