EVALUATION OF SOUTHERN AFRICAN TRANSPORT ROUTES

A Regional Distribution Cost Model

by

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DECLARATION

Apart from the quotations specifically referenced in the text, this thesis is entirely my own work, and has not been submitted for a degree at any other university.

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1.0 INTRODUCTION - THE PURPOSE OF THIS RESEARCH

The purpose of this research is to provide a methodology with which to evaluate the various transport routes in southern Africa in terms of total distribution costs to the user. Existing flows over these routes, cost and service factors are incorporated in a Regional Distribution Cost Model which is the primary tool for this evaluation.

Outputs of the model include estimates of transport costs incurred on behalf of each country for moving its foreign trade over each route, as well as a quantification of the time costs and other service costs attributed to each route so utilised. The estimates of these costs are performed for existing distribution patterns as well as for alternative routings.

While the primary model as presented in this paper represents the flows and costs for goods movements throughout the southern African region, a specialised application of the model has been made for Malawi's foreign trade and results of this special application are shown as an appendix to this report. This special application was performed on behalf of the Government of Malawi and was for the purpose of estimating the distribution cost savings which would likely result from a shift of 50 percent of that country's foreign trade over the Nacala railway line. Similar such specialised applications are possible in the future.

This methodology provides a rational basis for the evaluation of the transport dilemma in which many countries in southern Africa find themselves by incorporating the principle that economic welfare is best served by production and delivery cost minimisation. It proposes also, that the criteria for evaluation of the viability of transport routes, from the perspective of the user, is the comparison of total distribution costs for each of these routes. Total distribution costs are defined as the cost of transport, transshipment, risk of loss and damage and the time costs of goods in transit.

The tools for analysing these routes are incorporated within a series of linked spreadsheets which form the basis for a Regional Distribution Cost Model, where each cost element is identified and total costs accumulated for each route. The description of each route is in terms of time and distance, transport costs, transit times, risk of delay and product losses.

The primary tasks of this research are:

1. Describe the region's primary transport routes;
2. Compute total distribution costs for each of these routes;
3. Show total tonnage moved over each route;
4. Develop a Regional Distribution Cost Model through a series of linked spreadsheets for the purpose of systematic evaluation and analysis.

These tasks will be accomplished through the application of economic theory, coupled with a working knowledge of the transport routes and facilities, and will be used to develop a quantitative simulation of the region's goods flows and their costs.

Previous comparisons of regional routes in southern Africa, undertaken primarily by SADCC and their consultants, have focused primarily on distance (Stephens: 1985), and the transport tariff. Distance only does not imply that a particular route is more or less cost effective than another, from the perspective of economic efficiency, as the important parameters of transit times and reliability are ignored. The tariff structure of most African railways is rarely cost based and the results of any analysis based solely upon tariffs would be misleading, if the objective were to analyse total transport costs.

It has been the policy of many countries to heavily subsidise transport by establishing an ad valorem tariff structure which often does not cover costs. However, there is a definite trend towards establishing freight rates on a cost-based principle, as demonstrated by the recent move towards deregulalation of transport in South Africa. Most cross border rail traffic moving in the southern African region, moves at contract rates, established by the various railways, and these contract rates are more likely to reflect actual costs than the tariff system.

In order to reflect costs incurred by the operator as well as rates actually paid by transport users, the analysis of transport costs will be performed on two bases: operator costs and transport tariffs. In addition, high and low value commodities will be evaluated to reflect the ad valorem rail tariffs which still exist. This range of parameters will permit a comprehensive analysis of the transport situation within the region and the effects on specific types of commodities.

The premise upon which this analysis is based is that the use of all the region's transport facilities will be available to any country without restriction.

The choice of route and the condition of the infrastructure cannot be separated from the political issues which face the southern African countries. While it is not the intention to evaluate, to a great level of detail, these political issues and their implications, their relevance and selected effects on transport will be reviewed and briefly discussed.

The political issues have been identified through discussions with representatives of governments and private sector organisations within the region; the framework for analysis of economic implications are based on the application of relevant economic theory; and the quantitative simulation is accomplished through identification of current conditions faced by transport users and the likely future condition and capacity of the region's transport infrastructure.

The linked spreadsheets which comprise the Regional Distribution Cost Model are not meant to be static, produced only for this paper. The assumptions, cost coefficients and route characteristics can easily be amended or updated with the effects of the changes readily shown in the output spreadsheets. These output spreadsheets show the following results: identification of the least cost route, total distribution costs for SADCC countries and the amount of SADCC traffic using RSA routes. A flow diagram of this model as well as copies of each table are shown in this report.

At this point, an explanatory note is necessary regarding two points:

- the model itself and its level of simplicity;

- the accuracy of some of the transport cost factors.

The real value of a model, however simplistic or complex, lies in its usefulness in representing economic activities and their consequences, and not in the intricacies or complexities of its construction or incorporation of mathematical formulae, as are typically found in many data - hungry econometric models, which purport to replicate human behaviour. It is the usefulness, potential or real, against which the author wishes the model presented in this paper to be judged, and the extent to which it incorporates the relevant costs incurred by transport users in the region.

The author is aware of several such attempts at complex mathematical models of transport routes and costs; in particular, one model recently developed at the cost of several hundred thousand dollars on behalf of the foreign aid agency of a western country, has never been used. Due to its complex structure and inaccessibility, the client was not able to utilise the model to test the impact of route improvements in terms of cost, evaluate different goods flow patterns or even to properly assess the cost of moving goods over existing routes, the purpose for which the model was originally developed.

This is not to say that all complex econometric models are of no use to researchers, but it does point out a serious shortcoming in their practical use and the flaw in using these models as a bench mark against which all subsequent models are to be judged.

In contrast to these more complex mathematical representations, the model described within this paper is comparatively simple, consisting of a series of linked spread sheets, but retaining the flexibility of user - directed adjustment of routing options, with the results, in terms of transport and total distribution costs, being calculated instantly. While lacking in certain "dynamic capabilities" (i.e., the user must input the percentages for each commodity moved over the various routes) the model incorporates a simplicity of design and ease of use which, in the opinion of the author, as well as other transport experts in the region, outweigh its lack of mathematical complexity and "dynamic capabilities".

Obtaining reliable transport cost information is a frequently encountered obstacle in undertaking studies in third world countries. While government railways usually keep records of expenditure, their reliability and accuracy are often questionable, as well as the consistency of accounting and asset treatment policies.

One method used recently by an overseas consultant to address this transport data problem was to use standard costs for certain elements (i.e., replacement value and maintenance cost of rolling stock, labour rates, fuel costs and other work units required to perform certain rail operations) and apply these to all railways throughout the region. There were very strong objections to this method on the part of regional railway representatives and the issue has yet to be resolved to the satisfaction to both client and consultant.

With regard to road transport costs, individual road hauliers rarely keep detailed cost records, and what documents do exist are not generally available. In order to obtain representative data on road transport, individual hauliers must be interviewed and convinced that what information they do possess, should be made available to the researcher.

While it is recognised that this is far from a perfect procedure to undertake a rigorous academic exercise which attempts to compare costs of various modes and routes, it is often the only method possible and this method was, out of necessity, used in obtaining some of the cost information included in this paper.

What is lacking in absolute accuracy in some of the cost factors developed, is more than compensated by the flexibility of the model. Should individual cost factors be challenged, and alternative costs become available, the new costs can simply be entered in the model and results calculated immediately.

2.0 THE REGIONAL TRANSPORT DILEMMA

> "Although Mozambique's ports are closer to most of these countries than SA ports and therefore should be cheaper for clients, the country's comparative advantage from a cost point of view is being undermined by SATS contract rate policy. Maintaining dependence, particularly transport dependence, is important for several reasons.....it allows transport to be used as a weapon against the independent states of southern Africa "
>
> ("Rate Cutting and the Preservation of Dependence: South Africa's Response to Transport Initiatives in SADCC", Jeanne Stephens, December, 1985)

2.1 Political Rhetoric, Dependency and Economic Efficiency

The countries of the Southern African region find themselves in a difficult dilemma - they officially reject the political structure of South Africa yet they are heavily dependent upon the transport facilities of the Republic for moving imports and exports. In addition, South Africa is a major source of supply for many manufactured products needed to keep their precarious economies from total collapse.

The "traditional" transport routes for the region's landlocked countries (i.e., Zimbabwe, Zambia, and Malawi) are primarily through Mozambique and Angola, countries which are now ravaged by armed insurrection, making movements through these countries an uncertain proposition. The security situation within both these countries is at best, highly dangerous, and at worse, totally paralytic.

While some of the routes through Mozambique are operational (i.e., the Beira Corridor, the Goba line and the Komatipoort to Maputo route), they are frequently interrupted by activities of armed bandits and often require military escorts for convoys. Even with these precautions, attacks still take place with destruction of property and loss of life. The only international link through Angola is the Benguela Railway, which has been virtually unusable for through traffic since 1975.

Because of this uncertainty regarding the security of the "traditional" direct routes to the sea, much of the regional traffic has been diverted to the longer routes through South Africa. It is often claimed that the use of these longer routes is much more expensive than using the "traditional" routes. In addition, the South African government is often cited as playing an active role in "causing" this diversion through support of the resistance movements in neighbouring countries and by rate cutting on the part of the South African Transport Services to divert traffic away from these "traditional" routes (Stephens:1985).

This dependency on South African routes is a source of embarrassment for many countries in the region. One of the primary goals of the program of rehabilitation of transport infrastructure in the region is to reduce or eliminate this dependency through the development of transport routes through SADCC countries.

In 1980, the Southern African Development Coordination Conference (SADCC), was established and assists these Southern African countries in generating funds for the rehabilitation of these "traditional" routes, with the goal of reducing, or eliminating, the dependence on South African routes and the additional cost burden.

However, this alleged "cost burden" which is being borne by the SADCC countries, has been estimated by means of a comparison of today's routes through South Africa and the "traditional" routes which existed during the colonial period. The validity of this argument rests on the assumption that the "traditional" routes can be operated at a level of efficiency at least equal to that which existed approximately twenty years ago, during the colonial period. Based on recent experience within the region and the analyses of several rehabilitation projects, this has not been the case (Kennedy:1988).

The transport infrastructure of many SADCC countries has deteriorated dramatically during these recent periods of chronic internal instability. While the infrastructure can be rehabilitated through aid projects, the capability must exist to maintain these facilities if the route is to become viable in the long term. In addition, these routes must be perceived as viable before a regular shipping service will be provided to and from the ports, and the routes must be secure before sufficient cargo can be attracted to the routes on a regular basis. It is a circular process - there needs to be sufficient cargo for regular shipping services to be offered, yet without a regular and reliable shipping service, it is difficult to attract significant amounts of cargo. Simply rebuilding infrastructure is not enough.

While the infrastructure on these routes is being improved, although at a slower pace than hoped, the real problem is that sufficient cargo is not being attracted and that many of the route improvements cannot be maintained. There are several reasons for this, and within this paper the criteria for the choice of transport route will be identified and quantified in a model which replicates this route choice decision. The proposition is that only as these "traditional" routes are improved and they become more cost and service competitive with the South African routes, on a total distribution costs basis can there be a significant lowering of the transport cost burden within the region. As routes are improved and the factors which drive the modal choice become modified, the Regional Distribution Cost Model can be used to estimate the magnitude of the expected traffic shifts and the financial implications.

Within this paper a quantification of the criteria for modal choice selection will be developed. Through the application of these criteria, a rational and objective comparative analysis can be made of the relative costs of the various transport routes in Southern Africa. This approach addresses directly the issue of economic efficiency and the minimisation of total distribution costs.

2.2 The Development of a Simplified Quantitative Analysis

Despite its importance to the countries involved, the transport flows have never been successfully quantified and presented in a comprehensive manner on a route basis to allow a systematic analyses of routes and total costs. Such and attempt was made by an overseas - based consultant several years ago with the development of a mathematical model of the primary transport routes but this previous effort was not found to be useful in regional analyses.

This previous model was a complex mathematical representation of the region's transport routes and costs, developed at considerable cost on behalf of an international aid organisation. The user found that modification of this model was extremely difficult and it was not possible to evaluate alternative routing strategies, which was its primary function.

Even today, some four years after its initial development, the client is still dissatisfied with the model and it remains unused.

Despite its high development cost, this previous model did not incorporate the value of time and comparative reliability of routes and transport costs were expressed only in terms of transport tariffs.

Because of the failure of this and other models which proved to be far too complex for easy manipulation or scenario analysis, it was decided by the author to develop a more simplified representation of the regional transport situation.

This simplified model consists of a series of linked spread sheets containing basic data concerning each route, such as distance, costs and transit times, and for each country, a table showing tonnages of imports and exports. The user must only specify the percentage of each country's foreign trade using each available transport route. Once this routing information is entered, the model computes total transport costs as well as total distribution costs, by route and country. In addition, one table shows the percentage of total regional trade using transport routes through South Africa. Comparative annual costs can be calculated by simply entering different routing percentages for the imports and exports of each country.

This model is in the form of a spreadsheet, in Super Calc 4 format, and can be operated on any IBM -compatible personal or portable computer.

While there have been attempts to develop similar models for the region, most of them fail to take into consideration the value of time and service reliability in an adequate manner. Also, many of these previous models lack the simplicity of structure and ease of manipulation that would enable the analyst to readily evaluate the impact of route changes and improvements. This capability of easy adjustment and sensitivity testing is an important feature of the model.

Transport costs are calculated on two bases within the model: the first reflecting the cost functions of each transport operator and the second based on transport tariffs.

An important element of this model is the incorporation of service quality costs. These costs reflect the value of transit time, delays at the various ports, and probability of loss and damage to the commodity enroute. Based on conversations with many transport users and freight forwarders in the region, these service quality elements are often the determining factors in route selection and modal choice.

2.3 Hypothesis

The comparison of transport routes in the Southern African region has often been made only on the basis of distance (Stephens: 1985). The results of these comparisons imply that the traffic moving over the longer South African routes is using an economically inefficient route, thereby causing a waste of resources. This analysis fails to incorporate the impact of the value of time, service quality and total distribution costs.

Political considerations aside, these total distribution costs are the criteria with which users evaluate the viability of transport routes. This minimisation of production and delivery costs also is an indication of economic welfare (Hazelwood:1964). Therefore, by minimising total distribution costs, both economic welfare and the viability of transport routes can be evaluated.

Within this paper an evaluation of the major transport routes in the southern African region will be undertaken in terms of total distribution costs and the methodology presented which will enable the impact of future improvements to these routes to be quantified.

It is hypothesised that the elimination of artificial restrictions on freight routings within the region would result in a net decrease in the total transport cost burden, and a corresponding increase in economic efficiency for the region. It will also provide analysts with tools and criteria with which to quantify the benefits of improvement projects and to assess the financial impact of transport on each country in the region and how this might change over time.

3.0 ROLE OF ECONOMIC THEORY

> "Before consideration is given to the costs incurred by railways and road hauliers in providing transport, it is necessary to point out that these costs do not constitute the whole cost of transport. In addition to the costs incurred by the transporter there are costs which fall on the user. The lowest cost form of transport is that for which the sum of user's and transporter's costs is the lowest."
>
> (Hazlewood, A (1964). "Rail and Road in East Africa", Oxford: Basil Blackwell.)

Transportation has been described as "providing the interregional linkages on which the flows of export goods will be channelled....the demand for transport facilities is obviously a derived demand, and it is the nature of the basic sector which determines the geographical direction of the transportation links and also the appropriate selection and coordination of technologically different modes. Commodities or services have specific shipping characteristics, such as weight, volume, divisibility, and perishability, to which one mode or a specific combination of modes will be best adapted" (Kraft: 1971).

These same author goes on to say: "All this, however, is not very relevant until transportation is analyzed in terms of costs, which cannot be done in the framework of the base doctrine. The base theory is limited, in general, by its descriptive rather than analytical nature."

In the course of analysis of economic activities within a region, economists have developed a body of knowledge and analytical techniques known as trade theory and location theory. After being developed as separate disciplines, these two now are frequently incorporated in a combined analysis, after the concept of transportation is included. Once transportation costs are incorporated into trade theory, the relationship between transportation and growth can be analyzed, and most theorems of location theory can be derived.

The determining factor in a region's volume and direction of trade is its efficiency in manufacturing and distributing its goods at advantageous levels over other regions; i.e., the production advantage and the transportation advantage.

Changes in transportation costs can have significant effects on the interregional distribution of activities. These effects must not be overemphasised, however, as there must be an inherently efficient production capability within a region in order for good transport routes to be supportive. A high cost producer cannot be protected by the existence of an efficient transport route if a lower cost producer is within the same marketplace.

Shippers, because of the varying nature of the commodities to be transported, rank the various transport properties differently. These transport properties include speed, regularity of service, waiting time and probability of loss and damage (Glasson: 1978). These properties are particularly relevant to the transport system which presently exists in southern Africa, particularly with regard to regularity of service and probability of loss and damage. Transporting any food products (i.e., sugar) through Mozambique typically results in very high product losses, some reported to be as high as 10 -12 percent and more. Moving valuable imports through the port of Dar es Salaam is also done with a considerable amount of risk - many importers avoid this route because of very high incidence of product theft as well as the disorganisation at that port which also results in erratic service levels. The quantification of as many of these transport properties as possible leads to the development of the concept of total distribution costs, which is the essence of the analysis presented in this paper.

In addition to the properties of the transport system, specific characteristics of the commodity are also important in the determination of total transport costs.

"Transportation costs... are influenced, to a great extent, by the "transportability" characteristics of the product. While distances do not change, products and production technologies do change in a progressive economy" (Kraft: 1971).

The notion of transportation advantage has been addressed by several mathematically oriented economists in attempts to make it operational. What resulted was the development of a spatial general equilibrium theory with a tool of analysis called the interregional programming technique. While this technique is theoretically attractive to many economists, there are several important limitations to its potential applicability and should be carefully considered. "Although the principles of linear programming are simple, the mathematical structure is complex and the data requirements can be large" (Kraft: 1971).

The basic premise of these linear programming models consists of a region manufacturing the goods and services which are profitable to produce and deliver to the marketplace. The capacity of a region sets certain constraints upon any solution to this problem. The transportation cost relationships express these networks as they exist and allow consideration of factors such as transport costs and rate structure differentials. These models typically determine which interregional flow of commodities gives a maximum (or, possibly a minimum) value to an objective function, while still satisfying certain production capacity constraints. More specifically, these models minimize cost within the capacity of the production units and transport links. Kraft makes the following comment regarding the use of these models: "It is possible to determine how a region will be affected...by changes in transportation costs, and what kind of industries it will lose to or attract from other regions, as a result of extension of the network".

Some models are designed specifically to trace how an improvement in a transportation system reduces the cost of production. Regional growth has been assumed to be linked to transportation, directly or indirectly, and to the intra regional integration of production and consumption activities. The model presented in this paper addresses this issue, though because of its relative simplicity, avoids many of the pitfalls associated with more complex mathematical representations.

Kraft, as well as Glasson, however, place the important restriction on the use of this technique: "While the linear programming approach appears to be a powerful analytical tool in investigating the impact of transportation programs, its use is subject to practical limitations. To begin, the underlying assumptions are obviously quite restrictive. The models developed have rarely been tested on real or even contrived data. Furthermore, the models are static and must be revised to incorporate the effects of changes in production or transportation technology. Finally, they do not achieve a complete general interregional equilibrium where regional supplies and demands are interdependent with the transportation system....The general interregional models are conceptually superior to partial equilibrium analysis of the traditional location theory, and add to our understanding of the exchange mechanism in spatially extended economies. The role of transportation to the economy as a whole, and to a particular region can be determined with the use of the models. However, they have practical drawbacks in that the solution cannot be determined unless the model is implemented with empirical data. The model is so complex that its empirical implementation is time-consuming and very costly. Furthermore, these models are not entirely satisfactory because of their rigid assumptions on the forms of production functions, production technology, and final demands" (Kraft: 1971).

A brief review of some of the important elements of location theory will give some insight into the role of transport in the decision process of industrial siting.

Traditional location theory, as set out in Alfred Weber's "Theory of the Location of Industries", argues that the optimal location of industry is determined by the site which minimises transport costs. This site of minimum transport cost will be found at either the source of materials or at the place of consumption, depending to a certain extent upon the nature of the commodity, its weight and the freight rate structure according to value which is charged by the provider of transport.

In describing the impact of these commodity characteristics, Weber devised a material index in order to indicate whether the optimum location was closer to the source of materials or to the market. This index is shown by the following:

$$\frac{\text{Weight of Local Material Inputs}}{\text{Weight of Final Products}}$$

If the index was greater than one, the firm was material oriented; if the index was less than one, it was market oriented (Glasson: 1978).

Labour costs, determined to be Weber's second location factor, were said to attract a firm to a location if the savings in labour costs per unit of output were greater than the additional transport costs incurred.

Agglomeration benefits were Weber's third location factor. The agglomeration factors include the development of a pool of skilled labour and the establishment of special services which are frequently present where many industries are concentrated at a single location.

Weber's model assumed that transport costs were directly proportional to distance and weight. A simplifying assumption which was later improved upon by Hoover, where he divided costs into transport (procurement and distribution) and production, each analysed in a more detailed and realistic manner. In addition, transport costs were varied according to the length and direction of haul as well as the nature of the commodities being transported. Both Hoover and Weber's theories were firmly entrenched within the least cost approach.

One of the weaknesses of this least cost approach is the overemphasis of cost minimisation, with no regard for the output or demand side; simply assuming that a firm can sell all it produces, regardless of location. In some cases, the access to the appropriate market in order to serve the greatest demand may be a major determinant of industrial location, perhaps even overriding the least - cost location.

Other factors, of course, influence the actual location of industries, such as the cost and relative skills of labour at several locations and other non - quantifiable risk factors associated with transporting of a particular type of commodity.

In Richardson's Regional Economics, the concept of distance and the frictions of space are described: "The frictions of space are increased by uncertainty, since uncertainty costs (price variability, the need to hold higher inventories with increasing distance from supply sources) rise with distance from the market. The results vary according to type of country. In developed, industrial countries uncertainty favours concentration in a few large cities or advanced regions. In low income, rural countries, on the other hand, the same principle - minimizing distance to markets - leads to more dispersed location patterns and the decentralization of urban activities."

The elements of safety of transport and security are also addressed by Richardson and indicate that the location of industries at the place of minimum transport costs cannot always be the result of a simple cost comparison: "Strict profit maximisation becomes tempered with a desire to secure profits. Locational choices are less risky and more defensive, hence more agglomeration in big cities or close to markets" (Richardson: 1979)

Hotelling introduced a model which illustrates the aspects of the problems of interdependence and agglomeration. His theory shows how two firms "leapfrog" over each other while trying to relocate closer to the market, while gaining the benefits of agglomeration. When the point of equilibrium is reached, both firms are located adjacent of each other at the centre of the market, and neither firm can increase profits by relocating. This shows how pursuit of the profit maximisation principle leads to agglomeration, though by incurring socially wasteful transport costs. A minimum transport cost location (one which is a "social optimum") would require that firms locate in a more dispersed manner. (Richardson: 1979).

