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PRE-PAAD STUDY
AN ANNEX ON ROAD TRANSPORT

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LOUIS BERGER INTERNATIONAL INC.
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A

PREFACE

The purpose of this Appendix is to examine the constraints on and the capacity of the road transport sector to respond favorably to improved road conditions through increasing transport services at lower prices, and to determine the capacity and willingness of the construction industry to take on an increasing role in maintenance and rehabilitation activities.

Following the Introduction, the discussion begins with an outline in Chapter 2 of the methodology adopted for data gathering. This is followed in Chapter 3 by a description of the different components of the road transport sector, namely the formal trucking industry, company owned fleets, merchant transporters, and ends with ways to improve the road sector. The next chapter analyses relationships between the rates charged by different road transport entities and the costs of operating on deteriorated and improved roads and terminates with a discussion of the impact of fuel price increases on rates. Chapter 5 presents the results of discussions with various construction firms regarding their interest in road maintenance. Chapter 6 concludes with suggestions for future studies regarding road user charges, road inventories and traffic counts.

APPENDIX ON ROAD TRANSPORT

EXECUTIVE SUMMARY

The purpose of this Appendix is twofold. The first is to present a synopsis of the road transport sector, its structure, constraints and capacity to respond favorably to improved road maintenance in the form of lowered rates and increased transport services. The second purpose is to evaluate the capacity and willingness of the private construction industry to assume more responsibility for road rehabilitation and maintenance.

The data for the study was obtained primarily through interviews with truck owners, ranging from formal, large trucking companies through industries with their own fleets to small merchant operations, and with large construction firms. In all, some 50 entities were interviewed, 37 of which were truck operators. The interviews were carried out in Lubumbashi, Shaba region, Bandundu Region and Kinshasa. The conclusions drawn apply mainly to the Regions from which the samples were taken, although evidence suggests that they may apply to other sections of the country as well.

THE STRUCTURE AND PROBLEMS OF THE ROAD TRANSPORT SECTOR

The road transport sector may be divided into three sections. The first is the formal trucking industry comprized of firms which have transport for hire as their primary or only activity. The second group consists of industries which have their own fleets for trasporting their products and raw materials, and finally the merchant transporters who use their own trucks for the transport of their own products. The basic structure of each are as follows.

1. The formal trucking industry

The formal trucking industry is concentrated in the Bas Zaire/Kinshasa/Kikwit axis, hauling goods between the major cities on the trunk road system. A few companies in Shaba concentrate on hauling copper for export or ore to the smelters under contract to Gecamines. Most of the companies are small with below 30 vehicles, although one has nearly 100 tractors and 168 trailers. They are quite modern by third world standards, with fleets comprized almost exclusively of articulated trucks, with complete repair facilities and computerized dispatching. Some are beginning multiple trailer operations. The only major operational shortcoming is communication with vehicles on the road, which sometimes creates major delays when trucks break down.

2. The Manufacturer Owned Fleets

In Shaba the manufacturers of cigarettes, beer and textiles had fleets varying from 5 to 30 vehicles, mainly lorries with some pickups for distribution locally and to nearby towns. Because of the poor roads, most long distance distribution was handled by rail or air.

3. The Merchant Transporters

The merchants studied in Bandundu operate in a trade cycle, buying agricultural produce in the villages and taking it via their warehouses in the larger towns such as Kikwit to the Kinshasa market. The money from the sale of the produce is used to buy merchandise which they take back to their stores in the villages, where the cycle begins all over again. The more prosperous merchants are diversifying into palm oil production and cattle raising. Merchant fleets consist of one to 30 rigid two or three axle lorries, averaging about six. The trucks are generally old, with a median age of 13 years and many are in poor condition. All the merchants, however, have their own repair facilities of varying sophistication, from mechanic/drivers to complete shops with expat mechanics.

In Lubumbashi, Shaba, the smaller merchants are engaged in the fish trade, bringing fresh and smoked fish from Lake Moero on the Tanzania border to Lubumbashi. This trade is lucrative, as suggested by the newness of their trucks which average three years of age. One merchant renews his fleet each year to minimize problems on the road. Ice is taken to the lake for bringing back the fresh fish. In the case of smoked fish, other cargos such as beer or merchandise is carried on the up trip.

4. Problems Cited by Truck Owners

The problem common to all three groups was the condition of the roads, which is reaching the critical state in many cases. Some formal truckers have discontinued service to Kikwit because of the advanced deterioration of the paved highway. The textile plant management is repairing the road to Cotolu in west Shaba in order to continue bringing in cotton for the looms. The largest fish merchant is on the point of abandoning the cooperatives he has set up among the fishermen on Lake Moero because of the condition of the Kilowa road.

The problem cited principally by the Bandundu merchants as having the next greatest impact on their operations was the availability and cost of financing for replacing their aging fleets. Although all groups complained about the cost of financing, the availability seemed to be more a function of collateral and otherwise meeting the bank conditions. Over half the formal truckers interviewed were purchasing new vehicles through SQFIDE, the government development finance agency.

Other problems, such as the availability and cost of spare parts and delays in the Kinshasa market, seemed to vary between truck owners depending upon the resourcefulness of each.

PRINCIPAL CONCLUSIONS

1) The road transport sector is quite competitive, suggesting that operating savings as a result of road improvements will be passed on to other groups in the form of lowered rates and possibly higher farmgate prices. Attempts at price and other forms of collusion in the formal trucking sector have met with failure in the past due to price cutting by some individuals. There is competition among merchants at the village level which would be increased by improved road access, by allowing additional merchants from further away to enter the market.

2) Improved roads would mean a de facto increase in trucking capacity by

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allowing more trips to be made in the same time period. For example, improving the Matadi road would mean that a trip which today takes 12 hours, would take 7, nearly doubling capacity. This increased capacity would result in lower rates, as per §1 above.

3) The contention that food rots in the villages at present because of lack of transport was denied by merchants interviewed. The merchants said that all produce for sale eventually reaches the market. Farmers usually manage production in accordance with what they know from experience that they can sell. The only exceptions to this are when everyone decides to plant a cash crop which subsequently falls in price. This does not mean, however, that lack of transport does not make an impact in villages not normally visited by the traders.

4) Overloaded vehicles is a serious problem which should be addressed in any future road maintenance strategy

5) A comparison of rates with the cost of trucking over good and bad roads suggests that the rates are high enough to comfortably cover the operating costs including amortization and interest.

6) The impact of fuel price increases on trucking rates is between 20 and 30 percent of the fuel price change. This is in spite of the fact that fuel constitutes around seven percent of the vehicle operating cost structure in Zaire.

7) The private construction industry has the necessary capacity to assume the responsibility for road maintenance and interest in the privatization program, but is unwilling to participate under long term contracts exclusively to ODR, unless there are guarantees through international organizations that ODR will settle its financial obligations to the contractors on time.

SPECIFIC POLICY RECOMMENDATIONS

In light of the interview program and observations of road transport operations, a number of suggestions are offered for improving the lot of the sector.

1) Any future new vehicle financing programs should be targeted towards special groups, such as the Bandundu merchants, and not applied generally to the sector. Smaller merchants should be provided with hands on elementary training in bookkeeping as a condition for eligibility.

2) Different policies for the control of axle weights such as weigh bridges should be investigated. The other alternative is to rehabilitate the roads to accommodate the heavier axle loadings.

3) Specific factors should be taken into consideration in any rehabilitation of the main paved trunk roads. These are:

-Widen the shoulders to enable disabled vehicles to pull off the carriageway, reducing the present hazardous situation.

-Make wreckers available for the removal of wrecked and disabled vehicles.

-Provide basic signalization on the main roads.

-provide rest stops for drivers at predetermined intervals.

4) The possibility of using animal traction as a means of getting produce from isolated villages to market centers should be studied to reduce the total dependence on motorized transport and the concurrent expenses of maintaining motorable feeder roads.

TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	METHODOLOGY	1
3.0	A SUMMARY OF THE ROAD TRANSPORT SECTOR IN ZAIRE	2
3.1	An Overview of the Sector	2
3.2	The Formal Trucking Industry	3
3.2.1	Equipment	4
3.2.2	Financing	4
3.2.3	Operations	5
3.2.4	The Informal Trucking Sector	7
3.2.5	Problems Raised by Truckers	8
3.3	Manufacturing Company Owned Fleets	9
3.4	Merchant Transporters	10
3.4.1	An Overview of the Sector	10
3.4.2	Equipment	13
3.4.3	Financing	13
3.4.4	Operations	14
3.4.5	Road Maintenance	14
3.4.6	Problems cited by Merchants	15
3.5	Policy Considerations	15
3.5.1	Road Maintenance and Rehabilitation	16
3.5.2	Financing	16
3.5.3	Animal Traction	17
3.5.4	Axle Load Control	17
4.0	ANALYSIS OF RATE/COST PERFORMANCE	18
4.1	A Summary of Actual Rate Levels	18
4.2	Vehicle Operating Cost	18
4.3	Results	19
4.4	Impact of Fuel Price Increases	29
5.0	THE PRIVATE CONSTRUCTION INDUSTRY, ROAD MAINTENANCE AND REHABILITATION	30
5.1	Interest, Capacity and Experience of the Private Sector	31
5.2	Terms and Conditions for Private Sector Participation	32
6.0	SUGGESTIONS FOR ADDITIONAL STUDIES	33
6.1	Road User Charges	33
6.2	Road Inventories	34
6.3	Traffic Counts	35

LIST OF TABLES

1.	Inputs for Articulated Truck	20
2.	Inputs for Bandundu Merchant Truck	21
3.	Inputs for Shaba Fish Merchant Truck	22
4.	Results for Articulated Truck on Rehabilitated Road	23
5.	Results for Articulated Truck on Deteriorated Road	24
6.	Results for Bandundu Merchant on Improved Road	25
7.	Results for Bandundu Merchant on Deteriorated Road	26
8.	Results for Shaba Fish Merchant on Rehabilitated Road	27
9.	Results for Shaba Fish Merchant on Deteriorated Road	28
10.	Participation of Fuel in Operating Cost Structure	30

APPENDIX ON ROAD TRANSPORT

1.0 INTRODUCTION

The purpose of this Appendix is two fold. The first is to examine the constraints on and the capacity of the road transport sector to respond favorably to improved road conditions through increasing transport services at lower prices. The second is to determine the capacity and the willingness of the construction industry to take on an increasing role in maintenance and rehabilitation activities.

