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ANNEX B

Evaluation of Force Account

Construction of Lake Shore Road

May, 1973

A.I.D.
Reference Center
Room 1656 NS

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Summary

The purpose of this study is to assess the effectiveness of the modified force account construction method used in the construction of Lake Shore Road Project in Central Malawi. The advantages and disadvantages of this method (in which an American construction firm was engaged to manage the construction work, using labor, equipment and materials provided by the Government of Malawi) are compared with those of normal contract construction.

The findings and conclusions of the study are:

1. The administrative/management efficiency of the modifi force account method is much poorer than for contract construction. Many matters required the attention of the construction management firm, the consulting engineer, the Government of Malawi (G.O.M.) and AID which, in normal contract construction would be handled by one or two of these entities.

2. More technical manpower training was accomplished with the force account method than would have been accomplished with contract construction, but the few additional men trained will have little impact on the Malawi economy.

3. On a force account construction project as simple as the Lake Shore Road Project it would be preferable to engage only a construction management firm rather than having both a construction management firm and a consulting engineer.

4. The use of force account methods will have an adverse effect on the development of local construction industry.

5. The Government of Malawi has planned effectively for the continued utilization of the equipment and personnel used on the force account project.

6. The net cost of construction of the Lake Shore Road Project is estimated to be 5% to 20% less than it would have been if the project had been built under a construction contract awarded to the lowest of the four U.S. bidders. (But it was because the low bid was considered excessive [illegible] the force account method was chosen.)

7. In quality, cost and (except for a late start) in speed, force account construction of the Lake Shore Road Project was fairly successful. But there is no assurance that another similar project would be equally successful. Side benefits, such as training were minor. G.O.M. is opposed to use of the force account method on another major road construction project. The method should not be adopted if the host country does not strongly wish to use it. Even then, because of the risks of delay, cost overruns and poor quality construction, AID should be very cautious in considering the financing of other major force account projects.

Introduction

The Lake Shore Road Project was the construction of two roads, totalling 126 miles in length, from Balaka to Salima and from Mua to Monkey Bay in central Malawi(see map). Construction began in March 1970 and by November 15, 1972 had been completed except for the placing of a bituminous seal coat on the road surface. The latter work was begun in April, 1973, at the end of the rainy season.

Because the low bid for contract construction of the road was considered too high, it was decided to build the road by force account, with construction management provided by an American construction firm, Nello Teer of Durham, North Carolina. Engineering supervision of construction was provided by Tippetts, Abbott, McCarthy, Stratton (TAMS).

This modified force account construction was unusual and a number of questions concerning its effectiveness have arisen. It was to help to obtain answers to these questions that the consultant visited Washington, Nairobi, and Malawi during the period of April 16 to May 15. The work was done under Contract No. AID/CM/afr-C-73-18.

Mr. John Westley, RESDO/Nairobi and the consultant were together for one week in Malawi, during which they inspected the entire length of the Lake Shore Road Project and had discussions with Government of Malawi officials, with officers of the German sponsored Central Region Agricultural Development Project and with Mr. Farver of the U. S. Embassy, Blantyre. The consultant spent a second week in Malawi, obtaining information from the Director of Roads, the Chief Mechanical Supervisor of the Plant and Vehicle Hire Organization and other officials

of the Government of Malawi, inspecting, again, the southern half of the Salima-Balaka Road and inspecting the construction work in progress on the Liwonde-Monkey Bay Road.

The topics included in the consultant's scope of work are discussed in the sections of this report numbered 1 to 7.

Description of Project

The two legs of the Lake Shore Road Project lie almost entirely in flat land bordering Lake Malawi. In only two very short reaches are there roadway cuts over 5 feet deep. No rock excavation was required for the grading of the roads, but there was extensive stripping of black cotton soil and some swampy areas were crossed. The two lane road surfacing consists of a 6-inch layer of gravel which is being sealed with a coat of bitumen and stone chips.

There are 11 bridges, the longest almost 900 feet long. All of the bridges are of very similar design, with short span, rolled steel beam and concrete deck super-structures and piers with spread footings or supported on steel pipe piles. Culverts of 24 inch and 30 inch diameter are of reinforced concrete, while larger culverts are of multiplate corrugated steel.

The structure designs are such as to minimize design and construction labor cost and maximize the use of imported materials. More labor intensive structure designs, such as cast in place reinforced concrete bridges, or bridges with precast, prestressed beams and large culverts of reinforced concrete have been used on much

recent road construction in Malawi. (The Malawi Roads Department has a casting yard for the production of prestressed bridge beams and six bridges using such beams have been built by force account.) The choice of structure designs for the Lake Shore Road may have been influenced by the desire to maximize the ratio of foreign exchange cost to local cost as well as the desire to expedite construction.

Project Implementation

The design of the Lake Shore Road was completed by TAMS in the spring of 1968 and bids from four prequalified U. S. contractors were received on June 5, 1968. The low bid was about 12% above the Engineer's estimate and in excess of the ceiling agreed upon by AID and G.O.M. in advance of the bid opening. In accordance with G.O.M.'s contingency plan it was decided to construct the project under a modified force account program in which labor, materials and equipment would be provided by G.O.M., an American construction firm engaged to manage the construction and TAMS retained to provide engineering supervision of construction. A loan agreement providing $7.0 million for financing the foreign exchange costs and part of the local costs of construction was signed on July 17, 1969.

An invitation for proposals for supplying construction management services was issued to American construction firms early in 1969, but it was not until November 28, 1969 that a contract for providing these services was executed by G.O.M. with the Nello Teer Co. of Durham, North Carolina. Notice to proceed was issued to Teer on March 15, 1970, thus fixing the required date for completion of construction as

November 15, 1972, thirty-two months later. In February, 1970 the first U. S. employees of TAMS and Teer arrived at the site. Subsequently additional U. S. engineers and construction men were assigned to the project bringing the TAMS on-site employees up to eight men and Teer's to 10 men.

Invitations for bids for construction equipment and materials were issued in the U. S. by Teer's home office in April, 1970 and orders for most of the required imports were placed in June and July, 1970. None of the U.S. construction equipment was delivered to the site until the rainy season of 1970-71. Consequently during the normal construction season of April to November in 1970, only used construction equipment provided by G.O.M. was available for use on the project. Overall construction progress by November 30, 1970 was only about 15%.

