

IMPLEMENTATION OF ROAD MAINTENANCE WORK IN NIGERIA USING LABOUR-BASED METHODS AND TECHNOLOGIES

by

F. FALADE

Department of Civil Engineering
University of Lagos, Akoka, Lagos

ABSTRACT

Roads form an integral part of our lives and provide means of safe and economic transport of goods and people for various purposes. Presently, majority of our roads both in rural areas and urban centre are in a deplorable state because simple functional defects on them are being left to degenerate to structural defects due to lack of timely maintenance. The existing maintenance procedure is equipment intensive. The aging machineries require spare parts, refurbishment or utter replacement but the deregulation of the economy and devaluation of Naira have made it almost impossible to acquire these items, therefore, road maintenance suffers a serious neglect.

In this paper, the existing maintenance methods and their short-comings are examined. Alternative methods are presented for rehabilitation and maintenance of roads at local, state and federal levels to an acceptable performance level throughout the year. Labour - and equipment - based construction methods of infrastructure are compared using a pilot project: Rehabilitation and maintenance of an existing Noforija - Imokun Yewa Road at Epe, as a case study. Labour - based methods and technologies are recommended as versatile tools to achieve an efficient way of keeping the roads in good condition considering the high level of available local resources and reduction in maintenance cost.

INTRODUCTION

In Nigeria, roads are classified as federal, state and local government roads. Most of the federal roads are highways and are paved while those of state and local governments are either paved or unpaved. The paved roads are either of bituminous, asphaltic concrete or portland cement concrete surfaces. The unpaved roads which constitute a large percentage of our roads are of earth, being very dusty in the dry seasons and possibly impassable during rainy season. On most of our roads, simple functional defects are left to degenerate to structural defects due to lack of timely maintenance. One of the essential activities required to ensure the tremendous amount of investment of hard earned resources in road infrastructures is not other than effective maintenance of road and drainage structures. The success of road maintenance depends to a large extent on its being carried out at the right time, at a technically competent level and according to local requirement. Postponed and delayed maintenance entails not only expensive reconstruction and rehabilitation but also adversely affects and retards national development in all sectors of the economy.

The economic cost of neglected road maintenance is becoming more widely recognised and it is increasingly realised that road maintenance must be given a serious attention. The imposition of toll collection on some major highways in the country as a source of generating fund for regular maintenance of these roads underscores the awareness of the need to maintain the roads. Even with the efforts to source fund by the government, the sorry state of our roads indicates that there is no programme in place for routine maintenance of these roads.

In 1995, a random survey nationwide revealed that budgetary allocation for maintenance of

roads took about 14% of the entire states budget. The survey also showed that on the average, only a third of the roads earmarked for rehabilitation were completely rehabilitated. One third of the roads were partially rehabilitated and the remaining one third was not touched at all. In some state, none of the road projects was full executed, a situation that was attributed to lack of fund. Investigation further revealed that most of projects executed soon went bad because of poor quality of materials that were used and the roads are back in their deplorable condition. Presently, major rehabilitation of roads are being carried out nationwide by the Petroleum Trust Fund. This is a welcome development but the methods and technologies are heavy equipment =-based supported with a small number of skilled labour.

MAINTENANCE WORK

The type of maintenance work required for the upkeep of both paved and unpaved roads include timely patching of potholes, periodical sealing of cracks and joints to prevent infiltration of surface run-off, where the roadside is grass this must be mowed and sometimes treated with line, large trees should be avoided at roadside as they pose danger to motorists especially during rainy and windy periods. Thick bushes along the roadside should be regularly trimmed to ensure good visibility and adequate sight distance. Drainage maintenance involves keeping ditches, culverts, structures and appurtenances such as drop inlets, catch basins, clean and ready to carry the rest flow of water. ~~Sediments deposited during periods of heavy flow of water.~~ Sediments deposited during periods of heavy flow must be removed. Brush, branches and other debris that collect in trash racks or at culvert and structure entrances must be disposed of. Badly eroded channels and dikes must be repaired and pavings, seeding, saddling, riprap and bank protection must be adopted to prevent recurrence. All these task necessary for good maintenance work can be carried out manually with tools and light equipment without relying much on heavy equipment (graders, bulldozers, excavators, etc.) which characterises the current construction and maintenance schemes. But when prompt action is not taken to rectify functional defects, they degenerate to structural defects whereby the use of heavy equipment is inevitable.