The first purpose is by far the most difficult to ascertain because of the complexity of the road transport sector and the interrelationships between its various components, not to mention that it is spread over a very large country. Due to time limitations, only a small segment of the total sector could be examined. However, it is felt that that part is representative enough so that the conclusions drawn will have meaning in relation to the sector as a whole.

The discussion begins with an outline of the methodology adopted for data gathering. This is followed in Chapter 3 by a description of the different components of the road transport sector, namely the formal trucking industry, company owned fleets merchant transporters, and ends with ways to improve the road sector. The next chapter analyses relationships between the rates charged by different road transport entities and the costs of operating on deteriorated and improved roads and terminates with a discussion of the impact of fuel price increases on rates. Chapter 5 presents the results of discussions with various construction firms regarding their interest in road maintenance. Finally, Chapter 6 includes suggestions for future studies regarding road user charges, road inventories, and traffic counts.

2.0 METHODOLOGY

The approach used in conducting the study on the road transport sector consisted of two parts. The first was to review the existing documentation on the subject, particularly on the structure of the rural agricultural sector. The second was an intensive interview program to gather first hand data from truckers, merchant truck owners, industries which use trucks as well as other modes for the transportation of their products and raw materials, government officials, agricultural cooperatives and construction companies. In all, 50 entities, government and private, were interviewed, 37 of which were directly engaged in road transport. A list of entities interviewed is included at the back of the report.

The interview program was carried out during March, 1990, in Lubumbashi, Shaba Region, and throughout central Bandundu Region.

Additional interviews with trucking companies were undertaken in Kinshasa in April.

Two forms were employed during the interviews, copies of which can be found at the end of the Appendix. These were used to establish a framework for the interviews and to make sure that answers were obtained to the same questions. The first form was used in all interviews with truck owners, whether they hauled their own cargo or for third parties. The interview started with questions about equipment utilized, such as types, numbers, age and condition. The next questions concerned problems in acquiring new equipment, such as availability and financing. The following part was related to operations, such as products carried, trip origins and destinations, loads, rates, tire cost and backhaul. Competition and other costs such as taxes and insurance were addressed in the final section which terminated with questions regarding major problems and the impact of fuel price increases on rates. Although not within the scope of the survey, transporters operating on the feeder road network were asked about their experience and willingness to undertake maintenance activities under the *Attributaire* system.

The second form was used in interviews with manufactures utilizing road transport for their own products and raw materials. They were asked about the sourcing of inputs, distribution of outputs, mode used, if they contracted trucking or used their own vehicles. In the latter case, the first form was also utilized in the interview.

Discussions with the construction industry followed no fixed format.

3.0 A SUMMARY OF THE ROAD TRANSPORT SECTOR IN ZAIRE

3.1 AN OVERVIEW OF THE SECTOR

The road transport sector in Zaire consists of three categories of truck owners. The first is the formal trucking industry which is comprized of firms whose sole, or principal function is to transport goods for third parties for a fee. Most of these enterprises are located in the major urban centers and show varying degrees of sophistication. The second category is composed of producers, mainly of manufactured goods, who operate their own truck fleets for hauling raw materials to the plant and/or for the distribution of their final product to customers. The final category, and by far the greater number, is made up of merchants, many located in the small towns and villages, who own trucks for the purpose of collecting produce purchased by them in the villages and taking it to large urban centers for sale, and returning with merchandise for sale in the villages and small towns. There are also firms which combine aspects of all three types of operations, such as larger merchants which have production facilities, such as a palm oil plant, and will sell

extra space on their trucks to third parties. But the larger number of truck owners fit quite well into the three aforementioned categories.

The following sections will summarize the characteristics of each of the three categories of truck owners with respect to their equipment, financing, operations and problems encountered. The chapter will end with a discussion of possible policy considerations for the improving of the capacity of the road transport sector.

3.2 THE FORMAL TRUCKING INDUSTRY

The formal trucking industry consists of firms organized for the sole purpose of providing road transport services to third parties. Firms in this sector do not have other business interests, although some may have been established by holding companies or manufactures for the transport of certain products. Examples of the latter category are Merzario and Nicaza trucking companies in Shaba, both working primarily under contract to the GECAMINES, the national copper mining company, for the transport of copper to Dar Es Salam and ore for processing respectively, and COTRAZAL in Kinshasa for the transport of wood. The Merzario group also has an interest in the Orion-Zaire trucking company in Kinshasa. Most companies, however, are run by founder-managers and are concentrated in the Kinshasa area. The survey recorded 16 in Kinshasa and three in Lubumbashi.

Trucking firms located in the Kinshasa area haul principally between Bas-Zaire (Matadi and Boma) and Kinshasa. Some firms operate to the east as far as Kikwit, and on rare occasions, Kananga in Kasai Occidental. No firms were found to transport far from the paved road system. One only admitted to very occasional trips to Bandundu-ville. Road transport in the Kasai and northern Shaba is undertaken by local firms in those areas. It is interesting that none of the firms interviewed in Lubumbashi nor in Kinshasa truck into those areas. This is for the most part because of the poor road conditions and the availability of sufficient haulage closer to their bases of operations. In the case of Lubumbashi, the greater part of the commerce is to the south with Zambia, Zimbabwe, Tanzania and South Africa rather than with the interior of Zaire. The principal port for Lubumbashi exports and imports has traditionally been Lobito in Angola. However, since that has been closed, most imports and exports pass through southern African ports. Most foodstuffs consumed by the local population come from the south also, as evidenced by the large number of foreign trailer trucks unloading grains and other products. According to a freight forwarder interviewed, under the best circumstances it takes 40 to 50 days to move products between Lubumbashi and Matadi (Matadi-Kinshasa by road, Kinshasa-Ilebo by river, Ilebo-Lubumbashi by rail). There is no regular road transport. Driving a truck the same distance (2750km) takes 17

days over bad roads. At the time of independence, this trip was 4-5 days at most. In contrast, the trip to Durban (3465km) takes 10 to 12 days over good paved roads.

3.2.1 Equipment.

All road transport companies use exclusively trailer-tractor combinations for long distance haulage, though a few have lorries for use in the towns. Tractors are either 2 or 3 axle as are trailers, though in both cases two axle (four axle total configuration, tractor + trailer) dominate. The number of tractors per company varies from 10 to 99, and trailers from 10 to 168. Most had ten to 30 units.

The survey encountered considerable variation in brands of vehicles used, including Mac, DAF, Volvo, Kenworth, International Harvester and Mercedes. Even some of the smaller firms had as many as three truck types. Most, however, had one or at most two. The average age of vehicles was about six years, with some greater than ten years and others practically new. Over half the firms interviewed had new trucks and trailers on order.

Kilometers travelled per year per unit varied from 80000 to 93000 for Kinshasa based firms to 115000 for Shaba based trucks engaged in export haulage. The distance travelled by Kinshasa firms was slightly higher than for other African countries reviewed. The average for Nigeria, Cameroun and Ghana were 77,600, 70,000 and 74,500 respectively. However, in Nigeria some truckers average 140,000 kilometers per year. (Source: Federal Trunk Road Study, Nigeria, LBI, World Bank)

3.2.2 Financing.

Financing the purchase of new vehicles was a problem for most firms, although not an insurmountable one as most were able to obtain loans through SOFIDE, the Zaire state financing corporation. Repayment periods varied from four to six years, although one company claimed ten year periods were possible. Interest rates were claimed to be high, but variable. All contended that financing was not impossible for well established firms with sufficient equity to provide as collateral, up to 100 percent or more of the value of the financing. All firms arranged their own equipment importations, with no one purchasing new vehicles off the local market because of high markups. A popular alternative to new vehicles was the purchase of used ones, particularly from Belgian leasing firms. These vehicles were said to be at most three years old and in good condition, and included spare parts as part of the package. Some managers expressed concern regarding the future of the Zaire, as payments to SOFIDE were readjusted in accordance with the exchange rate. If there is a significant devaluation of the Zaire, some firms could find themselves in difficulties to maintain payments. In sum, it appears that financing is not a major obstacle to expansion of the formal trucking industry.

3.2.3 Operations.

Haulage is generally contracted by the load with individual clients. There is no less-than-full-load service. That is to say, a client must contract for the entire truck on the basis of a 25 tonne load. If he ships less, he still pays for 25 tons. Clients can, of course, get together to hire a truck if individually they cannot fill it, but this is difficult to arrange and is not usually the case. There are very few long term contracts, most haulage being contracted by the truckload. Rates paid vary considerably depending on the amount the client wants shipped and the type of product. For instance, rates from

Matadi to Kinshasa vary from 28000Z to 50000z per tonne. Rates in the other direction vary from 16000Z to 20000Z, on the average about half of the downtrip rate. Because most of the demand for haulage is from Matadi, truckers are willing to accept lower rates rather than have the truck return empty. Trucks have loads on the return trip, or backhaul, about half the time. Rates for haulage to the east, such as Kikwit, are based on the round trip. That is, a client pays for the trip up and the return trip as well. If he has cargo both directions, fine, but if not he pays anyway. Round trip rates range from 1200000Z to 2000000Z per 30 tonne load. The price includes the use of the trailer for two days in the market for selling the produce. If it is not sold in that time, the trailer is unloaded in the warehouse which means the merchant gets less for his produce when he does sell it.

Competition appears to be healthy in the formal trucking industry. Attempts to form a cartel and fix rates in the past have failed as temptation to undercut the crowd are often hard to resist. The truckers have formed a transporters organization, but it remains weak. Cooperation among truckers along positive lines also fails, such as forming a pool of information on cargo to be hauled. Some truckers interviewed complained about small, independent lorry operators which they claim offer prices far below those of larger trucking companies, creating "unloyal competition". As the lorries are less economical to operate than trailers, this happens largely because their owners are not aware of the true cost of making a trip, especially amortization. This phenomenon is common in most developing countries, and usually only works itself out as a function of the sophistication of the transport industry. (see next section)

Taxes and insurance expenses were major complaints of truckers. The principal annual fixed costs for a tractor/trailer unit are descriminated as follows:

Tax Routier	250,000 Z
Circulation(vignette)	38,000 Z
Insurance	800,000 z
Autorisation de transport	40,000 Z
Total	1,128,000 Z

The Tax Routier, so far as can be determined, has nothing to do with the roads. Insurance is ineffective, according to one trucker, as it takes a year or more to be awarded, plus a "payment" of 10 percent of the value in order to receive it.

Payments during the journey, such as Tax Regional on produce carried and harassment by authorities on the roads were considered by nearly all interviewees as not constituting a significant problem especially when compared with the situation in previous years. The government of Shaba has cracked down especially hard on errant officials, eliminating all complaints from transporters in that Region.