With U.S. equipment in hand at the beginning of the 1971 construction season, progress was much faster, reaching approximately 45% by November 30, 1971. However, by that time 64% of the allotted construction period had elapsed. To accelerate progress in 1972, the construction equipment fleet was expanded by rental of machines from the G.O.M. Plant and Vehicle Hire Organization and Teer was authorized to increase his on-site crew of Americans to 14 men. It was planned to change from single to two shift earth moving operations, but after a brief trial, earthwork was returned to single shift operation. Because of anticipated overruns in construction costs the amount of the U.S. loan was increased to $8.2 million by an amendment of the agreement dated August 25, 1972.

Construction was completed by November 15, 1972 except for the application of a seal coat of bitumen and stone chips on the road surface. This work was originally included in the construction management scope of work of the Teer Co., but it was decided to delete it from Teer's contract and to place the seal coat with G.O.M. forces during the 1973 construction season. (Work on the seal coat began in April, 1973). All of the American employees of TAMS and Teer had left the site before November 30, 1972.

1. Administrative/Management Efficiency: Force Account vs. Contract Construction

We believe that the total administrative/management effort of the four entities involved in the construction of the Lake Shore Road was much greater for the force account method which was used than it would have been if the road had been built by an independent contractor under a normal firm unit price contract. A comparison of the two methods follows:

Procurement of U.S. Commodities:

Because of the necessity of complying with AID requirements regarding competitive bidding, approval of contract awards, etc., Nello Teer, acting as the Construction Management Firm (CMF) had a much greater U.S. procurement task than it would have had if it had been buying construction equipment and materials for its own use under a unit price construction contract. The burden of procurement work placed upon TAMS, the consulting engineer, upon G.O.M. and upon AID also was much greater than it would have been with a normal construction contract. Purchases were made from

approximately 130 U.S. suppliers and for all except very minor orders, the issuance of invitations for bids and the awarding of contracts required the recommendation of TAMS and the approval of G.O.M. and AID.

Under a normal construction contract, the contractor would be free to procure construction equipment by any procedure which he wished to use. He could buy from favored suppliers without competitive bidding (thereby expediting delivery) or import used equipment owned by him. TAMS, G.O.M. and AID would have been concerned with the contractor's procurement of construction equipment only to the extent needed to assure themselves that the contractor complied with AID source and origin requirements and that his equipment procurement schedule was not obviously too little or too late to get the job done on time. For imported permanent construction materials, the consulting engineer would, of course, have to be sure that the contractor furnished items complying with the specifications, but again, the contractor would have been free to buy pretty much as he pleased.

With very efficient work by Nello Teer and excellent cooperation from TAMS, G.O.M. and AID, U.S. procurement for the project may well have been as fast and free from snags (such as complaints from unsuccessful bidders) as any AID financed procurement program of equal complexity which has ever been undertaken. But, the expenditure of administrative/management effort was great.

Construction Progress and Costs

Construction contracts normally require performance bonds and provide for the assessment of liquidated damages for failure to complete the work on time. The C.M.F. contract contained no liquidated damages provision, nor would it have been practicable to include one sufficiently large in amount to have had any appreciable effect. With the limits placed on its freedom of action and its dependence on G.O.M. for much local supply of equipment and materials, the Teer Co. might justifiably have refused to accept any provision for liquidated damages or have accepted one only with the protection of a very large amount of contingency money in its fee.

With the C.M.F. having much less financial incentive to finish the job on time, G.O.M. and AID had reason to be much more involved in monitoring construction progress and in trying to expedite the work than would have been the case if the road had been built under a construction contract. There were numerous high level meetings of G.O.M., TAMS, Teer and AID devoted largely to discussion of progress "bottle necks" and of ways of breaking them. Major problems which had to be resolved in the latter part of the construction period in order to get the project completed on time were the needs for more G.O.M. furnished construction equipment and for more on site American construction management personnel than had been specified in the Teer contract. The problem of losing skilled equipment operators to private contractors who would pay higher wages was discussed but not resolved. G.O.M. wage scales and/or classification

determining the eligibility of local costs for AID loan reimbursement. In the force account construction used on the Lake Shore Road Project there have been such problems and AID and G.O.M. have devoted considerable time to dealing with them. More time may be spent upon them. Perhaps partly because of the unfamiliarity of TAMS and Teer with G.O.M. accounting and cost keeping practices, final costs for the work which was completed by November, 1972 (all work except the application of the bitumen and stone chip seal coat) are not yet available.

Conclusion

Accepting the fact that the total administrative/management effort on the Lake Shore Road Project was much greater than it would have been if the road had been built by contract, the question is: "Was it worthwhile?" The answer is "yes, for this particular project." The total cost of the road construction was less than it would have been if a contract had been awarded to Reynolds Construction Co., the lowest of the June, 1968 bidders. Depending on the assumptions one makes regarding the residual value of equipment, contractor's claims, etc. it might have been as much as 20% less. The shift from contract to force account construction because the low bid was considered too high resulted in about 11/2 years delay in the start of construction and, because of rainy seasons, may have delayed completion of the project by as much as two years. However, the actual working time was about the same as one would have expected under a contract and the delay in starting construction should not be charged entirely to the use of the force account method.

The quality of the road work is good, but probably no better than it would have been with contract construction. There were "spin-off" benefits of force account construction (principally training) which we will consider elsewhere in this report. We do not have the data required for making a reasonably reliable estimate of the cost of the increase in administrative work over that which would have been required for contract construction, but we believe that the saving in construction cost well justified the increased investment in administrative/management effort. We conclude that the administrative/management efficiency of using the force account method is much poorer than under a firm unit price contract program, but that for the Lake Shore Road Project the investment of effort paid off.

2. Effects on Malawi Economy of Technical Training Provided by Lake Shore Road Construction: Force Account vs. Contract

The training of Malawians in construction skills was a specific requirement of the Teer contract for construction management services. But even if the C.F.M. had not been required to provide training it probably would have been forced to do so. Skilled heavy construction labor is in short supply in Malawi and probably will continue to be so for several years. We were informed that the following training was accomplished by Teer during the course of the Lake Shore Road construction

3 crawler tractor operators
3 motor scraper operators
1 front loader operator
5 mechanics
2 tire men
4 lubrication men
10 men on pile driving

6 carpenters
6 carpenter helpers on bridge crews
15 men on the placing of hanged underwater riprap
Total 91

In addition, many of the 191 experienced construction workers from its contractors who were assigned to the project by G.O.M., increased their skills while working on the project. Approximately ten senior African supervisory personnel were assigned to the project by G.O.M. These men had an opportunity to become familiar with planning, scheduling, and expediting activities and should have benefited greatly from the experience. Undoubtedly, many more men in the labor force (which, during the 12-month active construction period averaged 754 and peaked at 1450) learned a good deal about various construction methods.

