ROAD MAINTENANCE MANAGEMENT SYSTEM – THE PANACEA FOR SUSTAINABLE ROAD DEVELOPMENT IN NIGERIA

By

Engr. Dr. Felix Atume, FNSE, FAEng, mni

At

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Preamble

- Transportation infrastructure forms the bedrock for the economic and social development of Nations. J.F. Kennedy once said, "America has good roads, not because America is rich, but America is rich because it has good roads."

- The implication of this quote from the 1960s is an eternal economic truism.

- No country can become economically buoyant without good infrastructure, especially a good road network.

- The problem is how to maintain the network of roads for sustainable Development.

MAINTENANCE MANAGEMENT SYSTEM

- **What is Maintenance**
  * Reduces the rate of deterioration
  * It lowers the cost of operating vehicles on the road by providing a smooth surface.
  * Keeps the road open on a continued basis, be preventing it from becoming impossible.

Maintenance can be classified as

- **Routine**

  Required, whatever the engineering characteristics of the road, traffic density it carries. This is a fixed–cost activity.

  Example include; grass cutting to enhance sight distance, drain clearing to check siltation, recutting of ditches, culvert maintenance. Bridge maintenance, road furniture maintenance.

- **Recurrent**

  It is required at intervals throughout the year but the frequency varies with traffic. Activities in this category:

  * Repairing of potholes, grading – unpaved roads

  Potholes, surface patching, edge repairs, sealing of cracks, road surface marking.

Urgent

- Must be carried out with minimum delay to avoid danger to traffic
  - When a road cut.
  - Removal of debris
  - Erection of warning signs
  - Construction of diversions.

Periodic Maintenance

  - Required at specified intervals
  - Variable cost activities because they depend on the engineering characteristics of the road and traffic loading. e.g.
    - Regravelling for unpaved roads
    - Surface dressing (rescaling), regravelling of shoulders, overlay.

Upgrading

- Aims specifically at providing additional capacity when a road is nearing the end of its design life, or
- there has been an unforeseen change in the use of the road.

Typical Examples of upgrading activities

- Paving of gravel roads
- Provision of overlays for paved roads
- windening of roads.

Upgrading projects should not be confused with maintenance. It is important that feasibility studies for upgrading should be based on future predictions of road condition on a realistic assessment of existing maintenance capability.

Rehabilitation

- Needed either because a road has outlived its design life or the road has received insufficient maintenance to enable it to provide an appropriate level of service to the end of its design life.
- Rehabilitation can be required because the road was not built to the standards of quality required by the original design.

ECONOMIC JUSTIFICATION OF MAINTENANCE EXPENDITURE

Even with proper maintenance roads deteriorate with time. The rate of deterioration will depend on

- the climate
- the type and strength of the pavement
- the strength of the underlying soil
- the volume of traffic and the axle loads of commercial vehicles.

* For all roads, there will eventually come a time when they reach the end of their design life and they will need strengthening or improving.

* strengthening, rehabilitation and reconstruction are all high cost activities and it is important to postpone them as long as possible by carrying out effective and timely maintenance.

Maintenance and Rehabilitation Costs:

S/N	Road Type	Activity	Cost Range (US dollars/km
1.	Earth Road	Routine and recurrent maintenance	100 – 1000
2.	Gravel and Paved	Routine and recurrent maintenance	200 – 1,000
3.	Gravel and Paved	Periodic maintenance	8,000 – 10,000
4.	Paved	Strengthening overlay	50,000 – 75,000
5.	Paved	Rehabilitation	120,000 – 200,000

Maintenance and Rehabilitation Costs (Cont'd)

Let us consider for example

1. If proper routine and recurrent maintenance is not carried out, drains will not be cleared, surface defects not repaired, both of which will result in water penetrating the pavement structure.

   - will lead to premature need for periodic maintenance which is 10 times more expensive than routine and recurrent expenditure.

2. Failure to carry out a periodic maintenance of a road may lead to the pavement deteriorating to level that it will require an overlay and this is about seven (7) times more expensive.

3. If you do not carry out strengthening at the right time, it will lead to major deterioration and rehabilitation will be required which is

   20 times more expensive than periodic maintenance.

4. Failure to maintain the scouring effect on a bridge abutment could lead to the road cutting through. From above, there is considerable economic benefit in carrying out appropriate and adequate maintenance.

LOWERING VEHICLE OPERATING COSTS

- Regular maintenance produces smooth surfaces.
  - Reduction in fuel consumption
  - Reduction in tyre wear
  - Spare parts consumption => leads to lower cost of operating vehicles on the road

- The consideration of the vehicle operating costs dictates what level of road surface is acceptable and economic

- The cost of road maintenance is normally borne by the Government Agency but in actual sense, it is paid for through taxes, fuel levy and motor vehicle charges among others.

The benefits due to vehicle operating costs saving are received directly by the road users but are normally passed on to the general public through lower passenger fares, and freight tariffs.

The best measure of the smoothness of a road is the roughness index.

Typical roughness values (mm/km)

Paved roads		**Unpaved roads**
Good	2500	5000
Start of potholing	4000	10,000
Badly broken	10,000	15,000

Effect of lack of maintenance on vehicle operating costs

- For a well maintained 2 lane bituminous road expected to have a 10 years life span, carrying above 750 vehicles per day, the operating cost will be about 4(four) times the cost of construction. To achieve this maintenance, routine plus periodic should be about 2% the annual cost of construction.

- If the road is not maintained, the roughness index will increase from 2500 mm/km to 4500 mm/km. This raises the operating cost by 15%.