All trucking firms were self sufficient in repair facilities for their vehicles. All had shops with full time mechanics and parts warehouses with yards for parking vehicles.

Crews consist of a driver and a helper, or convoyeur. The drivers are paid a base salary and an amount per trip and trip expense money, as well as receiving meals and a place to sleep during the trip. Most of their earnings are derived from the trip payments, so that the more trips made, the higher the total earnings. Thus, while the base salary is 38,000 Z/ month, drivers making the usual ten trips per month to Matadi can earn up to 150,000 Z. The drivers are responsible for their trucks, and do not drive other tractors, even if theirs is being repaired. This insures that drivers take good care of their vehicles, as when it is not running they are not earning their trip money. Convoyeurs are paid on much the same basis as the drivers, though in lesser amounts, and are responsible for the trailers and loads. Thus, if a trailer is unhitched and left to be loaded or unloaded, the convoyeur looks after it and supervises the loading and unloading.

One operational aspect as yet underdeveloped is the use of multiple trailers. The ratio of tractors to trailers among the firms interviewed varied from 1:1 to 1:2.1. The optimal operational ratio is 1:3, permitting one to be unloaded/loaded at each end of the route with the third in transit. Only one company was found to engage in these kinds of operations, though another had plans to start. Most simply maintained the tractor hitched to the trailer during loading/unloading, resulting in suboptimal utilization of tractors. However, the practise discussed above of assigning drivers to specific vehicles could

be a drawback as it would require drivers to travel much more, increasing the risk of driver fatigue.

Another problem from the operational standpoint is communications between the dispatcher and trucks on the road. This is currently done simply by telephone or by sending word with a passing truck. Thus, if a truck breaks down it normally takes a long time to find out about it with consequent delays and potential spoilage of the cargo. There are no radio communications directly with the trucks. Mechanics are always sent out on the road to repair the truck and bring it back. Very few companies had wreckers available to retrieve incapacitated or wrecked vehicles. The result is that a wreck may remain in situ for a week or more awaiting removal.

A final but very significant problem from the road standpoint is vehicle overloading. Nearly all persons interviewed claimed that they did not overload their trucks, that it was always the "other one". One trucker, however, said he did overload, but that that was the only way he could compete. As axle weights were not controlled, some truckers began carrying loads up to 40-50 tons. By carrying larger amounts, they could offer lower rates per tonne than could truckers carrying normal loads. Thus, everyone had to charge competitive rates and thus overload in order to lower their cost per tonne. As all recognized, this lower cost was only apparent, as the extra strain on the vehicles as well as the damage to the roads meant much higher real costs in the medium term. Everyone said they would have no problems with the installation of weigh bridges, so long as they were correctly run and applied equally to everyone.

One item that exacerbates the overloading problem is the tendency of drivers to supplement their incomes by picking up passengers and extra cargo along the way. Truckers have partially eliminated this by using containers, but it still remains a serious problem.

3.2.4 The Informal Trucking Sector

The informal trucking sector consists of lorries whose owners rent them to customers for hauling goods. Truckers generally own one vehicle which they drive themselves. These gather in a certain locale, or "parking" in the cities to await customers and passengers. Each "parking" relates to a given destination, such as Kikwit, Bandundu-ville or Boma. However, the trucks will transport goods to any place in the vicinity of the principal destination. Truck rentals are 130,000 Z per day. Time lost to repairs on the road is not counted. The rates are in fact higher per tonne than for trailers. Assuming a six day round trip to Kikwit- 2 days up, 2 days back and 2 days in the market- a nine tonne load up and back will be 86,666 Z per round trip tonne for the lorry and 74,400 Z for the trailer. The advantage for the informal trucker is not in their prices, but that they will drive directly to the villages, which the formal

truckers will not do. Therefore, they attend the lower end of the market, namely the small trader who cannot fill a trailer both ways and lacks transport to and from his village.

The vehicles used are generally old Mercedes or Mann lorries which are simply repaired as needed to keep them running. One trucker said that his truck had had the engine replaced four times. The owner/drivers are usually the mechanics as well. They take two convoyeurs along on each trip to help with any problems.

Cargos for the return trip must be found at the destination. But, one driver operating to Bandundu-ville said this was not a problem as there were more cargoes available than trucks. No particular problems were cited by these truckers as seriously affecting their operations.

3.2.5 Problems Raised by Truckers.

Without exception, truckers cited the condition of the roads as being the principal problem for their operations. First, the increased trip times meant that fewer trips could be made and consequently less hauled per vehicle. For instance, a trip to Matadi that used to take seven hours now takes twelve. A round trip to Kikwit that three years ago took three days now takes five. The efficiency of the drivers is lowered also as it is much more tiring to drive slowly through holes than over a good road. Secondly, there is the increased wear and tear on the vehicles and tires due to road conditions and the greater probability of breakdowns on the road resulting in loss of perishable cargoes such as mandioc. As a result deteriorating road conditions, some truckers have stopped operating on the Kikwit road. Others have increased rates or reduced the number of trips. Were the roads put in order, all said the volume of traffic would increase as there was plenty of demand for haulage. It is on that premise that some truckers were increasing the size of their fleets.

Parts availability appears to be the next biggest problem. Parts obtained locally have very high markups making them very expensive. On the other hand, while imported parts are less expensive, they take longer to receive, although this item varied considerably between truckers. One reported a three day turn around between ordering and receiving a part, whereas others reported up to 4 months. The delivery times obviously depended upon the type of part ordered (small parts could be DHLed) and the model of truck it was for. Parts for older models were harder to obtain.

In addition to the problems of financing, wreckers and axle loadings mentioned above, truckers cited the lack of signalization on the roads, particularly warning signs and pavement markers and speed limits. One special item was the lack of areas where a driver could pull his rig off the road and rest if he felt tired. The narrow or non-existent shoulders are a

real hazard in Zaire because if a truck breaks down, which is a frequent occurrence, it remains in the middle of the road, sometimes for several days.

3.3 MANUFACTURING COMPANY OWNED FLEETS

Large business enterprises in Zaire make special arrangements for the transport of their products and raw materials. Some create, finance or contract trucking companies, as discussed above, while others purchase their own trucks. Several of the latter type of companies were interviewed in Lubumbashi. These included the local textile mill, cigarette factory and brewery.

The fleets for these entities were all light vehicles of 10 tonnes or less, and in the case of the cigarette factory, included Toyota pickups as well. Fleet sizes ranged from seven trucks for the textile mill to 30 for the cigarettes and beer. The beer company also hires trucks from firms engaged in the fish trade for haulage to Kasenga. (see below) Toyotas were the favorite brand followed by Mercedes, most of which are brought in from South Africa. The average age of the fleets was about 3 years, and all the companies said they replace some vehicles each year.

Like most other companies operating in Zaire, all three were self sufficient in repair facilities for their vehicles. Parts were obtainable from South Africa in a matter of ten days, if not available locally.

The longest haulage was cotton for the textile mill from Cotolu, about 800 kilometers from Lubumbashi. The distribution of products by road from the other two firms was limited to southern Shaba, principally Likasi and Kolwesi. Outside of this area, distribution of textiles and cigarettes was handled by air and sometimes by train, or by traders who would buy the products at the factory. Most raw materials such as chemicals, malt and tobacco were brought in by truck or train from South Africa.

The biggest problem was the bad condition of the roads. All factory managers lamented the state of the roads which prevented less expensive and more efficient truck transport to be utilized over a greater area. For the textile firm it is especially critical because the cotton for their production comes from an isolated area near the Angola border. They are currently having to do their own road repair work to maintain the road open due to neglect of the roads in that area by the authorities.

Financing of new vehicles does not appear to be a major problem for these companies, and probably only constitutes a small portion of their total financial commitments.

3.4 MERCHANT TRANSPORTERS

The main differences between merchant transporters and the foregoing groups is that the former are small and mainly engage in trade and transport their own produce. For the sake of exposition, three sub groups of merchant transporters will be described. The first consists of traders in agricultural commodities and hard goods, which in some instances have expanded into productive activities as well. This group forms the vast majority of transporters in the interior. The second are those primarily engaged in the production of palm oil and the third are a group of merchants in the fish trade in Shaba Region. All these are very important for the economy as it is they who provide the communication and the basis and stimulus for economic activities beyond the subsistence level among the local population.

3.4.1 An Overview of the Sector

The first group of merchants were studied mainly in Bandundu Region. However, in talking to individuals from other regions it is apparent that similar activities take place to a greater or lesser degree throughout the the interior of the country. The primary activity of these merchants is trade, trucking being only a means of getting their goods to market. As the formal trucking sector does not reach beyond the major centers, the merchants have to depend on themselves for needed transport facilities. All the merchants visited in Bandundu follow the same basic trade pattern. They first purchase agricultural products from the villages. This is done by buyers who go from village to village buying up agricultural produce. What is bought depends upon what the merchant feels will yield the greatest margin. Prices for produce are usually arranged through the chief or headman in each village. The produce is sacked and when a truckload is accumulated, a truck is sent out to pick it up. Some merchants complained about "pirates", or other merchants who will offer higher prices and buy the produce promised to the first merchant, for by so doing will induce the villagers to increase prices. However, others said that pirates were not a significant problem as they did not buy large quantities and were not steady customers at the villages.

The goods are then taken to the merchant's warehouse where they are stored until the price is right and then loaded for a trip to the main market in Kinshasa, either on the merchant's trucks or a trailer hired from a trucking company. Most of the haulage from central Bandundu is by road, but because of the deterioration of the highway between Kikwit and Kinshasa, some merchants are looking to river transport. However, those who said they have tried it have not been altogether satisfied, for, while cheaper, the length of time involved (two to three weeks), the uncertainty of barge schedules and lack of storage facilities means it cannot compete with the convenience of road haulage for most products. The only product consistently using barge

transport seems to be palm oil.

Upon arriving in Kinshasa, the truck goes to the central market where wholesalers purchase the produce. The length of time it takes to sell a load seems to vary between merchants, some being able to sell everything at once, and others taking as much as five days. Once the truck is empty, it picks up merchandise the merchant has purchased, such as salt, soap, pails and cloth for distribution to his stores in the villages, as well as other goods, such as fuel. As the volume of goods moving into Kinshasa is greater than the volume the other direction, there is sometimes space on the truck which is then hired out to third parties. As a rule, the trucks never return to Bandundu empty. The goods are distributed to the merchant's stores and the cycle begins all over again. Recently there has been less payment of villagers in cash and more on a pseudo barter basis. That is, the merchant will give the villager a paper entitling him to a certain value of goods in the merchant's store. In one case, strict barter was found to be the rule, the merchant trading salt or soap for certain quantities of produce.