TAMS also was active in training, developing, in the course of the project, three survey crews and other subprofessional employees, such as laboratory technicians.

The training of men in construction skills during the last few years has by no means been limited to that accomplished on the Lake Shore Road Project. Men are being trained on another force account road construction project, the Liwonde-Monkey Bay Road. This project, (approximately 53-miles long) like the Lake Shore Road, was originally expected to be built by contract, but because the low bid was considered too high, was shifted to force account construction, supervised and managed by a group of seven expatriate Crown Agency engineers and construction men. Some practical training takes place in the G.O.M. road construction units, the small force account units which are used for road construction work which because of their small size or for

other reasons would not attract competent contractors. Training of construction workers continues at the Training Center in Zomba, which is operated by the Ministry of Works and Supplies. This center, established about ten years ago, has a capacity of 100 men and offers one year courses in all of the more common mechanical and construction trades. Private heavy construction contractors also engage in some training activity in Malawi, but on a smaller scale than was the case on the Lake Shore Road. Not restricted by fixed G.O.M. wage scales, (as was the Lake Shore Road Project) the private contractor can pay as much as necessary to attract skilled labor from considerable distances or from Government employment.

No doubt, the Lake Shore Road Project did more to increase the skilled and semi-skilled heavy construction labor force of Malawi than any other recent construction project. Some of the men who were trained, such as carpenters and carpenter helpers, may be able to make some use of their skills in self help projects in their villages. Most of the heavy equipment operators and mechanics are now employed, many by G.O.M. Plant and Vehicle Hire Organization. They can look forward to much greater earning power than they had before being trained. G.O.M. supervisory personnel, returning to the smaller scale operations of road construction units or other employment in the Ministry of Works and Supplies should be more effective because of their experience on the Lake Shore Road. There is little prospect that any of these men will be able to enter the heavy construction business "on their own" even on a very small scale.

It would be unrealistic to think that the training of technical manpower on the Lake Shore Road project has had or will have more than a very slight effect on the economic development of Malawi.

3. Advantages and Disadvantages of Using Both a Consultant and a Construction Management Firm for Force Account Construction

The advantages of engaging both an engineering consulting firm and a construction management firm for force account construction are:

(a) Providing adequate expertise for carrying out the distinct functions of each type of firm. Some U.S. firms are "engineers and constructors", capable of designing and constructing turnkey projects. In such projects the owner may be protected against defective design, materials or workmanship by extended guarantee periods. But such practice is virtually never used in U.S. highway construction. Many U.S. construction contractors who would be well qualified to manage construction work would not be well qualified to exercise quality control or to make engineering decisions on design changes which might be needed during the course of the work because of unanticipated soil conditions, changes in the availability of materials, etc. On the other hand, consulting engineering firms do not normally have on their staffs men who are capable of efficiently handling the practical problems of procurement, training and mangement of labor, equipment operation and maintenance, etc.

(b) Clear cut separation of responsibility for getting the work done fast and efficiently (the job of the C.M.F.) and

the responsibility for insuring that the work is done right that it meet the specifications, (the principal job of the resident engineer and his staff). No matter how conscientious the C.M.F. may be, it is almost too much to expect that all of its men will always see that the work is done properly - particularly if the work is behind schedule or if the owner is complaining about high costs. The C.M.F. would not be tempted to "cut corners" as much as a contractor who is losing money, but there would be some temptation. One might think that quality control is over emphasized, that most road construction operations need less inspection, laboratory testing, etc. than they usually receive. However, the way to save money by lowering standards is by the preparation of economically sensible designs and specifications, not be accepting poorer work than has been specified.

Some operations can be performed by either a construction contractor or the engineer almost equally well - construction surveying, for example. The original invitation for bids for construction of the Lake Shore Road provided that the contractor would do the survey work, with the engineer checking the work fairly closely. In the Teer contract this was changed to provide that the engineer would do the survey work. By making the C.M.F. responsible for construction surveys, one potential source of friction between the C.M.F. and the engineer might be eliminated. The C.M.F. could not complain of being delayed, awaiting the setting of stakes or checking of line and grade by the engineer.

The disadvantages of employing parate firms for engineering supervision and for construction management were quite apparent on the Lake Shore Road Project. They are:

(a) Unsatisfactory cooperation between employees of the two firms. Occasional incidents of friction between on-site employees of the engineer and of a construction management firm (or construction contractor) are almost inevitable, but on the Lake Shore Project, the relationship between the engineer and the C.M.F. apparently was not as good as one would normally expect it to be.

(b) The need for more on-site American employees during the construction period. Each of the two separate organizations requires a head man. Only one "boss" would be required if the two groups were combined. Probably a considerably greater saving in manpower could be made.

On a simple road contruction project such as Lake Shore, it is unlikely that design changes requiring much engineering expertise will occur in the course of construction. The C.M.F. would have no financial incentive to do substandard work. Furthermore, the resident engineer (of an engineering consultant) would have less control over the C.M.F. than over a firm price contractor since he could not withhold payment to the C.M.F., for unsatisfactory performance, whereas he can withhold payment from a firm price contractor. There is less need for independent engineering on a force account project than on a normal contract project. In view of these considerations and the problems of cooperation and coordination experienced on the Lake Shore Project, it probably would be better on another similar project to have the C.M.F.

provide on site engineering, i.e. use only one firm.

4. Implications of the Government of Malawi's Use of Force Account Construction Methods on the Development of Local Private Construction Industry

Local heavy (road) construction industry owned and operated by Malawians is practically non-existent. Shown below is a list of the civil engineering (heavy or road construction) contractors which are registered in Malawi. Their bidding capacities in Kwacha (K1.00-$1.25) are shown in parenthesis.