EXISTING MAINTENANCE METHODS AND TECHNOLOGY

When roads tend to be unserviceable, the affected government may map out such roads for rehabilitation and maintenance particularly if the roads for rehabilitation and maintenance particularly if the roads are of economic or social importance to the government. The maintenance of such roads is accomplished by one of the following methods:

(i) Equipment-based:

Usually, because of the deplorable state of the roads before the commencement of maintenance work, heavy equipment supported by few labour characterises the current practices. The costs of the equipment are high due to devaluation of Naira and deregulation of the economy therefore the indigenous contractors can not afford them while the few items of equipment in their possession are already old. The aging machineries require replacement but in a dwindling economy, the tasks can not be accomplished. This situation has left the construction, rehabilitation and maintenance of roads in the hands of foreign contractors who adopt equipment based methods. The high cost of rehabilitation and maintenance works can be avoided if a programme for routine road maintenance is put in place by the government. This approach will benefit the local contractors, enhance technological development and enable civil engineering industry to generate the required employment opportunity.

(ii) Task Force

Occasionally, a government task force is set up to patch potholes to prevent the

degeneration of functional defects to structural defects. Filling materials (laterite, granite and atimes bitumen) as conveyed to locations by shovels, wheel barrows or tippers depending on the relative distances between the point of application and where the materials are sourced. The filling materials are spread, pressure from moving vehicles is relied upon for compaction. This method is unsatisfactory because full compaction can hardly be achieved and if the repair is carried out during the rainy season, the filling materials are washed away before any tangible compaction is attained.

Voluntary Service

When road tend to be impassable, a group of people may emerge within the vicinity to salvage the road by patching the road with earth sourced from nearby location. The tools they use consist of headpans, buckets, shovels, hoes and diggers. They rely on pressure from vehicles for compaction. The technology comprise simple tools but lacks organisations and supervision.

LABOUR-BASED METHODS AND TECHNOLOGIES

Labour-based construction method implies the use of locally available skilled and unskilled labour supported with light equipment for the maintenance, rehabilitation and construction of infrastructure. A construction equipment is considered to be light when it has an output which is compatible to the output of workers. It should be easy to operate, repair and maintain and it should have relatively low initial cost. The method is used for the purposes of socio-economic development when the key constraints to growth include limited import capacity and high rates of employment and under-employment which generate a substantial labour surplus. In labour-based construction method, labour costs account for a large proportion of the total costs of the infrastructure works since it is a deliberate effort to give priority to local labour inputs supported when necessary by light equipment. Presently, unemployment rate is high and cut across all levels of labour force both in urban and rural areas. Although building industry is relatively labour-intensive but civil engineering is heavy equipment reliant and would not generate that many employment opportunity unless it become labour-based. While labour-based road maintenance/construction is not a panacea to resolve all the nation's problems of employment, it will offer an opportunity to alleviate unemployment. Over the past 20 years, the use of labour-based methods to construct and maintain infrastructure in rural areas has been established as an effective and cost efficient alternative to machines. Studies, pilot projects and full scale programmes carried out by ILO, World Bank and other international and national bodies have produced extensive information on the best way to mobilise people together with appropriate light equipment to produce and maintain high quality and low cost infrastructure. In South Africa, labour-based methods have been employed on projects which include rural roads (McCutcheon 1989, Markman 1991, Boothway 1993, Scott 1993), dams (Manson 1993), residential Roads using water-bound macadam bases (Watermeyer 1992, Harrison 1993), block paved roads (Kelly 1993) Water and Sewerage reticulation for townships (Saxby 1993, Watermeyer 1993, a,b. Powers et al 1994) and low voltage electrical reticulation (Watermeyer 1993). It has been reported that labour based construction method is in use in a number of African countries including Soweto, Ghana and Tanzania.