Besides each other, the merchants face competition from cooperatives. The idea of cooperatives is that the villagers should be able to market their produce directly in Kinshasa, thus obtaining the merchant's profit margins for themselves. In the two cooperatives interviewed, however, the marketing had not been very successful, mainly because of lack of coop transport resulting in the need to hire transport through third parties. In both cases, the transport had been subsidized by missionary organizations, but was not always enough to evacuate all the produce.

The question arises to what extent there is a transport crisis in the interior and produce is left to rot because there is no way to transport it. All the merchants interviewed claimed that this was not the case, and that in the villages they serviced there was plenty of competition for whatever the villagers had for sale. The only problems arose when prices had been high for a particular commodity the year before, so villagers planted more of it, only to find that demand and prices had dropped. But, as merchants operate at the most in a 140 kilometer radius of their home base, there probably are more isolated villages where there is underutilization of production capacity. In general, with the exception of the cooperatives, most of what is produced for sale seems to find its way into the markets. Merchants did point out, however, that due to the lower buying power of the local populations, they had closed some of their stores in the villages, suggesting that less agricultural produce is being bought now than previously.

The palm oil industry is based on a number of small processing factories spread out over the central and northern areas of Bandundu region. The fruit is gathered from palms grown on traditional palm oil estates or from wild groves. Because the

trees on the estates are quite old and their production has been dropping, oil producers have depended more on wild groves as a source of palm fruit. The fruit from these is gathered by people in the villages who place it on racks by the roadside to await the truck from the palm oil plant. The processors usually collect fruit in adjacent areas of about a 40 kilometer radius from the plant. From the plant, the processed oil and palm nuts are sent to Kinshasa for sale. If the plant is near a river port, the oil is usually sent by barge; in fact, some larger oil companies have their own barges. As the processed oil does not spoil easily, there is no problem with delays in transport. The nuts, however, are sent by truck. Those producers located far from the rivers take the oil to Kinshasa in tank trucks. These trucks return carrying fuel to the plant. Because of a number of problems with the palm oil industry (competition from artesanal production, parts, cheap importation, etc.) many palm oil concerns are diversifying into other areas, such as other crops, cattle, seed production. Conversely, abandoned factories are being bought by prosperous merchants, combining palm oil production with their other activities.

In Shaba Region, a fairly lucrative transport service has been built around the transport and marketing of fish. In Lubumbashi and other Shaba towns there is high demand for fish, both smoked, dried and fresh, for which people are willing to pay high prices. The fish is brought mainly from Lake Moero (Kilowa) 343 km from Lubumbashi, or from Kasenga, 211km. away. On the up trip trucks collecting fresh fish take ice, and those going for smoked or dried usually transport some other cargo, such as beer or merchandise. At least one merchant has set up a fishing cooperative, supplying the fishermen on the lake with boats and gear in exchange for fish. This one merchant transported over 200 tonnes of fish during 1989. There is no doubt but that the Lubumbashi fish market is an important factor in the economy of eastern Shaba.

The fish brought back belong both to the merchant and third parties. The freight rates for third party fish are 100 Z per kilo for fresh and 50Z for smoked and dried fish. As between four and five tonnes are brought per trip, this means a gross earnings to the transporter of 400,000 to 500,000 Z for fresh fish. However, there is considerable risk, because if the truck breaks down, the result is disaster. Merchants figure the round trip must be made in 48 hours. Any longer time, and the ice has melted. This means that considerable amounts must be spent in maintaining and purchasing trucks. The principal fresh fish merchant replaces his fleet each year with new trucks as a guarantee against losses.

In addition to fish, these merchants haul maize flour from the border areas to Lubumbashi, according to them, from their own farms.

3.4.2 Equipment.

Unlike the formal trucking industry, the fleets of the merchants are made up primarily of rigid body trucks of eight to ten tonne capacity with two, or occasionally three axles. Some do have trailers, but these are few in number accounting for only about eight percent of the total vehicle fleet. As most of the roads are earth and in poor condition, and loads small and haul distances short, trailers would be uneconomical.

In Bandundu, the average number of trucks owned by each firm interviewed was 9. However, two large merchants had 38 and 20 trucks. The average of the others was about 5 each. One Bandundu firm had no trucks running. The most common brand of truck is Mann. The average age of the fleets was around 13 years, the oldest trucks being about 33 years and the newest two. Trucks were bought second hand, even those directly imported from Europe. The average number of kilometers travelled each year per truck was about 33,000 with a maximum of 60,000, less than half of that travelled by the formal trucking industry. Trucks were generally in poor condition, as evidenced by the numbers of disabled trucks parked beside the main roads. Typical merchant's compounds contained three or four broken vehicles awaiting new engines or other parts. Some would be obviously unrepairable.

In Shaba, the average fleet size was 6, usually Toyotas. The average age of the vehicles was three years and the oldest five. Most of the fish merchants had at least one new truck, which reflects the relative profitability of their operations. Average kilometers traveled per vehicle per year was 61,000, twice that of Bandundu merchants, but perhaps due to the relative newness of their trucks.

3.4.3 Financing.

The availability of financing for new trucks is a major concern for much of the merchant trucking sector, particularly in Bandundu. There, only one merchant had bought a financed truck, and most considered it out of reach, though few had checked recently on what current terms and conditions were. Some, particularly in Kikwit and USAID project areas expressed interest in the CIP program and said they were looking into it. However, interest was universal in purchasing new trucks to replace older ones, although only two said they wanted to purchase trucks to expand their operations. Others expressed the opinion that with the current cost of financing and the state of the roads, the better proposition was to continue to repair the old trucks until one of the two foregoing conditions improved. All felt that with new trucks and better roads their movement of goods would increase. Whereas three to four years ago they were averaging four trips to Kinshasa per month per vehicle, now they were averaging two only. In the past there apparently were more vehicles available for transport, but it is difficult to say how many more or the degree of attrition of the fleet and consequently of its capacity.

Shaba merchants financed their trucks out of their operations and did not resort to bank loans.

3.4.4 Operations.

Each merchant normally hauled his own products and only sold space to third parties when available. The exceptions were a large company in Bulungu which had contracts as a supplier to the large agro businesses in Kinshasa, and the fish merchants who would haul for third parties as well.

Like the formal trucking companies, each merchant was self sufficient in maintenance facilities for his trucks, although this obviously differed in quality. Some did their own repair work, while others depended on the drivers to fix the trucks. Others complained about the availability of qualified mechanics. The quality of service was usually a function of the mechanical ability of the merchant himself, or the size of his operation. One of the larger merchants had an expat mechanic for his fleet.

In addition, each merchant had a storehouse or two for keeping his merchandise, plus his stores in the villages which numbered anywhere from one to 65. As mentioned, some merchants had bought their own farms and were processing their own production. Some had rice and corn processors, and others were buying palmoil factories and raising cattle. To all these people trucking was merely a sideline, albeit an important one, though not always first on their list of priorities for investment.

Finally, most complained about harassment by authorities, particularly tax officials. Although officially there was no more stopping of vehicles on the roads for the payment of taxes and fees, the regional tax per sack of produce is still collected at the ferry in Bandundu-ville. Most activity has now moved to the merchant's offices where tax collectors make periodic appearances demanding payment of new taxes. The only defense is to be up to date on the new tax legislation so as to be able to defend one's interests.

3.4.5 Road Maintenance.

Although not part of the original scope of the survey, merchants in Bandundu were asked about road maintenance and their willingness to undertake road maintenance activities in their areas. All were interested. In fact, many performed maintenance on some of the roads they used. This varied from formal activities under the Cantonnier system traditionally carried out by larger firms, such as Fernandes and PLZ, to informal activities, such as one merchant who mobilized his entire village when needed and paid them himself in goods in exchange for needed repairs on the access road to his village. Some merchants said they would be willing to undertake this activity at cost, as they would benefit through better access and lower vehicle operating costs. The one condition in all cases was that they be paid on a

regular basis. This has discouraged them in the past from working with Office des Routes, and no one was willing to do it again unless certain guarantees were in place regarding Office des Routes honoring their contractual obligations.

3.4.6 Problems cited by Merchants.

Like the other groups of truck owners, the merchants complained most about the condition of the road network, especially the feeder roads. All recognized the impact of the time lost and increased wear and tear on their operations. The work done by most was just on the roads of their particular interest or as a stop gap measure to get their truck through. All the merchants stressed the need to improve the maintenance situation. Particularly vocal in this respect were the fish transporters who claimed that continued deterioration of the roads to Kasenga and especially Kilowa would have great impacts on the fishermen populations, not to mention their own businesses.

The second problem, and one cited as most important by many Bandundu merchants, was the availability of financing for the purchase of new vehicles to replace their aging fleets. This was the most pressing problem for the merchants of Idiofa, most of whom had less than a third of their vehicles in running condition. One had none at all. They claimed that the banks would provide financing to larger merchants in the bigger towns (who undoubtedly had the collateral to guarantee their debts.) This was not cited as a problem by the Shaba merchants, who do not have to depend on bank financing.

The third problem was the availability of spare parts, which take a long time to arrive and cost a lot, according to some merchants. However, this item varied in its gravity depending upon the resourcefulness of the merchant. One businessman gets his smaller parts DHL in a couple of days from the USA.

Other complaints, such as about the quality of fuel and lubricants, quality of mechanics and drivers, time lost in the Kinshasa market in selling products seem to depend largely on the situation of the individual merchant, and are not general problems.

3.5 POLICY CONSIDERATIONS

During the course of the interview program a number of possible areas came to light in which donor organizations could contribute to solving some of the aforementioned problems encountered by the road transport sector. In this section, a number of suggestions will be made on areas which it is felt would yield the greatest returns to the transport sector.