These concepts of transport cost minimisation and the importance of security are of direct relevance to the transport situation in southern Africa and the premise upon which the distribution cost model presented in this paper, is based.

The principle of "satisficing" places the emphasis on security rather than profit in the choice of industrial location. It implies that the choice of location will not necessarily be the optimum, but it will likely be the first "reasonable" site considered. Important elements of the satisficing principle include the viability of a location with only a minimum profit constraint and economising on time and collection of information in the selection of location for industry. This principle implies that management will spend only a limited amount of time and resources in the analysis of possible sites. Once a site which meets minimum criteria is found, it is often chosen, without an inordinate amount of further investigation and analysis.

In essence, these principles imply that while the management of firms would prefer to locate where total costs are minimised, the amount of time and money spent on the search for such an "ideal" location is limited. Once a "reasonable" location is found, it will be usually be selected.

While these theoretical principles just described refer to the location of industry considering the total costs of transport, and the several methods employed in evaluating these factors, the basic premise upon which this thesis is based reflects the reverse situation - the choice of transport routes by producers (and consumers) is hypothesised to be based on the minimisation of transport as well as other distribution costs. Locations of production and consumption are fixed while the selection of available transport routes is the variable to be analysed.

The literature describes several types of mathematical representations sometimes used to evaluate these interactions between transport and production / consumption. In several of these references, the practical use of these types of models is brought into question because of severity of assumptions inherent in the models as well as the requirement for an extensive amount of basic data for their calibration and successful application.

Largely because of these reservations expressed in the literature, a more simplified model was developed for the purpose of representing these relationships between transport and economic activity. This simplified model is in the form of a series of linked spread sheets with the regional routes defined in terms of transport cost as incurred by the operator, as well as the transport tariff which is actually paid by the user. Other features of each route are also incorporated, such as transit time, probability of loss and damage and the number of days spent waiting at ports. The production and consumption values for each country are incorporated in the model, as the user need only input the routing percentages of each commodity imported or exported for the model to compute the total distribution costs for each route, as well as for each country.

In addition to location and trade theory, benefit - cost analysis is deeply involved in the study of industrial activities and the relative efficiency of transport systems. The suggestion is that competitive behaviour of optimizing individuals generally leads to an efficient allocation of resources (Kraft: 1971). While there are typically many imperfections in the market that tend to distort the "optimal" situation, transport has been found to deviate little in competitive characteristics from other sectors of the economy and cost - benefit analysis has been found to be extremely useful in the evaluation of transport investment decisions (Meyer: 1959).

Applying this cost - benefit principle, it has been suggested that the efficiency of a regional transport system could be tested in the following manner: the return on investment in any transportation facility within the region should be above or equal to the opportunity cost of the investment. If the rate of return is below the opportunity cost, the regional transportation system is overinvested; if it is abnormally high, investment should continue until the rate of return decreases to the opportunity cost. This is meant to give a guide to the formulation of regional transportation investment policies (McKean: 1958).

Recent applications of cost - benefit analysis to specific projects require the identification of all the effects of the project on the individual welfare of all members of the community. These costs and benefits need to be expressed in a common unit so that the aggregate of costs can be compared with the aggregate benefits (Sugden: 1985).

The manner in which people's welfare is identified, measured and compared is somewhat more complicated. One system of addressing the question of welfare changes is the "potential Pareto improvement criterion".

A Pareto improvement is a change that makes at least one member of the community better off as a result of the project, and none worse off. In theory, the potential Pareto improvement criterion means that changes in people's welfare should be measured by their the price they are willing to pay for the benefits of a particular project and the amounts they would accept as compensation for the harm they perceive as being imposed on them by the project's negative impacts. The project is deemed to be worthwhile if the sum of these social benefits are greater than the social costs, i.e., if the net social benefit is positive (Sugden: 1985).

The application of the theory of cost - benefit to actual problems can be a difficult exercise as the definition and quantification of the extent to which various members of society are affected, in both a positive and negative manner, can be an extensive and exhaustive undertaking. It is essentially a process of defining "cause and effect" of a particular project and quantifying these effects (benefits), brought about by the project, and comparing them with the costs.

The model and analytical techniques presented in this thesis can be of great assistance to economists undertaking such cost - benefit evaluations of transport related projects in southern Africa. For example, the savings in transport costs for transport systems improvement projects can be readily evaluated as well as the identification of the impact of total transport costs for the region or for a particular country.

It is clear from the literature review and the examination of the underlying economic theory, that there is a void in the body of knowledge and experience of applied economics. Within this void there should be a relatively simplified manner with which to represent the physical and service characteristics of regional transport systems, the cost and tariff structures of transporting imports and exports over these routes and the capability to readily estimate the financial impacts of utilising alternative routes. The Regional Distribution Cost Model described in this paper represents such an original approach to this problem and fills this void in the literature of applied economics.

Economic theory substantiates that transport has a significant influence on the location (and viability) of industries within a region. This same theory describes several possible methods with which to quantify and evaluate such influence and presents some severe criticisms and disadvantages of these methods when applied to "real life" circumstances (lack of data, imperfect information, restrictive assumptions, inflexibility, etc.).

For these reasons, a simplified approach to the analysis of regional transport costs and freight flows was developed in this paper. As economic theory stipulated that the "optimum" solution is frequently not the objective of many industrial location decisions but that a "satisficing" solution is sufficient. Therefore, an "optimising" model is not necessary for a realistic representation of transport and its influence on the total costs of production and distribution.

The Regional Distribution Cost Model as presented in this paper and its use is central to the evaluation of regional transport routes as they now exist as well as for estimating the monetary impacts of utilising alternative routes or the changing of the cost or service characteristics of these routes.

Economic theory is only beneficial to the betterment of society if it can produce theories, models and methods of analysis which better equip the researcher to describe and identify impacts of possible solutions to real issues which exist and thus far escape satisfactory resolution. Through the addition of the model and the techniques presented in this paper to the body of economic knowledge, the discipline is strengthened and better equipped to assist in the evaluation and eventual resolution of these regional transport issues and, thus far, insoluble problems.

3.1 Transport and Distribution Costs

The demand for transport has been defined as a derived demand for the commodity being transported. "Freight transport is a service, not a commodity. It has no value except as it is used to enable the production and distribution of goods desired for ultimate consumption or capital investment. Freight transport is an input in the processes of production and distribution. The demand for the transport of a commodity may, thus, be said to be derived from the demand for that commodity in its final market." (Fair & Williams 1975:285) The mechanism for moving commodities to the final market is the distribution system, of which transport is an important component.

While the cost of transport may constitute a significant proportion of the value of some commodities, the cost of total distribution for many commodities is often a critical element in not only the choice of transport route but, in some cases, for the viability of that commodity in world markets. From the perspective of the transport user, total distribution costs are usually the most important criteria for route selection. In section 7, Tables 9 and 10 show the importance of distribution costs, expressed as a percentage of commodity value.

Within the southern African region, there are other issues which may preclude the selection of the lowest cost transport route. For example, routings via South Africa may be the least costly in terms of time and other user costs. However, there is intense pressure on transport users within SADCC countries to avoid South African routes and transport facilities. The additional cost of using these more expensive transport routes can be estimated using the model.

Total distribution costs as defined in this paper incorporate transport costs, loading costs, time costs enroute, delays at ports and the likelihood of commodity loss and damage.

3.1.1 Economic and Financial Costs

Transport studies undertaken for the purpose of policy issue analysis typically incorporate economic resource costs for each mode. Economic resource costs would exclude taxes and other transfer payments within the economy and would reflect the true scarcity value of the nation's resources. This study, however, is a simulation of modal choice and the calculation of total distribution costs, as perceived by the user. Based on discussions with transport users, operators and freight forwarders it was determined that the total financial costs to the user are the most important criteria for route choice. Financial costs are therefore the most appropriate costs for this analysis. The model developed is designed to simulate the route selection process and the assumption is made that the route with the lowest total distribution costs will be the most attractive route. At a later stage, however, this model could be adapted to analyse routes based on economic resource costs.

Estimates of the financial costs for each transport link in the various routes were developed using accounting data from annual reports and other financial statements for each railway and from cost estimates provided by various private road haulage firms. These costs were then expressed in terms of unit costs per ton kilometre and applied to the relevant sections of the route. The calculation of these costs are incorporated in section 7 of this report.

3.1.2 Value of Time

The primary element in the distinction between transport costs and total distribution costs is time. The time incurred for transport means that interest is being paid on capital used to purchase the goods. This cost is incurred by the owner of the goods until they are sold. In addition, the absence of certainty in transit times often requires that higher levels of inventory be carried, resulting in further interest costs as well as the cost to provide and maintain the storage capacity. The effect of transit times and reliability on inventory levels was investigated in a previous study of South African road and rail transport. (see Kennedy: 1984). Results of this study showed that an additional two weeks' inventory is carried when using rail transport when compared with road. It was felt, however, that even by applying the carrying cost of this additional inventory, this would result in an understatement of the true costs to the user of unreliable transport.

It is difficult to accurately measure the real impact of unreliable transport. "Fluctuations in supply and demand necessitate that a trade-off be made between the cost consequences of being without an item ("stock-out"), the cost of stockholding, and the time and cost to have goods delivered. The value of time for goods which are in transit to meet an anticipated demand or replenish stocks is the interest cost, whereas for goods being moved deal with a stock-out, the value of time can be very high...the average value of time is far higher than the interest costs alone". (Cundill, 1983:12)

The research performed by Cundill (1983) showed that the interest cost of the transit time differential was only one twentieth of the revealed preference for the more reliable transport mode. Likewise, Hodgkin and Starkie (1979), in their study of freight carried between Perth and North West Australia, concluded that the most likely value of time was 40 times larger than the interest charge.

To estimate the total cost of carrying additional inventory for each industry in the region would involve a significantly more complex analysis, the results of which would likely be unreliable and probably not directly applicable. To a certain, extent, this additional inventory holding cost is partially included in the model by adding the delay days at the port to the transit days, and multiplying by the interest cost per day.

The model presented in this paper incorporates the more conservative assumption of valuing transit time at the interest cost of carrying goods during the time in transit. Even by accepting this conservative assumption, the cost differences between routes are quite dramatic, as shown in the tables in sections 7 and 8.

3.2 Pricing Strategies

As most railway systems in the southern African region are government owned organisations, "the primary objective of public enterprise pricing should be economic efficiency rather than to generate sufficient revenue to defray total expenses. (Wallis,1983:2) Wallis continues by stating that a public enterprise's pricing policy should be based on marginal cost. There are, however, other factors which preclude the strict adherence to this objective.

While most transport firms are profit-seeking with a rate structure designed to maximise their net returns or to minimise their losses (Nelson: 1983), government-owned railways often have external constraints placed upon them which precludes a cost or even market based pricing system. Hence, the proliferation of ad valorem tariffs.

Regional development and the support of certain economic sectors have often resulted in a differential tariff structure. "There can be no doubt of the importance attached by many people in East Africa to the maintenance of the railways' differential tariff...it was essential for the economic well-being of the East African territories that the railways' differential freight tariff be maintained" (Hazlewood, 1964: 130).

The differential tariff system often is based on the value of the commodity and its ability to support a high rate. This typically results in agricultural products moving under relatively low rates compared with manufactured goods or most imports. In addition, certain regions of the country may be favoured with lower rates or a system of freight rate rebates can be offered by the government. This is exemplified by the system of transport rebates to and from decentralised areas and other specified zones in South Africa.

Economic theory promotes the notion of pricing on the basis of marginal costs. "Marginal costs are the costs of producing one more unit of output, or the cost saved by decreasing output by one unit." (Nelson, 1983:135). As railways typically have a high ratio of fixed costs, the existence of excess capacity means that average total unit costs fall with increasing output. Marginal costs may well be far below average total costs.

In reality, much of the freight traffic moving in southern Africa is on the basis of negotiated contract rates. The level of these negotiated rates depends on the relative bargaining power of the shipper and the transport organisation. The range of these rates is usually between the marginal costs of the transport company and the rates charged by the competition.

While railway prices may be quite different from railway costs, trucking rates tend to be more closely aligned with costs. "Their competitive rates will be close to their marginal costs and also to their average total unit costs, as such firms have costs that are almost wholly variable with traffic and they can often operate near the optimal output rates. (Nelson, 1983: 142)

3.3 Models of Transport Systems

Analytical models have frequently been applied to the problem of predicting equilibrium transport flows. These models include econometric models, spatial price equilibrium models and freight network equilibrium models. (Harker,1987:9)

The transport systems of southern Africa do not comprise such a complex network and the level of mathematical expression as incorporated within these analytical models was not necessary to analyse the regional transport choices. There are often non-quantifiable factors (i.e., political pressures) which dictate route choice (or at least limit route choice) which cannot be optimised in a mathematical expression. The tables shown further in this paper demonstrate the financial effects of these political pressures.

The model presented in this paper is a spreadsheet analysis with each route defined in terms of time, cost and reliability. With the series of spreadsheets, the total imports and exports of each country are defined, tonnages of imports and exports are assigned to routes, total costs of each route are computed and the total transport and distribution costs for each country are calculated. Any combination of routes can be incorporated and the cost consequences of each are readily computed. The essence of the analytical procedure is the analysis of various iterations of the model by changing assumptions regarding costs, rates or route characteristics.

3.4 Review of Other Regional Studies

While there have been several regional studies which include the analysis of regional transport routes, most of these studies have been conducted by overseas consultants on behalf of foreign governments or international lending institutions. Regional studies performed from South Africa tend to be somewhat limited with regard to detailed information being made available in SADCC countries to South Africans, largely because of political barriers.

The most comprehensive work undertaken from South Africa is Maasdorp's "Transport Policies and Economic Development in Southern Africa", published by the University of Natal in 1984.

Maasdorp's study covered primarily the organisation of transport within each country in the southern African region with regard to government controls, tariff policy, freedom of modal choice and levels of user charges and subsidies. The report demonstrates that a preferred policy of maximising economic efficiency of transport in the region would require elimination of cross subsidisation, full user cost pricing of services and allowing the price mechanism to allocate resources. The restrictive permit system, which existed in South Africa at that time, as well as within other countries, was also cited as a significant impediment to free movement of goods across regional borders and an inhibitor to an economic allocation of resources. The study concluded with a recommendation that "countries in the region should direct their efforts towards influencing the adoption of economically - efficient transport policies and promoting the smoothest possible flow of traffic across borders" (Maasdorp, 1984: 259).

While it was not the primary purpose of Maasdorp's study to undertake a comprehensive analysis of regional transport goods flows, some statistics were given but very little information regarding costs of road and rail transport and movements over major routes used by each country.

In September, 1988, the Southern Africa Transport and Communications Commission (SATCC) published "A Scenario Model for Goods Transport in the SADCC Region". This document was prepared by SATCC, and their consultants, in order to estimate existing and projected future goods flows over major routes for each country, for three selected time periods - 1990, 1995 and 2000. Capacities of ports, railway lines and road routes were considered in making these allocations. In addition, interviews were undertaken in each country with importers, exporters, government officials and transport operators. The SATCC study faced severe of data collection problems regarding tonnages of goods moving by road. "Regarding road traffic, only Malawi collects continuous data on tonnages by commodity, while most other regional export/import flows had to be estimated from available customs data and vehicle counts. As customs data are frequently only given in value terms, tonnages were estimated by making assumptions about the weight/value ratio for different goods, which adds to the uncertainty of estimated flows" (SATCC, 1988: 15).

While this report is a good source for tonnage estimates moving over existing routes, its usefulness for future projections is somewhat limited. Estimates of future capacities of ports and other facilities are often optimistic and future flows are shown only by country of origin for imports or destination of exports and not by route utilised. No transport cost information is shown in the report for each country, by route, which would form the basis of any future traffic diversion. Indeed, the method actually used to route traffic in future years was not described.

Nevertheless, this "Scenario Model" was used as a basic working document for several subsequent regional transport studies undertaken by Canada, the Netherlands Economic Institute (NEI) / USAID and the World Bank, all completed during 1989.

The Canadian study, undertaken by SLI Consultants of Vancouver, focused primarily on the transport corridors in the region, tonnages presently being moved, estimates of capacities of rail lines and ports and projections of future traffic under several scenarios of possible disruption of these routes (primarily, a "South African borders closed" scenario). During the course of this project, the analysis of the "South African borders closed" scenario faded from prominence and the focus of the study became an analysis of transport bottlenecks and recommendations for remedial action. No information regarding transport costs was obtained during the course of this study.

The USAID/NEI study has not been finalised as of early 1990, with part of the delay being the discussion of the rail costing methodology employed (the "standard cost" approach used instead of obtaining actual costs from each country). From the limited amount of information available to the author regarding this study, it is more of a quantitative effort than the Canadian project, with operating costs, tariffs and quality of service aspects all incorporated. While this project does include a traffic allocation model, projections of total trade by main commodity were derived from the SADCC Scenario Model. Until this project is finalised, the model developed by NEI cannot be properly studied and evaluated.

The NEI did analyse modal split in the region using regression analysis, and results showed that the transport tariff, value of the cargo and transit time were the three most important factors in determining modal choice. The allocation algorithm used in their model allocates available cargo over all possible routes, based on cost and transit time. The formula was estimated using information from recent data on actual shipments so it implicitly includes non -quantifiable factors, such as risk aversion to certain routes or special cargo characteristics. This implies that the mode, and route, choice decision is significantly influenced by factors other than the transport tariff, emphasising the importance of service quality.

With regard to transport statistics, a report has been prepared by the Institute of Transport Economics at the Norwegian Center for Transport Research entitled "Study on Road Traffic and Transport Statistics in Southern Africa" and published in December, 1988. The report reviews the types of reports and statistics available for each country as well as a brief description of the road network, expenditures and road user charges within each country.

While very little information is shown regarding tonnage moved by road within each country, this report does indicate those countries where traffic count data is available and some estimates of freight carried by road could be developed. In particular, Zambia, Botswana, Tanzania and Zimbabwe have good records of traffic counts but very little information on tonnage moved on a route basis. Only Malawi has detailed information showing tonnage by commodity, country of vehicle registration for each of the country's border posts.

The Economist Intelligence Unit in "The Price of Apartheid - a Political Risk Analysis" state that "...about 70 percent of the region's trade currently passes through South Africa" (EIU,1988; 75). The corresponding percentage resulting from the study presented in this paper shows an estimated 62 percent of the SADCC trade moving through South Africa. While the EIU document does not include a transport model of any sort, the source cited for the South African routing of SADCC traffic is "various national and international sources; author's guesstimates". Even the EIU, a well respected research organisation, often resorts to "informal" estimates of regional trade figures for southern Africa.

Another recent study (1989) of regional transport is by Laurent Demuynck of the Maitrise en Relations Internationales CERI entitled "Etude des Dependances en Matiere de Transport". This study deals primarily with the condition of the region's transport infrastructure, regional destabilisation, current rehabilitation efforts being undertaken by SADCC with emphasis on the political and economic issues of dependency of SADCC countries on South Africa. Some tonnages are shown for selected ports and some railway lines but it is not a quantitative evaluation of the region's transport system.

Other research on the subject of regional transport deals primarily with political issues, detailed studies of infrastructure rehabilitation and the likelihood of "restoration" of traffic over the "traditional" transport routes which were operational prior to the early 1980's. The author found virtually no additional research in the field of trade flow analysis, by transport route, incorporating an in depth critical analysis of transport costs and service quality.

4.0 REGIONAL TRANSPORT ROUTES - HISTORICAL PERSPECTIVE

"I want two million pounds to extend the railway to Lake Tanganyika - about 800 miles...Look at the matter...you get the railway to Lake Tanganyika and ...you have Kitchener coming down from Khartoum...It is not imaginative; it is practical. That gives you Africa - the whole of it...the conquest of Africa by the English nation is a practical question now."

(Cecil Rhodes, London, 1898)

4.1 Description of Principal Routes

Rhodes never achieved his dream of a rail system stretching from the Cape to Cairo, but by the 1960's, the region's transport network very nearly resembled the system of today, with the exception of the Tazara line between Dar es Salaam and Zambia and the Beit Bridge extension of the Rhodesian Railways. Both links were completed in the mid-1970's.

With the independence of many countries in the region during the 1960's, three major events came about: 1. The departure of skilled labour and management; 2. The emergence of internal insurrections in Angola and Mozambique; and 3. severe economic constraints on the economies of these newly-independent nations. The effects of these are still in evidence today in the form of inadequate management, a very unstable security situation ranging from periodic acts of sabotage to complete closures on transport routes and economic difficulties ranging from irritating and debilitating shortages of foreign exchange to total collapse of the national economy.

For these reasons, the routes South Africa became important for regional traffic during the time of Rhodesian UDI, when the "natural" routes through Mozambique were closed to Rhodesia.

Rail transport predominated over most of these routes, with road transport important only for internal movements. This was primarily due to the policy of governments offering low rates to encourage use of the railways, thus requiring heavy subsidies. Also, the trunk road network within the region was not well developed (particularly within Angola and Zaire) and the transport policies of some countries (particularly Mozambique) were designed to discourage long haul movements by road which were in direct competition with the government-owned rail system.

The most convenient manner to show the region's principal transport routes is to identify the route choices of each country in the southern African region. These routes are shown in Table 1. While not all routes shown in this table are in full operation at present, cost and service functions can be developed and entered to the model for these routes when they become viable. The routes as shown in Table 1 are the same as those incorporated in the spreadsheet model developed for the region, as described in section 7 in this report.

The letters A, B or C, shown in the left hand column of Table 1 are the transport mode indicators (i.e., A = road, B = rail and C = water). These codes will be used in all further spreadsheets which show individual routes.

Table 1 Southern African Transport Routes

BOTSWANA		
A	RSA	Road
A	Durban	Road
A	Zimbabwe	Road
B	Durban	Rail
B	Maputo	Rail
A	Walvis Bay	Road
MALAWI		
A	Zimbabwe	Road
B	Beira	Rail
B	Nacala	Rail
A/B	Beira (Hre)	Road/Rail
A	RSA	Road
A	Dar	Road
A	Durban	Road
A/B	Durban	Road/Rail
A	Walvis Bay	Road
A/B/C	Dar (Lake)	Road/Rail/Water
SWAZILAND		
A	RSA	Road
A	Durban	Road
A	Maputo	Road
B	Durban	Rail
B	Maputo	Rail
ZAIRE		
B	Lobito	Rail
A	RSA	Road
B	RSA	Rail
A	Walvis Bay	Road
B	Beira	Rail
A	Durban	Road
B	Dar	Rail
B	Durban	Rail
B/C	Dar (Lake)	Rail/Water
B/C	Matadi	Rail/Water

Table 1 (continued)

ZAMBIA		
A	Zimbabwe	Road
A/B	Beira	Road/Rail
A	RSA	Road
B	Lobito	Rail
A	Dar	Road
A	Walvis Bay	Road
B	Beira	Rail
B	Dar	Rail
A	Durban	Road
B	Maputo (RSA)	Rail
B	E Lon	Rail
ZIMBABWE		
A	Beira	Road
B	Beira	Rail
A	RSA	Road
B	Maputo (Limpopo)	Rail
A	Durban	Road
B	Maputo (RSA)	Rail
B	Durban	Rail
A	Walvis Bay	Road

4.2 Regional Independence and Infrastructure Deterioration

Historically, the most important transport routes to the sea were the Benguela Railway connecting the copperbelt regions of Zaire and Zambia with the port of Lobito, and the three international routes across Mozambique serving primarily Rhodesia, Malawi, South Africa and portions of Zambia.

