Sida Evaluation 02/31

Welfare Economic Assessment – Reconstruction of 11 Bridges in Honduras

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Summary

The combination of wind, rain and flooding that hit Honduras in 1998 was a unique catastrophe to be expected only every 200 years or so. It was an immediate human disaster that cost thousands of people their lives and made many others homeless. At the same time it was a severe blow to the long-term development of Honduras as much of the country's infrastructure was swept away in a few days, including most of the important bridges.

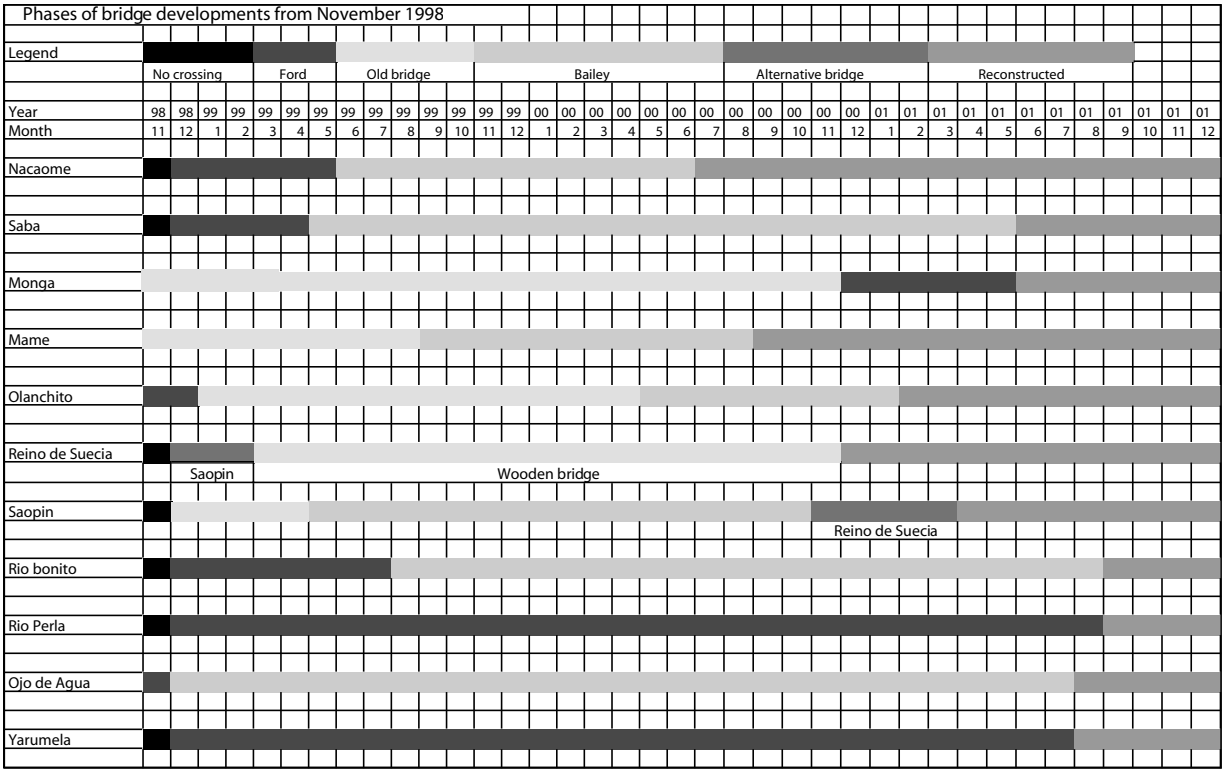
In this situation it was natural for the international community to come to assistance and that included Swedish Sida. In order to save valuable time, Sida applied an unconventional working procedure, bypassing some of the normal formalities. The bridge construction could start quickly by the Swedish companies – SWECO and SKANSKA. The bulk of Swedish assistance was construction of provisional bridges over seven rivers and complete reconstruction of 11 bridges.

Beside the humanitarian objective aiming at facilitating rescue work and rehabilitation, another main objective was to restore the country's infrastructure in order to allow economic development.

Sida now wishes to draw experiences from the effort and has commissioned the present study to assess the economical benefit of the reconstruction of the bridges.

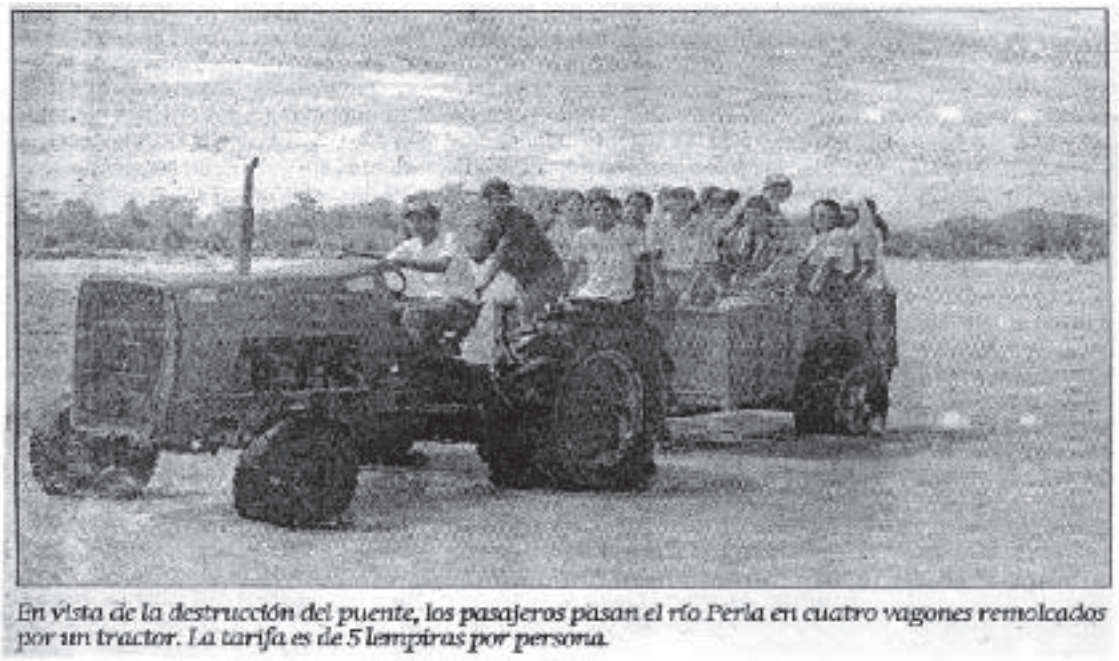
How to cross the rivers after the catastrophe?

During the first weeks or months after the disaster it was not possible to cross some of the rivers at all. Then a variety of temporary solutions were applied, among them the provisional co called Bailey bridges, built by the Swedish Räddningsverket. The figure below shows our general description of the various possibilities for river crossings from November 1998 to December 2001.



At several places, the riverbed itself could be negotiated at so called "vados" (here translated with "fords"). Occasionally, alternative bridges were used. Eventually, the bridges were reconstructed. For each phase with respect to each bridge we have assumed specific losses in terms of time or in terms of longer distances or in terms of no possible crossing. These costs concerning both freight and passengers are here called user costs. The four pictures below illustrate four of the main phases: no crossing possible, ford, Bailey bridge and reconstructed bridge.

Phase 1: No crossing possible. Saba bridge. Source: SWECO



En vista de la destrucción del puente, los pasajeros pasan el río Perla en cuatro vagones remolcados por un tractor. La tarifa es de 5 lempiras por persona.

Phase 2: Ford over Rio Perla

Phase 3: Bailey bridge at Bonito. Source: SWECO

Phase 4: Reconstructed bridge Reino de Suecia at La Ceiba. Source: SWECO

The scheme applied by Sida and possible alternatives

The approach of the analysis has been to compare the scenario that actually developed with other, conceptually possible interventions. That reconstruction compared to no reconstruction is socially beneficial is probably self-evident, but is also demonstrated in quantitative money terms in this report. A more intricate issue is whether the scheme applied for reconstruction seems socially beneficial compared to other alternatives. Here the benefits and costs of following alternatives are compared.