REGISTRATION

DATE	CIVIL ENGINEERING CONTRACTORS (K100,000)	
10-12-69	Burch Construction	PO Box 989, Blantyre
14-10-70	E. L. Stuart	PO Box 618, Blantyre
9-7-71	Onions Plant Hire	PO Box 5689, Blantyre
	CIVIL ENGINEERING CONTRACTORS (K300,000)	
28-2-70	J. M. Crawford	PO Box 551, Blantyre
21-4-72	Construction Earthworks & Asphalt Services Limited	PO Box 5941, Limbe
1-11-72	Manobec Limited	PO Box 5632, Limbe
	CIVIL ENGINEERING CONTRACTORS (K1,000,000)	
6-9-70	Duckworth Civil Engineering,Ltd.	PO Box 513, Blantyre
5-2-72	Cilcon Limited	PO Box 454, Blantyre
	CIVIL ENGINEERING CONTRACTORS (UNLIMITED)	
10-12-69	Murray & Roberts Roads & Earthworks (Pty) Limited	Private Bag, Kasupe
15-12-69	Roberts Cons. Co. (Malawi)Ltd.	PO Box 461, Blantyre
10-12-69	W & C French (Malawi) Ltd.	PO Box 478, Blantyre
10-12-69	Philipp Holzmann A.G.	PO Box 27, Salima
28-2-70	General Construction Co. Ltd.	PO Box 5656, Limbe
28-2-70	GECDEC - General Construction Dragages Ermoque Consortium (Temporary)	PO Box 54, Ncheu

Some of these firms might now qualify as being "local" and therefore eligible for U.S. financing. The last six of these firms would have been able to bid on the Lake Shore Road project so far as bidding capacity is concerned. Some of the smaller civil engineering contractors might have been capable of subcontracting portions of the project. Obviously, U.S. financing for the Lake Shore Road project took some potential business away from contractors operating in Malawi.

The equipment acquired by the Ministry of Works and Supplies at the completion of the U.S. financed force account work may, by increasing G.O.M's capacity for future force account work, encourage it to do some small projects by force account which otherwise might be contracted. But such adverse effect on the construction industry probably would be very small.

It is highly improbable that any of the Malawians who worked on the Lake Shore Road project will be able to become independent road construction contractors, even on a very small scale within the foreseeable future. As discussed later in this report, labor intensive road construction methods, such as those used in India, are not likely to prove generally feasible for major roads in Malawi. To buy even a minimum outfit of road construction equipment may for many years require more capital than any of these men could hope to raise. Knowledgeable construction and finance men to whom we talked were unanimous in their pessimism about prospects for the development of a truly local road construction industry. There is a much better prospect for development of the local building construction industry. In fact, 22 building contractors (probably all local) with bidding capacities of

K3,000 ($3,750) and 12 building contractors (mostly local) with bidding capacities of K30,000 ($37,500) are registered. Much less capital is needed to enter the building construction business than to become a road construction contractor.

5. Plans of the Government of Malawi for Utilizing the Equipment and Personnel Used for the Force Account Work on the Lake Shore Road Project

A. Equipment

A major portion of U.S. construction equipment financed by AID is still in use on the Lake Shore Road, where the placing of the bitumen and stone chip seal coat began as soon as the weather would permit in late April. Before sprinkling the road with the prime coat of bitumen, the road surface (which had received practically no maintenance since last November) must be reshaped with a layer of fine gravel, made smooth with a motorgrader, sprinkled and rolled. The following major items of equipment were assigned to the Lake Shore Road as of March 13, 1973:

4 White water trucks
8 White dump trucks
2 White flat rack trucks with hydraulic cranes
8 International pickups
1 Caterpillar 16 Motorgrader
2 D-6 Caterpillar crawler tractors
1 Caterpillar 930 front loader
3 Pumps
1 Autocar truck tractor
1 Low bed semi-trailer
6 Portable generator sets
2 Allis Chalmers loader-backhoes
1 Bros Vibratory roller
1 Huber pneumatic roller
5 Air compressors
3 Welding sets
3 Huber tandem rollers
Miscellaneous small items

Other construction equipment allocations as of March 13, 1973 were: Project Engineer at Liwaladzi (Nkhotakota-Nkata Bay Road)

2 White Flat rack trucks
1 White Dump Truck
5 International pickups

Crown Agency (Liwonde-Monkey Bay Road Construction)

1 White flat rack truck with hydraulic crane
3 International pickups
2 Caterpillar 621 motorscrapers
1 Pump
1 Grid roller
1 Anco disc plow
1 Plymouth Station Wagon

Resident Engineer - Central Region - Roads Department

1 Caterpillar 16 motorgrader
3 Caterpillar 621 motorscrapers
2 Caterpillar D-8H crawler tractors
4 pumps
2 concrete mixers
1 welding set
3 concrete vibrators
2 Rampactors
1 Reinforcement steel bar bender

Resident Engineer - Southern Region - Roads Department

1 Pump
2 Rampactors
2 Concrete mixers
1 reinforcement steel bar bender

Director of Roads

2 concrete buckets

Director of Design

1 drilling rig

G.O.M. Plant and Vehicle Hire Organization (PVHO)

1 White van truck
2 International pickups
1 D8-H tractor
1 Koehring motor crane
1 Koehring crawler crane

Many small items not listed above have been allocated. In fact, of 165 pieces of equipment shown in the G.O.M. March 13 listing, all but 10 had been allocated. The consultant observed the motorscrapers, tractor and grader assigned to the Regional Engineer, Central District at work on a small road construction job near Lilongwe. This equipment appeared to be performing well. It began work in an Army cantonment area near Lilongwe in January and, despite wet weather, has done some extensive grading work. The equipment allocated to the Lake Shore Road project was not working on the day the writer visited the project (because of a holiday) but obviously must have worked pretty effectively during the period of about ten days since the seal coat work was started. By May 2, 1973, nine miles of road had been reshaped, 8 miles prime coated and 4 1/2 miles finished with the second coat of asphalt and the spreading and rolling of chips. AID financed equipment on the Liwonde-Monkey Bay Road also was observed in use.

The mobile equipment which we saw was remarkably free from external signs of abuse, such as dented sheet metal, broken glass, etc. Most of the mobile equipment had been repainted. The equipment looked very good indeed, but we had little basis except for hours or miles of use for appraising its mechanical condition.