The Benguela Railway has been effectively closed for international traffic since 1975. While the Mozambique routes continued to operate on a regular basis until the early 1980s, the political impact of the Rhodesian UDI rendered the routes to Beira and Maputo through Mozambique effectively closed to international traffic. These events caused a major change in the transport regional transport network and pattern of flow of goods.

In January, 1973, Zambia sealed off the Rhodesian border. While this was done in retaliation against the Rhodesian government, it effectively eliminated Mozambique routes for Zambian traffic. At this point, Zambia began seriously to consider construction of an alternative rail route to Dar es Salaam to provide a reliable alternative route for copper exports. The deteriorating political situation in Angola made the disruption of the Benguela route a real possibility. Subsequent discussions with Tanzania prompted engineering studies and eventual construction of the Tazara railway, a bi-national railway linking the port of Dar es Salaam with the Zambian Railways network at Kapiri Mposhi. Operations began on this railway soon after hand over from the Chinese engineers in July, 1975. (African Development, 1975)

The impact of the Mozambique/Rhodesia border closures prompted Rhodesia to construct a direct rail link to the South African system at Beit Bridge in 1974, and routing the bulk of their traffic via South Africa.

The impacts on Malawi came later, but proved to be the most costly. When the direct routes between Malawi and the ports of Nacala and Beira became the targets of military sabotage during the early 1980's, road haulage was substituted via the long route to South African ports. Today, this long and expensive route is costing Malawi an estimated US $ 100 million annually in additional transport costs when compared with the Mozambique routes. (Kennedy, 1988)

In addition to the impact of internal military activities within these newly-independent countries, there was a severe drain of skilled labour and, more importantly, of middle and lower-level managerial expertise. As rail lines sustained damage, repairs were slow to be made and operations became increasingly erratic and unreliable. A once-effective transport system quickly was grinding to a halt. The effects were not only increased transport costs for the landlocked countries but losses in valuable foreign exchange for the ports and harbours of Mozambique (Martin:1988).

Even the newly-constructed Tazara Railway, was never able to carry significantly more than 1 million tons per year - the line was designed to carry 5 million tons annually. This was due to a combination of poorly performing Chinese locomotives and a lack of competent management of the line (CPCS:1984).

The rehabilitation process began in earnest in 1980, just after the independence of Zimbabwe and the creation of the Southern African Development Coordination Conference (SADCC). This "umbrella organisation" has had significant effects on the funding of transport projects in the region, though the real impact of these projects on significantly improving the transport system in yet to be realised (SADCC:1989). The progress made towards these rehabilitation efforts is described in the next section.

4.3 Rehabilitation Efforts

Despite optimistic claims to the contrary, SADCC, at its February 1989 meeting in Luanda, admitted that "One of the basic goals of SADCC, the reduction of dependence on South Africa, still remains to be achieved. The share of the region's overseas trade going through South African ports is, at present, at the same level as it was in 1981." ("Transport and Communications - Southern African Development Coordination Conference", Luanda, People's Republic of Angola, 1 - 3 February, 1989)

The SADCC transport projects are grouped according to corridors, including links and facilities which provide connections to a regional port. Total costs for these project groups were tabled at the Luanda meeting and are shown in Table 2.

TABLE 2 Total Cost of SADCC Transport Projects (millions of US Dollars)

Port System	Total Cost	Funded
Beira	676.5	337.6
Dar es Salaam	612.8	426.5
Lobito	575.8	13.8
Maputo	757.9	278.3
Nacala	293.7	261.1

(source: Documents tabled at the SADCC meeting in Luanda, February 1989)

The primary failing of the SADCC rehabilitation program is the emphasis on infrastructure to the detriment of maintenance and management of the system. These areas have been left up to the various countries in the region to finance and implement. "The economic difficulties faced by member countries have been particularly felt in the recurrent budgets, where financial pressure has forced governments to allocate inadequate funds for the operation and maintenance of transport and communications facilities. This situation has caused deterioration of facilities and infrastructure; and hence a growing need for investment in reconstruction and rehabilitation. An illustration of this is the fact that, so far, the major part of the SATCC program consists of infrastructural reconstruction and rehabilitation." (documents tabled at the February, 1989 SADCC meeting in Luanda)

"Tendencies in African countries to prefer capital-intensive solutions and, in donor countries, to seek projects offering markets for their manufacturers, have sometimes greatly reduced the real contribution of foreign assistance to development, and even imposed serious long-term burdens. Aid suppliers, in addition to financing projects oriented to maintenance as such...should include components contributing to the development of maintenance capacity, even in projects mainly concerned with new construction." (The World Bank:1987).

The lending program of the World Bank includes a properly designed and implemented maintenance program before it will grant additional funds for capital equipment. SADCC's investment program, however, has no such central body to ensure that projects are indeed in the region's best interests.

The lack of competent middle and lower level management is probably the single most important factor which contributes to the low capacity of SADCC transport facilities. For example, turnaround time for wagons between Komatipoort and Maputo was in excess of 30 days because there was no-one "on the ground" to make the decision for returning empty wagons. This extreme centralisation of authority and power is typical of developing countries around the world and absence of delegation of authority frequently leads to very low levels of efficiency (Kennedy:1988).

In nearly every aspect of transport in the region, the need for proper management is blatantly evident. In order to make the most of existing infrastructure, strong lower and middle management is urgently required, yet not a single SADCC project is specifically directed towards the training of management staff.

A familiar criticism of the colonial powers in Africa is that the local populations were not brought into the mainstream of the transport business at a decision-making level. While this may have been true in parts of the continent in the past, there can be no doubt that management training has been the most sadly lacking element in current transport improvement projects in the region.

5.0 CURRENT POLITICAL ENVIRONMENT

> "Direct and indirect acts of military and economic sabotage by South Africa, particularly in Angola and Mozambique, have continued to disrupt the region's transport systems. The efforts deployed by SATCC and its member countries...have started to pay off...in reshaping the transport and communications patterns of the region."
>
> (Southern African Development Coordination Conference, Review of Transport and Communications Sector, Luanda, February, 1989)

5.1 Transport Dependency and Political Rhetoric

There are several measures with which to measure dependency on South Africa's transport infrastructure. One measure is the extent to which the railways of SADCC countries utilise SATS locomotives and wagons on their lines. During 1987, approximately 50 locomotives and more than 7 000 freight wagons were in use on railways outside South Africa. The use of this equipment is controlled by means of business agreements between the contracting railway organisations, which provide for terms of payment for the use of this equipment. (Africa Institute:1988, 143)

Another measure is the extent to which SADCC traffic is routed via South Africa. Estimates have been made using several sources, including consultants' studies showing the flow of traffic in the region, from discussions with freight forwarders as well as with major transport users. Based on these sources, it was determined that 62 percent of the region's tonnage moves via South African ports or has its origin or destination in the Republic. (see this report, section 5) For imports, this dependency is 75 percent; for exports, only 48 percent. The distribution of these figures are shown on a country basis in Table 3.

TABLE 3 DEPENDENCY ON RSA ROUTES FOR SADCC TRAFFIC

Country	Percentage of Annual Tons
Botswana	80,3
Malawi	88,6
Swaziland	58,7
Zaire	58,0
Zambia	32,0
Zimbabwe	70,0
total	61.88

Source: this report, section 7

These figures are in contrast to the estimated 20 percent of regional tonnage which used South African routes 20 years ago. In fact, transit traffic was so important to Mozambique that it was the source of 70 percent of Mozambique's foreign exchange earnings. (Martin:1988). As stated by Maasdorp in "Southern African Development Coordination Conference", in South Africa in Southern Africa - Economic Interaction, page 75, April, 1988, "Thus the SADCC program is merely restoring the colonial transport patterns disrupted in the post - colonial period. South Africa in the late - 1960's never was the focal point of the foreign trade of the landlocked countries north of the Limpopo nor of the export trade of Swaziland."

Conflicting information was presented by SADCC at their conference in Luanda in February, 1989. At that conference it was stated that: "The share of the region's overseas trade going through South African ports is, at present, at the same level (about 21%) as it was in 1981. For the six landlocked countries the share, on average, is as high as 45%". (SADCC:1989). In fact, the dependency is much greater when considering the goods which have their origins or destinations in South Africa (see section 8 of this report).

Regardless of the measure chosen, it is clear that the SADCC countries are still heavily dependent on the transport infrastructure of South Africa and that this dependency has changed little since the inception of SADCC in 1980.

Any economic analysis of transport routes in southern Africa cannot be performed in isolation from political realities within the region. These political realities include the existence of the Republic of South Africa as a strong force in the region, the desire on the part of many of the "front line" states to avoid using the Republic's transport infrastructure, and the allegations that South Africa itself plays a dominant role in "destabilising" the "natural" SADCC routes, primarily through Mozambique and Angola, thus promoting the dependence on its own routes for the region's imports and exports, using this as an economic lever.

These political realities can be summarised as follows:

1. The existence of South Africa as a regional economic power;

South Africa has long dominated the region as a strong economic power, providing many of the goods consumed within the region. It is also an important source of employment for thousands of the region's workers. This is particularly true for Lesotho, Mozambique and in the past, Malawi. Many Botswana and Swaziland citizens are also employed in the Republic.

2. The dependence of many of the SADCC countries on the Republic's transport infrastructure;

Historically, the transport routes of South Africa played only a minor role in moving goods between ocean ports and many of the region's landlocked countries. During the past 10 - 15 years, however, severe instability following the independence of Angola and Mozambique, effectively rendered routes through these countries unusable on a regular basis for significant amounts of traffic. South African routes were subsequently used to a greater extent.

3. The claims that South Africa is active in the process of destabilising the transport and economic infrastructure of the SADCC countries.

Recent statements by the South African government implied some role in this destabilisation process during the early 1980's but refute totally the claim that the RSA still is actively involved in these efforts. There are, however, still likely to be pockets of support for the MNR operating within South Africa without official sanction.

The South African Transport Services (SATS) has also been accused of reducing rates on SADCC goods via South African gateways in order to deliberately divert this traffic from the "natural" SADCC routes and ports. The implication is that this "rate cutting" allows SADCC traffic to be carried at below cost rates, while South Africa gains the political "bonus" of forcing the region to increase their dependence on South Africa and its transport infrastructure (Stephens:1985).

While it is true that SATS moves a significant amount of traffic between the Republic and neighbouring countries on the basis of contract rates, it is doubtful that any of these contracts are non-compensatory. With transport deregulation in progress in South Africa, cross subsidisation between SATS's services is being rapidly phased out and each service must be financially solvent. There was no evidence found that the South African government makes a financial contribution to SATS in return for attracting SADCC traffic at unremunerative rates.

5.2 The Politics of Route Selection

The choice of transport routes can have significant impacts on the expeditious flow of goods, particularly where some routes are subject to severe disruptions and subsequent delays.

Ideally, the route choice should be made on the basis of least cost (on a total distribution cost basis) and over a route which offers an acceptable level of service. However, there are political considerations which play a major role in influencing route choice, particularly with regard to avoiding routes through South Africa. The use of a route through South Africa may cause political embarrassment to the country of origin yet the choice of a route which avoids South Africa is often an expensive undertaking, a cost which many of the region's economies cannot afford.

The route selection decision is often dependent upon the terms of sale of the goods. For exports sold ex works, the buyer usually chooses the routing and mode of transport from the factory to the port of export. If the goods are sold on a CIF basis (cost, insurance & freight), the exporter, usually in the country of origin, determines the routing.

Some routes are selected on the basis of least cost, while others are purely on the basis of politics. For example, some donor countries of food aid prohibit the use of South African ports. Others stipulate that certain SADCC ports must be used (i.e., Beira) for selected routings. While governments may promote a policy of avoiding South African routes, the firms within that country which is financially and legally responsible for the movement of the goods, often choose the most reliable and quickest route, which often is via South Africa.

In the following section of the paper, the concept of economic efficiency will be described, as it applies to the analyses performed in this study. Following this discussion, the development of the spreadsheet model used to analyse the transport routes, will be described in detail and results presented.

6.0 ECONOMIC EFFICIENCY OF TRANSPORT ROUTES

> "An Egyptian attache was recently posted from Mauritius to his embassy in Malawi. He asked his new boss in Lilongwe about the best way to ship his container of household goods to his new post. The ambassador immediately advised a routing via Durban. The attache, however, had a twinge of conscience about routing his belongings through South Africa and said that he would prefer to ship them via Dar es

Salaam. His boss again recommended the Durban routing, but the attache decided on Dar es Salaam anyway. Three months later they found his empty container at a remote station in Tanzania - the location of the contents is still a mystery."

("Transport in Southern Africa", T L Kennedy; The South African Institute of International Affairs, November, 1988)

6.1 Criteria for Economic Efficiency

With no external influences, traffic will flow over the least costly routes, i.e, the most economically efficient route, from the perspective of the user. The situation in southern Africa, however, is one in which political factors have a significant influence on the choice of transport route.

It is important to distinguish among the various concepts of cost which can be applied to the comparison of routes. The cost paid by the user (the tariff) is one approach. Rail tariffs, however, rarely reflect actual costs incurred by the railway, resulting in large government subsidies. Road haulage rates generally more closely represent actual costs, or market forces. The comparison can also be based on the cost incurred by the transport operator. This latter method is dependent upon the analyst obtaining reasonably accurate and representative cost information from these transport organisations. Nevertheless, reasonable approximations of average costs for most transport organisations in the region have been made and details are shown in Section 7 of this report.

For the purpose of this evaluation, two analyses of the regional routes will be made: the first will be based on existing tariffs, as well as the service quality factors (these service quality factors will be more fully explained in the next section); the second will assume that prices have been set to equal average costs incurred by the various transport operators, also including the service quality factors.

Based on these cost criteria, the route choices for each country in the region will be ranked according to relative total distribution costs, for both the tariff and cost based evaluation criteria.

6.2 The Total Distribution Cost Concept

Ignoring for the moment the political criteria for route selection, cost and service have been found to be the most important factors in the route selection and modal choice decision, based on discussions with transport operators, users and freight forwarders (Kennedy:1988).

The important distinction to make here is that the concept of total distribution costs includes more than just the transport tariff. They include the cost of probable delays enroute, the likelihood of damage to the commodity, losses during transit or at transshipment points, costs for loading/unloading for multi-modal routings, costs and associated delays for documentation enroute, the additional cost of stockholding where transit times are erratic, and the cost of delays at ports. Each of these items has been quantified and incorporated in the Regional Distribution Cost Model to enable each route to be compared on an equal basis.

The route characteristics were determined through discussions with transport users, operators and forwarders within each country in the region. In addition, reports prepared by overseas consultants for SADCC and on behalf of aid agencies were reviewed.

Unit cost elements such as cost per transshipment, interest rate and commodity value are shown in the spreadsheet, but these elements have been determined to be common to all routes.

7.0 REGIONAL FLOWS AND DISTRIBUTION COSTS

"If all the existing non-SATS railways and ports were working to their full design capacity,they could already carry more than the total volume required for overseas trade of all the SADCC countries. This is in one sense reassuring, in that rehabilitation, alone can in time, given security, solve the problem of transport dependence on South Africa. In another sense it complicates decision taking for SADCC governments and donors, in that there is no point in diverting scarce development funds to the creation of excess transport capacity in the region while investment in productive capacity is starved of funds, economic growth rates are low or negative and the SATS service adequate....."

("Southern Africa: The Price of Apartheid - A Political Risk Analysis"; The Economist Intelligence Unit, London, 1988)

Within this section, the major flows within the region are identified and total distribution costs calculated. Each table shown in this section is an integral part of the spread sheet model.

7.1 Flows of Principal Commodities

The flow of goods over transport routes is developed by allocating the imports and exports of each country to each route. This allocation was based on discussions with freight forwarders, transport operators, private and public companies based in each country. It is extremely difficult to obtain accurate figures for these distributions, partly because of the scarcity of information and the sensitivity of some countries to disclosing such data. This allocation of goods to routes can change over time, and the spreadsheet is structured such that any changes in the distribution pattern of imports and exports can be readily incorporated in the model.

Table 4 shows the import and export volumes (expressed in terms of tons) for each country, the percentage moved over the various routes and the total tons moving over each route based on this distribution. In order to reflect a change in the distribution pattern, the new percentages for each route need only to be entered in the appropriate cells in the spreadsheet.

The volumes of imports and exports were obtained from the SATCC publication, "A Scenario Model for Goods Transport Demand in the SADCC Region", SATCC, September, 1988. As values for Zaire were not included in this reference, they were obtained from a confidential consultant's report prepared for an international aid agency. The distribution of traffic over each route was also made from this consultant's report. These results were reviewed with transport operators and forwarders in the region for accuracy. The model presented in this paper is designed such that any of these volumes and route distribution assumptions can be quickly modified.

7.2 Total Distribution Costs

An important element of total distribution costs is transport costs. These were developed for each country in the region, for rail, road and water transport and are expressed in

TABLE 4 ROUTING OF IMPORTS AND EXPORTS

Route Codes
A = Road
B = Rail
C = Water

(tons in thousands)

		Percentage		Country Totals		Route Totals	
		Imports	Exports	Imports	Exports	Imports	Exports
BOTSWANA				815	129		
B	Durban	5	54			41	70
A	Durban	2	6			16	8
B	Maputo					0	0
A	Walvis Bay					0	0
A	RSA	72	28			587	36
A	Zimbabwe	21	12			171	15
MALAWI				514	291		
A	Durban	80	80			411	233
A/B	Durban	5	15			26	44
A/B	Beira (Hre)					0	0
B	Beira					0	0
B	Nacala					0	0
A/B/C	Dar (Lake)					0	0
A	Dar		5			0	15
A	Walvis Bay					0	0
A	RSA					0	0
A	Zimbabwe	15				77	0

TABLE 4 ROUTING OF IMPORTS AND EXPORTS

TABLE 4 (continued)

		Percentage		Country Totals		Route Totals	
		Imports	Exports	Imports	Exports	Imports	Exports
SWAZILAND				565	1250		
A	Durban	10	10			57	125
B	Durban		20			0	250
A	Maputo					0	0
B	Maputo		60			0	750
A	RSA	90	10			509	125
ZAIRE				422	587	0	
B/C	Matadi	10	55			42	323
B	Dar					0	0
B/C	Dar (Lake)		10			0	59
B	Durban		35			0	205
A	Durban	60				253	0
B	Lobito					0	0
B	Beira					0	0
A	Walvis Bay					0	0
A	RSA	20				84	0
B	RSA	10				42	0

TABLE 4 (continued)

		Percentage		Country Totals		Route Totals	
		Imports	Exports	Imports	Exports	Imports	Exports
ZAMBIA				1329	726		
B	Dar	10	70			133	508
A	Dar	15				199	0
B	Beira		20			0	145
A/B	Beira		10			0	73
B	E Lon					0	0
A	Durban	25				332	0
B	Lobito					0	0
B	Maputo (RSA)					0	0
A	Walvis Bay					0	0
A	RSA	25				332	0
A	Zimbabwe	25				332	0
ZIMBABWE				1922	2204		
B	Beira	10	10			192	220
A	Beira	6	7			115	154
B	Maputo (RSA)	7	20			135	441
B	Maputo (Limpopo)					0	0
B	Durban	6	50			115	1102
A	Durban	15	3			288	66
A	Walvis Bay					0	0
A	RSA	56	10			1076	220

terms of unit cost coefficients per ton kilometre. In some cases, reliable data are available, either in published form or in working papers of the author during the course of consulting assignments. For other countries, however, such reliable information is not available and estimates had to be made based on best judgement. Costs were indexed up to 1989 price levels.

RAIL COSTS

For most rail systems, information was obtained from published annual reports.

South Africa

Based on the 1987/88 annual report data, the total cost for railway services (less commuter, tourist services and road transport) was R 6 360 707 000. Allocating 90 percent to freight service (based on revenue) and applying the freight portion to 85 629 million ton kilometres, results in a unit cost of R 0.06685 per ton kilometre. Indexing this amount to 1989 levels by 15 percent results in a unit cost of R 0.0769 per ton kilometre. (source: South African Transport Services Annual Report, 1987/88.)

Swaziland

Total costs for 1985/86 were shown to be E 16 449 000 in the Swaziland Railway Annual Report. Total tonnage moved was 1 082 104 for the same period. As ton kilometres are not reported by the Swaziland Railway, estimates were made using an average length of haul of 80 kilometres, resulting in 86 568 320 ton kilometres. The resulting unit cost is E 0.19 per ton kilometre. Indexing this to 1989 levels, using an annual inflation rate of 10 percent, gives a current cost coefficient of E 0.2529 per ton kilometre. The Elangeni and the Rand are currently valued on a 1 to 1 basis.
(source: Swaziland Railway Annual Report and Accounts, for the year ended 31 March, 1986.)

Malawi

The total costs for rail services during 1985/86 was K 17 043 000. The ton kilometres generated during 1985/86 were 223 988 000, resulting in a unit cost of K 0.0761 per ton kilometre. Indexing up to 1989 at 10 percent annually and applying the exchange rate of R 1 = K 0.861 which existed during 1986, the current cost coefficient is R 0.11764 per ton kilometre.
(source: Malawi Railways Statistics, March 1986.)

Zimbabwe

Total freight service costs were found to be Z$ 299 927 000 for 1985/86. Ton kilometres for the same period were 6 573 000. Indexing these values to 1989 prices at 10 percent annually results in a unit cost of Z$ 0.0607 per ton kilometre. Converting to South African rands at a rate of Z$ .804 = R 1, the coefficient becomes R 0.0755.
(source: Zimbabwe Railways, General Overall Average Costs (ANOP), 1985/86; Zimbabwe Railways Annual Report, 1985/86.)

Botswana

While the Botswana Railways is now a separate entity from the NRZ, the cost and service characteristics are assumed to be very similar to those of the former parent company. For this reason, the same cost coefficients as used for NRZ, are used for the Botswana Railways.