APPROACHES TO IMPLEMENTATION

Labour-based construction technologies are currently implemented in Southern Africa in one of these five approaches or combination thereof (Watermeyer, 1992;

- (i) The Public Sector approach: Workers, predominantly labourers are trained and employed directly to perform specific tasks.
- (ii) The conventional Contractor Approach: Restriction is placed on the use of plant and training obligations are imposed on the contractors.
- (iii) The Managing Contractor Approach: An experienced contractor contracts to administer, manage, finance, train and supply materials and equipment to nominated labour-based contractors.
- (iv) The Development Team Approach: Professionals and specialists provide support to a labour-based contractor in administering and managing his contract, financing the contract, giving technical training, engaging specialist contractors and supplying materials and equipment.
- (v) The Project Manager or Managing Consultant Approach:
A project manager in addition to providing conventional engineering services undertakes to manage labour-based contracting teams and thereby provide support, materials, training and equipment required by such teams.

The contractual relationship between the participants involved in the above-mentioned five basic approaches are illustrated in Figure 1.

THE STATE OF DEVELOPMENT IN NIGERIA

The labour-based construction method is recognised by the Government as a construction method introducing to Nigeria. In 1987, the Federal Government, through the National Directorate of Employment (NDE) requested the UNDP and ILO to assist it in introduction and promotion of the labour-based method of construction in Nigeria. In response to this request, the UNDP and ILO fielded a Multi-disciplinary Mission to Nigeria (1987) to assess the scope of the productive employment opportunities in the sectors of the economy including construction, rehabilitation and maintenance of infrastructures. The mission reported that the current economic situation in the country: labour surplus and shortage of capital is indeed appropriate for the successful implementation of labour-based construction programmes but that necessary managerial capacity has to be modified. Based on the positive report of the mission, the Government's phased pilot programme approach towards the introduction and promotion of labour based construction Technology was approved. The Government planned the pilot programme in four phases:

Phase	I	Preparation of the pilot programme
Phase	II	Demonstration project
Phase	III	Implementation of the pilot programme
Phase	IV	Nationwide expansion programme.

The first and the second phases were supported by UNDP/ILO projects NIR/87/001 and NIR/87/001 and NIR/87/025 respectively (Hussain et al). The two phases were successfully implemented. As part of the programme, seminar (May 1992) was organised with participants from professional bodies, Polytechnics and Universities. In 1995, a workshop was organized by NDE/UNDP/ILO for civil engineering lecturers from four Universities namely Ahmadu Bello University (ABU), University of Lagos (Unilag), University of University (UI) and University of Nigeria, Nsukka. The Workshop

Demonstrated the achievement of the programme and its feasibility in Nigeria. Two roads (Igboku farm Access Road and Noforija-Imoku-Yewa Road) were rehabilitated and one irrigation scheme (Imoku Irrigation Scheme) was executed using labour-based methods and technologies.

Case Study - Noforija-Imokun-Yewa Road

Noforija-Imoku-Yewa Road is 4.2 km stretch. The first 0.6 km of the road is bitumen-surfaced followed by earth road. Its both sides are provided with concrete drains up to 1.5 km length and on one side only up to 1.70 km and subsequently no drain was provided. According to the report during a visit to the project site, the bitumen-surfaced section was full of pot-holes before the commencement of the rehabilitation work while the earth road had been periodically graded to a level below the side drain therefore water from the road surface could not drain into the gutters provided as a result of that the road was always flooded during the rains. The effect of erosion was found to be severe on the road particularly in the earth road section. The road was rehabilitated and maintained by labour-based methods and technologies. The results obtained were compared with those of equipment based using all the data available (machine output, operating cost, etc.) for the equipment. Table 1 shows the level of participation of both men and women in the demonstration project at Epe. The project recorded a good turn out of both genders. In Table 2, the results show that it took 9 weeks to rehabilitate the road using labour-based construction method while it would have taken 7 weeks if equipment-based method had been used. The estimated costs are ₦145,343.52 for labour-based method and ₦282,156.48 for equipment-based method (Hussain et al 1992). The difference of 2 weeks in the rehabilitation period is not significant particularly when the possibility of any of the equipment breaking down had not been considered and could not be totally ruled out. The estimated cost of ₦145,343.52 using labour-based method represents a reduction of about 48.5% in the cost if equipment-based method had been used. This shows that labour-based method is economical for implementation of road maintenance projects.