3.5.1 Road Maintenance and Rehabilitation

This item is what the present USAID and World Bank programs are all about, specifically decentralization and privatization of these functions. Thus, there is no need to discuss them in detail in this Appendix. However, there are a few items which should be taken into consideration in future programs and design specifications which are of special interest to the transport sector. These are:

a) Widen shoulders on the existing trunk roads. This item is extremely important because of the hazard created by disabled vehicles which have no way to pull off the carriageway. As trucks may remain for long periods on the roads while being repaired, because of poor communications, parts problems, etc this is extremely important, especially as rehabilitation will mean higher speeds for oncoming traffic. Truckers currently put small branches in the road to warn vehicles coming in the lane which the truck is blocking, but almost never in the lane of oncoming traffic. This situation is hazardous for overtaking vehicles in the oncoming traffic flow, especially at night. Present rehabilitation programs should thus include provision for widening shoulders to two meter widths.

b) Wreckers. Road maintenance units, or highway police should be provided with wreckers to remove disabled vehicles from the carriageway. During the visit to Bandundu the road was blocked for several days by a jackknifed rig.

c) Signalization is virtually nonexistent on the trunk roads. Not only are there no warning signs, but there is not even a white line in the middle of the road. Rehab and maintenance contracts should make a point of including this item.

d) Reststops. Places where a tired driver can pull his rig off the road for a rest or repair are nonexistent, except in some villages. These are very inexpensive to provide and pay big dividends in avoiding driver fatigue and consequent hazards.

3.5.2 Financing.

Financing of vehicle purchases was cited as an urgent need by many of the smaller merchants. Indeed, the growing age and precariousness of much of the fleet is cause for concern, as it means the de-capitalization of the part of the transport sector on which all the rest depend, namely the movement of goods to and from the rural sector. However, the extension of special financing terms to the sector as a whole would be folly, as there are groups of transporters, namely the formal trucking industry and certain small merchants, such as the fish transporters in Shaba who are managing to get by under present conditions. Among the others, the adoption of any criteria for choosing the beneficiaries is going to favor the expatriate community at the expense of the local Zairois, with few exceptions. Assuring that

the purpose of a financing program is to help the local population, then additional measures are needed to increase their eligibility for financing. It is apparent, even in casual conversation with Zairois merchants that their concept of their business is that the difference between their purchase and selling price is their profit, minus trip expenses such as fuel and driver costs. Few have a concept of amortization of their vehicles, consequently little money is saved for renewing their fleet. Records usually don't go beyond annotating the transaction. Social pressures for sharing profits with relatives, etc also limit the amount of savings accumulation. This situation has been well documented in previous studies. (Coopers & Lybrand, 1987) Thus, to be effective, financing should be coupled with training in basic business management, not just some group lectures, but hands on orientation of each merchant on how to manage his books, possibly through the Peace Corps or some similar organization.

3.5.3 Animal Traction.

One item noted, especially in talking to agricultural cooperative officials, is the psychological dependence on motorized transport as the only means of transporting produce out of village areas. One official in DPP in Idiofa said he needed 32 trucks to transport the produce from the 600 villages in his area. In east and southern Africa a frequently seen item is the ubiquitous cart, either two or four wheeled pulled by donkeys or bullocks. Villages in a particular area use these carts to haul produce to certain centers where storage facilities are available to keep the produce until it can be picked up by trucks. This provides commercial transport without the need for maintaining motorable roads. In Bandundu, there are recognized problems as the people do not have a tradition of animal husbandry. This is evidenced by villagers seen herding animals by ropes tied to the animals' legs, each rope held by an individual. However, in some areas, particularly around some missions, animal traction has apparently been used with some success, and the increase in cattle raising is a sign that there may be possibilities in this area.

3.5.4 Axle Load Control

Once the trunk roads are rehabilitated, axle load control is imperative. cursory examination of vehicles suggests that overloading is quite common, especially in merchant lorries. Overloading creates additional maintenance costs as pavement deteriorates more rapidly. One possible solution is the establishment of weigh bridges on the heavily travelled routes which would fine or prohibit overloaded trucks to continue their trips. The truckers interviewed said they had no objection to such a system, especially as it would control everybody on the same basis. All recognized the problems of overloading on reduction of truck life and roads. It would also serve to reduce unauthorized extra loading of trucks by drivers. The other

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alternative is to design and rehabilitate the roads for the heavier axle loads, charging the cost to truckers with discounts to encourage the use of vehicles with more axles.

4.0 AN ANALYSIS OF RATE/COST PERFORMANCE

The purpose of this section is to present a summary of the rates charged by the trucking industry for haulage between specific points. This will then be compared with the operating costs per kilometer for different kinds of vehicles under different road conditions. This will suggest the profitability of trucking operations in Zaire, especially in view of the necessity of replacing vehicles. In addition, the analysis will show approximate savings in vehicle operating costs due to road rehabilitation and maintenance, and how this will affect trucker's profit margins. The section will terminate with a discussion of the impact of fuel price increases on operating costs and rate levels.

For the purpose of the vehicle operating cost calculations, the World Bank Highway Design Module was utilized.

4.1 A SUMMARY OF ACTUAL RATE LEVELS

The average rate Matadi to Kinshasa is 36,000Z per tonne and return is 20,000Z per tonne. Assuming that the backhaul rate is 50%, then the expected value of backhaul is 10,000Z (.5X20,000), and of the round trip 46,000Z. Divided by the round trip distance and times 30 tons, the expected value per kilometer is 2300Z, or US\$4.18. If there is no backhaul, the gross income for the trip is US\$3.27 per kilometer.

To Kikwit, the average rate is 1,860,000Z per 30 ton load round trip. This becomes 1,755Z per kilometer for the round trip, or US\$3.18, slightly less than the Matadi run.

In the case of the fish merchants in Lubumbashi, the rate is 100Z per kilo for fresh fish from Kasenga. As the trip up carries ice, the payload is only on the return trip. This normally is four tonnes of fish, the rest of the space being taken up by what is left of the ice. This means that the transporter can make 400,000Z per round trip of 422 kilometers, 948Z or US\$1.72 per kilometer.

4.2 VEHICLE OPERATING COST

For the vehicle operating cost calculation, four situations are envisaged. The first is the cost of a trailer truck travelling on a good paved road, and the second the same truck travelling on the same road, but with the road in bad condition. The difference is in the roughness estimate utilized in the program. The good road has an International Roughness Index of 1.8 meters per kilometer, and the bad road an IRI of 10 meters per kilometer. The third case simulates a two axle lorry on a good unpaved road and the fourth the same truck on a bad unpaved road. The IRI values are the same in each simulation.

The assumptions for vehicle utilization and cost parameters are based on information from the interviews. The data was entered in the HDM model which was then used to calculate the operating costs for each vehicle simulation. The assumptions are shown in Table 1 for the articulated truck, and 2 and 3 for the Bandundu merchant lorry and the Shaba fish merchant respectively. The lorry case was divided in two because of the different operating assumptions affecting the two types of merchants. The Shaba merchant depreciates his truck in one year and travels twice the distance of the Bandundu merchant. The input data shown on the tables comprise mainly default values calculated by the HDM program for each vehicle type. Thus, of the first 16 items only the load carried and the number of tires per vehicle were added. The average annual utilization kilometer figures were taken from the interviews. An average service life of six years is the time period used for the depreciation calculation except in the case of the Shaba merchant where it is one year. Average life kilometrage is simply the average service life times the yearly kilometers. The vehicle and tire costs were obtained from dealers, and are representative of a DAF tractor and York trailer for an articulated truck with 30 tonne capacity, and a 8 tonne Toyota for the lorry. Crew costs are the salaries and trip expenses of the drivers and convoyeurs assuming the present number of monthly vehicle trips made by truckers and each type of merchant. Interest represents the current financing rate of 90 percent per year. All prices have been translated into US dollars at 550 Z to the dollar.

4.3 RESULTS

The financial results for the tractor/trailer can be seen in Tables 4 and 5 for the good and bad roads respectively, and Tables 6, 7, 8, and 9 for the Bandundu and Shaba lorries. The assumptions for the geometric road standards in each simulation are only guesses as no specific data exists on the roads in question. The results for each simulation indicate the physical quantities of fuel, parts, tires etc. consumed per 1000 vehicle kilometers, the resulting vehicle operating costs per item, and their percentage participation in the total.

For the articulated trucks, the cost on the good paved road is \$1.77 per kilometer, and \$2.42 on the same road in poor condition. This shows that even on bad roads the rates charged by the trucking industry are sufficient to cover all trip costs including depreciation and interest by a healthy margin. This is not to say that truckers are getting rich, because it does not include fixed overhead, taxes, nor breakdowns nor failure to make the minimum number of trips per month. It does suggest that given the continuation of present circumstances, truckers can make enough to replace and maintain their existing fleets.

The difference between the cost per kilometer on the good and bad roads suggests the savings to articulated trucks from

TABLE 1 INPUTS FOR ARTICULATED TRUCK

INPUT DATA			
Vehicle class : Articulated truck			
Tare weight.	kg		14730.00
Load carried.	kg		30000.00
Maximum used driving power.	MetricHP		310.00
Maximum used braking power.	MetricHP		500.00
Surface type-specific desired speed.	km/hour		84.10
Aerodynamic drag coefficient.	Dimensionless		0.63
Projected frontal area.	m ²		5.75
Calibrated engine speed.	RPM		1700.00
Energy-efficiency factor.	Dimensionless		1.00
Fuel adjustment factor.	Dimensionless		1.15
Number of tires per vehicle.	£		22.00
Wearable volume of rubber per tire.	dm ³		8.39
Retreading cost per new tire cost.	Fraction		0.15
Maximum number of recaps.	Dimensionless		3.57
Const. term of tire consumption model.	dm ³ /m		0.16
Tire wear coefficient.	10E-3 dm ³ /j-m		12.78
Average annual utilization.	km		90000.00
Average annual utilization.	Hours		2875.00
Hourly utilization ratio.	Fraction		0.85
Average service life of vehicle.	Years		6.00
Use constant service life ?	Flag: 1-Yes	0-No	0
Average life kilometrage of vehicle.	km		540000.00
New vehicle price.	\$		118742.00
Fuel cost.	\$/Liter		0.65
Lubricants cost.	\$/Liter		0.29
New Tire cost.	\$/Tire		749.00
Crew time cost.	\$/Hour		2.00
Maintenance labor cost.	\$/Hour		0.60
Annual interest rate.	%		90.00