Zaire

Total operating costs for the Societe Nationale des Chemins de Fer Zairoise were Z 15 068.6 million during 1986. As these represent costs for passenger and freight services, an estimate for the passenger portion must be deducted. This apportionment was done on the basis of "unitere de trafic"; that is, ton kilometres and passenger kilometres. This is a common measure of output for francophone railway system. On this basis, it is estimated that freight traffic accounts for 92 percent of the railway's costs, or Z 13 863.1 million.

Freight ton kilometres were 1 791 million during 1986, resulting in a unit cost of Z 7.74042 per ton kilometre. Indexing this value to 1989 prices at 10 percent annually, and converting to South African Rands (Z 54.19 = R 1), results in a coefficient of R 0.19012 per ton kilometre.
(source: Evolution de la Remuneration des Services de la SNCZ de 1975 a 1986; Evolution du Trafic de 1979 a 1986.)

Tanzania

Costs for the Tazara Railway were examined from several sources, including consultants investigations and Tazara publications. However, during discussions with Canadian consultants who have undertaken recent investigations of the Tazara, it became evident that the costs, as reported, are not representative. There is no proper system of asset valuation and the operating costs are not deemed to be accurate or even representative of current conditions.

For these reasons, it was determined that the cost coefficients for other railways in the region be used to represent actual Tazara costs. The Zimbabwe Railways (NRZ) represents a relatively efficient rail system in the region. The Tazara, due to management inefficiencies and chronic locomotive problems, is likely to be less efficient than the NRZ, though probably not so inefficient as the Malawi railways due to higher traffic densities. It was determined that a cost midway between that of the NRZ and Malawi Railways would be used for Tazara.

Based on the information shown earlier in this section, the cost coefficient for Tazara is R 0.09657 per ton kilometre.
(source: Tazara Operational and Staffing Study, Canadian Pacific Consulting Services, 1984; Ten Years of Tazara Operations - Review and Perspective, 1986.)

Zambia

Any cost information which could have been obtained for the Zambian Railways would not be representative of current cost conditions in that country. The rapidly changing value of the Kwacha in foreign markets make reasonable assessments of costs and outputs a futile effort. In order to represent the costs of Zambian Railways, the same cost coefficient as developed for Tanzania was used (i.e., R 0.09657 per ton kilometre).

ROAD COSTS

Road haulage costs were obtained from private haulage firms operating within each country. Due to the sensitive nature of this information, the identity of each haulier cannot be revealed. The exchange rates applied may differ from those used for developing rail costs due to the varying time periods of extracting information.

The road haulage costs were obtained from the hauliers in terms of cost per vehicle kilometre. In order to express these costs on the basis of ton kilometres, certain assumptions regarding average loads per vehicle need to be made.

Most vehicles operating over these international routes have a carrying capacity of 24-30 tons. Because of the highly competitive nature of the road haulage business, return loads are a necessity for survival, and most commodities moved by road are high density, high value. It is therefore reasonable to assume an average load of 25 tons per vehicle when calculating cost per ton kilometre. This average load was confirmed through discussions with major transport operators and forwarders in the region.

A further note is necessary regarding the road haulage costs shown in this paper and incorporated in this model.

No country publishes actual costs for road haulage through their respective countries. The costs shown here have been extracted from records of, in some cases, a very small sample of road hauliers in each country. Where this was not possible, costs from other countries in the region had to be used as surrogate costs (i.e., Zaire and Tanzania). Even in cases where actual data was available, it was not possible to verify the validity of accounting practices and accuracy of the information provided. Another researcher could likely obtain different cost factors from other operators within many of these countries.

The costs shown in this report were those obtained during the course of research and are, in fact, the costs which are being incurred by operators in the region. The author has found it necessary to incorporate these less than perfect costs in the model, even though they may appear to be rough approximations and the result of relatively small samples. The countries under study in this paper are third world countries and the availability of reliable published data is simply non - existent.

Zimbabwe

Total costs are Z$ 4.00 per vehicle kilometre, or R 4.71 (Z$ .8495 = R 1). On a ton kilometre basis, the cost is R 0.1884.

Zambia

No reliable statistics could be obtained for road transport costs in Zambia. Even if data in kwachas could be obtained, the wide fluctuations of the currency make representative cost calculations merely speculative. For this reason, the same costs as found in Zimbabwe have been applied.

Zaire

As with the case of Zambia, no road cost information was available for Zaire. The Zimbabwe cost factors were used in the absence of better data.

Tanzania

No reliable cost information could be obtained for Tanzania. The Zimbabwe costs were again applied in this case.

Malawi

Total costs are K 4.56 per vehicle kilometre, or R 4.38 (K 1.0415 = R 1). On a ton kilometre basis, the cost is R 0.1752.

South Africa

Total costs are R 3.27 per vehicle kilometre. On a ton kilometre basis, the cost is R 0.1308.

Swaziland

Total costs are E 2.50 per vehicle kilometre (the lilangeni is on par with the rand). On a ton kilometre basis, the cost is R 0.10.

Mozambique

Specific information is available for Mozambique, but primarily for the movement of goods internally. For international traffic, the primary route is between Malawi and Zimbabwe via Tete. Most of the traffic over this route is conveyed in Malawi or Zimbabwe registered vehicles, so an average of the ton kilometre cost of these two countries would be more appropriate. Based on the figures presented previously, the cost per ton kilometre for Mozambique would be R 0.1818.

Botswana

Two sources were used for developing vehicle costs for Botswana. An operator based in Francistown, making primarily domestic trips within the country reported a cost of 1.50 Pula per vehicle kilometre. Using an exchange rate of P 0.7335 to the rand, this would be R 2.04 per vehicle kilometre.

Another operator, based in Johannesburg who operates extensively through Botswana as well as through other neighbouring countries, reports a cost of R 2.18 per vehicle kilometre. Averaging these two costs results in R 2.11 per vehicle kilometre. Expressed in terms of ton kilometres, the figure is R 0.0844.

This apparently low figure, when compared with South African hauliers, is probably due to very high annual kilometres operated over the long regional routes. The South African cost incorporates a portion of relatively short trips between the Johannesburg area and the South African border, thereby making the average cost figure comparatively high. It was not possible, with the data available at the time of undertaking this research, to isolate the operation and maintenance costs for vehicles used exclusively in cross border trips.

WATER TRANSPORT

There are only three important transport links over which water transport is used in the region under study: Lake Malawi on the Malawi-Dar es Salaam route; Lake Tanganyika on the Zaire - Dar es Salaam route and the Zaire River on the Zaire-Matadi route. Cost data were only available for the Lake Malawi service so this information will be applied to the other water routes.

Lake Malawi

The lake service is operated by Malawi Railways and during 1985/86 costs were K 3 568 500. Apportioning this amount between passengers and goods on the basis of revenue (K 631 815 and K 1 517 477, respectively), the lake costs allocated to freight amounts to K 2 533 635.

The total tons moved on the lake service was 36 900, over an average distance of 339 kilometres, resulting in total ton kilometres of 12 509 100. This is a unit cost of K 0.2025 per ton kilometre. Indexing this amount to 1989 prices (at 10 percent annually) results in a value of K 0.2695 per ton kilometre. Expressing this in terms of South African rands, using an exchange rate of K 0.861 = R 1, the amount is R 0.313 per ton kilometre.
(source: Malawi Railways Limited, Report and Accounts 1986/87; Malawi Railways Statistics, March, 1986.)

TRANSSHIPMENT COSTS

When goods are transferred from one mode to another, a cost is incurred. While the method of achieving this transfer will vary by location, the costing is based on a typical loading crew and the time required to load a rail wagon or road truck.

This amount has been calculated to be R 5 per ton. Discussions have been held with several transport operators and freight forwarders, and this rate has been determined to be a reasonable estimate of the costs involved.

The number of transshipments are the number of loadings of a transport vehicle and are shown in Table 5 for each route. The value of R 5 per ton is applied to each of these transshipments in order to estimate the total transshipment costs for the route.

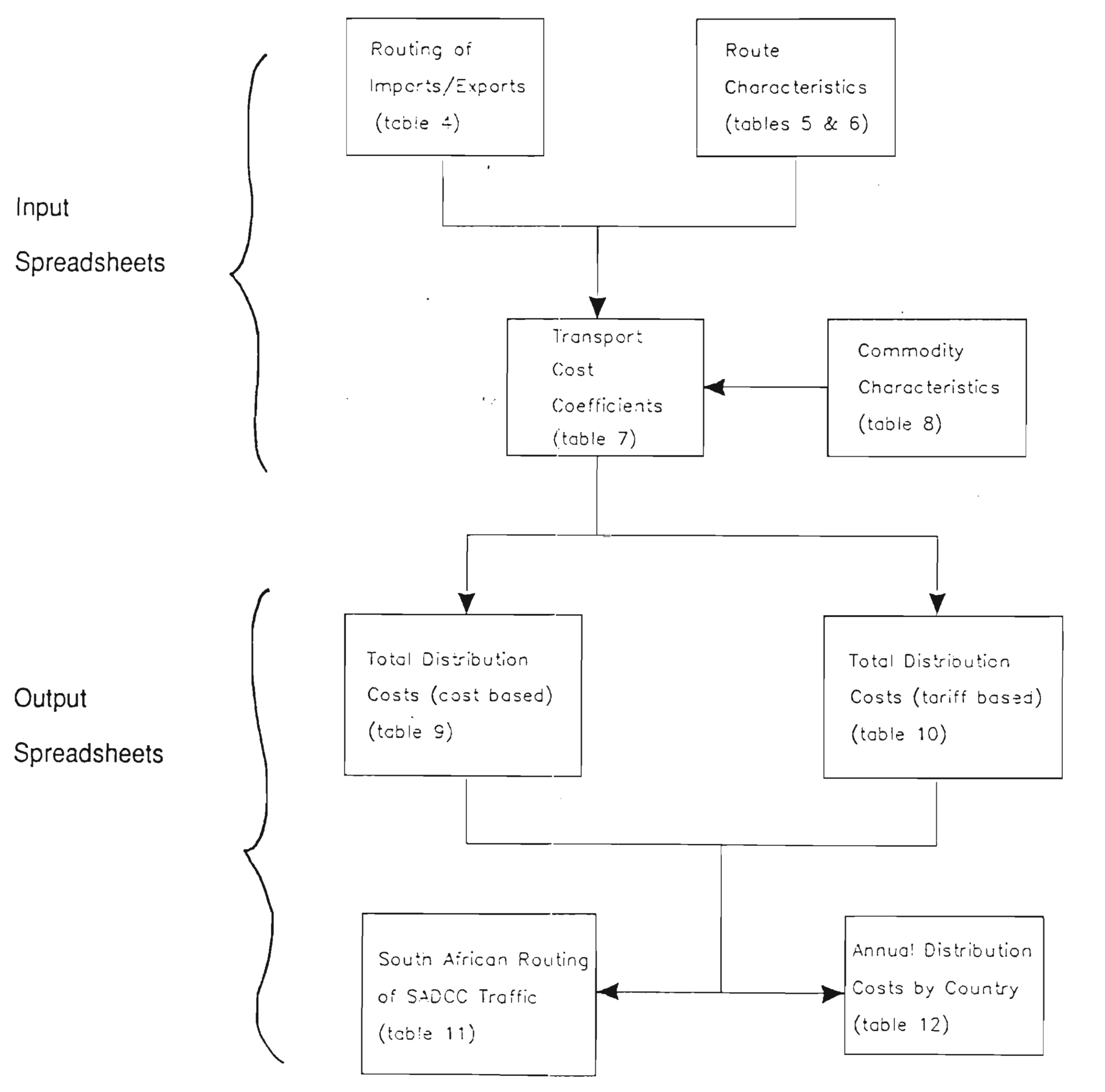
7.2.1 Regional Distribution Cost Model

The model consists of several linked spreadsheets which identify the imports and exports attributed to each country, expressed in terms of tons, allocated to each route in accordance with the routing percentages, and develops total distribution costs for each route and country. Each route is described in terms of transport modes, distances, service characteristics and transit times. Transport unit costs are expressed in terms of unit cost coefficients on a ton kilometre basis.

This cost comparison is, admittedly,, an over simplification. There are literally hundreds of rules and regulations regarding the movement of goods , particularly by rail. The shipment size, packing requirements, empty backhaul of the transport vehicle all combine to create specific circumstances for each shipment. In some cases, these regulations and circumstances dictate modal choice. For example, small sized parcels may not be shipped by rail due to minimum weight regulations between South Africa and Zaire. Freight forwarders, however, can consolidate many such small shipments and dispatch them by road in a full truckload at an economical rate per ton. This model, as it must be generalised to a certain degree, cannot incorporate the level of detail and complexity necessary to reflect the movement characteristics of the entire range of commodities, origins and destinations. It does, however, provide a reasonable cost calculation procedure which can be applied to the majority of commodities and between typical origins and destinations within the region.

The relationship among the spreadsheets is shown in Figure 1, and each spreadsheet is described in the following section.

Figure 1 Regional Distribution Cost Model



The spreadsheets which comprise the model can be defined as input or output spreadsheets. The input spreadsheets (Tables 4-8) require the user to supply certain elements:

- Volumes of imports/exports
- Routing percentages
- Route characteristics
- Cost coefficients
- Tariff coefficients
- Commodity value

The output spreadsheets (Tables 9-12) show the results of the model, in terms of the following indicators:

- Least cost route for each country
- South African routing of SADCC traffic (indicating dependency)
- Total distribution costs for each country

A brief description of each table in the spreadsheets is included in the next section.

Table 4 Routing of Imports and Exports

The contents of this table were described in the previous section. The flow of goods over each route as developed from this table forms the basis for the cost analysis and route evaluation.

These route characteristics were obtained from estimates obtained from the South African Transport Services, freight forwarding organisations in the region and from consultants' studies of regional routes. While it is recognised that these characteristics can vary widely for each route, it is the relationship of these factors, comparing one route with another, which is significant.

Tables 5 and 6 Route Characteristics

The distances for each mode of transport are shown on a country basis in Table 5. These distances are summed for the links in the each route available to the various countries and shown in Table 6. In addition, this table shows transit times, port delays, number of transshipments and loss and damage estimates.

These route characteristics were obtained from estimates provided by the South African Transport Services, from freight forwarding organisations and from consultants' studies of regional routes. While it is recognised that several of these characteristics can vary widely for each route, it is the relative values of these factors that is important, when comparing routes with one another.

Table 7 Transport Cost Coefficients

The transport costs for each mode, on a country basis, are shown in Table 7. The derivation of these costs has been described for each country in section 7.2 of this report.

These represent financial costs of operation and capital provision incurred by each railway organisation. It is recognised that this is a risky undertaking, as the treatment of capital and other costs may not be consistent among the various organisations. Adjustments have been made where these inconsistencies were obvious, such as for the Tazara Railway. From information obtained from Canadian studies of Tazara, a proper asset accounting system does not exist. For this reason, total costs were reconstructed for Tazara using the proportion of asset costs to total costs for SATS.

The costs for transport on a tariff basis are also shown in Table 7. The derivation of these rates requires some explanation.

TABLE 5 ROUTE CHARACTERISTICS - DISTANCES BY COUNTRY (kilometres)

		Angola		Botswana		Malawi		Mozambique		South Africa	
		Road	Rail	Road	Rail	Road	Rail	Road	Rail	Road	Rail
BOTSWANA											
B	Durban				148						1034
A	Durban			17						943	
B	Maputo				148				93		847
A	Walvis Bay			863						701	
A	RSA			17						341	
A	Zimbabwe			474							
MALAWI											
A	Durban					101		265		1165	
A/B	Durban					101		265			1120
A/B	Beira (Hre)					101		265	319		
B	Beira						209		255		
B	Nacala						194		620		
A/B/C	Dar (Lake)						199				
A	Dar					510					
A	Walvis Bay					101		265		1582	
A	RSA					101		265		563	
A	Zimbabwe					101		265			

Route Codes A = Road
B = Rail
C = Water

TABLE 5 ROUTE CHARACTERISTICS - DISTANCES BY COUNTRY

TABLE 5 (continued)

		Angola		Botswana		Malawi		Mozambique		South Africa	
		Road	Rail	Road	Rail	Road	Rail	Road	Rail	Road	Rail
SWAZILAND											
A	Durban									248	
B	Durban										388
A	Maputo							78			
B	Maputo								69		
A	RSA									292	
ZAIRE											
B/C	Matadi										
B	Dar										
B/C	Dar (Lake)										
B	Durban				654						1034
A	Durban			914						943	
B	Lobito		1075								
B	Beira								319		
A	Walvis Bay									1582	
A	RSA			914						341	
B	RSA				654						304

TABLE 5 (continued)

		Angola		Botswana		Malawi		Mozambique		South Africa	
		Road	Rail	Road	Rail	Road	Rail	Road	Rail	Road	Rail
ZAMBIA											
B	Dar										
A	Dar										
B	Beira								319		
A/B	Beira								319		
B	E Lon				654						1330
A	Durban			914						943	
B	Lobito		1075								
B	Maputo (RSA)								93		
A	Walvis Bay									1582	
A	RSA			914						341	
A	Zimbabwe										
ZIMBABWE											
B	Beira								319		
A	Beira							298			
B	Maputo (RSA)								93		670
B	Maputo (Limpopo)								534		
B	Durban										1120
A	Durban									1165	
A	Walvis Bay									1582	
A	RSA									563	

TABLE 5 (continued)

		Swaziland		Tanzania		Zaire		Zambia		Zimbabwe	
		Road	Rail	Road	Rail	Road	Rail	Road	Rail	Road	Rail
BOTSWANA											
B	Durban										
A	Durban										
B	Maputo										
A	Walvis Bay										
A	RSA										
A	Zimbabwe									540	
MALAWI											
A	Durban									836	
A/B	Durban		186							246	721
A/B	Beira (Hre)									246	273
B	Beira										
B	Nacala										
A/B/C	Dar (Lake)			180	845						
A	Dar			995							
A	Walvis Bay							88		1268	
A	RSA									836	
A	Zimbabwe									246	

TABLE 5 (continued)

		Swaziland		Tanzania		Zaire		Zambia		Zimbabwe	
		Road	Rail	Road	Rail	Road	Rail	Road	Rail	Road	Rail
SWAZILAND											
A	Durban	153									
B	Durban		158								
A	Maputo	90									
B	Maputo		151								
A	RSA	79									
ZAIRE											
B/C	Matadi						1754				
B	Dar				970		280		1024		
B/C	Dar (Lake)				1256		1320				
B	Durban						280		793		595
A	Durban					96		981			
B	Lobito						655				
B	Beira						280		793		1225
A	Walvis Bay					90		981			
A	RSA					90		981			
B	RSA						280		793		595

TABLE 5 (continued)

		Swaziland		Tanzania		Zaire		Zambia		Zimbabwe	
		Road	Rail	Road	Rail	Road	Rail	Road	Rail	Road	Rail
ZAMBIA											
B	Dar				970				1024		
A	Dar			925				964			
B	Beira								793		1225
A/B	Beira							135		354	235
B	E Lon								799		595
A	Durban							891			
B	Lobito						935				
B	Maputo (RSA)								793	670	1005
A	Walvis Bay							891			
A	RSA							891			
A	Zimbabwe							135		354	
ZIMBABWE											
B	Beira										273
A	Beira									265	
B	Maputo (RSA)										721
B	Maputo (Limpopo)										735
B	Durban		186								721
A	Durban									590	
A	Walvis Bay							88		901	
A	RSA									590	

TABLE 6 ROUTE CHARACTERISTICS SUMMARY

		Distances (kms) Road	Rail	Water	Transit Days	Port Days	Trans-shipments	Loss & Damage %
BOTSWANA								
B	Durban	0	1182		4	3	1	.5
A	Durban	960	0		3	3	1	.2
B	Maputo	0	1088		15	10	1	1
A	Walvis Bay	1564	0		4	3	1	.2
A	RSA	358	0		2		1	.2
A	Zimbabwe	1014	0		3		1	.2
MALAWI								
A	Durban	2367	0		8	3	1	.2
A/B	Durban	612	2027		21	3	2	.5
A/B	Beira (Hre)	612	592		15	10	2	1.2
B	Beira	0	464			10	1	1
B	Nacala	0	814		6	5	1	1
A/B/C	Dar (Lake)	180	1044	405	18	10	4	5
A	Dar	1505	0		4	10	1	2
A	Walvis Bay	3304	0		8	3	1	.2
A	RSA	1765	0		6		1	.2
A	Zimbabwe	612	0		2		1	.2

Route Codes A = Road
B = Rail
C = Water

TABLE 6 ROUTE CHARACTERISTICS SUMMARY

TABLE 6 (continued)

		Road	Rail	Water	Transit Days	Port Days	Trans-shipments	Loss & Damage
SWAZILAND								
A	Durban	401	0		2	3	1	.2
B	Durban	0	546		3	3	1	.5
A	Maputo	168	0		1	10	1	1
B	Maputo	0	220		3	10	1	1.5
A	RSA	371	0		2		1	.2
ZAIRE								
B/C	Matadi	0	1754	798	60	8	3	5
B	Dar	0	2274		21	10	1	3
B/C	Dar (Lake)	0	2576	135	30	10	3	5
B	Durban	0	3356		17	3	1	.5
A	Durban	2934	0		5	3	1	.2
B	Lobito	0	1730		10	8	1	1
B	Beira	0	2617		20	10	1	1
A	Walvis Bay	2653	0		5	3	1	.2
A	RSA	2326	0		4		1	.2
B	RSA	0	2626		15		1	.5

TABLE 6 (continued)

		Road	Rail	Water	Transit Days	Port Days	Trans-shipments	Loss & Damage
ZAMBIA								
B	Dar		1994		18	10	1	3
A	Dar	1889	0		7	10	1	2
B	Beira	0	2337		15	10	1	1
A/B	Beira	489	554		12	10	2	1.2
B	E Lon	0	3378		15	3	1	.5
A	Durban	2748	0		10	3	1	.2
B	Lobito	0	2010		12	8	1	1
B	Maputo (RSA)	670	1891		20	10	1	1
A	Walvis Bay	2473	0		4	3	1	.2
A	RSA	2146	0		4		1	.2
A	Zimbabwe	489	0		2		1	.2
ZIMBABWE								
B	Beira	0	592		16	10	1	1
A	Beira	563	0		4	10	1	1.1
B	Maputo (RSA)	0	1484		22	10	1	1
B	Maputo (Limp	0	1269		5	10	1	1
B	Durban	0	2027		12	3	1	.5
A	Durban	1755	0		7	3	1	.2
A	Walvis Bay	2571	0		5	3	1	.2
A	RSA	1153	0		5		1	.2

TABLE 7 TRANSPORT COST COEFFICIENTS

(Rands per ton kilometre)

COUNTRY	Cost Basis Road	Cost Basis Rail	Cost Basis Water	Tariff Basis (high value) Road	Tariff Basis (high value) Rail	Tariff Basis (high value) Water	Tariff Basis (low value) Road	Tariff Basis (low value) Rail	Tariff Basis (low value) Water
Angola		.09657		.194	.1758	0	.194	.0879	
Botswana	.0844	.0755		.194	.1758	0	.194	.0879	
Malawi	.1752	.11764	.313	.194	.1758	.3756	.194	.0879	.3756
Mozambique	.1818	.117		.194	.1758	0	.194	.0879	
South Africa	.1308	.0769		.194	.1758	0	.194	.0879	
Swaziland	.1	.2529		.194	.1758	0	.194	.0879	
Tanzania	.1884	.09657		.194	.1758	0	.194	.0879	
Zaire	.1884	.19012	.313	.194	.1758	.3756	.194	.0879	.3756
Zambia	.1884	.09657		.194	.1758	0	.194	.0879	
Zimbabwe	.1884	.0755		.194	.1758	0	.194	.0879	

Transport cost coefficients are also shown on a tariff basis, for both low and high value goods. This is necessary on account of the railway rating structure which typically attributes a higher rate to high value goods. Even for rates which are negotiated, the higher value goods generally move at higher rates than for lower value products. The rates for road and river transport are unchanged for low or high value goods.