Situation 1: Actual scheme applied by Sida

This reference situation corresponds to the actual scheme where Sida applies an unconventional, informal procurement procedure with respect to the permanent bridges. The bridges are reconstructed piecemeal during 22 months, from November 1999 to September 2001.

Situation 2: Conventional scheme applied by Sida – one-year delay

This situation refers to the case where Sida is assumed to have applied the conventional procurement scheme. The bridges are reconstructed piecemeal during 22 months, from November 2000 to September 2002. A one-year delay is assumed to depend on employment of traditional procurement procedures, something that for example means separate procurements of design and construction respectively.

Situation 3: Emergency and financial aid – two years delay

For this situation it is assumed that Swedish aid had been provided in terms of emergency oriented temporary bridges plus financing of reconstruction carried out solely by Honduran authorities, consultants and constructors. Temporary bridges and fords are finalised between December 1998 and March 1999. The bridges are reconstructed piecemeal during 22 months, from November 2001 to September 2003. The even longer delay is assumed to depend on the poverty of the country and limited experience of high-tech design and construction.

Situation 4: No reconstruction

For this situation it is assumed that Swedish aid had been provided in terms of emergency oriented temporary bridges only and that the bridges were never reconstructed. This situation is clearly not realistic. It only serves as a reference in order to indicate the loss if the bridges were never rebuilt.

Note that that in our model it is only the difference in timing and therefore the costs of thepermanent bridges that affects the difference in cost outcomes between the four situations. The key factor influencing the difference between the situations is the loss made until the new bridges are in place. For each situation we assume a more or less inferior alternative for river crossing prevalent before each new bridge is in place. This may be a ford, Bailey bridge or other bridge, lasting during different periods of time in each alternative. This inferior alternative causes user costs, in terms of freight and passenger time. What we compare is the total cost – investment cost in new bridges plus the user costs – for each situation.

Basic methodology

The basic approach that was used to try to find the effects of Sida's engagement is welfare analysis. It includes micro-economic analysis, complemented by a macro-economic perspective and a social perspective, expressed in qualitative terms.

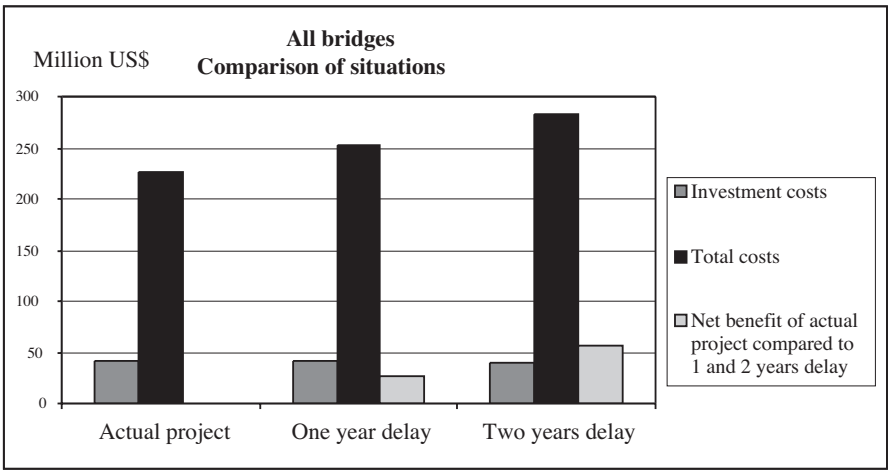
In order to be able to value the cost of the extra travel time when bridges were not in proper function we have to make assumptions on these values based on income, derived from the gross national product, GNP. Since income differs substantially between socio-economic groups also the value of time will differ.

The study leans heavily on uncertain historic data that have proven difficult to obtain. In total the analysis is based on a number of prerequisites and assumptions. The most critical assumptions concern time lost when bridges were not in function and traffic flows over the bridges. Our estimations of time lost are based on interviews with various persons in Honduras, mainly at SOPTRAVI. With respect to traffic flows a problem is the lack of data on number of pedestrians and cyclists over the bridges. This means that the results will underestimate the benefits ofreconstruction in general and in particular the benefits of the poor many of whom walk and cycle.

Because of the uncertainties due to lack of data and the fairly complex web of assumptions and estimations, the prerequisites and assumptions are given a substantial space in the report and should be regarded as principally important for this kind of studies. In spite of all these data troubles we are convinced that the main results are valid and would not change dramatically with modified assumptions.

Effects of Sida's engagement

The diagram below summarises the micro-economic results for all eleven bridges. For each situation there are three columns, investment costs, total costs and net benefits of the actual project undertaken (situation 1) compared to the other situations that would have meant one or two years delay respectively. The net benefits of the actual project are then defined as the total cost of each of the alternatives respectively, minus the total cost of the actual project. In other words, the third, green, column for each alternative shows the additional cost of the alternative, which is then the same as the net benefit of the actual project. The norm is thus the actual project that by definition has no additional cost.



In total, for all eleven bridges the quantified calculations indicate that:

- Compared to no reconstruction of permanent bridges, the actual scheme applied, situation 1, turns out to be, self-evidently, very beneficial. The construction costs could have been 20 times higher and still being socially worthwhile. Bear in mind, however, that this calculation is less meaningful also since many aspects have not been quantified so the real gains may be much larger.
- Compared to a one-year delay of construction of permanent bridges, the actual scheme applied has meant a net benefit of 27 million US$ according to the calculations. In other words, with a one-year delay the bridges should have cost only a third of the actual cost to construct in order to make this delay socially preferable.
- Compared to two years delay the calculations indicate a net benefit of 56 million US$ of the actual

scheme applied. In other words, since the investment cost is around 40 million US$, the bridges should have had to be free to construct in order to make a two years delay socially preferable.

The unconventional procedure – and consequently the speedy implementation – undertaken in this case is thus found to be socially beneficial. In fact it would appear even more beneficial if data had existed on number of pedestrians and cyclists for all bridges. That this procedure is worthwhile thus leaves no doubt for this bridge project. As a matter of course we cannot say anything in general on whether such an unconventional procedure is beneficial in other projects.

The table below shows the user costs, the investment costs, the total costs (user costs plus investment costs) and the net benefits of the scheme applied (situation 1) in relation to a one-year delay (situation 2) and a two years delay (situation 3). The investment costs differ quite much between bridges, ranging from 0.2 to 7.5 million US$. The minor difference between the investment cost of situation 1, 2 and 3 respectively reflects that costs have been discounted by the calculation rate 4%, i.e., reflects the costs saving of postponing the reconstruction work.

Apparently the scheme applied seems socially beneficial not only in total but also for each single bridge. We should then bear in mind that the number of pedestrians and cyclists are missing for the bridges Olanchito, Mame, Rio Perla, Rio Bonito, Monga, Yarumela and Ojo de Agua. For these bridges the calculated net benefits are relatively low, except for Rio Perla, but underestimated because of the missing benefits of pedestrians and cyclists.