CONCLUSIONS

From this study, the following conclusions are made:

- (i) Adoption of labour-based methods and technologies for road maintenance will enhance the transfer of technology to both skilled and unskilled labour.
- (ii) The approach will minimize maintenance cost and ensures timely repairs of defects on the roads since emphasis is on labour rather than equipment.
- (iii) Employment opportunity will be created both in urban and rural areas thereby reducing under- and unemployment in the urban area thus minimizing the crime rate.
- (iv) The approach will provide opportunity for the development of small-scale enterprises as a result of earnings from participation in the labour-based construction.

RECOMMENDATIONS

It is recommended that the public sector approach be adopted to enable all levels of government participate in its implementation. The Federal Government may execute

TABLE 1

ACTUAL LABOUR SITUATION ON THE

UNDP/ILO DEMONSTRATION PROJECT, 1989 - 1991
EPE, LAGOS STATE.

YEAR	GENDER MIX	MONTHS											
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
1989	NO OF WOMEN	-	-	-	-	-	-	6	15	30	40	40	80
	NO OF MEN	-	39	39	39	94	149	182	195	235	244	240	296
	TOTAL	-	39	39	39	94	149	188	210	265	264	300	378
1990	NO OF WOMEN	130	169	166	79	117	148	143	156	153	160	166	181
	NO OF MEN	263	301	366	196	296	209	207	204	214	211	227	205
	TOTAL	396	470	452	270	325	352	350	360	269	371	393	366
1991	NO OF WOMEN	162	184	132	181	136	-	-	-	-	-	-	-
	NO OF MEN	161	170	186	171	164	-	-	-	-	-	-	-
	TOTAL	323	354	368	352	350	-	-	-	-	-	-	-

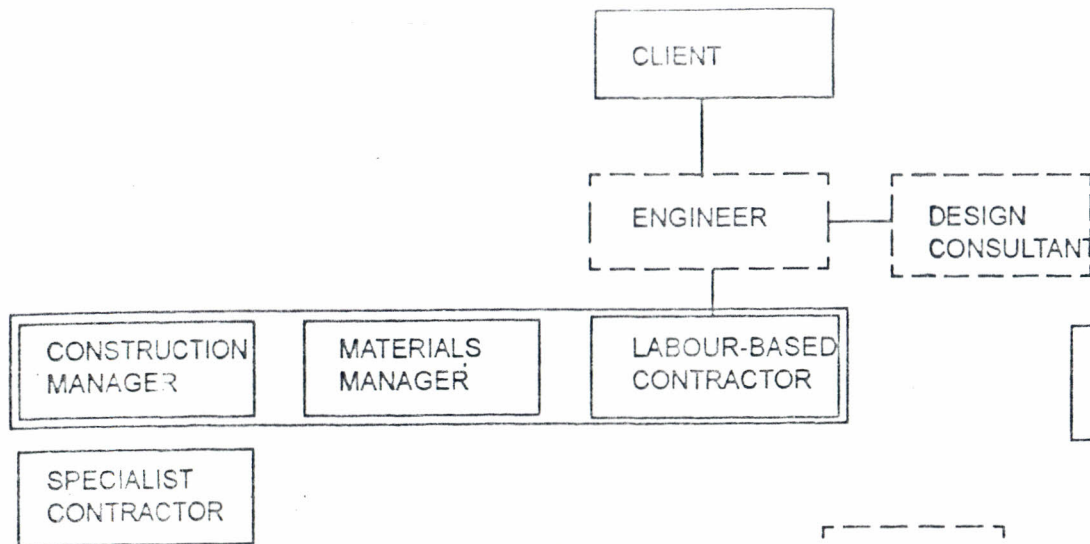
its own projects through the Ministry of Works and Housing or set up an effective public works division mainly for implementation of labour-based tasks. Each State Government may zone its operation to different local government areas while the local government operates on community bases having teams headed by supervisors in each town or village. Supervisors are to be selected and made to attend training workshops at the local government headquarters. Having undergone the orientation course, they return to their different teams to disseminate the information on the procedure for the implementation of labour-based method. The state, local government and the community benefitting from the proposed scheme should contribute financially towards it. An efficient monitoring and controlling system must be put in place to check misappropriation of fund and to match performance with the expended fund.