While the transport costs on a cost basis, as shown in Table 7, are computed for each country, the tariff charges are the same per ton kilometre for any country. While the rail tariffs may vary between countries, a large portion of the cross border rail traffic is on a contract basis for the entire route with the rates of individual railways having little effect. This is not universally true, but for reasons of simplicity of application, this model treats the rate per ton kilometre through each country, constant for both road and rail.

The rates for high value commodities were determined by examining actual charges paid, as determined by examining records of a regional freight forwarding company for shipments of manufactured products between Johannesburg and nine selected destinations in the region. These destinations were Lusaka, Ndola, Harare, Bulawayo, Gaborone, Francistown, Lubumbashi, Blantyre and Lilongwe. The commodity was classified in the SATS tariff as tariff 3. These charges were then expressed as a cost per ton kilometre and entered to Table 7.

The rail tariff for low value commodities (i.e., agricultural products) is considerably less than for high value commodities, by at least 50 percent. While there is quite a bit of variation in these rates, it was determined that a 50 percent reduction from the high value goods tariff was representative of the rates for low value goods. This was done for rail rates only and shown in Table 7.

The number of transshipments indicate the number of loadings of a transport vehicle which is particularly important when changing modes of transport. The cost for this handling is often only a small price which is paid for a multi-modal route. Changing modes and the additional handling involved often increases the probability that goods will be lost, damaged or stolen. This risk is not expressly included in the transshipment cost, but is reflected in the loss and damage probability for each route.

Table 8 Commodity Characteristics

Commodity characteristics are shown in Table 8. These are expressed in terms of rands per ton and an interest rate of 15 percent is applied to this value, representing the costs of capital for carrying inventories and the cost of capital per day per ton. This capital cost per day is used to quantify the cost of transit times and port delay days.

TABLE 8		**COMMODITY CHARACTERISTICS**	
	Value (R/ton)	**Interest Rate %**	**Commodity Cost/Day (per ton)**
Low Value	500	15	.21
High Value	5000	15	2.05

In order to differentiate among commodities, the value of the commodity is changed in Table 8. While it is difficult to identify these values precisely, estimates were obtained using previous work by the author during the course of a study of rail and road transport costs in South Africa (Kennedy, 1984). These values were indexed up to 1989 values and are shown by the following:

- Low value R 500 per ton
- High value R 5000 per ton

The variation in commodity value affects the cost of time elements, loss and damage risk and the railway rate which is applied to a particular movement.

The total distribution cost calculations shown in the various tables use the high value commodity assumption when using the cost basis. The tariff based cost calculations use both the high and low value assumptions, in order to demonstrate the effect of commodity value on the railway rating system.

Table 9 Total Distribution Costs (cost based)

The total distribution costs, based on transport costs, are computed in Table 9. The transport costs are shown for each mode in the routing and summarised. Inventory costs for the two time elements (transit time and port delay days) are computed, as are transshipment costs and the risk of loss and damage. In computing the time elements of cost, as well as the loss and damage risk, the high value commodity value is used. All of these costs elements are summed and shown in the second to last column of the table for each route. All costs in this (as well as the other tables) table are expressed in terms of rands per ton.

In the last column of Tables 9, 10 and 10 A is the distribution costs expressed as a percentage of the commodity value. This is a good measure with which to compare route costs. For high value goods, this percentage is typically between 3 and 10 percent, with a maximum amount of just over 13 percent. For low value goods, however, these figures are very high, sometimes exceeding the total value of the goods. This demonstrates the theory behind pricing "what the traffic will bear". Clearly, low value commodities cannot bear the extremely high costs of many of these routes.

Table 10 Total Distribution Costs (tariff based - high value)

The analysis of total distribution costs on the basis of transport tariffs (high value commodities) is shown in Table 10. All elements of cost are similar to those costs shown in Table 9, except that tariffs are used for the transport costs instead of cost estimates.

Table 10 A Total Distribution Costs (tariff based - low value)

This analysis is the same as that shown in Table 10, except that the low value commodity is assumed for the purpose of time evaluation, loss and damage risk and the calculation of rail tariffs.

Table 11 South African Routing of SADCC Traffic

This table summarises the tonnages of SADCC traffic using South African transport routes. These tonnages indicate the dependency on RSA routes and are also expressed in terms of percentages of total imports/exports routed via the RSA.

Table 12 Annual Distribution Costs by Country (high value)

The total distribution costs for moving imports/exports for each country are summarised in this table. These costs are shown both on a cost and tariff basis for comparative purposes, and high value commodities are assumed for both of these calculations.

TABLE 9 TOTAL DISTRIBUTION COSTS (cost based - high value)
(Rands per ton)

		Transport Costs by Mode			Transport Costs Summary	Inventory Costs	Loading Costs	Loss & Damage	Total Distribution Costs	Percentage of Commodity Value
		Road	Rail	Water						
BOTSWANA										
A	RSA	46.04	0	0	46.04	4	5	10	65.04	1.3
B	Durban	0	90.69	0	90.69	14	5	25	134.69	2.69
A	Durban	124.78	0	0	124.78	12	5	10	151.78	3.04
A	Zimbabwe	141.74	0	0	141.74	6	5	10	162.74	3.25
B	Maputo	0	87.19	0	87.19	51	5	50	193.19	3.86
A	Walvis Bay	164.53	0		164.53	14	5	10	193.53	3.87
MALAWI										
B	Beira	0	54.42	0	54.42	21	5	50	130.42	2.61
A	Zimbabwe	112.22	0	0	112.22	4	5	10	131.22	2.62
B	Nacala	0	95.36	0	95.36	23	5	50	173.36	3.47
A/B	Beira (Hre)	112.22	57.93	0	170.15	51	10	60	291.15	5.82
A	RSA	297.02	0	0	297.02	12	5	10	324.02	6.48
A/B	Durban	112.22	187.6	0	299.82	49	10	25	383.82	7.68
A	Dar	276.81	0	0	276.81	29	5	100	410.81	8.22
A	Durban	375.76	0	0	375.76	23	5	10	413.76	8.28
A	Walvis Bay	528.27	0		528.27	23	5	10	566.27	11.33
A/B/C	Dar (Lake)	33.91	105.01	126.77	265.69	57	20	250	592.69	11.85

Route Codes
A = Road
B = Rail
C = Water

TABLE 9 (continued)

		Transport Costs by Mode Road	Rail	Water	Transport Costs Summary	Inventory Costs	Loading Costs	Loss & Damage	Total Distribution Costs	Percentage of Commodity Value
SWAZILAND										
A	RSA	46.09	0	0	46.09	4	5	10	65.09	1.3
A	Durban	47.74	0	0	47.74	10	5	10	72.74	1.45
A	Maputo	23.18	0	0	23.18	23	5	50	101.18	2.02
B	Durban	0	69.8	0	69.8	12	5	25	111.8	2.24
B	Maputo	0	46.26	0	46.26	27	5	75	153.26	3.07
ZAIRE										
B	RSA	0	247.49	0	247.49	31	5	25	308.49	6.17
B	Lobito	0	228.34	0	228.34	37	5	50	320.34	6.41
A	RSA	323.52	0	0	323.52	8	5	10	346.52	6.93
B	Durban	0	303.63	0	303.63	41	5	25	374.63	7.49
B	Beira	0	259.62	0	259.62	62	5	50	376.62	7.53
A	Durban	403.39	0	0	403.39	16	5	10	434.39	8.69
A	Walvis Bay	408.7	0		408.7	16	5	10	439.7	8.79
B	Dar	0	245.79	0	245.79	64	5	150	464.79	9.3
B/C	Dar (Lake)	0	372.25	42.26	414.51	82	15	250	761.51	15.23
B/C	Matadi	0	333.47	249.77	583.24	139	15	250	987.24	19.74

TABLE 9 (continued)

		Transport Costs by Mode Road	Rail	Water	Transport Costs Summary	Inventory Costs	Loading Costs	Loss & Damage	Total Distribution Costs	Percentage of Commodity Value
ZAMBIA										
A	Zimbabwe	92.13	0	0	92.13	4	5	10	111.13	2.22
A/B	Beira	92.13	55.07	0	147.2	45	10	60	262.2	5.24
B	Beira	0	206.39	0	206.39	51	5	50	312.39	6.25
A	RSA	289.61	0	0	289.61	8	5	10	312.61	6.25
B	E Lon	0	273.74	0	273.74	37	5	25	340.74	6.81
B	Lobito	0	281.57	0	281.57	41	5	50	377.57	7.55
A	Walvis Bay	374.79	0		374.79	14	5	10	403.79	8.08
B	Dar	0	192.56	0	192.56	57	5	150	404.56	8.09
B	Maputo (RSA)	126.23	163.34	0	289.57	62	5	50	406.57	8.13
A	Durban	368.35	0	0	368.35	27	5	10	410.35	8.21
A	Dar	355.89	0	0	355.89	35	5	100	495.89	9.92
ZIMBABWE										
B	Beira	0	57.93	0	57.93	53	5	50	165.93	3.32
A	Beira	104.1	0	0	104.1	29	5	55	193.1	3.86
B	Maputo (Limpopo)	0	117.97	0	117.97	31	5	50	203.97	4.08
A	RSA	184.8	0	0	184.8	10	5	10	209.8	4.2
B	Maputo (RSA)	0	116.84	0	116.84	66	5	50	237.84	4.76
B	Durban	0	187.6	0	187.6	31	5	25	248.6	4.97
A	Durban	263.54	0	0	263.54	21	5	10	299.54	5.99
A	Walvis Bay	393.25	0		393.25	16	5	10	424.25	8.49

TABLE 10 TOTAL DISTRIBUTION COSTS (tariff based - high value)

TABLE 10 TOTAL DISTRIBUTION COSTS (tariff based - high value)
(Rands per ton)

		Transport Costs by Mode Road	Rail	Water	Transport Costs Summary	Inventory Costs	Loading Costs	Loss & Damage	Total Distribution Costs	Percentage Commodity Value
BOTSWANA										
A	RSA	69.45	0	0	69.45	4	5	10	88.45	1.77
A	Durban	186.24	0	0	186.24	12	5	10	213.24	4.26
A	Zimbabwe	196.72	0	0	196.72	6	5	10	217.72	4.35
B	Durban	0	207.8	0	207.8	14	5	25	251.8	5.04
B	Maputo	0	191.27	0	191.27	51	5	50	297.27	5.95
A	Walvis Bay	303.42	0	0	303.42	14	5	10	332.42	6.65
MALAWI										
A	Zimbabwe	118.73	0	0	118.73	4	5	10	137.73	2.75
B	Beira	0	81.57	0	81.57	21	5	50	157.57	3.15
B	Nacala	0	143.1	0	143.1	23	5	50	221.1	4.42
A/B	Beira (Hre)	118.73	104.07	0	222.8	51	10	60	343.8	6.88
A	RSA	342.41	0	0	342.41	12	5	10	369.41	7.39
A	Dar	291.97	0	0	291.97	29	5	100	425.97	8.52
A	Durban	459.2	0	0	459.2	23	5	10	497.2	9.94
A/B	Durban	118.73	356.35	0	475.08	49	10	25	559.08	11.18
A	Walvis Bay	640.98	0	0	640.98	23	5	10	678.98	13.58
A/B/C	Dar (Lake)	34.92	183.54	152.12	370.58	57	20	250	697.58	13.95

Route Codes A = Road
B = Rail
C = Water

TABLE 10 (continued)

		Transport Costs by Mode Road	Rail	Water	Transport Costs Summary	Inventory Costs	Loading Costs	Loss & Damage	Total Distribution Costs	Percentage of Commodity Value
SWAZILAND										
A	RSA	71.97	0	0	71.97	4	5	10	90.97	1.82
A	Durban	77.79	0	0	77.79	10	5	10	102.79	2.06
A	Maputo	32.59	0	0	32.59	23	5	50	110.59	2.21
B	Durban	0	95.99	0	95.99	12	5	25	137.99	2.76
B	Maputo	0	38.68	0	38.68	27	5	75	145.68	2.91
ZAIRE										
B	Lobito	0	304.13	0	304.13	37	5	50	396.13	7.92
A	RSA	451.24	0	0	451.24	8	5	10	474.24	9.48
B	RSA	0	461.65	0	461.65	31	5	25	522.65	10.45
A	Walvis Bay	514.68	0	0	514.68	16	5	10	545.68	10.91
B	Beira	0	460.07	0	460.07	62	5	50	577.07	11.54
A	Durban	569.2	0	0	569.2	16	5	10	600.2	12
B	Dar	0	399.77	0	399.77	64	5	150	618.77	12.38
B	Durban	0	589.98	0	589.98	41	5	25	660.98	13.22
B/C	Dar (Lake)	0	452.86	50.71	503.57	82	15	250	850.57	17.01
B/C	Matadi	0	308.35	299.73	608.08	139	15	250	1012.08	20.24

TABLE 10 (continued)

		Transport Costs by Mode			Transport Costs	Inventory	Loading	Loss &	Total Distribution	Percentage of Commodity
		Road	Rail	Water	Summary	Costs	Costs	Damage	Costs	Value
ZAMBIA										
A	Zimbabwe	94.87	0	0	94.87	4	5	10	113.87	2.28
A/B	Beira	94.87	97.39	0	192.26	45	10	60	307.26	6.15
A	RSA	416.32	0	0	416.32	8	5	10	439.32	8.79
B	Lobito	0	353.36	0	353.36	41	5	50	449.36	8.99
A	Dar	366.47	0	0	366.47	35	5	100	506.47	10.13
A	Walvis Bay	479.76	0	0	479.76	14	5	10	508.76	10.18
B	Beira	0	410.84	0	410.84	51	5	50	516.84	10.34
B	Dar	0	350.55	0	350.55	57	5	150	562.55	11.25
A	Durban	533.11	0	0	533.11	27	5	10	575.11	11.5
B	Maputo (RSA)	129.98	332.44	0	462.42	62	5	50	579.42	11.59
B	E Lon	0	593.85	0	593.85	37	5	25	660.85	13.22
ZIMBABWE										
A	Beira	109.22	0	0	109.22	29	5	55	198.22	3.96
B	Beira	0	104.07	0	104.07	53	5	50	212.07	4.24
A	RSA	223.68	0	0	223.68	10	5	10	248.68	4.97
B	Maputo (Limpopo)	0	223.09	0	223.09	31	5	50	309.09	6.18
A	Durban	340.47	0	0	340.47	21	5	10	376.47	7.53
B	Maputo (RSA)	0	260.89	0	260.89	66	5	50	381.89	7.64
B	Durban	0	356.35	0	356.35	31	5	25	417.35	8.35
A	Walvis Bay	498.77	0	0	498.77	16	5	10	529.77	10.6

TABLE 10 A TOTAL DISTRIBUTION COSTS (tariff based - low value)

		Transport Costs by Mode Road	Rail	Water	Transport Costs Summary	Inventory Costs	Loading Costs	Loss & Damage	Total Distribution Costs	Percentage of Commodity Value
BOTSWANA										
A	RSA	69.45	0	0	69.45	0	5	1	75.45	15.09
B	Maputo	0	95.64	0	95.64	5	5	5	110.64	22.13
B	Durban	0	103.9	0	103.9	1	5	2.5	112.4	22.48
A	Durban	186.24	0	0	186.24	1	5	1	193.24	38.65
A	Zimbabwe	196.72	0	0	196.72	1	5	1	203.72	40.74
A	Walvis Bay	303.42	0	0	303.42	1	5	1	310.42	62.08
MALAWI										
B	Beira	0	40.79	0	40.79	2	5	5	52.79	10.56
B	Nacala	0	71.55	0	71.55	2	5	5	83.55	16.71
A	Zimbabwe	118.73	0	0	118.73	0	5	1	124.73	24.95
A/B	Beira (Hre)	118.73	52.04	0	170.77	5	10	6	191.77	38.35
A/B/C	Dar (Lake)	34.92	91.77	126.77	253.46	6	20	25	304.46	60.89
A	Dar	291.97	0	0	291.97	3	5	10	309.97	61.99
A/B	Durban	118.73	178.17	0	296.9	5	10	2.5	314.4	62.88
A	RSA	342.41	0	0	342.41	1	5	1	349.41	69.88
A	Durban	459.2	0	0	459.2	2	5	1	467.2	93.44
A	Walvis Bay	640.98	0	0	640.98	2	5	1	648.98	129.8

Route Codes A = Road
B = Rail
C = Water

TABLE 10 A (continued)

		Transport Costs by Mode Road	Rail	Water	Transport Costs Summary	Inventory Costs	Loading Costs	Loss & Damage	Total Distribution Costs	Percentage of Commodity Value
SWAZILAND										
B	Maputo	0	19.34	0	19.34	3	5	7.5	34.84	6.97
A	Maputo	32.59	0	0	32.59	2	5	5	44.59	8.92
B	Durban	0	47.99	0	47.99	1	5	2.5	56.49	11.3
A	RSA	71.97	0	0	71.97	0	5	1	77.97	15.59
A	Durban	77.79	0	0	77.79	1	5	1	84.79	16.96
ZAIRE										
B	Lobito	0	152.07	0	152.07	4	5	5	166.07	33.21
B	Dar	0	199.88	0	199.88	7	5	15	226.88	45.38
B	RSA	0	230.83	0	230.83	3	5	2.5	241.33	48.27
B	Beira	0	230.03	0	230.03	6	5	5	246.03	49.21
B	Durban	0	294.99	0	294.99	4	5	2.5	306.49	61.3
B/C	Dar (Lake)	0	226.43	42.26	268.69	8	15	25	316.69	63.34
B/C	Matadi	0	154.18	249.77	403.95	14	15	25	457.95	91.59
A	RSA	451.24	0	0	451.24	1	5	1	458.24	91.65
A	Walvis Bay	514.68	0	0	514.68	2	5	1	522.68	104.54
A	Durban	569.2	0	0	569.2	2	5	1	577.2	115.44

TABLE 10 A (continued)

		Transport Costs by Mode Road	Rail	Water	Transport Costs Summary	Inventory Costs	Loading Costs	Loss & Damage	Total Distribution Costs	Percentage of Commodity Value
ZAMBIA										
A	Zimbabwe	94.87	0	0	94.87	0	5	1	100.87	20.17
A/B	Beira	94.87	48.7	0	143.57	5	10	6	164.57	32.91
B	Lobito	0	176.68	0	176.68	4	5	5	190.68	38.14
B	Dar	0	175.27	0	175.27	6	5	15	201.27	40.25
B	Beira	0	205.42	0	205.42	5	5	5	220.42	44.08
B	E Lon	0	296.93	0	296.93	4	5	2.5	308.43	61.69
B	Maputo (RSA)	129.98	166.22	0	296.2	6	5	5	312.2	62.44
A	Dar	366.47	0	0	366.47	4	5	10	385.47	77.09
A	RSA	416.32	0	0	416.32	1	5	1	423.32	84.66
A	Walvis Bay	479.76	0	0	479.76	1	5	1	486.76	97.35
A	Durban	533.11	0	0	533.11	3	5	1	542.11	108.42
ZIMBABWE										
B	Beira	0	52.04	0	52.04	5	5	5	67.04	13.41
A	Beira	109.22	0	0	109.22	3	5	5.5	122.72	24.54
B	Maputo (Limpopo)	0	111.55	0	111.55	3	5	5	124.55	24.91
B	Maputo (RSA)	0	130.44	0	130.44	7	5	5	147.44	29.49
B	Durban	0	178.17	0	178.17	3	5	2.5	188.67	37.73
A	RSA	223.68	0	0	223.68	1	5	1	230.68	46.14
A	Durban	340.47	0	0	340.47	2	5	1	348.47	69.69
A	Walvis Bay	498.77	0	0	498.77	2	5	1	506.77	101.35

TABLE 11 SOUTH AFRICAN ROUTING OF SADCC TRAFFIC
(thousands of tons)

	Total Annual Tons		RSA Routing Percentages		RSA Routed Tonnages		Percentage RSA Routings by Country (imports plus exports)
	Imports	Exports	Imports	Exports	Imports	Exports	
Botswana	815	129	79	88	644	114	80.3
Malawi	514	291	85	95	437	276	88.57
Swaziland	565	1250	100	40	565	500	58.68
Zaire	422	587	90	35	380	205	57.98
Zambia	1329	726	50	0	665	0	32.36
Zimbabwe	1922	2204	77	63	1480	1389	69.53
totals	5567	5187			4171	2484	61.88
Percentage routed via RSA					74.92	47.89	

TABLE 12 ANNUAL DISTRIBUTION COSTS BY COUNTRY (high value)

TABLE 12 ANNUAL DISTRIBUTION COSTS BY COUNTRY (high value)
(thousands of rands)

				Country Totals	
		Cost Based	Tariff Based	Cost Based	Tariff Based
BOTSWANA					
B	Durban	14951	27950	89384	128668
A	Durban	3643	5118		
B	Maputo	0	0		
A	Walvis Bay	0	0		
A	RSA	40520	55104		
A	Zimbabwe	30270	40496		
MALAWI				309594	376328
A	Durban	266461	320197		
A/B	Durban	26867	39136		
A/B	Beira (Hre)	0	0		
B	Beira	0	0		
B	Nacala	0	0		
A/B/C	Dar (Lake)	0	0		
A	Dar	6162	6390		
A	Walvis Bay	0	0		
A	RSA	0	0		
A	Zimbabwe	10104	10605		

Route Codes A = Road
B = Rail
C = Water

TABLE 12 (continued)

				Country Totals	
		Cost Based	Tariff Based	Cost Based	Tariff Based
SWAZILAND		0	0	197401	220141
A	Durban	13239	18708		
B	Durban	27950	34498		
A	Maputo	0	0		
B	Maputo	114945	109260		
A	RSA	41267	57675		
ZAIRE				634037	768732
B/C	Matadi	360343	369409		
B	Dar	0	0		
B/C	Dar (Lake)	44929	50184		
B	Durban	76799	135501		
A	Durban	109901	151851		
B	Lobito	0	0		
B	Beira	0	0		
A	Walvis Bay	0	0		
A	RSA	29108	39836		
B	RSA	12957	21951		

TABLE 12 (continued)

		Cost Based	Tariff Based	Country Totals Cost Based	Country Totals Tariff Based
Zambia				699361	933351
B	Dar	259323	360595		
A	Dar	98682	100788		
B	Beira	45297	74942		
A/B	Beira	19141	22430		
B	E Lon	0	0		
A	Durban	136236	190937		
B	Lobito	0	0		
B	Maputo (RSA)	0	0		
A	Walvis Bay	0	0		
A	RSA	103787	145854		
A	Zimbabwe	36895	37805		
Zimbabwe				937787	1324137
B	Beira	68363	87373		
A	Beira	51944	53321		
B	Maputo (RSA)	136996	219969		
B	Maputo (Limpopo)	0	0		
B	Durban	302546	507915		
A	Durban	106037	133270		
A	Walvis Bay	0	0		
A	RSA	271901	322289		

8.0 CONCLUSIONS

"If I needed shoes and South Africa was the only place I could get shoes, I would do without them. But if I needed corn and South Africa was the only place to get corn, I would go to South Africa."