	User costs Million US$	Investment cost Million US$	Total cost Million US$	Net benefit of actual project compared to 1 and 2 years delay Million US$
Nacaome S 1	46,4	2,6	49,0	
Nacaome S 2	47,7	2,5	50,3	1,2
Nacaome S 3	49,0	2,4	51,5	2,4
Sabá S1	7,7	7,5	15,3	
Sabá S2	9,4	7,3	16,7	1,4
Sabá S3	11,1	7,0	18,1	2,8
Monga S1	0,8	0,2	1,0	
Monga S2	1,2	0,2	1,3	0,3
Monga S3	1,5	0,2	1,7	0,7
Mame S1	0,2	0,9	1,1	
Mame S2	0,3	0,9	1,2	0,1
Mame S3	0,4	0,9	1,3	0,2
Olanchito S1	0,2	1,5	1,7	
Olanchito S2	0,4	1,4	1,9	0,2
Olanchito S3	0,6	1,4	2,1	0,4
Reino de Suecia S1	21,0	2,7	23,7	
Reino de Suecia S2	27,5	2,5	30,0	6,3
Reino de Suecia S3	35,7	2,5	38,2	8,2
Saopin S1	32,5	1,5	33,9	
Saopin S2	45,1	1,4	46,5	12,6
Saopin S3	57,7	1,4	59,1	25,2
Rio Bonito S1	8,1	1,6	9,8	
Rio Bonito S2	9,2	1,6	10,8	1,0
Rio Bonito S3	10,2	1,6	11,8	2,1
Rio Perla S1	17,0	2,0	19,0	
Rio Perla S2	21,1	2,0	23,1	4,1
Rio Perla S3	25,1	1,9	27,0	8,0
Ojo de Agua S1	2,8	2,1	4,9	
Ojo de Agua S2	3,1	2,1	5,2	0,2
Ojo de Agua S3	3,4	2,0	5,4	0,5
Yarumela S1	47,2	0,9	48,0	
Yarumela S2	47,6	0,8	48,5	0,4
Yarumela S3	48,1	0,8	48,9	0,9

Distribution of benefits

As mentioned above, the quantified results on passenger' costs are based on individuals' willingness to pay for timesaving in various socio-economic groups, in turn depend on incomes of these groups. Therefore, when we estimate passenger benefits per income group it is found, self-evidently, that the rich have gained more than the poor. However, besides the fact that this result is a reflection of incomes, there is also another reason for this outcome. That is that the rich travel more than the poor, at least according to our assumptions on choice of mode per group, but this is probably true in general since consumption of travel seems to be positively correlated with income in all countries.

So, the distribution effects of the project needs cautious considerations, and the following aspects have to be taken into account.

- The missing information on number of pedestrians and cyclists over most bridges, results in underestimating the amount of travel and the benefits of the new bridges that go to the poor. In reality, if pedestrians and cyclists were properly represented, the benefits of the poor are larger than calculated here, both for separate values of time and a common value of time.

- It is not always the case that individuals' preferences are politically accepted. The crucial concern is that willingness to pay is related to ability to pay. From a distribution or fairness point of view politicians may conclude that the values reflected by willingness to pay should be modified with respect to income or other individual resources. Another way to express such a political view in economic terms is that the poor have a larger marginal utility of money than the rich. It is also found here that if a common value of time for all groups were used, then the benefits would be more equally distributed among the groups, but still the rich seem to gain somewhat more per group than the poor.
- One should bear in mind that part of the benefits gained by the rich, as calculated here, indirectly benefit also the poor. These effects concern for example, the fairly rich, civil servants, who, when bridges are functioning, can serve also the poor with medical care, teaching etc.
- The benefits referring to freight costs are distributed between all social groups, probably more equally than the benefits referring to passenger journeys.

In total there is reason to believe that the benefits of the reconstruction of bridges are fairly evenly distributed, with one exception, depending on the fact that the poor do not travel that much, because they cannot afford to travel that much. The logic conclusion of this fact is that if there had been better transport facilities for the poor, mainly bus transport, then also the benefits of the poor would have been larger.

Macro-economic and social aspects

The macro-economic analysis indicates that the negative production impact of the Mitch disaster was most pronounced in the agriculture sector and (on the demand side) for commodity exports. The impact on private and private consumption indicated by National Account figures is rather limited, but for a number of reasons (see section 1 below) these figures do not reflect, in a comprehensive or meaningful way, the effects on households' living standard.

The recovery in total production (GDP) in 2000 is substantial. Although this, in part, reflects the direct production impact of reconstruction activities, it also indicates recovery in other sectors, especially agriculture. Exports of goods and services have increased, and the situation regarding current account balance and external government debt appears to have stabilised.

It is very difficult, at this early stage, to assess the macroeconomic effects of the speed in which the reconstruction efforts have been implemented. However, numerical examples indicate that the effects on GDP caused by a one-year delay in implementation of all such efforts in the Honduran economy may amount to several hundred million US$. One should then bear in mind that traditional methods for assessing macroeconomic effects of infrastructure investments tend to result in significant underestimation of the social-economic gains from the reconstruction of destroyed infrastructure.

From a social qualitative perspective our conclusion is that the Swedish project was not directly aimed at the poorest strata of the population in remote rural areas, but rather to provide the basis for a quick economic national recovery. This will allow for a return to the situation before Mitch, which was characterised by a decade of slow but gradual improvements of poverty reduction and of reduction of inequality. The project was instrumental in keeping for example the fruit industry in Honduras alive, which is of high economic and social importance.

Although the restoring of the bridges themselves was the main focus, the Swedish involvement had an impact far beyond the technical reconstruction of them. The Swedish work force demonstrated a way of doing things that was new to many hondureños. Many engineers and construction companies did

learn new methods. Another dimension was the efficient way of working and the transparent and ethical approach that was demonstrated. Our interviews concluded, without any doubt, that many people in different positions were impressed by the professionalism of the Swedish companies and agencies.

The new bridge in La Ceiba, renamed "Reino de Suecia", differs from the others and provides an example of a potential to be used as a development tool. This potential, however, is not fully used and this particular project is in a sense incomplete without the transport services, particularly bus services, which the bridge could provide.

Final conclusions

- This study concludes that the unconventional scheme applied by Sida for bridge reconstruction in Honduras has meant large social benefits and a significant contribution to development of the transport sector and the economy in general. As a matter of course, we cannot say whether this scheme would be superior in other situations.
- The study has demonstrated the importance and the socio-economic benefits of transport measures, here in the form of bridges. The study thus pinpoints the fact that bridges and roads are necessities in order to enhance mobility and productivity. Infrastructure facilities provide the potential for transport and economic development, but they only constitute the starting point for this development; efficient use of infrastructure is a key issue.
- The study notices one of the usual poverty traps in developing countries: insufficient and badly organised bus service, demonstrated here by the large amount of walking and cycling over the bridges. More equal opportunities of transport, that is better public transport service, would make it possible to use productively all the hours and months that the poor people now have to spend walking, cycling or waiting for a less overcrowded bus, if they can afford a bus ticket. This is a fact that has often been overlooked by politicians in developing countries and often also by international aid organisations.
- The Swedish engagement in total had an impact beyond the restoration of material values, because of the skills and integrity of the Swedish companies and agencies involved.
- Finally one should bear in mind that the benefits of the project certainly have been underestimated in several respects. The estimations of benefits only consider effects that have been possible to quantify. Already concerning these in principle quantifiable effects we know that proper data on number of cyclists and pedestrians would have increased the benefit measure, especially with respect to the poor. Benefits are based on values of time, which in turn are based on GNP statistics. Since these do not include the informal sector, the real time values and consequently the benefits are underestimated. Concerning the effects that are not possible to quantify, we know that speedy implementation has reduced the accident risks and the environmental costs associated with the temporary solutions. We also know that the speedy implementation has reduced the social costs in terms of abnormal high prices and feelings of uncertainty with respect to fast communications with schools, hospitals etc.

Thoughts for the future

The authors of this study finally draw some additional personal conclusions based on our work and our impressions from conversations with various people in Honduras.

- Reconstruction of the bridges the way it was performed certainly fulfilled the aim of the project, even if the full potential of the bridges could not be taken care of within this type of engagement. If

there were any regret at all in connection with the effort, it would be that the Swedish involvement in Honduras appears to be terminated as quickly and efficiently as it was started. Thus, the opportunity to use the considerable good will and confidence that was created during the project risks being lost.

- If further follow-up of the engagement in Honduras were considered, a suggestion is to focus on public transport. One example related to the bridges would be to engage in town-planning, public transport and non-motorised transport in La Ceiba, including appropriate use of the bridge Reino de Suecia. Such assistance, as far as we understood, would be highly desired by the city planning authorities, and would specifically benefit the poor part of the population.

Transport days after Mitch. Source. Source: La Prensa 1 November 1998

1 Background and aim of the project

Hurricanes and natural disasters are not new to Central America, but Mitch was different. The combination of wind, rain and flooding that hit Honduras in 1998 was a unique catastrophe to be expected only every 200 years or so. It was an immediate human disaster that cost thousands of people their lives and made many others homeless. At the same time it was a severe blow to the long-term development of Honduras as much of the country's infrastructure was swept away in a few days. This included most of the important bridges, and without them transport of goods and passengers came to a standstill. Hardly even a war could have brought such devastating damages to a poor country like Honduras.