Mileage or hours of operation for some of the more important items of mobile equipment were as follows at the completion of construction, (except for the bituminous seal) of the Lake Shore Road project:

ITEM	NO. OF UNITS	AVERAGE MILEAGE OR HOURS OF OPERATION PER UNIT
White dump trucks	10	52,000 miles
White flat rack trucks	6	46,000 miles
White water trucks	4	37,000 miles
White van truck	1	38,000 miles
Caterpillar #16 motorgraders	2	3,800 hours
Caterpillar #621 motorscrapers	6	3,900 hours
Caterpillar D8H tractors	3	4,600 hours
Caterpillar D6C tractors	2	4,000 hours
Autocar truck-tractor	1	43,000 miles
Koehring motorcrane	1	5,064 hours
Koehring crawler crane	1	2,000 hours
Caterpillar wheeled front loader	1	2,840 hours
Allis Chalmers loader-backhoe	2	1,500 hours
International 2 wheel drive pickup	14	52,000 miles
International 4 wheel drive pickup	7	49,000 miles

In many cases on AID financed projects, construction equipment which is by no means worn out at the completion of the project is very poorly utilized thereafter. G.O.M. appears to be doing well in putting the Lake Shore Road equipment back to work. Most of this equipment has been idle only during the 1972-73 rainy season. With the equipment now allocated to road projects, regional engineers and the Plant and Vehicle Hire Organization - all of which have had previous experience with similar equipment - the prospects for effective utlization are excellent. Upon completion of the bituminous seal work on the Lake Shore Road, no doubt more equipment will be allocated to PVHO, an agency which rents equipment to any ministry or department of G.O.M. which may need it. PVHO supplies a qualified operator with each major piece of construction equipment it rents. It should be able to achieve very effective utilization.

B. Personnel.

Ten senior G.O.M. personnel and approximately 194 G.O.M. foremen, skilled, and semiskilled laborers were assigned by G.O.M. to work with the C.F.M. in accordance with a schedule of personnel incorporated in the C.F.M. contract. The senior G.O.M. group initially included several expatriates, but for the major portion of the active construction period this group was all African. We understand that most of these G.O.M. employees have returned to their work with the Roads Department. A notable exception is a man who had the title of Chief Roads Supervisor. He is now working as an instructor in the Ministry of Works and Supplies Training Center at Zomba.

Despite the fact that no motor scrapers have yet been allocated to the Plant and Vehicle Hire Organization, PVHO has employed six motorscraper operators from the Lake Shore project. PVHO has also hired a group of mechanics from the project.

Presumably most of the additional men hired by the C.F.M. for the project- men who were not G.O.M. employees before the beginning of the Lake Shore Road construction - were laid off. (The number of such men was much larger than the number of men transferred to the project from other G.O.M. employment, since total project employment averaged 754 during the 32 month active construction period.) Probably some of these men have found other construction employment - some, perhaps, in the extensive construction work involved in the establishment of a new capital at Lilongwe.

If G.O.M. had planned to undertake another large scale force account road construction project shortly after the completion of the Lake Shore Road it would have been desirable to shift many of the experienced men to the new project. With no such project planned (the Liwonde-Monkey Bay Road construction was already under way) we think G.O.M. did as well as could be expected in making use of personnel from the Lake Shore Project.

6. Lake Shore Road Project Costs

A. Gross Foreign Exchange Costs - Force Account Construction

The estimate shown below is based on information obtained from the project on foreign exchange expenditures incurred as of April 30, 1973. The distribution of freight costs has been assumed to be a uniform percentage of purchase cost except for portable housing, an assumption that may be considerably in error for some items. In this and subsequent estimates most of the costs have been rounded off to the nearest $1,000.

Item	Purchase Price	Freight	Total
1. Construction Equipment & Tools	$1,954,000	$292,000	$2,246,000
2. Portable Housing	94,000	46,000	140,000
3. Spare parts	416,000	62,000	478,000
4. Temporary Materials & Supplies other than spares	112,000	17,000	129,000
5. Permanent Construction Materials	855,000	128,000	983,000
6. Imprest Fund for Small Purchases by C.F.M.	189,000	-	189,000
Subtotals - Equipment & Materials	3,620,000	545,000	4,165,000
7. Engineering Supervision of Construction	768,000		768,000
8. Construction Management	1,159,000		1,159,000
9. Bank charges (approx.)	15,000		15,000
Totals	$5,562,000	$545,000	$6,107,000

*Includes two claims totalling $15,000

B. Gross Local Costs - Force Account Construction

The following local cost estimates are shown in the loan paper for the $1.2 million increase in the amount of the loan. Originally it was not intended to include in the AID financed project any bituminous surfacing, but by the time the C.F.M. contract was negotiated it had been decided to include a seal coat of bitumen and stone chips. The local cost estimate included in the C.F.M. contract is the same as the so-called "original" estimate except for the addition of an item of $252,000 for bitumen, reduction in the contingency allowance and increase in the total estimated local cost from $1.94 million to $2.134 million

The revised estimate shown below was prepared in the spring of 1973 when construction of the road was about 50% complete. In addition to including an item of $300,000 for the procurement of bitumen, the revised estimate should have (and perhaps does) include in the labor and FOL items the estimated local costs of reshaping the road surface, of furnishing the stone chips and of placing the seal coat. The rental of equipment from the Plant and Vehicle Hire Organization was not originally anticipated, but in order to meet the construction schedule it was necessary to supplement the U.S. equipment and the equipment originally supplied by G.O.M. with rented equipment; hence the item for equipment rental in the revised estimate.

Item	Original Estimated Requirements	Revised Estimated Requirements
1. Parts for non-U.S. Plant*	$ 60,000	$286,800
2. Camps	252,000	338,400
3. Materials	232,800	603,600
4. Labor	741,600	819,600
5. FOL (without duty)	336,000	516,000
6. Transportation from Beira	55,200	18,240
7. Land compensation	12,000	18,000
8. Contingency	250,400	83,800
9. Rental of Equipment from PMD	-	278,400
10. Bitumen	-	300,000
Total	$1,940,000	$3,262,840

*These parts were for G.O.M. construction equipment furnished to the C.F.M. without any rental charges. Most of the equipment was very old and often out of service for repairs. We have assumed that the equipment was or will be as good or better after the installation of the spare parts covered by this item as it was when first assigned to the project. Hence no rental charge has been included in the adjustment of this estimate given later in this report.