(Julius Nyerere)

Within this last section the output spreadsheets of the Regional Distribution Cost Model will be evaluated with respect to least cost route evaluation, dependency on South African routes and an evaluation of total transport costs for each country.

The essence of the hypothesis described at the beginning of this paper is that a net decrease in transport costs would occur if the barriers to utilising the least cost transport route were removed and goods of any country could be shipped over any of the region's routes. This hypothesis is proved to be correct through application of the Regional Distribution Cost Model and results are shown within this section.

8.1 Least Cost Routes

For each country the transport routes are listed in sequence from lowest to highest cost and shown in Table 9 for cost based transport costs and in Table 10 for tariff based transport costs.

8.1.1 Least Cost Routes - Cost Based Transport Costs

In order to evaluate the ranking of routes for different commodity types, Table 9 is produced for three commodity values: R 500 per ton, R 5000 per ton and R 10000 per ton. Table 13 summarises the identification of the route rankings for each of these commodities, by country.

TABLE 13 ROUTE RANKINGS FROM LOW TO HIGH COST (cost based transport costs)

	Commodity Value per Ton		
	R 500	R 5 000	R 10 000
Botswana	South Africa	South Africa	South Africa
	Durban (rail)	Durban (rail)	Durban (rail)
	Maputo	Durban (road)	Durban (road)
	Durban (road)	Zimbabwe	Zimbabwe
	Zimbabwe	Maputo	Walvis Bay
	Walvis Bay	Walvis Bay	Maputo
Malawi	Beira (rail)	Beira (rail)	Zimbabwe
	Nacala	Zimbabwe	Beira (rail)
	Zimbabwe	Nacala	Nacala
	Beira (Hre)	Beira (Hre)	South Africa
	Dar es Salaam	South Africa	Beira (Hre)

Table 13 (continued)

	South Africa	Durban (ro/ra)	Durban (road)
	Dar (lake)	Dar es Salaam	Durban (ro/ra)_
	Durban (ro/ra)	Durban (road)	Dar es Salaam
	Durban (road)	Walvis Bay	Walvis Bay
	Walvis Bay	Dar (lake)	Dar (lake)
Swaziland	Maputo (road)	South Africa	South Africa
	South Africa	Durban (road)	Durban (road)
	Durban (road)	Maputo (road)	Durban (rail)
	Maputo (rail)	Durban (rail)	Maputo (road)
	Durban (rail)	Maputo (rail)	Maputo (rail)
Zaire	Lobito	South Africa (rail)	South Africa (rail)
	South Africa (road)	Lobito	South Africa (road)
	Dar es Salaam	South Africa (road)	Lobito
	Beira	Durban (rail)	Durban (rail)
	Durban (rail)	Beira	Durban (road)
	South Africa (rail)	Durban (road)	Walvis Bay
	Durban (road)	Walvis Bay	Beira
	Walvis Bay	Dar (rail)	Dar (rail)
	Dar (lake)	Dar (lake)	Dar (lake)
	Matadi	Matadi	Matadi
Zambia			
	Zimbabwe	Zimbabwe	Zimbabwe
	Beira (ro/ra)	Beira (ro/ra)	South Africa (road)
	Dar (rail)	Beira (rail)	Beira (ro/ra)
	Beira (rail)	South Africa (road)	East London
	East London	East London	Beira (rail)

Table 13 (continued)

	Lobito	Lobito	Walvis Bay
	South Africa (road)	Walvis Bay	Durban (road)
	Maputo (RSA)	Dar (rail)	Lobito
	Dar (road)	Maputo (RSA)	Maputo (RSA)
	Durban (road)	Durban (road)	Dar (rail)
	Walvis Bay	Dar (road)	Dar (road)
Zimbabwe	Beira (rail)	Beira (rail)	South Africa (road)
	Beira (road)	Beira (road)	Beira (rail)
	Maputo (Limpopo)	Maputo (Limpopo)	Beira (road)
	Maputo (RSA)	South Africa (road)	Maputo (Limpopo)
	South Africa (road)	Maputo (RSA)	Durban (rail)
	Durban (rail)	Durban (rail)	Durban (road)
	Durban (road)	Durban (road)	Maputo (RSA)
	Walvis Bay	Walvis Bay	Walvis Bay

source: Table 9 as amended by changing commodity values.

Several interesting observations can be drawn from these results. Firstly, it must be noted that all routes shown are not presently open for traffic; the Nacala route, the Beira rail route from Malawi, the Lobito route and the Limpopo line from Zimbabwe to Maputo. These routes are incorporated in the model, with estimated costs, to demonstrate the complete route choices when the rehabilitation efforts are successfully completed. Routes to "South Africa" and "Zimbabwe" indicate freight flows destined or originated in these countries. It does not imply transit through South Africa, for example.

For virtually every country analysed, routings via South Africa (or South African ports) increase in attractiveness as the value of the commodity increases. For Zaire and

Zimbabwe, South African routings become the least cost routes with increasing commodity value. It is also interesting to note that Matadi is the most expensive routing for Zaire, regardless of commodity value.

The including of Zimbabwe as an origin/destination can be misleading. While this routing appears to be the least cost route for some countries (i.e., Zambia and Malawi), in reality the Zimbabwe market for exports from these countries is limited and Zimbabwe as a source of imports is rapidly becoming less important as economic problems in that country become more severe.

Lobito (via the Benguela Railway) could be a very attractive route for Zaire, even for high value goods. It is interesting to note that Lobito is not an attractive option for Zambia. The Dar es Salaam route is favourable for Zambia only for low value commodities.

8.2 Dependency

Dependency of SADCC on South African routings is indicated in Table 11 entitled: "South African Routing of SADCC Traffic". This table indicates that at present, dependency ranges from 32 percent (Zambia) to 89 percent (Malawi). For the six SADCC countries analysed in Table 11, the overall dependency is 62 percent in terms of tonnage. For imports and exports these dependency figures are 75 percent and 48 percent, respectively.

With the completion of the SADCC transport improvement projects, the individual routing percentages can be entered in Table 11 and the extent of dependency can be readily computed by the model.

8.3 Total Distribution Costs

The total distribution costs for each country are shown in Table 12. The calculation is made by multiplying the cost per ton for each route as shown in Tables 9 and 10 (cost based and tariff based, respectively) by the total tons moved over that route as shown in Table 4.

The model can be used to analyse the effect of certain countries utilising more cost efficient routes as shown in Table 13. This is accomplished by adjusting the percentage of commodities moved over each route in Table 4 and was done for four countries: Malawi, Zaire, Zambia and Zimbabwe. The following describes the routing adjustments which were made and the annual amount of distribution costs saved by the new routings are also shown. The effect on total distribution costs for these countries is quite significant as shown in Table 14. The cost based transport costs were assumed, using the high value commodity.

1. Malawi — 80 % of imports and exports are routed via Nacala instead of Durban. The annual distribution cost reduction would be R 154 817 000.

2. Zaire — 90 % of exports are routed via Lobito instead of Matadi and Durban. Only 10 % are routed via Matadi. The annual distribution cost reduction would be R 186 877 000.

3. Zambia — 90 % of exports are routed via Beira, only 20 % via Dar es Salaam. The annual distribution cost reduction would be R 33 458 000.

4. Zimbabwe — 46 % of imports and 50 % of exports are routed via Maputo (Limpopo) with only 10 % of imports and exports are routed via South Africa. The annual distribution cost reduction would be R 54 336 000.

TABLE 14 TOTAL DISTRIBUTION COSTS BY COUNTRY
USING ADJUSTED ROUTING PERCENTAGES
COST BASED TRANSPORT COSTS (HIGH VALUE)
(thousands of rands)

	Base Case	Adjusted Routings
Malawi	309 594	154 777
Zaire	634 037	447 160
Zambia	699 361	665 903
Zimbabwe	937 787	883 451

source: Table 12 as amended by changes to Table 4.

This analysis can also be performed using tariff based transport costs, still with the high value commodity assumption. The results of this analysis are shown in Table 15.

TABLE 15 TOTAL DISTRIBUTION COSTS BY COUNTRY
USING ADJUSTED ROUTING PERCENTAGES
TARIFF BASED TRANSPORT COSTS (HIGH VALUE)
(thousands of rands)

	Base Case	Adjusted Routings
Malawi	376 328	198 519
Zaire	768 732	552 223
Zambia	933 351	916 758
Zimbabwe	1 324 137	1 258 237

source: Table 12 as amended by changes to Table 4.

8.4 Further Applications

Robert Banks, a prominent transport consultant who has been active in transport economic policy analyses for more than 30 years in Washington, D C, has said on several occasions: "Research which costs nothing is worth nothing". Research that lives out its existence in an academic thesis, no matter how original or innovative, and never is applied to a practical problem nor is instrumental in the identification of solutions to these problems, is of little value.

The Government of Malawi has contracted the author to adapt the framework of the regional transport model, as described in this paper, to Malawi's transport of imports and exports with the objective of ascertaining the distribution cost savings that would result if the Nacala rail route were to be a viable transport option to road haulage through South Africa.

A description of the adaptation of this model, showing the application to the specific purpose requested by the Government of Malawi, is shown in Appendix A. While it should be clearly understood that the contents of Appendix A represent essentially a separate report, prepared for a private client, it does represent an application of the principles discussed in this thesis development and a direct adaptation of the Regional Distribution Cost Model to the particular circumstances of Malawi. The example is shown to emphasise the point that the model is theoretically sound and has direct and useful application in identifying the magnitude of the transport cost burden faced by Malawi.

The potential applications of the model are not restricted to this paper nor the specific assumptions or conclusions contained within. As the region's transport routes are improved, routes which are presently closed become operational and the transport cost functions and operational characteristics change, there will be an even greater requirement for analytical tools with which to reassess the transport situation and its effects on the countries in the region.

Only a few of the potential applications have been presented in this paper to demonstrate the model's usefulness. In addition, accurate information regarding transit times is not always available. For example, Malawi's all rail route to Beira is not now operational and, based on recent investigations by SADCC consultants, not likely to become so in the near future. The number of transit days shown in Table 6 for this route are therefore set to zero which causes this route to appear artificially favourable. If this route does become a viable proposition, the actual number of transit days can be entered and the route will be ranked properly with respect to Malawi's other choices.

During the course of future applications, refinements can be made to the model to best reflect the changing transport and political environment in this region.

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TOTAL DISTRIBUTION COSTS
FOR MALAWI'S INTERNATIONAL TRAFFIC

LIST OF TABLES AND EXHIBITS

EXECUTIVE SUMMARY

Since the early 1980's, the rail lines linking Malawi with the Mozambique ports of Nacala and Beira have been effectively closed to international traffic on account of insurgency activities in the area as well as the deteriorated condition of the rail lines and facilities. During this time, most imports and exports have been moving by road using South African ports at greatly increased costs.

Recently, an extensive rehabilitation program has been initiated for the ultimate restoration of the Nacala rail line to a viable transport route. Funding for this rehabilitation has come primarily from France, Canada and Portugal. Initially, attacks on the rehabilitation team caused several temporary halts to the work, which had been completed less than half the distance from Nacala to the Malawi border.

As of December, 1989, a limited rail service has been inaugurated in order to give Malawi importers and exporters an option to the long and expensive road haul to South Africa. During the first six months of operation, several successful block movements of tobacco, tea and fertilizer have been made, though total tonnage over the line has been comparatively small - a total of just over 13 thousand net tons between December, 1989 and June, 1990.

The primary task of this investigation is to estimate the total distribution costs of moving Malawi's imports and exports over routes currently used and to ascertain the potential transport cost savings if the Nacala route could be utilised to a greater extent.

Based on discussions with past and present users of Nacala, as well as transport organisations and freight forwarders, it was determined that if the security situation were to become stabilised, the track rehabilitation work completed and increased shipping services were offered, that Nacala could handle 50 percent of Malawi's foreign trade. This 50 percent figure is incorporated in the definition of "Nacala Open" as used in this report.

Major importers and exporters were interviewed as well as transport operators, freight forwarders and overseas aid organisations. Information obtained from these organisations included tonnages of commodities moved, routes utilised, transit times and costs for each route.

In order to analyse this information in a structured manner, a transport cost model for Malawi's foreign trade was developed, incorporating the information obtained from the interviews. The model consists of a series of linked spread sheets which can be operated on any IBM compatible personal or portable computer. Within the model, the percentage of each commodity using various routes are specifically identified and can be changed as circumstances require, with the transport costs automatically recalculated.

Results of this investigation show that there are considerable potential savings and are summarised in Table 1.

TABLE 1 **TRANSPORT COSTS - EXISTING ROUTES COMPARED WITH INCREASED USE OF THE NACALA ROUTE**

(U S Dollars in Thousands)

	Annual Transport Costs	
	Existing Routes	**Nacala Open**
Imports		
Petroleum	29 485	19 288
Fertilizer	34 373	31 015
Other	181 716	127 337
Exports		
Tobacco	9 600	9 598
Sugar	9 222	8 683
Tea	10 925	10 785
Cotton	472	438
Other	5 738	5 295
Total	281 531	212 439
Cost Saving	69 092	

source: Malawi Transport Model

Based on this analysis, an annual saving of U S $ 69 million could be achieved under the "Nacala Open" scenario.

The majority of the cost savings are for imports, with cost differences for exports being comparatively marginal. This situation could improve with time and increased volumes of unit trains of tea and tobacco being operated and more favourable rail rates negotiated with CFM.

In terms of percentage of value, the transport cost saving for moving of imports amounts to more than 25 percent of the total value of imports.

With such high potential savings in transport costs, investigations should be made into the current track rehabilitation program being accelerated. The present program is for work to be completed in 2.5 - 3 years' time, and the Cuamba - Entre Lagos section has not yet been funded. During this three year period, the additional transport costs incurred on behalf of Malawi's foreign trade are estimated to be in excess of US $ 200 million.

The Nacala rail route is clearly the lifeline for Malawi. Successful rehabilitation of the line, as well as continued security within the region are essential to the economic well - being of the country and any means by which the rehabilitation work could be accelerated would be of significant benefit to the country.

TRANSPORT ACTION PLAN

Based on the evaluation of the critical transport problems facing Malawi today, several specific actions can be identified which could ease the transport cost burden on the country.

1. Promotion of the Nacala Transport Corridor as a single coordinated transport system

This action involves positive steps to enhance and promote the joint railway operations as presently being undertaken between the Malawi Railways and the Caminhos de Ferro de Mocambique. This is to complement the excellent work now being done by the Malawi Railways.

Several areas of possible improvement can be identified including the following:

Establishment of improved locomotive maintenance and servicing facilities at Nampula and Nacala. This would increase the possibility of Malawi Railways locomotives operating over longer distances in Mozambique. With the current serious shortage of serviceable CFM locomotives, this could be seen as a temporary measure to improve service on the line until additional power is available.

When the number and standard of CFM locomotives increases in the future, consideration should be given to joint running of CFM locomotives in Malawi and Malawi Railways locomotives running in Mozambique. By pooling power, wagons and train and engine personnel, the joint operation would reach its maximum efficiency.

While tonnage moving over the route has been relatively small, many successful trial shipments have been made and these "success stories" should be publicised. A specifically directed marketing effort and promotion of the Nacala Corridor should be undertaken, emphasising the service and facilities available and particularly the successful movements which have already taken place. This promotion could include professionally prepared brochures, presentations to potential clients and field trips for site inspections.

2. Improvement of the capability of Nacala to handle break bulk shipments.

Nacala has the reputation among many shippers and transporters of being a good container port but not an efficient break bulk port. Specifically, shortage of tarpaulins, lack of suitable CFM rail wagons and inadequate storage capacity have been identified. These issues should be specifically addressed, either directly with Malawi Railways or the CFM, or possibly even with potential donor agencies for quick action.

3. Acceleration of the Nacala - Malawi railway rehabilitation program.

Based on the significant amount of potential annual savings (US $ 69 million), approaches should be made to the countries representing the consortium undertaking the work, or possibly to other countries, for accelerating the pace of the work. With the value to Malawi at approximately US $ 1.33 million per day, on the strength of this study, the benefits to the country can be readily demonstrated. Presentation of this study's results could be one approach.

4. Reduction of transport tariffs over CFM for Malawi exports.

Because of relatively high value of most of Malawi's exports, rates on CFM are relatively high. With future unit or block trains of tea and tobacco possible, considerable rate reductions should be negotiated with CFM. This would increase the annual transport cost savings through using the Nacala route to even higher levels than shown in this report.

1.0 INTRODUCTION

This project was undertaken at the request of the Malawi Ministry of Transport with the objective to ascertain the total cost of moving Malawi's import and export traffic over routes currently being used. In addition, the financial impact of utilising the port of Nacala to a greater extent was analysed and results incorporated in this report.

In order for Nacala to play a greater role, however, importers and exporters, both within and outside of Malawi, must have confidence in the rail line and the port to move their goods in a fast and effective manner. Three events must happen in order for this confidence to be firmly established:

1. The rehabilitation process, which is already under way, must be successfully completed to allow significantly increased train speeds with a much greater margin of safety than which presently exists;

2. The security situation, though relatively quiet during the time of this investigation, must also remain under control;

3. The frequency of shipping services at Nacala must be adequate to meet the needs of users.

As this study was undertaken during the first half of 1990, the tonnage statistics and routes utilised for major imports and exports were based on 1989 annual results, transport costs and rates which were in effect during the latter part of 1989.

2.0 MALAWI'S TRANSPORT PROBLEM

Until the early 1980's, Malawi had one of the most impressive records of economic growth in Africa. The decline since that time has been attributed to two factors: influx of nearly one - half million refugees from Mozambique - this single event has caused Malawi to become a net importer of food; the second factor was the large increase in transport costs due to the near - total reliance on road haulage for moving the country's foreign trade. Previous studies have shown the excess amount of transport costs (land portion only) have been estimated to be in the order of 100 million Kwachas annually. The country's economy cannot continue to afford this high cost.

With the effective closure of the rail lines to Beira and Nacala since the early 1980's, the country has had to rely on road transport, primarily over comparatively long routes through South Africa, for moving its foreign trade. The amount of foreign trade crossing each of the three major road borders during 1989 is shown in Table 2.1.

TABLE 2.1 MALAWI'S FOREIGN TRADE FLOWS BY BORDER POST - 1989

Border Post	Tons (000)	Percentage
Mchinji	207	23 %
Mwanza	583	65 %
Kaporo	100	12 %
total	891	100 %

source: Malawi Ministry of Communications

Traffic crossing the Kaporo border post represents movements to and from Dar es Salaam over the "Northern Corridor" route. While this route was originally identified as a multi - modal rail/lake/road/rail route, most of the traffic now moving is by road over the entire distance. The 12 percent figure represents a significant increase in the use of this route over the past several years. In 1986 and 1987, only about 5 percent of Malawi's trade moved through Dar es Salaam.

At the heart of this transport problem is the fact that the Nacala railway line has not been operational for nearly eight years, due to insurgent activity in Mozambique as well as general deterioration of the condition of the line. In 1983, a Portuguese - French consortium was awarded a contract to rehabilitate the Nacala Railway line, with most track material being supplied by Canada. The Nacala - Nampula section was completed in November, 1986, but further work was halted because of a breakdown in security in April, 1987, with work completed only a few kilometres east of Namina.

With increased efforts directed towards maintaining security along the route, both in the field and at the negotiating table, the Nacala rail line was officially opened with a limited rail service in December, 1989. Security is being provided by Malawi and Mozambique, with assistance from other private security organisations, and the French - funded rehabilitation of the line between Namina and Cuamba is due to be restarted in July or August, 1990.

While many of Malawi's importers and exporters still are reluctant to commit significant amounts of traffic to the Nacala line at this time, some shipments of tea, tobacco and fertilizer have been successfully moved during the early part of 1990. Since the official opening of the route in December, 1989, a total of 10 750 net tons of imports and 2 576 tons of exports have been moved over the line (up to and including June, 1990). An important task of this project is to quantify the financial benefits of utilising the line to a greater extent.

3.0 METHODOLOGY

The methodology employed in the undertaking of this project consisted of three primary tasks:

Task 1. Identification of Major Route Characteristics;

This task was undertaken primarily by interviewing major importers and exporters as well as transport operators. In addition, recent SADCC publications regarding transport routes and rehabilitation programs were also consulted. The characteristics identified were transit times, modes of transport utilised and any problems associated with using a particular route.

Task 2. Determination of Route Volumes and Costs;

Total import and export statistics were obtained from Malawi Government reports. Routing information for individual commodities was obtained from discussions with importers and exporters in Malawi. Costs were obtained partly from importers and exporters and also from transport operators and forwarders. For each commodity, the percentage of movements over each route were incorporated in the model and form the basis of total route cost calculations.

Task 3. Development of Malawi Distribution Cost Model

This model consists of a series of linked spread sheets which incorporate the route characteristics, volumes and unit costs of goods moving over each route. Within this model, total costs for goods moving over each route are calculated, based on routing percentages for each commodity. The model is designed for maximum flexibility so that any cost or routing element can be changed and the impact on total transport costs is immediately calculated.

The Consultant undertook most of the work for this project in Malawi, with some discussions with freight forwarders and shipping companies in South Africa.

Statistics regarding the tonnages of each major commodity imported and exported were obtained from Malawi Government reports, primarily the Monthly Statistical Bulletin and Budget Document Number 4 - Economic Report published by the Department of Economic Planning and Development.