In this situation it was natural for the international community to come to assistance and that included Swedish Sida. Acting with remarkable speed, Sida assessed the situation and achieved from the Swedish Government the necessary authorisation to intervene. The bulk of Swedish assistance was defined to be the reconstruction of some of the major bridges that had been destroyed. In the end, this came to include 11 bridges.

In the short term perspective, the assistance had a humanitarian objective aiming at facilitating rescue work and rehabilitation, thereby saving lives and reducing human suffering. Another main objective, however, was to restore the country's infrastructure as quickly as possible in order to return to a situation where economic development would be possible.

In order to save valuable time, Sida applied an unconventional working procedure, bypassing some of the normal formalities. Thus, a procedure of direct negotiation with selected firms was applied rather than the normal tender process. The result was that the bridge construction could be started quickly and was efficiently executed by two major Swedish companies – Sweco and Skanska – in a much shorter time than would otherwise have been possible.

Regular progress reports were produced to describe the technical and economical progress of the work. Also, efforts have been made to review the relevance of Sida´s original goals and objectives and to assess the degree to which they have been fulfilled. As a further attempt to draw conclusions and experiences, Sida now wishes to examine the possibilities to perform a welfare economic assessment of the bridge project. There are two potential aspects of this, namely (i) the impact of the bridges as such on economic development and on social conditions, and (ii) the effects of the speed with which the project was undertaken. For this purpose, a relatively limited study has been carried out. The aim of this project is thus to assess the effects of the reconstruction of eleven bridges. In one way one might say that this is a "mission impossible". The eleven bridges constitute just above a tenth of all the bridges that were demolished or damaged. The damages of bridges constitute only part of the destroyed road infrastructure. There are many other sectors severely damaged.

According to the first analysis made by the World Bank on behalf of and in co-operation with the Honduran government already in November 1998 ("Estimaciones preliminares", World Bank 1998), the total replacement cost was estimated to be around 2 billion US$. The following costs of recovery of public sector physical assets, in US$, are estimated for various sectors. Transport: 458 million, Water and waste water system: 180 million, Schools and medicare: 56 million, Energy and telecommunications: 52 million, Housing: 275 million, Agriculture and environment: 400 million. Transport recovery costs thus constitute about 22% of total costs. Recovery of bridges was estimated to cost 50 million, which means 2.5% of total recovery costs. In addition the same report estimated the damages to the private sector to US$ 600 million.

In "Country Assistance Strategy", by the World Bank (2000) a reference is made to "A preliminary Assessment of Damages Caused by Hurricane Mitch, by UNDP/ECLAC (December 1998). Here the total replacement cost is estimated at 5 billion US$, of which roads, bridges and telecommunications constitute 713 million or 14 percent. The higher estimations made in 2000, compared to those made in 1998, we assume depend on that the information about the consequences of disaster has increased. In addition one must take into account the medium run consequences of spoilt soil and loss of education.

In order to assess the overall effects on national macro level of the eleven bridges through an economic/econometric analysis, one would need an enormous amount of data on all efforts made. In addition all these efforts are partly complementary and correlated in a complex manner. Such an analysis is of course not possible in, nor the purpose of, this study.

Within this limited project we still believe that we are able to provide indications of the welfare effects of the reconstructions. We are leaning mainly on microeconomic analysis of various situations with and without these eleven bridges being in function- economic welfare analysis that comprises effects in a broad sense, expressed in quantitative and qualitative terms. We then have to get very close to the circumstances around the bridges concerning roads, temporary river crossings and delays of passenger and goods transport.

As a complement we conduct a rough macro economic assessment, in order to cross-check the validity of the microeconomic analysis. We then try to put the impacts of the eleven reconstructed bridges in the perspective of the impacts of reconstruction of a larger amount of bridges and other measures undertaken after Mitch.

The macro economic assessment, however, will have to be a discussion in qualitative rather than quantitative terms. The standard basis for this type of analysis – e.g. National Accounts statistics – is much too aggregated to allow estimation of the effects of parts of large investment programmes, such as the Swedish contribution to the rebuilding of infrastructure in Honduras. Apart from the fact that Swedish projects constitute only part of a major reconstruction programme, one has to consider other factors that distinguish this case from "ordinary" assessments of the social benefits from investments in infrastructure.

- Traditional macroeconomic measures, such as GDP, private and public consumption, have limited value when it comes to situations where existing social capital has been destroyed. In part, this has to do with well-known criticism of the GDP concept as a measure of economic welfare, especially regarding the measures of public consumption in areas such as health and education.
- In the National Accounts, public consumption is measured from the input side, as the cost for labour and other production factors. When infrastructure has been destroyed, it primarily affects productivity in the sense of the amount of health and education services provided per employee, as the access to these services for many consumers are severely affected. These negative effects are not reflected in the consumption and GDP measures.
- To some extent, similar problems exist with respect to private consumption of, for instance food and water. Consumption is in this case measured by the amounts of marketed consumption goods at constant prices. Major effects of the access to transport infrastructure, however, have to do with the amount of time spent by individual households to obtain these consumption goods, and these costs are not reflected in the measures. They are instead a major component in the microeconomic analyses.
- Empirical methods for determining growth creating effects of infrastructure investment, based on "productivity" or "social profitability" measures (see Aschauer etc.) have limited value, when it comes to assessing the effects of recreating destroyed parts of the existing road and other transport

network. Typically, those methods apply to improvements "on the margin" of an existing network. If applied to the case of reconstruction of crucial parts of the structure serving existing population structures and firms, they tend to result in gross under-estimation of the productivity gains and growth impacts. The fact that reconstruction of the bridges cannot be analysed as marginal improvements of the infrastructure shall not be confused with another fact, namely that these infrastructure investments are marginal in relation to the economy in total. The latter fact motivates application of micro-economic Cost-benefit-analysis without having to employ complex equilibrium analysis where detailed effects on all sectors of the economy would have to be estimated.

In general, traditional methods for assessing macroeconomic effects of infrastructure investments would tend to result in significant under-estimation of the social-economic gains from the reconstruction of destroyed infrastructure. However, the use of National Accounts data could help to assess some partial effects, for instance on exports of agricultural products and other goods.

We conclude this background section with a short description of the geographical position of the bridges and their main roles.

Location of the 11 "Swedish" bridges in Honduras

The majority of the bridges, eight out of eleven, are situated in the north of the country and four of these are close to the city of La Ceiba. This group of bridges has a high importance for the agricultural region, dominated by the large banana companies. The Municipal bridge in La Ceiba – now renamed "Reino de Suecia" – has a different character than the other bridges since it is an urban construction and fulfils essentially different functions than highway bridges. Of the three southern bridges, the Nacaome bridge is of particular importance since it forms part of the Panamerican Highway.

2 Outline and principles of analyses

The microeconomic analysis is here carried out in terms of economic welfare analysis, which is conceptually normative, i.e., based on value judgements. The analysis is carried out as comparisons between situations. One wants to compare a historic or current situation with assumed future situations that appear through public or private sector investments.

For consequences that are considered possible to express in quantitative and monetary terms and to be comparable between individuals, the aim is to compare the welfare level of the various situations in the common currency unit.

A critical issue is of course how the valuations by individuals of benefits and costs have been derived or assumed. The theoretical fundament of microeconomics manifest that values should be based on each individual's preferences, and only measures that improve the level of welfare without making any single individual worse off are considered "efficient".

In practice, and most of all from political point of view, there are several difficulties related to this strict efficiency concept (the Pareto criterion). From a distribution or fairness point of view politicians may conclude that the values reflected by individual preferences manifested by willingness to pay should be modified with respect to income or other individual resources. In welfare economic literature this rational is expressed as that the marginal utility of extra consumption is higher for low-income than for high-income persons or households. To take into account this principal difference between actual willingness to pay and ability to pay is especially relevant for poor countries with very uneven distribution of incomes. One should therefore put extra emphasis on investments and other efforts that benefit the poor, even if such specific efforts could not be motivated solely based on the concept willingness to pay.