TABLE 2 INPUTS FOR BANDUNDU MERCHANT TRUCK

INPUT DATA

Vehicle class : Medium truck		
Tare weight.	kg	5400.00
Load carried.	kg	7000.00
Maximum used driving power.	MetricHP	100.00
Maximum used braking power.	MetricHP	250.00
Surface type-specific desired speed.	km/hour	72.10
Aerodynamic drag coefficient.	Dimensionless	0.85
Projected frontal area.	m ²	5.20
Calibrated engine speed.	RPM	1800.00
Energy-efficiency factor.	Dimensionless	1.00
Fuel adjustment factor.	Dimensionless	1.15
Number of tires per vehicle.	£	6.00
Wearable volume of rubber per tire.	dm ³	7.60
Retreading cost per new tire cost.	Fraction	0.15
Maximum number of recaps.	Dimensionless	2.39
Const. term of tire consumption model.	dm ³ /m	0.16
Tire wear coefficient.	10E-3 dm ³ /j-m	12.78
Average annual utilization.	km	35000.00
Average annual utilization.	Hours	2000.00
Hourly utilization ratio.	Fraction	0.85
Average service life of vehicle.	Years	7.00
Use constant service life?	0-No	0
Average life kilometrage of vehicle.	km	350000.00
New vehicle price.	\$	66727.00
Fuel cost.	\$/Liter	0.65
Lubricants cost.	\$/Liter	0.29
New Tire cost.	\$/Tire	749.00
Crew time cost.	\$/Hour	1.14
Maintenance labor cost.	\$/Hour	0.30
Annual interest rate.	%	90.00

TABLE 3 INPUTS FOR SHABA FISH MERCHANT TRUCK

INPUT DATA			
Vehicle class : Medium truck			
Tareweight.	kg		5400.00
Load carried.	kg		7000.00
Maximum used driving power.	MetricHP		100.00
Maximum used braking power.	MetricHP		250.00
Surface type-specific desired speed.	km/hour		72.10
Aerodynamic drag coefficient.	Dimensionless		0.85
Projected frontal area.	m ²		5.20
Calibrated engine speed.	RPM		1800.00
Energy-efficiency factor.	Dimensionless		1.00
Fuel adjustment factor.	Dimensionless		1.15
Number of tires per vehicle.	£		6.00
Wearable volume of rubber per tire.	dm ³		7.60
Retreading cost per new tirecost.	Fraction		0.15
Maximum number of recaps.	Dimensionless		2.39
Const. term of tire consumption model.	dm ³ /m		0.16
Tire wear coefficient.	10E-3 dm ³ /j-m		12.78
Average annual utilization.	km		60217.00
Average annual utilization.	Hours		3360.00
Hourly utilization ratio.	Fraction		0.85
Average service life of vehicle.	Years		1.00
Use constant service life?	0-No		0
Average lifekilometrage of vehicle.	km		60217.00
New vehicle price.	\$		66727.00
Fuel cost.	\$/Liter		0.65
Lubricants cost.	\$/Liter		0.29
New Tire cost.	\$/Tire		749.00
Crew time cost.	\$/Hour		1.14
Maintenance labor cost.	\$/Hour		0.30
Annual interest rate.	%		90.00

TABLE 4 RESULTS FOR ARTICULATED TRUCK ON REHABILITATED ROAD

- ROAD CHARACTERISTICS AND VEHICLE TYPE :			
Surfae type	Rehabilitated	Paved Road	
Average roughness.	m/km IRI		1.80
Average positive gradient.	%		6.00
Average negative gradient.	%		6.00
Proportion of uphill travel.	%		10.00
Average horizontal curvature.	Deg/km		20.00
Average superelevation.	Fraction		0.00
Altitude of terrain.	m		500.00
Effectivenumber of lanes.		More than one	
Vehicle class : Articulated truck			
- PHYSICAL QUANTITIES PER 1000 VEHICLE-KM :			
Fuelconsumption.	Liters		341.64
Lubricants consumption.	Liters		5.42
Tire wear.	£ of equivalent new tires		0.86
Cargo holding.	Hours		18.41
Maintenance labor.	Hours		29.41
Maintenanceparts.	% of new vehicle price		0.25
Depreciation.	% of new vehicle price		0.14
Interest.	% of new vehicle price		0.32
- VEHICLESPEED :	km/hour		54.33
- VEHICLE OPERATING COSTS PER 1000 VEHICLE-KM :			
Fuel.	\$	222.07	12.6%
Lubricants.	\$	1.57	0.1%
Tires.	\$	644.64	36.4%
Crew time.	\$	36.81	2.1%
Maintenance labor.	\$	17.65	1.0%
Maintenance parts.	\$	302.76	17.1%
Depreciation.	\$	163.83	9.3%
Interest.	\$	379.84	21.5%
TOTAL	\$	1769.18	100.0%

TABLE 5 RESULTS FOR ARTICULATED TRUCK ON DETERIORATED ROAD

- ROAD CHARACTERISTICS AND VEHICLE TYPE :			
Surface type.	Deteriorated Paved Road		
Average roughness.	m/km IRI		10.00
Average positive gradient.	%		6.00
Average negative gradient.	%		6.00
Proportion of uphill travel.	%		10.00
Average horizontal curvature.	Deg/km		20.00
Average superelevation.	Fraction		0.00
Altitude of terrain.	m		500.00
Effective number of lanes.			More than one
Vehicle class : Articulated truck			
- PHYSICAL QUANTITIES PER 1000 VEHICLE-KM :			
Fuel consumption.	Liters		364.63
Lubricants consumption.	Liters		6.66
Tire wear.	£ of equivalent new tires		0.96
Crew time.	Hours		26.50
Maintenance labor.	Hours		44.51
Maintenance parts.	% of new vehicle price		0.57
Depreciation.	% of new vehicle price		0.17
Interest.	% of new vehicle price		0.43
- VEHICLE SPEED :	km/hour		37.73
- VEHICLE OPERATING COSTS PER 1000 VEHICLE-KM :			
Fuel.	\$	237.01	9.8%
Lubricants.	\$	1.93	0.1%
Tires.	\$	720.90	29.8%
Crew time.	\$	53.00	2.2%
Maintenance labor.	\$	26.70	1.1%
Maintenance parts.	\$	672.47	27.8%
Depreciation.	\$	199.37	8.2%
Interest.	\$	507.72	21.0%
TOTAL	\$	2419.11	100.0%

TABLE 6 RESULTS FOR BANDUNDU MERCHANT ON IMPROVED ROAD

- ROAD CHARACTERISTICS AND VEHICLE TYPE :

	Improved Unpaved Road	
Surface type.		
Average roughness.	m/km IRI	1.80
Average positive gradient.	%	5.00
Average negative gradient.	%	5.00
Proportion of uphill travel.	%	20.00
Average horizontal curvature.	Deg/km	20.00
Average superelevation.	Fraction	0.00
Altitude of terrain.	m	500.00
Effectivenumber of lanes.		One

Vehicle class : Medium truck

- PHYSICAL QUANTITIES PER 1000 VEHICLE-KM :

Fuel consumption.	Liters	208.10
Lubricants consumption.	Liters	3.34
Tire wear.	£ of equivalent new tires	0.24
Crew time.	Hours	21.73
Maintenance labor.	Hours	7.28
Maintenance parts.	% of new vehicle price	0.12
Depreciation.	% of new vehicle price	0.24
Interest.	% of new vehicle price	0.61

- VEHICLE SPEED : km/hour 46.01

- VEHICLE OPERATING COSTS PER 1000 VEHICLE-KM :

Fuel.	\$	135.27	13.6%
Lubricants.	\$	0.97	0.1%
Tires.	\$	181.25	18.3%
Crew time.	\$	24.78	2.5%
Maintenance labor.	\$	2.19	0.2%
Maintenance parts.	\$	78.10	7.9%
Depreciation.	\$	162.46	16.4%
Interest.	\$	406.03	41.0%
TOTAL	\$	991.04	100.0%

TABLE 7 RESULTS FOR BANDUNDU MERCHANT ON DETERIORATED ROAD

- ROAD CHARACTERISTICS AND VEHICLE TYPE :			
Surface type.	Deteriorated Unpaved Road		
Average roughness.	m/km IRI		10.00
Average positive gradient.	%		5.00
Average negative gradient.	%		5.00
Proportion of uphill travel.	%		20.00
Average horizontal curvature.	Deg/km		20.00
Average superelevation.	Fraction		0.00
Altitude of terrain.	m		500.00
Effectiveness of lanes.			One
Vehicle class : Medium truck			
- PHYSICAL QUANTITIES PER 1000 VEHICLE-KM :			
Fuel consumption.	Liters		224.18
Lubricants consumption.	Liters		4.58
Tire wear.	£ of equivalent new tires		0.28
Crew time.	Hours		25.11
Maintenance labor.	Hours		16.61
Maintenance parts.	% of new vehicle price		0.57
Depreciation.	% of new vehicle price		0.26
Interest.	% of new vehicle price		0.67
- VEHICLE SPEED :	km/hour		39.83
- VEHICLE OPERATING COSTS PER 1000 VEHICLE-KM :			
Fuel.	\$	145.72	10.4%
Lubricants.	\$	1.33	0.1%
Tires.	\$	210.97	15.1%
Crew time.	\$	28.62	2.0%
Maintenance labor.	\$	4.98	0.4%
Maintenance parts.	\$	382.29	27.3%
Depreciation.	\$	175.34	12.5%
Interest.	\$	449.10	32.1%
TOTAL	\$	1398.35	100.0%

TABLE 8 RESULTS FOR SHABA FISH MERCHANT ON
REHABILITATED ROAD

- ROAD CHARACTERISTICS AND VEHICLE TYPE :

	Improved Unpaved Road	
Surface type.		
Average roughness.	m/km IRI	1.80
Average positive gradient.	%	5.00
Average negative gradient.	%	5.00
Proportion of uphilltravel.	%	20.00
Average horizontal curvature.	Deg/km	20.00
Average superelevation.	Fraction	0.00
Altitude of terrain.	m	500.00
Effectivenumber of lanes.		One

Vehicle class : Medium truck

- PHYSICAL QUANTITIES PER 1000 VEHICLE-KM :

Fuel consumption.	Liters	208.10
Lubricants consumption.	Liters	3.34
Tire wear.	£ of equivalentnew tires	0.24
Crew time.	Hours	21.73
Maintenance labor.	Hours	5.19
Maintenance parts.	%of new vehicle price	0.06
Depreciation.	% of new vehicle price	1.00
Interest.	% of new vehicle price	0.36

- VEHICLE SPEED : km/hour 46.01

- VEHICLE OPERATING COSTS PER 1000 VEHICLE-KM :

Fuel.	\$	135.27	10.5%
Lubricants.	\$	0.97	0.1%
Tires.	\$	181.25	14.0%
Crew time.	\$	24.78	1.9%
Maintenancelabor.	\$	1.56	0.1%
Maintenance parts.	\$	40.65	3.1%
Depreciation.	\$	669.27	51.7%
Interest.	\$	239.88	18.5%
TOTAL	\$	1293.63	100.0%