Primary transport routes utilised, as well as costs, for each of these commodities were identified though discussions with several Malawi government organisations as well as from freight forwarders, shipping companies, road and rail transport organisations. The costs represent typical land transport rates paid for the movement between Malawi and the port, all port charges and sea freight costs between the port and country of origin/destination. Where there was a choice of ocean carriers from a particular port, the conference line level of rates was selected for incorporation in the model. There may, however, be lower rates negotiated between individual importers/exporters and some non-conference shipping companies. It was not possible to obtain all these confidential agreements - by using the published rates from each port, the differences between Nacala and other ports can be used as a surrogate for the differences between such contract rates for the same ports.

An example of incentive ocean rates which already exist to promote the use of Nacala is the northbound rate offered by Safmarine of US $ 250 per 6 metre container from Durban to Nacala/Beira. This rate is offered only to Safmarine customers with traffic originating overseas. For traffic from other ocean carriers, Safmarine would charge US $ 555 per 6 metre container. For the purpose of this study, the incentive rate of US $ 250 has been used. A sensitivity analysis has been performed using the US $ 555 rate for imports and the impact on study results was found to be within five percent.

It must be understood that the rates shown in this report were obtained by the Consultant from transport organisations which were in effect during the time the study was undertaken. Should specific sea freight rates or land costs rates change in the future, the new values need only be entered to the spread sheet and the total costs are quickly recalculated by the model.

The security situation along the Nacala rail route was discussed in detail with representatives of the Malawi Railways, Lonrho and other individuals directly concerned with the operation over this route. In addition, current and future funding programs for the upgrading of the route were discussed with representatives of international aid organisations.

In addition to transport costs, the value of time has been quantified by applying a cost of money rate (15 %) to the average value of each commodity. This value is expressed on a daily basis and applied to the estimated transit time over each transport route. Combined with transport costs, these time values represent total distribution costs for moving each major commodity.

3.1 The Malawi Transport Cost Model

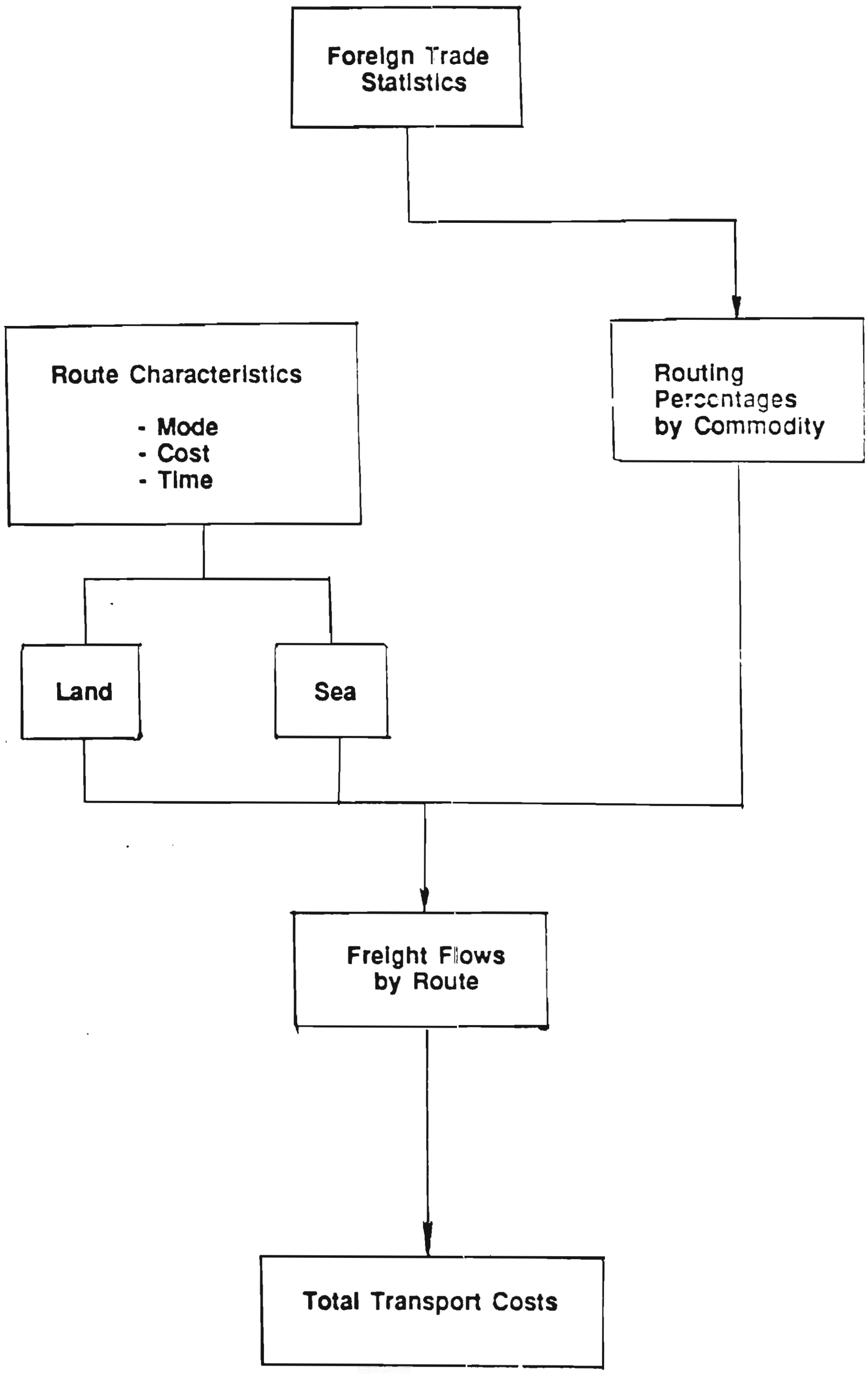
In order to analyse this commodity and cost information in a structured manner, a transport model has been developed which incorporates the interaction among commodities, costs and routes chosen. The model is in the form of a series of linked spread sheets which represent the major international trade flows of Malawi. The model is written in Supercalc 4 and can be run on any IBM - compatible personal or portable computer. A flow diagram of these spread sheets is shown in Exhibit 1.

The percentage of major commodities moved over each route are shown in Tables 1 through 3 of the spread sheets. These represent the routing of such commodities during 1989. As the Nacala route becomes more viable, with regard to transit times, reliability and improved shipping service, the percentage of each commodity using this route can be increased by retyping the adjusted percentages in the model. Examples of increased use of Nacala is quantified in this manner further in this report.

A summary of the annual tonnages for each commodity are shown in Table 4, along with the average value per ton, expressed in Malawi Kwacha as well as US Dollars. The exchange rate

EXHIBIT 1

MALAWI TRANSPORT COST MODEL



used throughout this report is KW 1 = US $ .40. The cost of money assumed for the purpose of this exercise in 15 percent.

The land transport cost functions are shown in Tables 5 and 6, expressed in US Dollars per ton, with sea transport costs shown in a similar manner in Table 7.

Table 8 indicates the transit times, in terms of days, between Malawi and the port indicated, for each commodity. This information is used to develop time costs, as applied to the commodity values shown in Table 4.
Routing of overseas trade is shown in Table 9 for each major commodity analysed.

The freight flows over each route, by commodity, are shown in Table 10. These values are calculated by applying the routing percentages in Tables 1 - 3 to the total tonnages shown in Table 4.

Transport costs, for both land and sea, are calculated and shown in Table 10, with the time costs and total distribution costs shown in Tables 12 and 13, respectively.

Tables 14 and 15 show costs per ton, over each route, for imports and exports, respectively.

There are two transport scenarios which are evaluated within this investigation - the "Base Case" which represents the transport routes as they were utilised by Malawi's foreign trade during 1989, and the "Nacala Open" scenario, which assumes that the rail route between Malawi and the port of Nacala is free from security risks, transit times are maintained on a regular basis and shipping services at Nacala are operated on a frequent basis to ensure users of reliable service over the route. It was determined that a rehabilitated Nacala would be capable of handling 50 percent of Malawi's foreign trade.

4.0 MALAWI'S FOREIGN TRADE

The analysis of imports and exports consisted of identifying total tonnages of each major commodity from government reports for the year 1989, estimating the percentages of each commodity moving over each major transport route (as well as the transport costs) through discussions with importers and exporters and entering this information to the transport model for analysis and evaluation.

It would be impractical to so evaluate each commodity in detail. For this reason, the most important imports and exports, in terms of total value and tonnage, were identified and analysed individually. The difference between the sum of the individual commodities evaluated and the total imports or exports were incorporated in the "other" category for exports and "containerised commodities" for imports. The sum of all categories of imports and exports evaluated in this study balance to the total trade figures shown in the Budget Document Number 4 published by the Department of Economic Planning and Development.

The terms of reference for this study initially identified the following commodities for analysis:

Imports	Exports
POL	Tea
Fertilizer	Tobacco
Manufactured Products	Sugar
Containerised Commodities	Cotton

In order to better incorporate all imports and exports of Malawi, this list has been slightly modified. Manufactured products and containerised commodities have been combined into one category (termed "containerised commodities") as these represent essentially the same type of commodity with regard to the cost of transport and routes utilised. Regarding exports, an additional category of "other" has been added in order to balance to the total exports of the country.

The total tonnage for each import and export commodity group is shown in Table 4.1. Also shown in Table 4.1 are the average values for each commodity, expressed in terms of US Dollars per ton. These values are used to estimate time costs, described further in this report.

TABLE 4.1 **MALAWI'S IMPORTS AND EXPORTS 1989 TONNAGES**

	Total Tons	Value ($ per ton)
Imports		
POL (fuel)	122 590	432
Fertilizer	184 720	306
Other	399 390	400
sub total	706 700	
Exports		
Tobacco	57 874	3 165
Sugar	53 106	492
Tea	38 210	1 061
Cotton	2 747	2 424
Other	32 863	1 481
sub total	184 800	
total	891 500	

source: Malawi Monthly Statistical Bulletin, December, 1989;
Budget Document No. 4, Economic Report, Malawi Department of Economic Development

The tonnage of POL was estimated using figures originally expressed in litres, as obtained from Oilcom and expressed in terms of tons by applying an average density factor for diesel and petrol.

The percentage of each commodity using the various routes have been identified through discussions with importers and exporters and these percentages have been incorporated in the spread sheet. The cost of transporting each commodity over the land route between Malawi and the port, and by sea to final destination, are applied to the annual tonnages and total transport costs calculated.

5.0 ROUTE DESCRIPTIONS

The following are descriptions of the primary routes which were used by Malawi's importers and exporters in serving overseas origins and destinations, respectively, during 1989.

5.1 Dar es Salaam

There is presently more than US $ 254 million allocated to the upgrading of the TAZARA Railway and Malawi - Dar es Salaam projects, as part of the Southern African Development Coordination Conference (SADCC) projects as tabled in Lusaka in January, 1990.

Malawi's use of Dar es Salaam was originally envisaged as a multi-modal route utilising rail transport to Chipoka, lake transport to Chilumba, road transport to Mbeya in Tanzania where goods were to be transferred to the Tazara Railway for final haulage to Dar es Salaam. While rehabilitation of the facilities along this route are currently under way, it is the general opinion among transport users that because of the number of transshipments necessary, the lack of suitable equipment and the logistical problems in coordinating such modal transfers, only an all road route between Malawi and Dar es Salaam will be viable in the long term.

While Tanzanian hauliers predominate over this route, more Malawi haulage firms are participating in this traffic.

The road from Lilongwe to Chilumba and Karonga is paved throughout and is in good condition. The condition of the road through Tanzania is reported to be in desperate need of repair, and the route from Karonga at the northern end of Lake Malawi and the Tazara Railway junction at Mbeya is yet to be fully tarred. While service on the Tazara Railway is considered to be unreliable because of the shortage of serviceable locomotives and wagons, the coordination with the Tanzanian Harbours Authority (THA) in Dar es Salaam is seen as one of the most serious problems with using the route.

Dar es Salaam is also utilised for the import of fuel, with crude oil transported via the Tazama pipeline to the Ndola refinery, and moved by road transport from the refinery to Malawi destinations. Refined fuel is also landed at Dar es Salaam and brought directly to Malawi by truck.

Despite these problems with the route, the port of Dar es Salaam is becoming more important for Malawi's trade. In 1986, only 5 percent of imports and exports crossed the northern border post of Kaporo, while in 1989 this percentage has increased to over 11 percent.

Port improvement projects have improved physical conditions at Dar es Salaam. There is a new container terminal and storage facility and the Malawi cargo centre is in final stages of completion. The main problem in making greater use of the port is the relatively high risk of loss and damage to high value commodities. In addition, the lack of serviceable handling equipment within the port means that result that freight forwarders and other organisations must provide their own handling equipment (while paying for such services through the port tariffs) for the expeditious movement of their customers' goods.

5.2 Nacala

Until intensified insurgency activities by Renamo guerrillas halted virtually all traffic in 1983/84, Malawi relied almost exclusively on its direct rail links to the ports of Nacala and Beira. In an effort to rectify this serious situation in 1983, a Portuguese - French consortium was awarded a contract to rehabilitate the Nacala - Malawi rail line, with rails supplied by Canada. The Nacala - Nampula section was completed in November, 1986, with work on the Nampula - Malawi border section scheduled to commence in April, 1987, but due to repeated Renamo attacks, the work had been suspended until recent months, with the rail link effectively closed during this time.

During 1989, a total of 73.6 thousand tons of goods were moved over the line, most of which was local Mozambique traffic and only 7.6 thousand tons for Malawi. Since December 1989, a regular rail service has been inaugurated over the route, with existing schedules showing 2 trains per week, in each direction, with transit times being advertised as 10 days, primarily on account of the poor track conditions. In many places, speeds in excess of 5 kilometres per hour cannot be exceeded. The total tonnage of Malawi imports and exports moved over the Nacala line between December, 1989 and June, 1990 are shown in Table 5.1.

TABLE 5.1 MALAWI TRAFFIC MOVED OVER NACALA RAIL ROUTE (19 December 1989 - 30 June 1990)

Month	Total Tons Imports	Exports
December	648	24
January	848	22
February	847	1 413
March	4 098	302
April	1 733	153
May	2 060	479
June	516	183
total	10 750	2 576

source: Malawi Railways

The first phase of the rehabilitation work (the 192 kilometres between Nacala and Nampula) has been completed with the second phase, between Nampula to Cuamba (346 kilometres) scheduled to begin again by mid - 1990. Additional security provided by Malawi and Mozambique, along with the general "easing" of the security situation in the region has resulted in the track condition being the main obstacle to faster and more reliable rail service to Nacala.

The work is being carried out by the Brigada de Melhoramentos do Norte (BMN), whose task is to manage, implement and supervise this work on behalf of the DNPCF (the Mozambique Ports and Railway Organisation). BMN works closely with the consortium of French and Portuguese firms in undertaking this rehabilitation.

While the major rehabilitation by the consortium is yet to begin in earnest, several sections of the line have been given "spot repairs" by Malawi Railways and CFM maintenance gangs. In particular, the Malawi Railways has undertaken such repairs on the Entre Lagos - Cuamba section (currently not covered by the consortium's responsibility) and a joint MR/CFM effort has been made between Malema and Tui.

Coupled with the need to rehabilitate the track structure over this line is the necessity to establish a frequent and reliable shipping service calling at Nacala. Most services now consist of feeder vessels connecting with long distance shipping at Durban or Beacon conference vessels at Mombasa. While some charter ships may provide direct links with Europe or North America, most shipments are made utilising these feeder routes. A direct shipping service between Nacala and the USA has been inaugurated in July, 1990, by Safbank. One vessel per month will call at Nacala sail directly to the USA (after a call at Durban - no transfer of Nacala cargo). Also on a monthly basis, Unistar offers a ship between Durban and Nacala.

Rail service is a joint operation with the Malawi Railways locomotives and crews operating from Liwonde in Malawi to Malema in Mozambique, where the Caminhos de Ferro de Mocambique (CFM) takes over to Nacala. The CFM is currently in need of serviceable locomotives and wagons, which occasionally results in an accumulation of traffic with resulting delays. All train services must also be coordinated with the security forces of both countries in order to ensure safe passage.

While more serviceable CFM locomotives and rolling stock would improve the situation, an interim measure would be for Malawi Railways to be permitted to operate further into Mozambique, possibly as far east as Nampula or Nacala. The key to any smooth running joint railway operation is reciprocal operation of each company's equipment over the other company's track with a minimum of changing power and personnel enroute. One possible solution would be for the Malawi Government to underwrite any losses or damage incurred to Malawi Railways equipment while in Mozambique. Financial assistance could also be sought from foreign governments for the establishment of locomotive servicing and maintenance facilities in Nampula and Nacala. This would help ensure that the CFM power, as well as the Malawi Railways locomotives are adequately serviced and maintained.

One obstacle to increased use of the Nacala route by South African exporters is the existing policy of a major credit insurance organisation to exclude from cover shipments made from South Africa to Malawi via Nacala. This exclusion was found necessary because of the excessive time goods spent in the port as well as due to the risk of insurgent activity along the rail route. Representatives of CGIC in South Africa (Credit Guarantee Insurance Corporation) have indicated that while this exclusion still is generally in effect, they would be sympathetic to individual exporters who may request that their shipment via Nacala be covered. This is an encouraging signal and could well boost an increase in South Africa - Malawi trade via Nacala.

5.3 Beira

The all rail route through Mozambique between Malawi and Beira has been closed since the early 1980's on account of concentrated insurgency activities in the region as well as the general deterioration of the line. In addition, the bridge across the Zambezi is in uncertain condition, as close inspection of the route and facilities has been impossible due to the security situation. The bridge is believed to have suffered serious damage.

Beira is linked to Malawi by rail to Harare, by road across the Tete corridor to Malawi; also, some goods are carried by road from Beira to Malawi. There is some hesitancy, however, for some Malawi shippers to use the Beira route to a greater extent, based on the perception that Zimbabwe traffic takes precedence over the Harare - Beira rail route. Occasional congestion and resulting losses at the port of Beira, while rehabilitation work continues, is also a barrier to greater utilisation of Beira.

Recent operational problems on the National Railways of Zimbabwe have also contributed to the reluctance to utilise this route. These problems are primarily the lack of spare parts and railway operation practices.

5.4 Durban

Routes between Malawi and Durban have been of major importance in moving the bulk of Malawi's imports and exports during recent years.

Most shipments between Malawi and Durban move by road to Johannesburg, then by rail to Durban. Some traffic is moved by unit trains between South Africa and Harare, then by road to Malawi, although this route has not been favoured recently on account of serious delays in Harare. Most South African road haulage firms operate via Zambia and the Gazankulu ferry as permits to transit Zimbabwe are difficult to obtain.

Some traffic is moved by rail to Lusaka, then by road transport to Malawi. Also, a recent route is the movement of goods from South Africa to Francistown, then by road haulage to destination in Malawi. This latter route is only recently developed, and significant increases in goods flows are possible in the future. Many shippers have experienced problems with the Lusaka route recently with heavy incidence of product loss while goods are moving by rail.

While comparatively more expensive than alternative routes, the port of Durban has the reputation of a high level of reliability, relatively fast transit times and the advantage of frequent shipping schedules between Durban and Europe, North America and the Far East. The ocean freight rate structure for SAEX vessels historically has also been more favourable than those of the East African routes through the Suez Canal.

5.5 Walvis Bay

With the independence of Namibia, the route through that country to the South African port of Walvis Bay has become a SADCC route and some Zambian traffic has been moved during 1989. The route is served primarily by Namibian-based road haulage firms and with recent and on-going road improvement projects within Botswana, the route's attractiveness may increase.

It is, however, a comparatively long and expensive route when compared with other options, and may only be viable for the transport of very high value commodities. Thus far, very few imports or exports of Malawi have used this route.

6.0 COMMODITY FLOW ANALYSIS

Within this section the flow of each major import and export commodity is examined. Tonnage, routes used during 1989 and the transport cost for the land and sea portions of this movement are shown. The tables in this section are reproduced in the spread sheets and are an integral part of the analysis. The flow model is so designed such that any cost item shown can be adjusted by entering the new value in the spread sheet and the total transport costs are recalculated immediately.

6.1 IMPORTS

Major imports identified within this section are fertilizer, petrol, oil and lubricants (POL), and containerised commodities (other imports).

6.1.1 Fertilizer

It has been estimated that 57 percent of Malawi's fertilizer originates from South Africa with the remaining 43 percent from Europe, via Beira and Dar es Salaam.

Rail transport has been used in the past between Johannesburg and Harare, but serious delays on the NRZ lines precipitated a return to the all road route. Most South African fertilizer is moved by rail from Durban to City Deep from which road transport is used to Malawi via Tete.

The importation plan for 1990 is to spread the source of the routing of fertilizer imports among South Africa, Beira and Nacala, with all of the overseas fertilizers brought in via the latter two ports.

A summary of the annual tonnages and routing of Malawi fertilizer is shown in Table 6.1.1.

TABLE 6.1.1 **FERTILIZER ROUTINGS - 1989**

Port/Origin	Percentage	Annual Tons
South Africa	57 %	105 290
Beira	23 %	42 486
Dar es Salaam	20 %	36 944
total	100 %	184 720

source: Consultant's discussions

The transport costs for fertilizer are shown in Table 6.1.2.

TABLE 6.1.2 FERTILIZER TRANSPORT COSTS (US Dollars per Ton)

Land Costs	**To Malawi**
South Africa	166
Beira	122
Dar es Salaam	75
Nacala	47
Sea Freight Costs	**From Europe**
Durban	85
Beira	100
Dar es Salaam	127
Nacala	100

source: Consultant's discussions

Loss and damage to fertilizer is reported to be essentially nil over the Tete route, however, when some shipments were made via Zambia, losses were between 2 and 3 percent of value. It is not considered to be a problem at this time.

6.1.2 POL

For strategic reasons, a wide variety of routes are used for importing POL. During 1989, South African sources accounted for over 50 percent of Malawi's requirements, primarily by sending fuel by rail to Harare, Lusaka and Francistown and moving the remaining distance to Malawi by road. This dependency is projected to decrease slightly during 1990.

While Nacala is the cheapest and shortest route it is anticipated that during 1990, just over 2 percent of Malawi's fuel needs will be served by this route, primarily because of the uncertainty of the capacity and reliability of the Nacala rail route. The shortage of suitable tank wagons in Mozambique is also a factor.

Table 6.1.3 shows the routing pattern for Malawi's fuel during 1989, in terms of millions of litres, type of fuel and the percentage moved over each route.