We mentioned that welfare analysis aims to take into account all effects for all groups. So far we have mainly discussed valuations in money terms. However, all effects cannot, and maybe should not, be expressed in money terms. Nevertheless these effects have to be taken into account. Effects in qualitative terms are here discussed in section number 7. There is thus no conflict between quantitative analysis in money terms and qualitative analysis. They complement each other. One must, however, be cautious so that the same effects are not taken into account twice, both in quantitative and qualitative terms.

The social, qualitative study focuses on difficulties, hardships and afflictions of the hurricane and on the alleviation that reconstruction of bridges may have implied.

The macroeconomic analysis focuses on indicators such as:

- Production in different sectors of the Honduran economy, especially agriculture and manufacturing;
- Exports of goods and services:
- Measures of private consumption and investment.

National Accounts and related statistical sources give indications of the negative effects on these macroeconomic measures in 1998/99, following Mitch disaster, and also of the recovery after the reconstruction of infrastructure. As explained in Section 1 above, there are serious limitations to this type of analysis as a tool for assessing the socio-economic impact. It should be regarded, therefore, only as a limited complement to the microeconomic analyses that form the core of this report. Also, to a large extent, the macroeconomic analysis will have to focus on the total impact of the international reconstruction programme, rather than on the specific effects of the Swedish funded projects.

3 Collection of information for analyses

Collection of data was carried out partly in Sweden between July 2001 and the beginning of October 2001. The data collection process comprised verbal and paper-based information provided by Sida, SWECO and Transport Consultants AB.

Most data were collected in Honduras October 15–25, 2001. The data collection process comprised:

- Interviews with representatives of the ministry SOPTRAVI
- Interviews with representatives of the Swedish companies SWECO and SKANSKA
- Interviews with representatives of the World Bank
- Interviews with representatives of USAID
- Interviews with representatives of various NGO's
- Written information by SOPTRAVI on transport costs, traffic counts etc.
- Written information by the World Bank

The full list of interviewees and written material is specified in References.

An important and critical part of the data collection concerns the status of the river-crossing possibilities during different phases between November 1998 and December 2001. The status includes the physical arrangement as well as the related extra distance and time that each arrangement imposed on various vehicle types, pedestrians and cyclists. With respect to physical arrangements the information stems from SOPTRAVI and SWECO. With respect to road deviations and time delays the input data are based on traffic counts carried out by SOPTRAVI and SWECO as well as our own "mini-counts".

4 Prerequisites for microeconomic analysis

4.1 Introduction

The microeconomic analysis is mainly based on calculations of welfare losses related to increased transport times when the bridges are not in function, or equivalently the reverse, i.e. the welfare gains of reconstructing the bridges. This analysis is thus mainly using quantified data and monetary values. An important issue is then how to estimate and value losses in terms of time, especially travel time for passengers with different income levels.

A first crucial issue is to what extent losses are related to difficulties to cross the rivers, i.e., to the loss of bridges, and to what extent the demand for river crossing was low because production units were damaged. If the latter aspect were significant the value of fast reconstruction would be lower compared to if all production units were functioning. We have no definite answer to this issue but as far as we have understood most production units could produce at full scale at the time when the bridges were reconstructed, the first one, Nacaome in July 2000, one and a half year after Mitch. Our assumption is thus that it was mainly the poor status of bridge crossing possibilities that constituted the hinder for mobility of persons and goods. This assumption is backed up by the macro-economic statistics that indicate a substantial recovery of production during the year 2000. The assumption is also backed up by the traffic counts made by SOPTRAVI that shows no significant differences in traffic flows at the time before Mitch compared to the time when the bridges had been reconstructed, for bridges were counts had been made at both these points of time. Also, in order to avoid the risk for over-estimations of benefits we have used the traffic counts conducted after the reconstruction of the bridges where such counts have been available.

Given that the bridges were the main problem, a second crucial issue when analysing increased transport times when bridges are not in function is of course what one means by bridges not being in function. It can be assumed that all bridges would be reconstructed in one way or another at some points of time. The analysis of the value of reconstruction must therefore be based on assumptions for alternative situations. The reference situation is naturally the scheme actually employed. Since the aim of this project is to assess the social gain of the reconstruction actually carried out on behalf of and financed by Sida, one must specify relevant alternative situations. Four situations have been assumed, two of which mean alternative timing of reconstruction.

Section 4.2 defines the situations that we compare, while section 4.3 specifies our assumptions on the various statuses of possibilities for river crossing over time until the new bridges were at place. Section 4.4 defines estimations of travel demand over the bridges. Timing and costs of actual bridge construction are presented in section 4.5, and values of time for passenger transport are discussed in section 4.6. Operating costs of vehicles and freight costs are treated in section 4.7. Environmental and safety aspects are discussed in section 4.8. Finally, our choice of interest rate for the calculations is presented in section 4.9. Some of the prerequisites and assumptions are more deeply described and explained in the appendix.

4.2 Four situations

Situation 0: Before Mitch and after reconstruction
This situation refers to the case where the former bridges were still functioning and the situation after reconstruction of the bridges. Here we could have treated these two situations as different ones since

the quality is clearly higher after reconstruction than before Mitch, due to the longer expected life length of new bridges and to the higher quality achieved by modern technology. The fact that we ignore the higher quality means that we underestimate the value of reconstruction, which (as can be expected) is found to be very large anyway. This underestimation of the value of all the three reconstruction assumptions can be borne in mind but the focus here is on assessment of alternative timings of reconstruction.

Situation 1: Actual scheme applied by Sida
This reference situation corresponds to the actual scheme where Sida applies an unconventional, informal procurement procedure with respect to the permanent bridges.

Temporary bridges and fords are finalised between December 1998 and March 1999.

The bridges are reconstructed piecemeal during 22 months, from November 1999 to September 2001. We assume an economic life of 60 years.

Situation 2: Conventional scheme employed by Sida – one-year delay
This situation refers to the case where Sida applies the conventional procurement scheme.

Temporary bridges and fords are finalised between December 1998 and March 1999.

The bridges are reconstructed piecemeal during 22 months, from November 2000 to September 2002. We assume an economic life of 60 years.

The one-year delay is assumed to depend on employment of traditional procurement procedures, something that for example means separate procurements of design and construction respectively.

Situation 3: Emergency and financial aid – two years delay
For this situation it is assumed that Swedish aid is provided in terms of emergency oriented temporary bridges plus financing of reconstruction carried out solely by Honduran authorities, consultants and constructors.

Temporary bridges and fords are finalised between December 1998 and March 1999.

The bridges are reconstructed piecemeal during 22 months, from November 2001 to September 2003. We assume an economic life of 60 years.

The even longer delay is assumed to depend on the poverty of the country and limited experience of high-tech design and construction. For this situation we could alternatively have assumed that the work commences earlier but that it is still finished in September 2003. This alternative assumption might seem more realistic but would have come out as more costly than the assumption actually assumed since part of the costs would then appear at earlier points of time.

Situation 4: No reconstruction
For this situation it is assumed that Swedish aid is provided in terms of emergency oriented temporary bridges only.

Temporary bridges and fords are finalised between December 1998 and March 1999.

No permanent bridges are constructed, but fords or temporary bridges are assumed to be in use throughout the 60 years period.

This situation is clearly not realistic. It only serves as a reference in order to indicate the loss if the bridges were never rebuilt. Note also that we underestimate the cost of this situation since we do not assume any replacement of the temporary bridges during the 60 years period.

Differences between situations

Note that all situations are assumed to have in common the various phases of river-crossing possibilities and the emergency aid in terms of provisional bridges until the new bridges are in place. The only difference is the timing and costs of the permanent bridges, and consequently a difference in the length of the phase before the permanent bridges are assumed to be in place. The costs of the permanent bridges are basically assumed to be the same; only the timing and the related discount by use of the interest rate affect the difference in costs. We ignore maintenance costs during the lifetime of the bridges since these are virtually the same for all reconstruction alternatives.