TABLE 9 RESULTS FOR SHABA FISH MERCHANT ON
DETERIORATED ROAD

- ROAD CHARACTERISTICS AND VEHICLE TYPE :

	Deteriorated	Unpaved	
Surface type.			
Average roughness.	m/km IRI		10.00
Average positive gradient.	%		5.00
Average negative gradient.	%		5.00
Proportion of uphill travel.	%		20.00
Average horizontal curvature.	Deg/km		20.00
Average superelevation.	Fraction		0.00
Altitude of terrain.	m		500.00
Effectiveness of lanes.			One

Vehicle class : Medium truck

- PHYSICAL QUANTITIES PER 1000 VEHICLE-KM :

Fuel consumption.	Liters	224.18
Lubricants consumption.	Liters	4.58
Tire wear.	£ of equivalent new tires	0.28
Crew time.	Hours	25.11
Maintenance labor.	Hours	11.83
Maintenance parts.	% of new vehicle price	0.30
Depreciation.	% of new vehicle price	1.08
Interest.	% of new vehicle price	0.40

- VEHICLE SPEED : km/hour 39.83

- VEHICLE OPERATING COSTS PER 1000 VEHICLE-KM :

Fuel.	\$	145.72	9.2%
Lubricants.	\$	1.33	0.1%
Tires.	\$	210.97	13.4%
Crew time.	\$	28.62	1.8%
Maintenance labor.	\$	3.55	0.2%
Maintenance parts.	\$	198.98	12.6%
Depreciation.	\$	722.51	45.8%
Interest.	\$	265.52	16.8%
TOTAL	\$	1577.21	100.0%

rehabilitating and maintaining the paved roads. This amounts to \$0.65 per vehicle/kilometer, or a drop of 27 percent in outlays, mainly for repairs, and a corresponding increase in transporters margins. Due to the inability of the truckers to collude among themselves, the results of road improvements would probably be lower freight rates in real terms. Beyond that, it is difficult to say where the incidence of the benefit would be. Whether the beneficiaries would be producers in the form of increased farmgate prices or to consumers in lower retail prices depends upon the existing structure of the market place.

For the Shaba fish merchants, the costs are \$1.57 per kilometer on the bad unpaved road and \$1.29 on the improved road. Their margins are not as great as the commercial truckers, but sufficient to cover trip costs plus depreciation and interest. The same qualifications hold in this case as with the articulated trucks. In addition, the "scrap" or resale value of their trucks after a year of use is higher than those used over a longer time period. The benefit derived from repairing the road is about \$0.28 per kilometer, or an 18 percent reduction in costs. Again, where the incidence of the benefits would lie is unknown. However, since these merchants are reputed to be able to collude on price levels, they would probably be the beneficiaries.

As for the Bandundu merchants, the costs on the bad road are \$1.40 and the good road \$0.99 per kilometer. An improvement on the road would result in a saving of \$0.41 or 29 percent of present costs per kilometer travelled. Costs are generally lower because depreciation is over a longer time period than in the case of the fish merchants. As there appears to be competition among merchants for purchase of farm produce which would be increased with improved roads and greater accessibility, some part of the benefits would accrue to the farmer.

In conclusion, it appears that the road transport industry is profitable, especially for owners of articulated trucks. As the markets and transportation sector evolve, lorries will be used primarily for bringing goods from the villages to the larger centers such as Kikwit, whence they will be shipped to Kinshasa by trailer. Lorries are uneconomical for long distance hauling. Even not considering operational problems, such as the fact that the motorized part is tied to the load, lorries are nearly twice as expensive as trailers per tonne/kilometer to operate. Dividing the trailer cost by 30 tonnes, and the lorry cost by eight, the latter costs \$0.078 per tonne kilometer compared with \$0.048 for the trailer on a good paved road.

4.4 IMPACT OF FUEL PRICE INCREASES

One of the questions asked during the interviews of the transporters was the extent to which rates are raised due to an increase in the price of fuel. Special reference was made to 1989 when fuel prices doubled. Truckers were also asked what

percent of their total costs were represented by fuel expenditures. Very few had a clear notion of the impact of fuel prices on their operations. A few said that rates were changed proportionally to the fuel increase; one said no change was implemented, and another that it was a function of the market, ie what every body did, and not on a rational basis. The average of the other replies was that fuel represents between 17 and 30 percent of expenses. Therefore, they said an increase in fuel prices should mean a proportionate change in rates.

The table below shows the participation of fuel costs in total vehicle operating costs and rates.

TABLE 10 PARTICIPATION OF FUEL IN OPERATING COST STRUCTURE

Vehicle	Lorry(Fish)	Articulated
Fuel Cost/km.	\$0.145	\$0.240
%VOC/km	9.2%	9.8%
%of Rate	8.4%	7.5% (Kikwit)

The foregoing suggest that first, the participation of fuel in VOC is lower than most truckers think. (Although it could be slightly higher than the above as the HDM assumes well regulated injectors) Secondly, to recuperate fuel price increases, rates would have to be adjusted by a far smaller amount. For example, if fuel prices doubled (+100%), the rates should increase by 7.5 percent to compensate. If the increase is 25 percent, then the rates should be readjusted by 1.9 percent. In other words, the elasticity of rate increases should be .075 in this case.

However, truckers think differently. In fact, they will apply an increase to the rates equal to the fuel price change to 20 or 30 percent of their costs, barring market or government intervention. Thus, the elasticity of rate increases is in fact between .2 and .3. Our 25 percent price increase would be reflected as a 6.2 percent rate increase on the average.

5.0 THE PRIVATE CONSTRUCTION INDUSTRY, ROAD MAINTENANCE AND REHABILITATION

In addition to an analysis of the road transport sector, a separate task was to determine the capacity and willingness of the private construction industry to take over a greater share of road maintenance and rehabilitation activities in line with the decentralization and privatization of Office des Routes activities. To that end, four large, private construction companies and one engineering company were interviewed in Shaba Region and Kinshasa.

The directors of the firms were asked about their interest

in the privatization scheme, equipment available to do the job, past experience, and contractual terms and conditions they would require to participate. In this section, each of these items will be treated in turn.

5.1 INTEREST, CAPACITY AND EXPERIENCE OF THE PRIVATE SECTOR

When informed about the privatization of Office des Routes activities, all construction companies expressed interest. After all, they said, it was part of their business to perform road construction and rehabilitation work. The Shaba firms said they would prefer working in Shaba, but would accept contracts in other Regions. The Kinshasa firms said they would be willing to work anywhere. Interest to pursue work in any part of Zaire seems to be the case with most of the larger construction companies. In recent bidding on roadwork in Shaba, six construction companies participated. It is significant the neither of the two Shaba based companies was selected. This suggests the existence of both capacity and willingness on the part of the private construction industry in Zaire to undertake work in diverse areas of the country.

All the companies interviewed had extensive experience in roadwork and general construction. All had the basic equipment for road construction and repair, specifically for earthworks, structures and surface treatment paving though some lacked such items as an asphalt plant, paving machines for asphalt concrete work and rock crushers. However, all were associated with firms outside Zaire, especially in Belgium and South Africa, and said they could obtain assistance and additional equipment as necessary to do whatever job they were contracted to do.

They expressed interest in renting or leasing Office des Routes equipment, in fact one who is presently working in Shaba has made an agreement with ODR for the renting of equipment whereby they pay a fixed amount and ODR does the equipment maintenance and repair.

All contractors expressed interest in participating in maintenance as well as rehabilitation, although none had had experience in running a long term maintenance operation in Zaire, mainly because this had in the past been handled by ODR. However, they said they would set up and run local maintenance organizations, including equipment centers, and would handle subcontracting activities, if any. All emphasized that they would favor a minimum amount of mechanization in maintenance of earth roads, such as periodic grading. One even had several small graders pulled by farm tractors available for such light road repair activities. Also, several suggested the application of new techniques for earth road improvement, such as asphalt and cement stabilization for road surfaces.

5.2 TERMS AND CONDITIONS FOR PRIVATE SECTOR PARTICIPATION

Terms and conditions under which rehabilitation/maintenance contracts would be given was the item of greatest concern to the private contractors interviewed. All expressed dissatisfaction with the present system and stipulated a series of general conditions for their participation in the program. The principal points are enumerated below.

- 1) Contracts should be given out on a competitive bid basis.
- 2) Road sections under each contract should be long and contiguous thereby permitting economies of scale and lower mobilization requirements.
- 3) The contracts should be long term, at least 3-4 years and renewable. This would avoid problems of frequent demobilization-remobilization between contracts and allow contractor and maintenance staff to become well acquainted with the necessities of each road in their area. This also would mean more efficient operations and reduced annual maintenance costs.
- 4) Contracts should include rehabilitation followed by maintenance. As roads deteriorate rapidly, especially unpaved ones, delay between rehabilitation and maintenance phases could require a second rehabilitation before maintenance could be undertaken. The rehabilitation phase should be used in setting up the maintenance organization so that no time would be lost between the two. Contractors said they would not undertake maintenance responsibilities on roads that had not been rehabilitated first.
- 5) One complaint concerned the quality of engineering work and contract supervision undertaken by ODR, especially on the Regional level. The Ingenieur du Zone were ignorant of most engineering questions and were easily compromised by small unscrupulous companies which, in some cases, would take their 40 percent up front money and do no work.
- 6) Most contractors said they would accept payment in Zaires, even the foreign currency portion, as Zaires were presently convertible. However, one contractor said he would have to have a portion in hard currency to guarantee his foreign based expenses, such as parts and expatriate staff. All expressed concern about the exposures involved in accepting 100% Zaire payments for long term contracts because of uncertainty regarding future inflation and devaluation, although two of those interviewed had agreed to all Zaire payments for short term road repair work they had contracted with ODR.
- 7) Terms and conditions could follow the normal government contracting procedures viz. indexation of Zaire portion, fuel costs and foreign expenses and an initial payment of up to 40 percent, depending on startup expenses. Contractors complained

about the contracts, saying that many clauses favored the government at the expense of the contractors, such as the readjustment of overdue accounts by 6 percent. All felt that late payments should be readjusted by the above indexes, or by a market interest rate formula. Small firms, such as engineering companies, are sometimes required to pay up to 30 percent of the contract value up front as a performance bond which is paid back at the end of the contract in Zaires with no readjustment. The biggest complaint was that there was no way to make ODR responsible under the terms of the contract, as it suffered no penalty if it failed to live up to its contractual obligations. .