- ***It has been established through studies that on a 100km length of road carrying 750 vehicles per day, the extra cost to vehicle operators, because of lack of maintenance, can be about $5m US every year.***

2.0 KEEPING THE ROAD OPEN

- Roads serve centres of population and industry, if the roads are closed, there is serious social and economic consequences.
- Agriculture food cannot be brought to the markets if the roads are not maintained
- Raw materials cannot be brought to the industry etc.

ACHIEVING BENEFITS

Nigeria today is incurring high economic costs due to the poor condition of roads. Large benefits are available as a result of maintenance but the maintenance must be:

- Carried out to a sufficiently high standard to achieve the required improvement in pavement condition.
- Durable so t hat the maintenance input is effective for a sufficiently long period.
- Efficiently carried out so that the cost is of the expected order.

BUDGETARY FOR MAINTENANCE

- Raising money for maintenance is a big problem in Nigeria and indeed in most developing countries. The emphasis is on new construction.

- The available resources have normally been spread thinly over the network and all roads receive inadequate maintenance.

- The better policy of deploying insufficient funds would be to identify that portion of the network for which resources exist to enable proper maintenance to take place and accept that the remaining lower priority network will be abandoned. – **But will the politicians accept that?**

SKILLS

- The management and operation of maintenance at all levels requires appropriate skills which can only be developed by proper training and the establishment of well designed courses and on the job training for road maintenance operations.

- Training and retraining on a long term continuing basis must be emphasized.

MANAGEMENT SYSTEMS

It is necessary to choose an appropriate level for the whole life cycle costing of the road. An attempt should be made to minimize the sum of maintenance cost, upgrading or reconstruction cost and road user cost over the life of the road by choosing an optimum level of maintenance.

- If roads are maintained too soon after construction then the full value of the existing pavement will not be realized and the maintenance cost will be too high.

- If the roads are maintained too late, the maintenance needed will be more expensive.

Thus, maintenance intervention levels should be chosen such that the resulting level is optimum from the economic standpoint. That requires an effective **Management System**

Definition:

Broadly defined, Highway Maintenance Management seeks to get the right people, materials and equipment to the right place on the road network, to carryout the right remedial or preventive work at the right time.

The objectives of maintenance management are broadly:

- To encourage the use of systematic approach to decision making within a consistent and defined framework.
- To provide a common basis for assessing maintenance needs and resource requirement.
- To encourage the adoption of consistent maintenance standards.

- To assist in the effective and optimal allocation of resources.
- To encourage regular review of policies, objectives, standards and the effectiveness of programmes.
- To provide the means of developing annual work programmes, resource requirements and budgets.
- To ensure an equitable distribution of funds over the country and to enable priorities for allocation to be determined in a rational way when available funds are inadequate.
- To authorize and schedule work
- To provide a system of monitoring the efficiency and effectiveness of maintenance works.

STEPS IN THE MANAGEMENT PROCESS

A Management System normally contains the following components:

- **Inventory:** This is used as the basic reference for planning and carrying out maintenance and inspections.
- **Inspection:** Road condition should be determined by taking physical measurements of defects on the road network in the field.
- **Maintenance Needs:** These are determined by comparing the measurements of the road condition with predetermined maintenance intervention levels that are based upon economic criteria.
- **Costing:** Unit costs are applied to the identified maintenance tasks to determine the budget required.

- **Priorities:** If the budget is insufficient for all the identified work to be carried out, it is then necessary to determine priorities to decide which work should be undertaken and which can be deferred critical decision.
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- **Execution:** The work identified should be carried out, and several systems of scheduling and cost accounting are available.
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- **Monitoring:** This serves two purposes:
- It ensures that work identified has been carried out.
- It provides data to enable unit cost and intervention levels to be checked and adjusted if necessary.

KEY SUCCESS POINTS IN MANAGEMENT SYSTEM

In order to ensure the successful introduction of a system, the following key elements are needed:

- Sufficient staff must be provided at all levels to operate the system. They must have enough time available to operate it and must not be overburdened with other bureaucratic tasks which prevent them from contributing to the maintenance system.

- Training must be provided, not only at the time of introducing a new system, but as an on-going exercise. Not only will new staff need to be trained regularly and frequently, but replacement staff must be trained when original managers and team members are transferred to other areas of work.

- Staff must be made aware of the benefits to them as individuals and to the department for the adoption of a management system and not be allowed to feel that it is being imposed from headquarters or from ‘outside’. Staff must be motivated and given incentives to operate the system, particularly in the case of technicians who will need to spend much of their time taking measurements on hot dusty roads instead of working in air-conditioned office.
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- Operation of the system must be properly supervised at all levels by people who have been thoroughly trained and who adopt a professional attitude towards work. This again applies to all levels from headquarters staff to maintenance officer working in the field.

Management Systems can be useful tools but, if introduced, their purpose and the benefit from their use must be fully understood by the people expected to operate them.

Conclusion

The country today is faced with the haphazard approach to maintenance of Highways.

- In some states there are many Agencies involved in maintenance without synergy and focus.
- Available resources are spread thiny and not properly directed.
- There is the need to reform the road sector (the Federal Government of Nigeria is currently working on the Road Reform)
- All the States of the Federation without exception should establish Road Maintenance Agencies without delay and fund them adequately.
- There should be a massive recruitment of Engineers and effective training for road maintenance.
- There should be sensitization among Civil Engineers to devote attention to maintenance issues instead of concentrating efforts on new construction projects.

THANK YOU.