Note, consequently, that it is only the difference in timing and therefore the costs of the permanent bridges that affect the difference in cost outcomes between the four situations. The key factor influencing the difference between the situations is the loss made until the new bridges are in place. For each situation we assume a more or less inferior alternative for river crossing prevalent before each new bridge is in place. This may be a ford, Bailey bridge or other bridge, lasting during different periods of time in each alternative. This inferior alternative causes user costs, in terms of freight and passenger time. What we compare is the total cost, investment cost in new bridges plus the user costs, for each situation.

Information and uncertainties

The actual construction times and costs are provided by the Swedish construction companies and could be regarded as rigorously reported and correct.

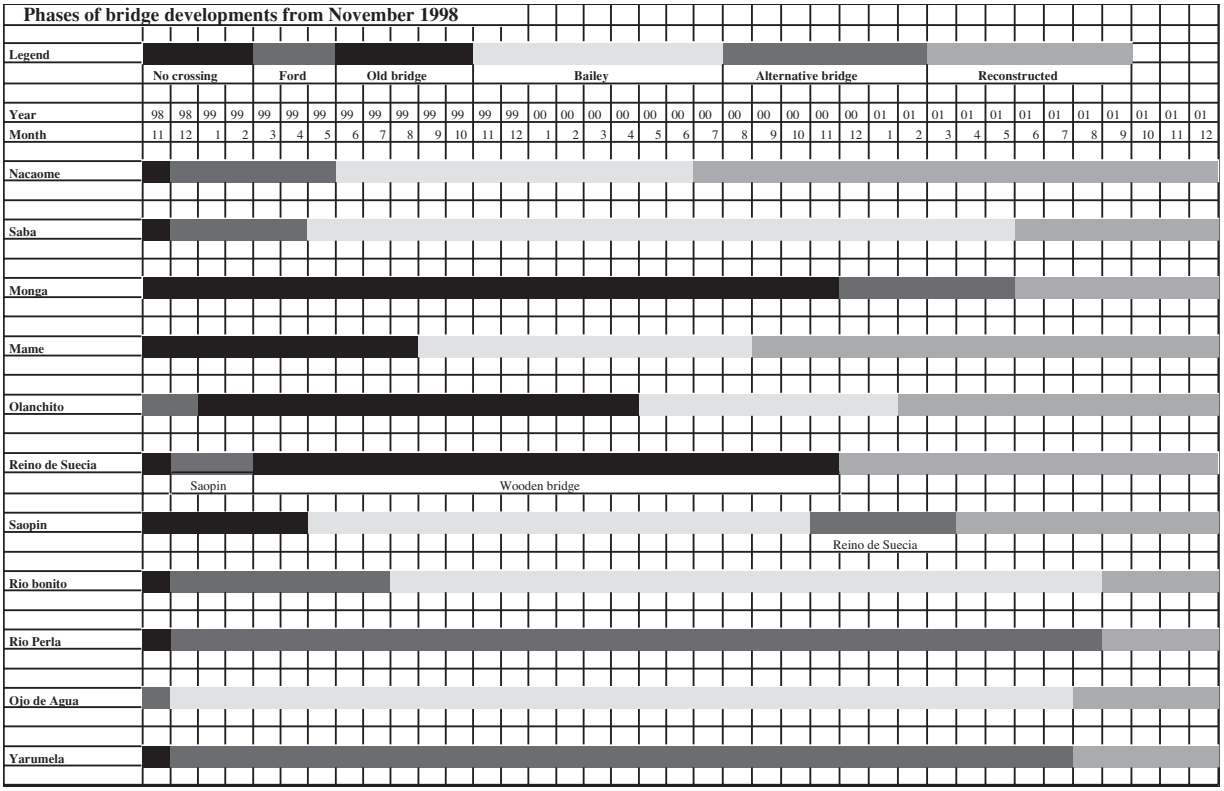
A more problematic part of the assessments concern assumptions on construction time and costs for the alternative situations as well as parameters on value of time, appropriate interest rate and future economic development. For these parts one should ideally make various assumptions that may give rise to different outcomes. The limited scope of this project does, however, not allow detailed calculations for different parameter assumptions, but we are convinced that in total our assumptions mean underestimation of the benefits.

The most problematic issues concern losses related to total loss of communication and limited delivery of necessary water, electricity and food supply as well as human and social implications. For these circumstances we do some rough quantified calculations based on assumed loss of value of freight, work time and leisure. Here we cannot and should not fully rely on assessments in monetary terms. Therefore we also try to describe the effects in social and human terms. Note, however, that the quantified assessment of the costs during the early phase without possibility to cross a river does not affect the comparison between the alternative situations.

4.3 Status of river crossings

The figure below shows our general description of the various phases of status of the river crossings from November 1998 to December 2001.

Figure 4.3.1 Estimated phases of river crossings



For each phase with respect to each bridge we have assumed specific losses in terms of time or in terms of longer distances or in terms of no passage at all. These assumptions are based on estimations made by officers at SOPTRAVI and, with respect to the bridges in La Ceiba, also by Mauricio Sanchez, director of land use planning.

A substantial part of the losses depend on queuing, for passing on a bed or ford or over a Bailey bridge. These bridges allow only one direction and are also risky for pedestrians and cyclists. This risk is one reason for our assumption on the same queuing time for pedestrians and cyclists as for vehicles even if the former might pass faster. In fact, many pedestrians and cyclists were often waiting until they dared to pass because of the vehicles, according to some of our sources.

In the appendix are found the results of these assumptions in table format. In the calculations the losses are expressed in money terms by use of operating costs and assumed values of time.

4.4 Demand and traffic flows

The effects of the demolition and the reconstruction of the bridges are largely related to the demand for transport over the rivers in question. Ideally one should know the origins and the destinations of various vehicles and passenger groups in order to calculate the time and kilometre losses and gains respectively. Within the scope of this project there has been no opportunity to conduct an origin-destination survey. We are dependent on traffic counts made on some bridges or nearby the bridges.

SOPTRAVI delivered counts for roads nearby all the bridges, which means that these figures do not necessarily reflect exactly the number of vehicles on the bridges. SWECO provided counts for the bridges Saopin, Reino de Suecia and Sabá, including pedestrians and bicycles. Our own small counts comprised Reino de Suecia, Saopin and Nacaome, including pwdestrians and bicylces and also separation between private cars and taxis. Merging of these various data sources resulted in the following assumptions on the average number of vehicles and passengers across the bridges per month. See appendix, A3, for more details on the sources.

Table 4.4.1 Estimated demand in terms of number of vehicles and passengers per month and bridge

No. of vehicles per month											
	Nacaome	Sabá	Olanchito	R de Suecia	Saopin	Mame	Perla	Yarumela	Bonito	Monga	Ojo de Agua
Car	15 060	2 700	6 990	16 800	28 800	2 847	10 050	18 090	10 050	9 180	7 080
Taxi	0	0	0	102 000	18 000	0	0	0	0	0	0
Buses	7 410	4 950	3 690	2 400	8 400	3 480	5 430	6 030	5 430	11 220	3 060
Pick-up	44 880	35 490	19 710	62 400	96 000	14 805	39 630	25 140	39 630	47 730	24 240
Truck 2 axles	12 420	8 430	5 580	5 116	9 849	3 815	15 060	9 270	15 060	12 300	6 990
Truck 3 axles	690	3 450	540	147	740	2 354	1 290	870	1 290	7 590	480
Truck >3 axles	9 090	4 020	1 350	737	2 611	2 308	9 420	4 080	9 420	7 440	3 090
Sum	89 550	59 040	37 860	189 600	164 400	29 610	80 880	63 480	80 880	95 460	44 940
No. of passengers per month											
Walk/bicycle	3 600	29 670	0	192 000	51 600	0	0	0	0	0	0
Car	30 120	5 400	13 980	33 600	57 600	5 695	20 100	36 180	20 100	18 360	14 160
Taxi	0	0	0	204 000	36 000	0	0	0	0	0	0
Buses	318 630	212 850	158 670	103 200	361 200	149 651	233 490	259 290	233 490	482 460	131 580
Pick-up	89 760	70 980	39 420	124 800	192 000	29 610	79 260	50 280	79 260	95 460	48 480
Sum	442 110	318 900	212 070	657 600	698 400	184 955	332 850	345 750	332 850	596 280	194 220

From table 4.4.1 it becomes apparent that the non-availability of data regarding the number of pedestrians, cyclists and taxis might be a problem since where data exist for these modes of transportation they are certainly not insignificant. Due to this lack of data we conclude that our estimations of costs are most reliable for the bridges Sabá, Reino de Suecia and Saopin. With respect to the other bridges our estimations probably represent considerable under-estimations of user costs.