TABLE 2

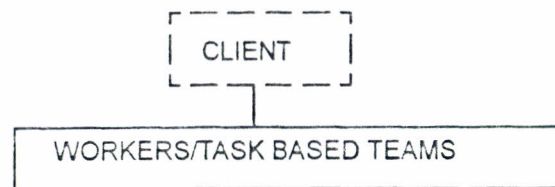
SUMMARY AND COMPARISON OF COST
REHABILITATION OF NOFORIJA-IMOKUN-YEWA ROAD

LABOUR -BASED METHOD EQUIPMENT-BASED METHOD

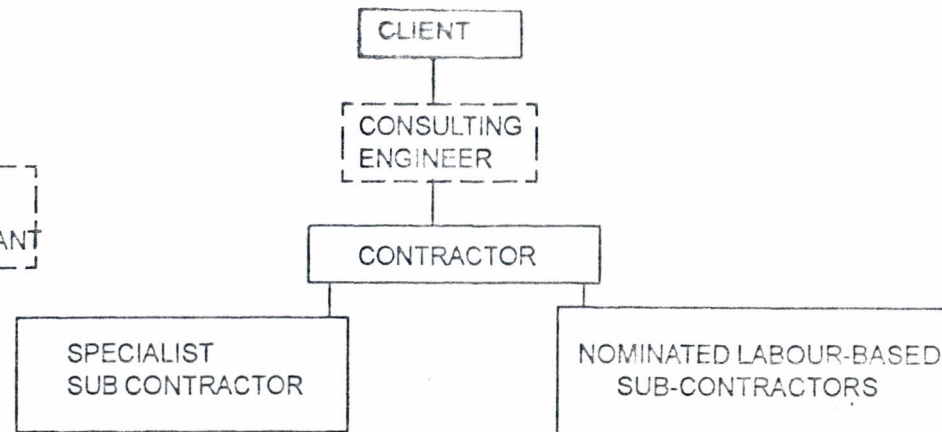
	LABOUR-BASED METHOD		EQUIPMENT-BASED METHOD	
ITEM	COST N	%	COST N	%
LABOUR	28,368.00	19.5	23,640.00	8.4
HAND TOOLS	50,887.20	35	11,698.80	4.1
EQUIPMENT	59,167.20	40.7	241,285.20	85.5
MATERIAL	-	-	-	-
SUB-TOTAL	138,422.40	95	276,624.00	98
ADD FOR SUPER-VISION	6,621.13	5	5,532.48	2
GRAND TOTAL TIME	145,343.52	100	282,256.48	100
COMPLETION TIME	9 WEEKS		7 WEEKS	