The bids for contract construction of the Lake Shore Road which were opened in June, 1968 did not include the placing of the bitumen and stone chip seal coat. Consequently, for the purpose of comparing force account cost with the estimated cost which would have occurred if the road had been built by contract, we need to determine (or estimate) force account cost exclusive of the cost of the seal coat.

We understand that a statement of local expenditures incurred as of January 31, 1973 will be provided to AID soon by G.O.M. However, at the time of our visit this statement had not yet been released. The same road construction as that covered by the bids received in June 1968 (no bituminous seal coat) had been completed by November, 1971 and no expenditures for the seal coat were made until after January 31, 1973. Hence the forthcoming statement of local expenditures as of January 31, 1973 would be very useful in developing a comparison between force account and contract construction costs. Lacking this statement, we estimate total local cost for the road construction <u>without</u> the bitumen seal coat as follows:

Revised local cost estimate of Spring, 1972			-$3,263,000
Plus 10% for G.O.M. Overhead* escalation, devaluation, etc.			326,000*
			$3,589,000
Less estimated cost of seal coat:			
Bitumen (actual cost)	K.279,000		
Furnishing stone chips and placing Seal coat	K.172,000		
	K.451,000	=	$ 564,000
Estimated gross total cost			$3,025,000

(K.1.00 = $1.25) (*exclusive of seal cost)

C. Total Net Cost - Force Account Construction

Foreign exchange cost	$8,107,000
Gross Local cost	1,025,000
Total gross cost (without seal coat)	$9,132,000

Less credits:
Estimated residual values:

(1) Construction Equipment: 28% of delivered cost = 0.28 x $2,246,000	= approx.	$ 629,000*
(2) Spares: 50% of $478,000	= approx.	$ 239,000
(3) Portable Housing: 40% of $140,000	= approx.	$ 56,000
(4) Camp: 30% of 1972 estimated cost of $338,400	= approx.	$ 100,000
		1,024,000-1,024,000

Estimated net cost (without seal coat) $8,108,000

Comments on Estimate of Cost of Force Account Construction

We understand that G.O.M. administrative and overhead costs properly chargeable to the Lake Shore Road project have not been included by G.O.M. in its cost accounting. We were unable to obtain an estimate of such costs, but doubt if they amount to as much as $100,000 - not enough to significantly affect the comparison of force account cost with hypothetical contract cost.

(1) The estimate of the residual value of the construction equipment is based on the average appraisal of residual value made by the Plant and Vehicle Hire Organization for about 80% (cost basis) of the total equipment purchased. The PVHO appraised residual values varied from 11% of delivered cost for 4x4 International Harvester pick up trucks to 43% for Caterpillar crawler tractors. We think the average appraisal of residual value of 28% of landed cost probably is on the low side, possibly by as much as 12%.

(2) We were unable to obtain data on the value of spare parts remaining in stock. Furthermore many of the remaining parts may be slow moving parts which never will be used. The assumption that the remaining parts are worth 50% of the total investment in parts for U.S. equipment is arbitrary.

(3) Some of the portable housing is in use and all of it probably will be used.

(4) We were informed that the Ministry of Agriculture might use the main camp some time in the future. The steel warehouse and shop buildings could be moved, but the residences and office building will be almost worthless if no one wants to use them in their present location.

D. Estimate of Net Contract Construction Cost

Total bid price exclusive of "provisional" bid items for camp construction which were not required because of the construction of the camp by G.O.M.

Dollar component:	$5,360,000
Local currency component:	
$788,092. ($1.00= $2.40)	1,891,000
Plus adjustment for changes in quantities (see page31 for details)	517,000
Subtotal - adjusted contract price	$7,768,000
Supervisory engineering (per TAMS estimate)	600,000
Cost of camp (from 1972 estimate)	338,000
	$8,706,000
Less residual value of camp	100,000
Estimated net cost of contract construction	$8,606,000
Estimated net cost of force account construction	$8,108,000

Comments and Details

(1) The above estimate indicates that force account construction cost 6% less than contract construction would have cost. However, a

few changes in assumptions could make the indicated saving much greater.

For example:

	Change in Force Account Estimate	Change in Contract Estimate
Assumption: 40% residual value of equipment instead of 28%	-270,000	-
Assumption: No increase in 1972 local cost estimate	-326,000	-
Assumption: Payment to Contractor on claims of 5% of adjusted contract price	-	+388,000
	-596,000	+388,000

With these assumptions, the estimated net cost would be:

Force account	$7,412,000
Contract	8,994,000
Indicated force account saving:	$1,582,000

Force account construction, on the basis of these assumptions, would be 18% less costly than contract construction, but still more than the original engineer's estimate. Contract construction cost might have been reduced considerably if G.O.M. had agreed to purchase the contractor's used equipment after completion of the work, but such an arrangement would have been difficult to administer and probably unacceptable to G.O.M. The Lake Shore Road is a fairly simple straight forward project. There would seem to have been little chance of a contractor's being able to develop valid claims for additional compensation. Nevertheless, it would be unusual to avoid paying any claims. (Mr. Richards, Sect. for Works and Supplies indicated that the thinks that such claims would have occurred if the work had been done by contract.) We can only conclude that the cost of contract construction of the road without bituminous seal coat would, on the basis of the low

bid of June, 1968, have been substantially more than the force account cost of the same construction.

(2) Adjustments for changes in quantities, i.e. differences between actual quantities for work and quantities given in invitation for bids

Quantity overruns and underruns shown below are based on the quantities shown in Teer's October, 1972 cost accounting report, which is stated to have been checked by TAMS. Some of the overrun in excavation apparently was due to over-width embankment construction. However, a very large part of the increase in excavation was due to heavy stripping of topsoil from embankment foundation and borrow pit areas. The estimated quantity of stripping (Excavation-Cut to Spoil) shown in the I.F.B. bill of quantities was 13,000 c.y., whereas the actual quantity shown in the October, 1972 cost accounting report was 615,616 cu. yds. Some of this stripping probably was unnecessary, but if a contractor had been doing the work the overruns might have been just as great and the contractor probably would have been paid for all excavation, measured in cut.