TABLE 6.1.3 **ROUTING OF MALAWI'S FUEL**
1989
(millions of litres)

Route	Petrol	Diesel	Aviation	Total	%
Harare	13.7	16.4	5.2	35.3	22.2
Harare (Tete)	3.1	3.3	7.8	14.2	8.9
Lusaka	11.1	16.8	-	27.9	17.6
Francistown	-	8.4	-	8.4	5.3
Ndola	19.4	0.4	-	19.9	12.5
Dar es Salaam	7.6	15.8	9.1	32.5	20.4
Beira	-	19.2	-	19.2	12.1
RSA	0.3	-	-	0.3	
Nacala	-	0.2	-	0.2	0.6
Feruka	0.4	0.2	-	0.6	0.4
total	55.7	81.2	22.1	159.0	100.0

source: Oilcom

Final 1989 figures showing the percentage of fuel moved over each route were used in the evaluation model and are shown in Table 6.1.4. The number of litres are also shown as well as the conversion to tons.

TABLE 6.1.4 **ROUTING OF MALAWI'S FUEL - 1989 - SUMMARY**

Route	Litres (millions)	Percentage	Tons
Harare (Mchinje)	35.1	22.1 %	27 062
Harare (Tete)	14.2	8.9 %	10 948
Lusaka	31.3	19.7 %	24 133
Francistown	5.6	3.5 %	4 318
Ndola	22.1	13.9 %	17 039
Dar es Salaam	31.3	19.7 %	24 133
Beira	18.1	11.4 %	13 955
Feruka	1.3	.8 %	1 002
total	159	100 %	122 590

source: Oilcom

Table 6.1.5 shows the planned routing of fuel imports for the year 1990.

TABLE 6.1.5 **ROUTING OF MALAWI'S FUEL SUPPLIES 1990 PLAN (millions of litres)**

Route	Petrol	Diesel	Aviation	Total	%
Harare	18.9	10.8	2.0	31.7	18.1
Harare (Tete)	-	16.2	8.1	24.3	13.8
Lusaka	6.3	9.0	-	15.3	8.7
Francistown	-	12.0	-	12.0	6.8
Ndola	18.0	-	-	18.0	10.2
Dar es Salaam	8.0	20.8	15.0	43.8	25.0
Beira	-	18.7	-	18.7	10.7
Nacala	-	3.6	-	3.6	2.1
Feruka	8.0	-	-	8.0	4.6
total	59.2	91.1	25.1	175.4	100.0

source: Oilcom

The routes via Harare, Lusaka and Francistown are used for moving fuel from South Africa by rail and then by road to Malawi. These routes amounted to 54 percent of Malawi's fuel supplies in 1989, and are projected to be reduced to 47 percent in 1990.

The cost of moving fuel over the several routes varies considerably. The land costs for moving fuel over each route are shown in Table 6.1.6. As the cost for moving each type of fuel varies (i.e., among diesel, petrol and aviation fuel), a weighted average cost was used in the evaluation model. These weighted average costs are shown in Table 6.1.6.

TABLE 6.1.6 **LAND TRANSPORT COSTS FOR MALAWI'S FUEL**

Routing	Tambala per Litre	Dollars per Ton
Nacala	12.2	63.3
Harare	52.5	272.4
Lusaka	54.1	280.7
Francistown	47.9	248.5
Feruka	29.5	
Dar es Salaam	35.5	184.2
Beira	36.0	186.8
Ndola	26.0	134.9

source: Oilcom

Sea freight charges for fuel were computed using a weighted average for crude oil and refined petroleum products. These sea freight costs are shown in Table 6.1.7.

TABLE 6.1.7 SEA FREIGHT COSTS FOR MALAWI'S FUEL (US Dollars per Ton)

Port	Route Costs
Durban	15.86
Beira	13.86
Nacala	13.16
Dar es Salaam	12.86

source: Consultant's investigations

While fuel brought from Nacala represents the lowest cost CIF price in Lilongwe, there are limits to the amount which could be imported over this route, in the short term. The fuel now being brought through Nacala is actually obtained from Petromoc in Mozambique, with a corresponding amount returned to Petromoc from Malawi stocks in Beira. While there are oil storage facilities for Malawi in Nacala, the limitations of CFM locomotives, wagons and uncertain transit times over the rail line make increased used of this route problematical at this time.

Based on discussions with major suppliers of Malawi's fuel requirements and with transport representatives, it was estimated that the maximum that Nacala could be expected to provide would be 50 percent of Malawi's fuel needs, based on full capacity of the rail line and the port system. For strategic reasons, Malawi would probably not want to be "tied" to any one route for more than 50 percent of its needs.

Certainly, when these conditions are improved, a greater percentage of Malawi's fuel could be brought through Nacala. However, other routes would have to be used in order to insure a constant supply in the event of service disruption on any route - this is the reason for the present situation where a variety of routes are used.

6.1.3 Containerised Commodities (Other Imports)

Based on sources of imports as shown in the Monthly Statistical Bulletin, more than one-third originate in South Africa, more than 50 percent originate overseas and a small percentage are brought from neighbouring African countries. The percentage of these other imports using each route are shown in Table 6.1.8.

TABLE 6.1.8 ROUTES USED BY OTHER IMPORTS

Route	Percentage
South Africa (originated)	35 %
South Africa (transit)	59 %
Other Africa	6 %

source: Malawi Monthly Statistical Bulletin - December 1989

While some of these "other imports" are break bulk commodities, most are containerised goods and the costs are based on container rates.

The cost of moving these commodities by land are shown in Table 6.1.9.

TABLE 6.1.9 LAND COST OF MOVING OTHER IMPORTS (US Dollars per Ton)

Route	Route Costs
Durban	450
Johannesburg	347
Other Africa	150
Nacala	58

source: Consultant's interviews

The cost for sea freight for these other imports are shown in Table 6.1.10.

TABLE 6.1.10 SEA FREIGHT COSTS FOR OTHER IMPORTS (US Dollars per Ton)

Port	Europe/UK	North America
Durban	96	154
Beira	110	167
Nacala	110	167

source: Consultant's interviews

Overseas origins of these other imports are primarily from Europe and the UK with a small amount from North America. Table 6.1.11 shows the percentages from each origin used in this analysis.

TABLE 6.1.11 OVERSEAS SOURCES OF OTHER IMPORTS 1989

Source	Percentage of Other Imports
Europe/UK	93 %
North America	7 %

source: Consultant's interviews

Imports of many valuable break bulk commodities (such as paper for the manufacture of packaging material) are moved exclusively through South Africa. During the early 1980's, Beira was used for imports of paper for packaging and 100 tons of paper was lost when the line closed. This paper was never recovered - incidents like this make the use of Mozambique routes unattractive.

6.2 EXPORTS

Within this section, the primary exports of Malawi are identified, in terms of tonnage, routes used and transport costs during 1989. These exports are tobacco, sugar, tea, cotton and other exports.

6.2.1 Tobacco

During 1989, most of Malawi's tobacco exports were moved through Durban with a small proportion routed via Dar es Salaam. The routing percentages are shown in Table 6.2.1. Because of the imbalance in Malawi's traffic moving via Dar es Salaam, there is often a problem with vehicle availability for this route. Some trial shipments have been made via Nacala during the first six months of 1990 - increased tonnage over this route will be directly dependent upon the success of these trial shipments.

TABLE 6.2.1 ROUTING OF TOBACCO EXPORTS 1989

Route	Percentage
South Africa	90 %
Dar es Salaam	10 %

source: Consultant's interviews with exporters

Beira is a possible route which has been considered by tobacco exporters but is not used at the present time as the line and port are handling primarily Zimbabwe traffic and it is felt by Malawi shippers that sufficient capacity does not exist to move Malawi cargo in an expeditious manner.

Customers for Malawi tobacco are primarily in Europe, though significant amounts are exported to the Far East and to North America. The routing percentages for each of these destinations are shown in Table 6.2.2.

TABLE 6.2.2 DESTINATIONS FOR MALAWI TOBACCO

	Percentage
Europe	60 %
Far East	25 %
North America and Other	15 %
total	100 %

source: Consultant's investigations

Transport costs for moving containerised tobacco over each route are shown in Table 6.2.3. These costs represent the inland costs and all wharfage and port charges and are based on a 6 metre container.

TABLE 6.2.3 **LAND TRANSPORT COSTS FOR TOBACCO EXPORTS (U S Dollars per Ton)**

Port	Route Costs
Dar es Salaam	77
Durban	88
Nacala	56

source: Consultant's interviews

The sea freight charges to major destinations are shown in Table 6.2.4.

TABLE 6.2.4 **SEA FREIGHT CHARGES FOR TOBACCO (U S Dollars per Ton)**

Port	Europe	Far East	N America
Durban	65	90	107
Dar es Salaam	66	116	155
Nacala	97	123	137

source: Consultant's interviews

Shipments routed via Tete are technically subject to the payment of terrorist insurance amounting to .9 percent of the value of the commodity. During the course of this investigation, it was determined that many users of the route do not take advantage of this insurance, possibly because of the relative safety of this route during recent years. This potentially high cost was, therefore, not included in the cost comparisons of this route.

The tobacco industry is projecting the use of Nacala for 10 percent of their exports in 1990, and increasing in future years. The anticipated routing of tobacco traffic is shown in Table 6.2.5.

TABLE 6.2.5 **PROJECTED ROUTING OF TOBACCO EXPORTS (percentages)**

Port	1990	1995
Dar es Salaam	10 %	25 %
Durban	80 %	50 %
Nacala	10 %	25 %
total	100 %	100 %

source: Consultant's interviews with tobacco exporters

6.2.2 Sugar

Both Beira and Durban are used extensively for the export of Malawi's sugar. Exports can be divided into two categories, bulk shipments to Portugal and the United States, and containerised shipments to EEC countries. All of the bulk shipments are currently moved through Beira and the containerised shipments through Durban. Of the bulk shipments through Beira, 50 percent are to North America and 50 percent to Portugal. All EEC sugar traffic is containerised and now moves through Durban.

Land costs to Beira and Durban are shown in Table 6.2.6.

TABLE 6.2.6 LAND COSTS FOR SUGAR EXPORTS (US Dollars per Ton)

Route	Cost per Ton
Beira	79
Durban	104
Nacala	42

source: Consultant's interviews

Incidents of loss and damage to sugar are quite high, but only for the rail movements to Beira, where losses were estimated at 2 - 2.5 percent of value.

Sea transport costs for sugar are shown in Table 6.2.7.

TABLE 6.2.7 SEA FREIGHT COSTS FOR MALAWI SUGAR (US Dollars per Ton)

Port	Europe	North America
Durban	54	104
Beira	87	134
Nacala	87	134
Dar es Salaam	69	155

source: Consultant's interviews

Proposals have been made to the sugar exporters for routing via Beira for the EEC sugar. There would be some transport cost savings and the offer is being considered with some trial shipments to be made later in the year. There is some risk involved in this movement, as the EEC is a very important client to the sugar industry and service quality is of highest priority.

Moving some sugar via Nacala is also being seriously discussed with rate proposals being evaluated. While Nacala routings would entail a transfer of the container from road to rail in Blantyre, the delays in this operation are likely to be less than such transfers in Harare. Many shippers have experienced problems in such transfers in Harare and is a serious disadvantage to that route.

6.2.3 Tea

At the present time, approximately 80 percent of Malawi's tea exports are routed through Durban, with the remainder moved through Dar es Salaam and Beira. Table 6.2.8 summarises these routing percentages.

TABLE 6.2.8 ROUTING OF TEA EXPORTS PERCENTAGE BY ROUTE

Route	Percentage
South Africa (transit)	80 %
South Africa	10 %
Beira	7 %
Dar es Salaam	3
total	100 %

source: Consultant's interviews

The cost of land transport of tea over the various routes is shown in Table 6.2.9.

TABLE 6.2.9 LAND TRANSPORT COST FOR TEA (US Dollars per Ton)

Route	Route Costs
South Africa (transit)	160
South Africa	130
Beira	160
Dar es Salaam	163
Nacala	96

source: Consultant's interviews

Major destinations for tea are shown in Table 6.2.10.

TABLE 6.2.10 DESTINATIONS FOR MALAWI TEA

Destination	Percentage Total Tons
Europe/UK	73 %
North America	17 %
South Africa	10 %

source: Consultant's interviews

Costs to the various destinations by sea from each port are shown in Table 6.2.11.

TABLE 6.2.11 **SEA TRANSPORT COSTS FOR TEA (US Dollars per Ton)**

Port	Europe/UK	North America
Durban	122	206
Beira	180	257
Nacala	180	257
Dar es Salaam	150	206

source: Consultant's interviews

A trial shipment through Nacala was made in early 1990. A unit train of 33 containers was organised by the Tea Exporters Association with special sea freight rate negotiated from Nacala. The tea exporters are eager to utilise the Nacala route providing these trial shipments are successful.

6.2.4 Cotton

Cotton is exported primarily through Durban, moving by road all the way. Buyers often store their product in warehouses in Johannesburg while a county of destination is selected based on the market. Virtually all sugar exports are moved through Durban harbour, though some inquiries are now being made for possible sale of some sugar to South Africa.

The costs for land transport to several ports are shown in Table 6.2.12 for information, as only the port of Durban in currently used.

TABLE 6.2.12 **LAND TRANSPORT COSTS FOR COTTON (US Dollars per Ton)**

Port	Route Costs
Durban	106
Dar es Salaam	101
Beira	79
Nacala	48

source: Consultant's interviews

Most cotton exports are shipped to Europe or the UK. Sea transport rates are shown in Table 6.2.13 for each port.

TABLE 6.2.13 SEA TRANSPORT RATES FOR COTTON (US Dollars per Ton)

Port	To Europe/UK
Durban	66
Dar es Salaam	75
Beira	87
Nacala	87

source: Consultant's interviews

6.2.5 Other Exports

There are other exports amounting to approximately 32 000 tons annually. Each of these exports was not analysed individually, and for the purpose of this study it was assumed that land and sea costs were similar to those for cotton.

Regarding routes used, a greater use is made of Dar es Salaam than for other commodities, primarily because of the relatively low value of other exports and the increased availability of road transport utilising Malawi hauliers. This increased use of Dar es Salaam is borne out by the border crossing statistics shown earlier in this report. The routing percentages for other exports are shown in Table 6.2.14.

TABLE 6.2.14 ROUTING OF OTHER EXPORTS

Route	Percentage
Dar es Salaam	50 %
Beira	10 %
Durban	40 %

source: Consultant's estimates

7.0 CONCLUSIONS

7.1 TRANSPORT COST COMPARISONS

The total tonnages of imports and exports estimated to have been moved via the major gateways during 1989 are shown in Table 7.1.

TABLE 7.1 **ROUTING OF MALAWI'S IMPORTS AND EXPORTS DURING 1989**

Routing	Tons (000)	Percentage
Dar es Salaam	101.5	11.4
Beira	92.6	10.4
Durban	424.5	47.6
South Africa	248.9	27.9
Zimbabwe	24.0	2.7
Nacala	-	-
totals	891.5	100.0

source: Consultant's interviews

Based on the analysis of tonnages moved during 1989 and the routes chosen, the total amount of transport costs incurred by Malawi's imports and exports (land and sea costs, to the port of origin/destination) amounted to US $ 281.5 million per year. During the course of this investigation, it has been determined that approximately 50 percent of Malawi's imports and exports could be handled through Nacala. This condition represents a scenario where the rehabilitation of the railway line is complete, the security situation is "normalised" to the point where users of the line are confident in regular and uninterrupted operation and shipping lines are calling frequently at Nacala, providing an adequate service to all potential users.

If 50 percent of Malawi's imports and exports were routed via Nacala, the total transport costs were estimated to decrease to US $ 212.4 million annually. This represents a "cost" to Malawi of in excess of US $ 69.1 million each year because of the effective loss of the regular use of the Nacala railway line and port. These amounts are shown in Table 7.2.

TABLE 7.2 **ANNUAL TRANSPORT COSTS FOR MALAWI'S IMPORTS AND EXPORTS (US Dollars in millions)**

Scenario	Transport Costs
Base (1989)	$ 281.5
Nacala Open	$ 212.4
Nacala "cost"	$ 69.1

source: Consultant's estimates

This transport cost differential between existing routes and the Nacala route is primarily attributed to the moving of imports, with the savings for exports being marginal. Also, imports predominate in terms of tonnage (tons exported amounted to 184 800 in 1989 and for imports, 706 700 during the same period), making the impact greater. The cost per ton for moving major imports and exports over the various routes are shown in Tables 7.3 and 7.4.

TABLE 7.3 **COST PER TON - IMPORTS (US Dollars)**

Route	Petroleum Land	Petroleum Sea	Petroleum Total	Fertilizer Land	Fertilizer Sea	Fertilizer Total	Other Land	Other Sea	Other Total
Dar es Salaam	164	13	177	75	127	202			
Beira	185	13	198	122	100	222			
Durban	274	16	290				450	100	550
South Africa			166		166	347		347	
Zimbabwe							150		150
Nacala	63	13	76	47	100	147	58	114	172

source: Consultant's interviews

TABLE 7.4 **COST PER TON - EXPORTS (U S Dollars)**

Route	Tobacco Land	Tobacco Sea	Tobacco Total	Sugar Land	Sugar Sea	Sugar Total	Tea Land	Tea Sea	Tea Total
Dar es Salaam	77	92	169				163	161	324
Beira				79	87	166	160	195	355
Durban	88	78	166	104	79	183	160	138	298
South Africa						130		130	
Zimbabwe									
Nacala	56	110	166	42	111	153	96	195	291

Route	Cotton Land	Cotton Sea	Cotton Total	Other Land	Other Sea	Other Total
Dar es Salaam	101	75	176	101	75	176
Beira	79	99	178	79	99	178
Durban	106	66	172	106	66	172
South Africa						
Zimbabwe						
Nacala	79	99	178	48	99	147

source: Consultant's interviews

While ocean shipping costs are higher to Nacala than to Durban, for example, the land cost portion is typically lower than for alternative routes. Exceptions to this pattern are for relatively high value commodities, such as tobacco and tea, for which relatively high rail rates are charged over the CFM. Unlike the Malawi Railways, the CFM has no box rate over the Nacala line and rates are dependent largely on commodity value.

With increased use of Nacala by exporters, these costs should decrease. For example, tea and tobacco would typically be moved in unit or block trains for which more favourable rail rates could be negotiated. Also, lower contract rates with shipping lines may be possible for these large volume exporters, making the cost comparison more favourable with respect to Nacala. Shipping lines contacted expressed great interest in developing the Nacala trade.

The existing transport costs for imports and exports, compared with estimates of these costs with Nacala handling 50 percent of Malawi's trade are shown in Table 7.5.

TABLE 7.5 TRANSPORT COSTS - EXISTING ROUTES COMPARED WITH NACALA OPEN SCENARIO (US Dollars in thousands)

	Existing Routes	Nacala Open
Imports		
Petroleum	29 485	19 288
Fertilizer	34 373	31 015
Other	181 716	127 337
Exports		
Tobacco	9 600	9 598
Sugar	9 222	8 683
Tea	10 925	10 785
Cotton	472	438
Other	5 738	5 295
Total	281 531	212 439

source: Consultant's estimates

With Nacala open and up to 50 percent of Malawi's trade moved over this route, the percentage utilisation of each route will naturally change. The percentage of trade now using each route as well as projections with an open Nacala are shown in Table 7.6.

TABLE 7.6 · ROUTING OF MALAWI'S FOREIGN TRADE

	Percentage of Trade	
Route	**Existing Routes**	**Nacala Open**
Dar es Salaam	11 %	7 %
Beira	10 %	6 %
Durban	48 %	23 %
South Africa	28 %	12 %
Zimbabwe	3 %	2 %
Nacala	-	50 %
total	100 %	100 %

source: Consultant's estimates

7.2 IMPACT OF TIME COSTS

Because of security considerations as well as physical conditions, movements over certain routes are more time consuming than others of comparable distances. Based on discussions with importers, exporters, freight forwarders as well as with transport organisations, estimates of transit times between Malawi and the port of entry/exit have been estimated and are shown in Table 7.7.

These times represent typical transit times between Malawi and ports. Additional time not specifically reflected is the waiting time for transfer between the land based mode and the ship. At ports where shipping frequency is relatively low (i.e., Nacala and Beira), the coordination between rail services and ship arrivals is of greatest importance.

TABLE 7.7 **TRANSIT TIMES BETWEEN MALAWI AND MAJOR PORTS (Days)**

Route	Transit Time
Durban (road)	11
Durban (City Deep)	13
Durban (Harare)	24
Johannesburg (road)	6
Johannesburg (Harare)	9
Beira	25
Nacala	25
Dar es Salaam	14
Zimbabwe	5

source: Consultant's interviews

The Mozambique ports of Beira and Nacala incur the longest transit times. The situation at Nacala should improve as the rehabilitation process continues, particularly as it affects rail transit times. The frequency of ships calling at Nacala will, however, have to increase in order to establish a well - coordinated transport service over the route.

The cost of transit time is computed by multiplying the inventory carrying cost (computed by applying the 15 percent annual cost of money to the commodity values as shown in Table 4.1), by the transit times and annual volumes moving over each route. The total annual time costs, using existing routes and for the increased use of Nacala, are shown in Table 7.8.

TABLE 7.8 **TIME COSTS BETWEEN MALAWI AND PORTS OF ENTRY/EXIT (U S Dollars in millions)**

Scenario	Annual Costs
1989 Routes	3 007
Nacala Open	4 479
savings via Nacala	1 472

source : Consultant's estimates

Time cost savings by using the Nacala route for 50 percent of Malawi's trade are estimated to be US $ 1 472 thousand per year.

Total distribution costs, which are the sum of transport costs and time costs, for moving goods over the existing routes compared with the Nacala open scenario, are shown in Table 7.9.

TABLE 7.9 TOTAL DISTRIBUTION COSTS - EXISTING ROUTES COMPARED WITH THE NACALA OPEN SCENARIO (US Dollars In thousands)

	Annual Costs
Existing Routes	$ 284 538
Nacala Open	$ 216 918

source: Consultant's estimates

In monetary terms, the time costs are not particularly significant when compared with transport costs for both the land and sea segments. The variation in transit times is very important, however, and greatly affects users' perceptions of the viability of a route.

7.3 The Importance of Nacala

Despite the comparatively long transit times between Malawi and Nacala which now exist, the lower transport costs over this route amount to US $ 69 million annually. This is a significant amount when expressed as a percentage of total value of commodities. As the majority of this savings is attributed to the moving of imports, it represents more than 25 percent of the value of goods imported.

The major problem now facing Malawi is that the rehabilitation of the rail route to Nacala is 2.5 - 3 years away from completion, if all work proceeds according to schedule. Also, the rehabilitation of the Cuamba - Entre Lagos section is not yet funded. This section must be at a comparable standard to that of the remainder of the line in order for the entire route to function as planned.

Over this three year (minimum) period, the transport cost savings foregone for moving Malawi's foreign trade is estimated to be in excess of US $ 200 million. The issue is to determine how this rehabilitation program can be accelerated to minimise the excessive price now being paid for transport.

At an annual cost of US $ 69 million, this means that for every week, the cost is US $ 1.33 million - the cost of accelerating the rehabilitation program should be critically analysed with these potential savings as important criteria.