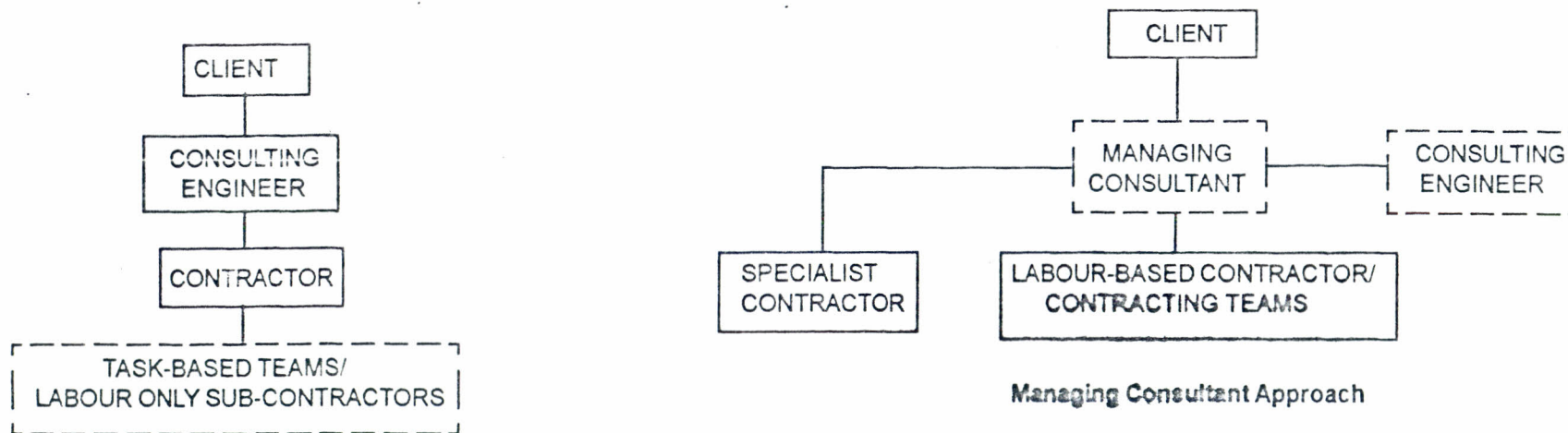
Development Team Approach



Direct Employment Approach



Managing Contractor Approach



Managing Consultant Approach

Conventional Contractor Approach

REFERENCES

1. Ampadu, S.K. and Tuffour, Y.A. (1995): Sustaining Labour-based Technology The Contribution of the School of Engineering Seminar on Labour-based Road Works, University of Witwatersrand, Johannesburg, South Africa.
2. Boothway, D.P. (1993): "Labour-intensive Construction of Roads: A Case Study: Masedoni Magisterial SAICE/SARF Symposium on Labour Construction, Midrand.
3. Harrison, D.M. (1993): Case Study on Waterbound macadam construction in Soweto. SAICE/SARF Symposium on Labour-intensive Construction, Midrand.
4. Hussain, M.I., Nwune, T.C. and Obi, A. (1992): Introduction of Labour-based Construction Technology in Nigeria: Demonstration and Experiences.
5. Kelly, P.J. (1993): Concrete block paving for enhanced construction, Midrand.
6. Manson, E.J. (1993): Case Study - rural dam. SAICE/SARF Symposium on Labour-intensive Construction, Midrand.
7. Markman, T.S. (1991): Labour-based Construction of a road in Kwazulu. Annual Transportation Conference (Developing Areas), Pretoria.
8. McCutcheon, R.T. (1989) Kenya: The rural access roads programme to 1986, Labour-intensive Construction details for success. University of the Witwatersrand.
9. McCutcheon, R.T., Van Zyl Cw, Crosswell J, Meyer D and Wattermeyer R.B. (1992). Interim guidelines for Labour-based construction projects. Development Bank of Southern Africa.
10. NDE/UNDP/ILO (1995): Workshop on Labour-based infrastructure Works Programme-orientation for Lecturers of Civil Engineering, Epe Training Centre, 19 - 25 February, 1995.
11. Powers, G., Potgieter, J., Judd, M., Burggher G.I. Stoffberg, M. and others (1994): Informal discussion and site visits, Cape Town.
12. Rwebangira, T. (1995): Regional Seminar on Labour-based Roadworks. University of Witwatersrand, Johannesburg, South Africa.
13. Saxby, R. (1993): The need for commitment of Client, community, Consultant and Contractor. SAICE/SARF Symposium on Labour-intensive Construction, Midrand.

Construction, Midrand.

14. **Scott, H.** (1993): Community Constructors of Township Services - Symposium on Labour-intensive Construction, Midrand.
15. **Watermeyer, R.B.** (1992): Contractor Development in Labour-based Construction. The Contractor Development Team: Johannesburg.
16. **Watermeyer, R.B.** (1993a): Community-based Construction. SAICE/SARF Symposium on Labour-intensive Construction, Midrand.
17. **Watermeyer, R.B.** (1993b): Community-based Construction.: Mobilising communities to construct their own infrastructure. XXIst World Housing Congress, Cape Town.