Bid Item	Description	Unit Change	Bid Unit Price $	Bid Unit Price ₤	Change in Cost. $	Change in Cost. ₤
4/01 & 4/03	Unclassified Excavation-Cut to fill & unclassified excavation borrow to fill	CY +575,910	0.56	0.025	+322,000	+14,000
4/02	Unclassified Excavation Cut to Spoil	C.Y. +602,616	0.48	0.025	+290,000	+15,000
6/02	Culvert Excavation	C.Y. -(25,549)	2.00	0.75	-(51,000)	-19,000
6/02A	Furnish & install corr. metal pipe-24" dia.	l.f -(9,214)	6.50	0.50	-(60,000)	-(5,000)

Bid Item	Description	Unit Change	Bid Unit Price $	Bid Unit Price £	Change in Cost $	Change in Cost £
6/028	Furnish & install corr. metal pipe-30" dia.	l.f -(24,776)	9.00	0.625	-(223,000)	-(15,000)
New Item	Furnish & install corr. metal pipe-24"	l.f +9,214	est. 1.00	est. 2.00	+9,000	+18,000
New Item	furnish & install corr. metal pipe-30"	l.f +24,776	est. 1.50	est. 2.50	+37,000	+62,000
9/01	Gravel wearing course	C.Y. +41,289	1.60	0.125	+66,000	+5,000
9/02	Gravel Haul	C.Y. Mile -(189,370)	0.20	0.0125	-(38,000)	-(2,000)
10/01	Class A Concrete	C.Y. -(241)	16.50	13.60	-(4,000)	-(3,000)
11/01	Reinforcement Steel	lb. -(189,370)	0.13	0.021	-(24,000)	-(4,000)
14/02	Piles Driven	l.f. +1,661	10.00	3.50	+17,000	+6,000
14/03	Piles Splices	ea. +67	10.00	12.50	+ 1,000	+1,000
			Totals		342,000	73,000
				=	$517,000	

7. Overall Evaluation of Force Account Implementation of Capital Projects

The decision to adopt force account construction for the Lake Shore Road was based largely on the belief that the project could be completed at much lower cost by force account than under a contract awarded to the lowest of the June 1968 bidders. The saving in cost probably has been less than anticipated, but there has been a saving. The quality of the construction work is good and the 32 month period of active construction was only two months longer than that specified in the invitation for bids for contract construction. (Notice to proceed was not issued to the force account construction management firm until about 2 1/2 months after the opening of bids for contract construction. Possibly with a quick award of contract the project could have been completed 2 years

earlier than it has been, but the starting delay would not necessarily occur in another force account road construction program of similar size and complexity).

Civil service project managers and potential project managers would have more opportunity to participate in planning and management activities on a force account construction project than in a similar project built under a normal contract. On the other hand, they might be able to see more efficient project management - better scheduling and cost control if they were acting as field representatives of the owner on a contract construction job (either directly employed by the owner or on loan to a consulting engineer). Force account work often has been grossly inefficient. We doubt if the prospect of effecting training of senior civil service personnel in construction management is sufficiently great to weigh very heavily in deciding whether or not the force account method should be adopted.

Force account construction offers an opportunity for training civil service technicians which can hardly be duplicated on a contract project. A contractor might not take kindly to being forced to train men who are not going to remain on his payroll. A training center not associated with an active construction project cannot always simulate actual construction operations effectively. If there is a real need for training more civil service technicians, for example, if more technicians are needed on smaller government construction projects - projects which are too small to set up effective training programs of their own, then the training opportunity offered by a fairly large force account construction project might be an important

reason for adopting force account construction. Otherwise training does not appear to be a very important consideration in deciding whether or not to adopt the force account method.

If more projects like the Lake Shore Road were to be built by force account, financed either by the U.S. or by other donors, the effect on the development of local construction industry probably would be adverse. Construction firms which are now registered in Malawi would have less potential business in the country. Some of these firms might become sufficiently "local" to qualify for U.S. financing if they can maintain a good volume of business in Malawi. There is little prospect that Africans acquiring some degree of construction management expertise on force account projects will be able to become small independent road construction contractors. In Malawi, labor intensive methods which might give the small entrepreneur a chance to enter the road construction industry do not appear feasible. With approximately 25% of the male labor force working outside Malawi there is no large reservoir of labor which could be mobilized for major road construction. Furthermore, in some road construction operations, such as compaction of embankments and bituminous surfacing it is next to impossible to achieve manually the quality of work which can be obtained mechanically. In Malawi (and probably most other African countries) major road construction probably will continue to be much more highly mechanized than in some Asian countries India in particular.