4.5 Actual bridge construction times and costs

The provisional, so-called Bailey bridges, constructed by Swedish Räddningsverket, comprised the following seven: Nacaome, Sabá, Mame, Olanchito, Saopin, Rio Bonito, Ojo de Agua. The total cost of US$ 4.34 million (SEK 36.5 million) has been divided equally between the 7 bridges to get the cost of US$ 0.62 million per bridge. For all four situations this cost was assumed to appear at one point of time: January 1 2000.

The fixed costs for reconstruction of the eleven bridges, so-called on-costs, were about the same as the variable costs, US$ 18.3 million (SEK 153.3 million). This cost is not spread on each single bridge but taken into account only for the assessment of the whole package. For each situation this cost was assumed to appear at the following dates:

Situation 1: January 1 2000, situation 2: January 1 2001, situation 3: January 1 2002.

The variable construction costs for the bridges actually built have occurred during 22 months at different points of time. These costs have been taken into account separately for each bridge. The timing of the costs is specified in the appendix.

Maintenance costs are disregarded since they can be assumed to be more or less the same for all alternatives, except for alternative 4 that means no reconstruction. Since this alternative is found to be the very worst situation and not even relevant for this study there is no problem to ignore maintenance costs.

4.6 Values of time – passenger transport

Values of time are based on estimation of hourly income of various groups, stemming from a couple of sources. The table below shows our interpretation of actual incomes, based on an assumed GNP of 850 US$ per capita in 2001, its distribution on deciles and the number of persons in the work force. How these values have been derived is explained in the appendix.

Table 4.6.1 Estimation of monthly and hourly salaries

Estimated GNP per deciles					Estimated incomes per working person						
Deciles	Lps/m	US$/m	Lps/h	US$/h	Lps/m	US$/m	Lps/h	US$/h	Quintiles	Lps/h	US$/h
1	42	2,8	0,21	0,01	108	7,2	0,6	0,04	1	1,16	0,08
2	134	8,9	0,68	0,05	346	23,1	1,8	0,12	2	3,43	0,23
3	215	14,4	1,10	0,07	556	37,1	2,8	0,19	3	6,14	0,41
4	305	20,3	1,56	0,10	788	52,5	4,0	0,27	4	10,66	0,71
5	406	27,1	2,07	0,14	1050	70,0	5,4	0,36	5	31,75	2,12
6	525	35,0	2,68	0,18	1357	90,4	6,9	0,46			
7	687	45,8	3,51	0,23	1775	118,3	9,1	0,60			
8	930	62,0	4,75	0,32	2403	160,2	12,3	0,82			
9	1391	92,8	7,10	0,47	3595	239,6	18,3	1,22			
10	3427	228,5	17,48	1,17	8853	590,2	45,2	3,01			
Average	806	53,8	4,11	0,27	2083	138,9	10,6	0,71		10,63	0,71

The average income per hour assumed in this report is thus US$ 0.71. The highest quintile earns about 25 times the lowest quintile.

Since these figures are based on GNP statistics we know that the real income is higher due to the fairly high proportion of informal employment. We do not know the magnitude of this under-estimation of GNP. In this context this means that the values derived for time-delays on inferior bridges are probably under-estimated. On the other hand, for cases where there is no way to cross the river we assume higher values than those given by the mere reported incomes since transport costs constitute only part of the total value lost.

In order to find reasonable values of time there are two problems that one may be concerned with, the "poverty problem" and the "unemployment/growth problem", both of which can be expressed as being related to political preferences.

The poverty problem is that the poor have very limited resources for buying shorter travel times. The fact that they have a very small "willingness to pay" actually means that they have very limited ability to pay. On the other hand the more affluent parts of the population have a real willingness to pay and ability to pay. From a societal welfare point of view it might be questioned if such different income conditions should be fully reflected in values for passenger transport.

In industrialised countries a similar question is raised, although at another scale. It is often the case that more affluent people live in one part of a city and the less affluent in another part. If different values of time, which are related to income, were used when investments in the transport system are considered, then relatively more resources would be put into the rich part of the city than to the poor part. Politicians do then typically not accept different values of time related to income. Instead an average value of time is used. Correspondingly it is typically the case that, according to value of time studies, private car drivers have higher values of time than public transport passengers. Again, if separate values of time were employed relatively more would be invested in roads than in public transport. Both from a fairness point of view and from environmental reasoning a common value for all passenger journeys is the typical recommendation.

The unemployment/growth problem means that part of the poverty problem is related to unemployment. As soon as the unemployed or partly unemployed gets a full-time job his/her value of time would grow. As long as an individual is still poor, even with a job, the value of time per hour can be supposed to be close to the net income per hour since alternative ways to use the time are less important for the poor compared to the rich. In addition when economic growth takes place the value of time grows as well, but probably at a smaller rate than the economic growth.

Both problems indicate that the value of time of bus passengers, pedestrians and cyclists should be raised. In a longer perspective, such as the life length of a bridge, one can also assume that the value of time is growing. Consequently, if the bridges had never been reconstructed, the losses would have been much larger than estimated here. However, this no reconstruction alternative is not regarded as realistic and is neither in focus of this study.

Since we estimate time delays per transport mode we have to make assumptions of choice of mode by various groups. We have made the following assumptions about choice of mode per group.

Table 4.6.2 Assumed choice of modes per group, %

	walk/bicycle	car	taxi	bus	pick-up
Very poor	40	0	0	10	0
Fairly poor	30	0	0	30	0
Poor	20	0	0	40	0
Middle class	10	10	30	20	10
Rich	0	90	70	0	90
Sum	100	100	100	100	100

Evidently our assumptions on choice of mode per group will affect the estimation of number of journeys per group and consequently also the distribution of benefits. This fact should be kept in mind when one interprets the distribution of travel timesaving of the actual scheme undertaken.

The number of journeys per group is thus dependent on the two sources: a) the traffic counts and b) our assumptions on choice of mode per group. It will be found in the results that the number of journeys is not equally distributed between the groups, given the two sources above. If our assumptions on choice of mode are more or less correct the results show that the poor travel much less than the rich, especially by motorised transport. In turn, the low mobility of the poor reflects that they cannot afford to travel by bus or it takes prohibitively long time to walk or cycle, for example to a better job.

In the table below we have combined the assumptions on choice of mode and calculated values of time in order to arrive at average value of time per mode.

Table 4.6.3 Assumed value of time per mode

	Total value	Leisure value	Work value
	US$/h	US$/h	US$/h
Walk/bicycle	0,19	0,07	0,25
Car	1,38	0,98	1,98
Taxi	1,19	0,83	1,69
Bus	0,28	0,12	0,38
Pick-up	1,38	0,98	1,98
Average	0,88	0,60	1,26

In section 4.7 below we will also discuss the assumptions behind the case with total loss of communication over bridges.

Finally we have assumed that values of time are 10% higher on non-paved compared to paved roads, motivated by difference in comfort, and we have added the information from SOPTRAVI (1999) on the average occupancy rate per mode.

4.7 Transport costs

Basic data

The report "Costos de operaciónes de vehículos", by the planning department UPAG at SOPTRAVI has been very useful in order to understand the structure of the Hondurian transports. However, some data apparently were wrong. For this reason we had to make some interpretations and modifications and we are fairly confident in the estimations of operating costs.