8) The biggest problem encountered in obtaining the support of the private sector for the privatization scheme was that none of the firms interviewed said they would work on long term projects for ODR without guarantees from third parties, in particular international organizations such as World Bank or USAID, that they would receive their payments on schedule for work performed. The experience of many contractors is that ODR simply does not pay its obligations and the contracts that it signs and guarantees it gives are worthless. This point was also mentioned frequently by merchants who had participated in the *Attributaire* system. Complaints were also heard of practises such as required payment of up to 20 percent of the contract value to an "intermediaire" in order to be selected for a project. It must be said, however, that this is not only a problem of ODR, but of the public sector in general. This has led firms in the construction industry to work mainly in the private sector and avoid government contracts.

However, some firms are beginning to work with ODR on some limited projects, such as the repair of the Kikwit road. The attitude of these is to wait and see. Some said they would study any proposals made. If they can be certain that they will be paid, then most of the other problems are resolvable.

6.0 SUGGESTIONS FOR ADDITIONAL STUDIES

6.1 ROAD USER CHARGE STUDY

A useful exercise for the future is a road user charge study. The theoretical idea behind road user charges is that, on the margin, road users should pay for the wear and tear they cause to the roads. More specifically, each vehicle, depending on the weight and number of its axles, should be charged for the cost of repairing the damage caused by its passage over the road.

In practice, what this entails is calculating the number of vehicle kilometers, or better, axle/ton/kilometers passing over the highway network each year, and, on the other side, determining the cost of repairing the corresponding damage to the network. The costs of the damage must be calculated as a function of actual maintenance and rehabilitation costs. This

cost is then divided over the vehicle fleet/kilometers to assess the amount each type of vehicle should be charged.

Once this theoretical exercise is completed, the next step is to compare the actual charges paid by road users with what they should pay to maintain the roads. Actually, road users pay numerous taxes, but only the fuel tax apparently goes to road maintenance. The analysis will indicate if that is sufficient or if additional taxes should be levied. If the latter case, then the optimal form of collecting the charges will be determined, taking into consideration the efficiency of collection and equity as well as incidence. For instance, trucks cause more damage than cars, but in most places pay proportionally less because trucks operators pass additional charges on to consumers whereas most auto owners do not. Forms of taxation will be evaluated in the Zairian social context to decide which are the easiest to collect and offer fewer possibilities for fraud. The end result will be a proposal for the most appropriate means of collecting from road users the costs of maintaining the roads on which they travel.

6.2 ROAD INVENTORIES

This section and the next were requested specifically by USAID to help in setting up future programs, and without the benefit of having assessed the status of the existing data base in Zaire. It is based on the Consultant's experience as to what the important elements are from the point of view of the needs of specific road studies which could be undertaken in the future. The elements comprising the road network data base should be general and not require extensive budgets and will not substitute for more detailed data gathering on specific road sections to be studied in the future. However, they should be sufficient to save consultant time and client money in the execution of future projects.

1. Maps. Maps should be available for the road network showing the alignments of major roads, hydrographic and topographic information, where available. Link-node maps should be prepared for the entire network with consistent codings for federal, regional and feeder roads. These link numbers should form the basic references for the road inventory items to follow, as well as traffic counts.

2. Road Types. Roads should be classified as to surfacing characteristics, such as asphalt concrete, surface dressed, gravel or earth, as well as width, number of lanes and shoulders. Soil conditions should be noted where possible.

3. Dates. The dates of construction and the last periodic maintenance applied to a road are useful for engineering and to help locate specific references on sections under study.

4. Condition. A set of condition categories for each road type should be established based on engineering criteria. As road conditions can change rapidly, these categories should be broad, but at the same time be able to draw attention to road sections which are due for periodic maintenance or rehabilitation.

5. Structures. An inventory of structures such as bridges per link should be compiled, with their physical characteristics as well as condition.

6. Cost Information. A file should be organized on costs of past projects, both force account and contracted to assist in estimating the costs of future projects.

7. Updating. Once the data base is set up, the only item requiring periodic updating is the condition survey, which ideally should be done annually following each rainy season.

8. Finally, a set of design criteria should be established for each type of road and for structures taking into account axle loadings and traffic volumes as well as climatic and other physical conditions to guide engineers and contractors.

6.3 TRAFFIC COUNTS

1. Classification Counts. Classification counts are done manually and record the numbers of each type of vehicle moving in each direction past a certain point. They are easy to do and compile, as well as organize. The first step is to locate counting stations on the higher volume road network and organize the counting teams. Counts should be done daily over a 2-3 week period once a year, and then for a week every 2 to 3 months. The dates and stations should not change so as to make the data consistent. If done regularly, an excellent traffic data base can be built up.

2. Moving Observer Counts. On lower volume roads with a few vehicles a day, it is suggested that moving observer counts be used. These are done from a car and extrapolate the daily traffic from the time over which the count was done and the vehicles observed. This can be done at the same time as the road condition survey updating, thus saving considerable expense. Villagers can also be asked how many vehicles passed their village during the day to check the MOC figures.

3. Machine Counts. If used at all, they should be done only on major high volume roads between major centers, such as Kinshasa and Matadi. Their advantage is that they collect data over 24 hour periods. Their disadvantage is that they are susceptible to pilfering and vandalism (the rubber tubes make good slingshots) and require some skill and constant attention to keep running, such as changing tapes and batteries. For this reason, they are generally not recommended, especially where labor is inexpensive.

and unskilled.

4. Origin/ Destination Surveys. In the opinion of this Consultant, origin/destination surveys would be a waste of time and money under Zaire conditions. This is because, first, the traffic volumes are generally low, meaning that surveys would have to be done over long periods to get statistically meaningful results. Secondly, similar information can be obtained more easily from the classification counts and interviews with merchants and shippers. Because O/D surveys are rather complicated in their execution and require sophisticated data processing techniques, they are not suited for regular use in many developing countries.

5. Axle Load Surveys. This kind of survey is very important for road design and planning of maintenance activities, as the axle weights determine the rate at which the deterioration of the roads will take place. This survey can be done once and then only repeated when there is reason to believe that axle loadings have changed. Scales can be portable and only require a solid concrete or asphalt surface for operation.

LIST OF ENTITIES VISITED

LOCALITY	NAME	TYPE
Lubumbashi	GMS-INTER	Transport, Merchant
	Mutila	Fish Merchant
	Mutombo	Fish Merchant
	Frigomero	Fish Merchant
	Kashiba wa Kashiba	Fish Merchant
	Nicaza	Trucking
	Katebe Kinsala	Fish Merchant
	Merzario	Trucking
	Agetraf	Freight Forwarder
	Syntextin	Textile Factory
	Tabazaire	Cigarette Factory
	Simba Beer	Brewery
	Fina Zaire	Petroleum Products
	Division Reg. de Transport	Government
M. Forrest	Construction	
Likasi	Swanspoel	Construction
Bandunduville	ANEZA	Ch. Commerce
	SOBRABAND	Brewery
	KANUS	Merchant
	Chambre Froide Moule	Cold Storage
	Service Reg. de Recouvrement	Tax Collection
Division Reg. de Transport	Government	
Lusekele	C. A. L.	Agr. Extention
Kikongo-Tango	Ferme Ngiamu	Merchant
Bulungu	Ets. Fernandes	Merchant, Transporter
Idiofa	DPP	Cooperative
	COMBILIM	Food Processing
	Ets. Bitshi	Merchant
	PADR	Merchant
	Ets. Musandji	Merchant
	Ets. Mukimi	Merchant
Kikwit	Interwood	Merchant, transporter
	Nogeira	Merchant
	Societe Bale-Card	Merchant
	JOPAL	Merchant
Lusanga	MBOLIKA	Merchant
	PLZ	Palm Oil
Masi-Manimba	Ets. SAMPEDRO	Merchant
	SGPI	Palm Oil
Kinshasa	Orion-Zaire	Trucking
	Transport Routier du Zaire	Trucking
	Transtshikem	Trucking
	Transmac	Trucking
	Trans-Zaire	Trucking
	CADIC	Engineering
	SAFRICAS	Construction
	M. K.	Trucking
M. D. ZAIRE	Construction	

EXPEDITEUR/ INDUSTRIE

RAISON SOCIALE _____ LOCALITE _____

PRODUITS _____

COMMENT ENVOYE _____

MODE DE TRANSPORT _____

PRODUCTION 1989 _____

CAPACITE INSTALLE _____

DESTINATION	MODE	COUT/TON	TEMPS DE VOYAGE	DISTANCE
-------------	------	----------	-----------------	----------

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

MATIERES PREMIERES	ORIGIN	MODE	COUT/TON	DISTANCE
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_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

CAMIONS:

CONTRAT OU PROPRES _____

CONCURRENCE _____

PROBLEMS _____

FIRME DE CAMIONAGE

RAISON SOCIALE _____ LOCALITE _____

N. DE CAMIONS _____ REMORQUES _____

MARQUES 2 ESSIEUS _____ 4+ESSIEUS _____

AGE MOYENNE _____ ANS KM/AN _____ POIDS/CHARGE _____

DISPONABILITE D' EQUIPMENT _____ FINANCEMENT _____

KM/PNEUMATIQUE _____

PROPRIETAIRE DE GARAGE _____ ENTREPOT _____

SALAIRE DE CHAUFFEUR/MOIS _____ MECANICIEN _____

PRODUIT	DESTINATION	TONS. AN	TAUX	TEMPS DE VOYAGE
---------	-------------	----------	------	-----------------

CHARGE DE RETOUR _____

CONCURRENCE _____

CONTRAT _____

COUTES POUR VOYAGE _____

AUTRES COUTS, IMPOTS _____

ASSURANCE _____

AUTRES PROBLEMS, DELAIS, ROUTE _____

EFFET DES AUGMENTATIONS DE CARBURANT _____

EXPEDITEUR/ INDUSTRIE

RAISON SOCIALE _____ LOCALITE _____

PRODUITS _____

COMMENT ENVOYE _____

MODE DE TRANSPORT _____

PRODUCTION 1989 _____

CAPACITE INSTALLE _____

DESTINATION	MODE	COUT/TON	TEMPS DE VOYAGE	DISTANCE
-------------	------	----------	-----------------	----------

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

MATIERES PREMIERES	ORIGIN	MODE	COUT/TON	DISTANCE
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_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

CAMIONS:

CONTRAT OU PROPRES _____

CONCURRENCE _____

PROBLEMS _____