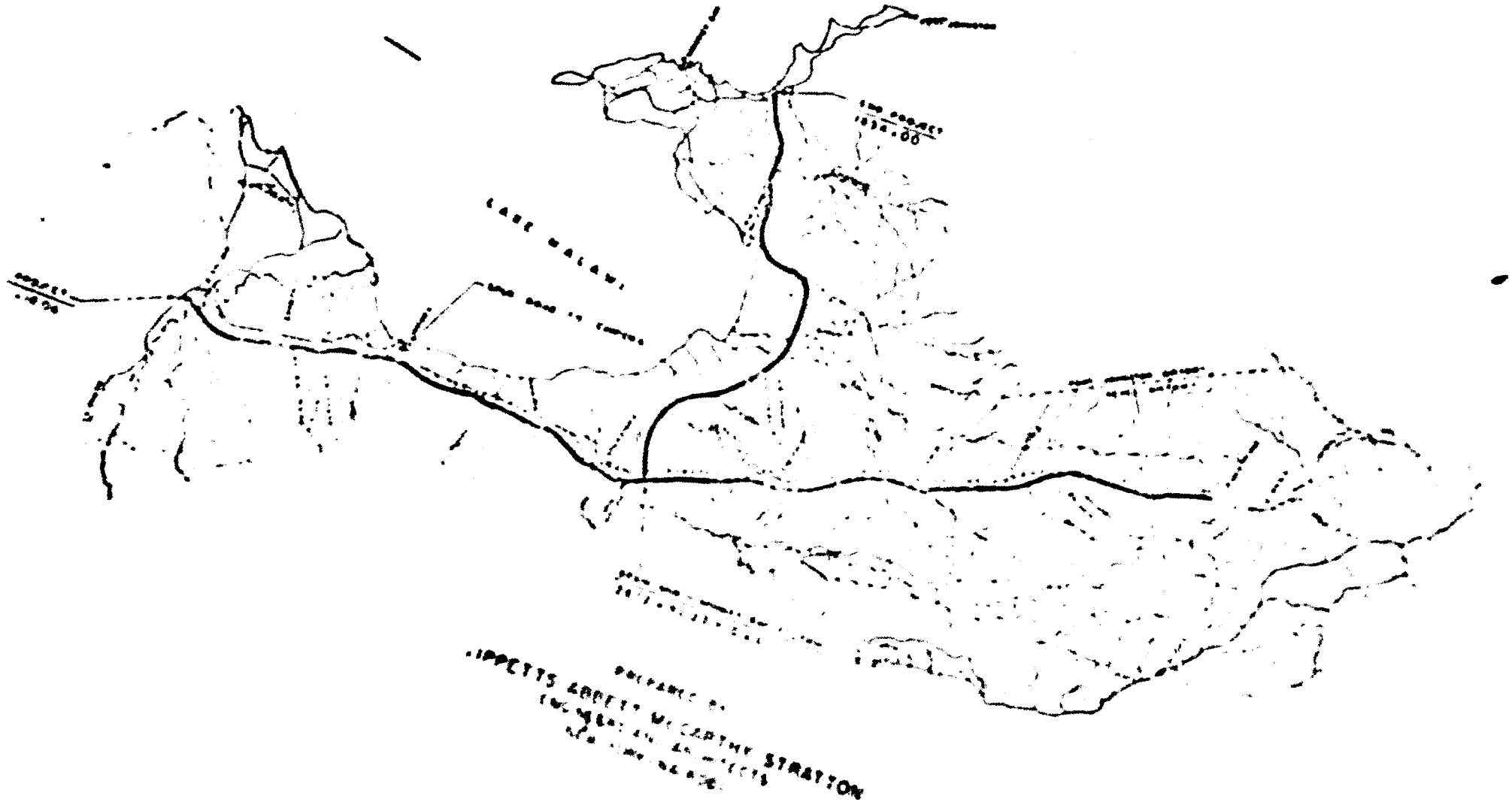
The Lake Shore Road experience indicates that a well managed force account road construction project can (if bids are high) result in a considerable saving in cost as compared with construction by an American contractor. But we would emphasize "well managed". There is no assurance that the good performance of the Teer Co. as C.M.F. on the Lake Shore Road would be duplicated by a different American C.M.F. on another project. The quality of Teer's performance no doubt was enhanced by the fact that Teer had, during the period of the Lake Shore Road construction, a contract for road construction in nearby Tanzania. Teer's senior staff probably visited the Lake Shore job far more frequently and took a much more active interest in it than they would have if they did not have other work in the area. Furthermore, the proximity of Teer's other job facilitated the transfer of men from that project to the Lake Shore Road. In several instances American construction men who for one reason or another, were separated from Teer's group on the Lake Shore Road, were replaced quickly with competent men from Teer's Tanzania work.

In view of the limited benefits other than possible cost saving, the difficult administrative problems inherent in large scale force account construction managed by an American C.M.F. and the high risk of much poorer C.M.F. performance than that experienced on the Lake Shore Road, we believe AID should be very cautious about engaging in another similar project. Certainly it should not consider construction by force account unless the host country wants to adopt that method and is capable of doing its part effectively in such a cooperative venture.

In Malawi, senior G.O.M. officials who were most directly involved in the Lake Shore Road project are strongly opposed to undertaking another similar major force account construction project. (The force account Liwonde-Monkey Bay Road construction project supervised and managed by the British Crown Agency was begun when the Lake Shore Road work was nearing completion, but is a much smaller and simpler project, with no bridges and with crushed stone being supplied by contract). These G.O.M. officers indicated that with their present and anticipated work load it would be virtually impossible for their small staffs to administer a major force account project properly. It seems improbable that plans for further U.S. financing of major force account road construction will develop in the near future. In other African countries and, perhaps even in Malawi, USAID financing of force account construction might deserve consideration for projects too small to attract good competition from U.S.contractors, but too large for local contractors. Such projects would, of course, involve a much smaller input of U.S. technical assistance than the Lake Shore Road project. On large projects for which low bids are not considered acceptable, force account construction might again deserve consideration, but if so, we suggest that these points be emphasized:

(a) Side benefits of force account construction are likely to be minor. The major justification for adopting force account construction must be anticipated reduction of cost.

(b) Force account construction involves far higher risk than contract construction. There is no assurance that the success of the Lake Shore Road project would be duplicated on another similar project. The record


LAKE MALAWI
HIPPETTS ABBETT McCARTHY STRATTON

Appendix A: Persons Contacted

Washington - AID
- Mr. Samuel Lubin
- Mr. Ronald Henrikson
- Mr. Stephen Klein
- Mr. Robert Berg
- Mr. Stephen Whitmer
- Mr. Edward Scoll

Washington
- Mr. Wm. Le Baugh (formerly with TANS)

Nairobi
- Mr. Robert Fedel, REDSO/EA
- Mr. Richard Nash, TANS
- Mr. Ed Bryant, TANS

Blantyre
- Mr. James Farber, U.S. Embassy

Malawi Roads Department, Lilongew
- Mr. H.G. Brind, Director of Roads
- Mr. Ray Lingard, Civil Engineer
- Mr. Donald Cullen, Civil Engineer
- Dr. W. W. Rigbye, Director of Design
- Mr. Miller, Cost Accountant
- Mr. G. S. Hubbarde, Principal Project Accountant
- Mr. A. A. Kachinda, Senior Roads Supervisor

Lilongwe
- Mr. J. R. Gale, Chief Technical Supervisor Plant & Vehicle Hire Organisation
- Mr. Wm. Anstead, Manager, W. & C. French Ltd. (Malawi)

Mangochi
- Mr. Mike Holme, Construction Supervisor, Crown Agency

Zomba
- Mr. Geraint Richards, Esq. CBE, Secretary for Works & Supplies
- Mr. L. S. Mihoa, Deputy Under Secretary, Treasury, Ministry of Finance
- Mr. David Boyd, Chief Instructor, Ministry of Works & Supplies Training Center

Salima
- Mr. Payar, Sr. Extension Officer, Central Region Agricultural Development Project