We distinguish between costs for paved and non-paved roads respectively, based on SOPTRAVI (1999). The reasons for this distinction is that maintenance costs of vehicles and roads, as well as combustible costs, are higher on unpaved roads.

The table below gives the assumed operating transport costs per kilometre and hour respectively.

Table 4.7.1 Assumed operating costs

	Paved road		No paved road	
	Cost/km	Cost/hour	Cost/km	Cost/hour
	US$	US$	US$	US$
Walk/bicycle				
Car	0,11		0,14	
Taxi	0,11	1,17	0,14	1,17
Buses	0,17	2,60	0,26	2,60
Pick-up	0,14	1,17	0,19	1,17
Truck 2 axles	0,25	2,60	0,46	2,60
Truck 3 axles	0,33	2,60	0,55	2,60
Truck >3 axles	0,53	2,27	0,86	2,27

Loss of communication

When the bridges fell some people did not even have a realistic alternative "emergency" travel path. They had to stay at home, if they still had a home. These people can be assumed to have suffered most. If they had a job they lost their income. Correspondingly the employers lost their workers and profit formerly earned. In some cases also the loss of communication meant that deliveries of food and water were stopped.

The costs related to loss of communication are of course difficult to estimate in monetary terms. Costs in terms of lost wage income and lost profits should in principle be reflected in economic statistics, such as the National accounts. The effects related to consumption – in a wide sense, including the access to for instance education and health services – are much more difficult to measure, and observed market prices and/or production costs do not give much help in this regard. Using the terminology of economic welfare theory, it is to a very large extent a question of loss of consumer surplus, when people are forced to abstain from consumption of important goods and services. Typically, one may assume that the initial effects (costs) include on the one hand high costs in terms of travel time to access fundamental consumption necessities such as water and basic food items and on the other hand the loss of other consumption (private and public).

One might assume that those who no longer had a realistic alternative path anyway had some path, even if unrealistic. The transport time of this path could be assumed to reflect a maximum of the real loss. Actually, the loss of value of transport that is stopped is the value of the goods in question at the final consumption stage. One can disregard all manpower costs saved downstream since the resources used there probably have no alternative use. For transports stopped we could thus in principle try to find the final consumption prices and try to estimate losses of consumer surplus.

This period without any possibility to cross lasted from no days for some bridges to several weeks for other bridges. The losses are thus based on assumptions on average kilometres produced by each type of truck and on the vehicle cost per kilometre of each type presented above. To use the kilometre cost is clearly an underestimation of the real cost since transport costs only constitute part of the final value of the goods transported. Even if we recognise that deliveries can be delayed with some acceptance by the buyers we still consider the transport costs corresponds to the lower limit for the real costs. Especially so since some goods such as fruit and other agriculture products will loose all their value.

The assumed kilometres produced by vehicle type per one-way trip are the following:

- Pick-up: 20 km
- Truck with 2 axles: 40 km
- Truck with 3 axles: 80 km
- Truck with >3 axles: 200 km

For persons who cannot cross the river we assume that each work trip lost means 4 hours loss (8 hours to and from work) and each other purpose means 1 hour loss. In the table below the assumptions are given. Note that the column "Months lost" constitutes one example for a bridge. For other bridges the time lost is longer and for some bridges there was no complete loss of river crossing (see appendix, A2, for detailed assumptions for each bridge).

Table 4.7.2 Assumed distance, speed, time for not fulfilled transports

	Phase 1 no crossing					
		Freight			Passengers	
	Months lost	Km lost	speed km/h	Hours/ trip	Hours/ trip, work	Hours/ trip, leisure
Walk/bicycle	0,5				4	1
Car	0,5				4	1
Taxi	0,5				4	1
Buses	0,5				4	1
Pick-up	0,5	20	30	0,67	4	1
Truck 2 axles	0,5	30	40	0,75		
Truck 3 axles	0,5	80	60	1,33		
Truck >3 axle	0,5	200	60	3,33		

A critical issue is how the total value lost from not performed freight transports relates to the cost of the not performed transport itself. As mentioned above, manpower time saved virtually has no alternative value. Combustible costs, operation dependent maintenance costs etc. could be saved. On the other hand we do not know the consumer surplus lost. All in all we have to make a guess. In general terms transport costs often constitute around 5–10 per cent of the total final consumption price. However, since in this case some of the products not being able to move can be stored and consumed at a later stage, one cannot assume that the final value is 10–20 times the transport costs. Anyway, since a large part of the production is fruit, vegetables and other nutrition related products we assume that the total value lost is only five times the cost of the not performed transport. Bear in mind also that this assump-

tion only affects the cost during the first phase after the catastrophe and since this cost is the same for all situations examined it does not affect our estimation of the benefits of reconstruction. The assumption only affects the estimation of the total cost of the fall down of the bridges.

4.8 Environment and safety

Environmental parameters could in principle be based on official values used in Sweden, converted to Lempiras by the ratio between GNP per capita in Honduras and in Sweden. In the absence of estimates of the willingness to pay for environmental protection in Honduras, such conversion seems to be warranted for emissions with mainly local or regional impact on environment. It can be argued, however, that in such case environmental costs may be over-estimated for a poor country, as the "income elasticity" for environment protection probably is high (above unity).

For emissions with global effects (such as CO^2) the ideal case would be an international system for reduction, based e.g. on marketable emission permits. In that case values should be internationally determined and the same for all countries. In the absence of such a system, one could use the conversion based on per capita incomes also for this type of environmental effects, although it would tend to under-estimate the costs when applied to a poor country like Honduras.

However, it has appeared during the course of this project that the environment costs in terms of exhaust gases have been negligible in comparison with other costs and also extremely difficult to assess. The reasons are two: Firstly, the temporary stop of vehicle movements has reduced emissions. Secondly, the forced route-deviations due to demolition of bridges have been rare, with one exception, the Nacaome bridge. All in all it can be assumed that reconstruction of bridges has improved the environmental situation but it is not meaningful to try to estimate this gain in quantified monetary terms.

With respect to safety it is self-evident that river crossings without a bridge are dangerous. Even crossing on a Bailey bridge is risky, especially for pedestrians and cyclists. In this respect we have added some time for crossing for pedestrians and cyclists as a proxy for the risk. This concern in no way covers the whole pattern of risk, but there is no obvious way to quantify the risk. We can only say that new bridges reduce the risks and that the net benefit calculated under-estimates the value of risk reduction.

4.9 Interest rate and future economic development

The real interest rate applied in economic analysis should reflect the relative value of consumption at various points of time. Future costs and benefits are thus discounted by an interest rate that is supposed to reflect the individuals' trade-off between consumption today and next year respectively.

In this study we have assumed the real discount rate 4% for all periods of time. All costs are valued at the date 1 January 2002. A higher real discount rate than 4% could be defended only if a) one assumes a very fast economic development or b) there are so many projects with a social return over 4% that a choice had to be made within a budget constraint. For condition a) there is no reliable forecast and condition b) is not relevant for this kind of restoration project since no alternative investments are considered.

Anyway, in order to illustrate the effect of a higher discount rate, for example 12%, we demonstrate the difference in results for 4 and 12% interest rate respectively, for the bridge Saopin that has the largest net benefit. Below we show the net benefit of the actual project undertaken (situation 1) compared to situations 2, 3 and 4.

Net benefit of actual project compared to	Rate 4% Million US$	Rate 12% Million US$
Situation 2 – one year delay	12.6	13.1
Situation 3 – two years delay	25.2	25.1
Situation 4 – no reconstruction	313.9	130.3

The reason why the net benefit is larger for 4% than 12% interest rate when actual project is compared with situation 2 is that costs are valued at 1 January 2001, that is, after the actual reconstruction work. Note that the difference is small. In case we had made the valuation at a point of time before the construction work started we would also get a small difference, but in the other direction. If no reconstruction were assumed the difference in net benefit for the two alternative assumptions on discount rate would self-evidently be large since we deal with a 60 years long period, but the benefit of the actual scheme undertaken would still be huge with the higher interest rate.

To conclude we state that the choice of discount interest rate has no significance with respect to the alternative schemes in focus: actual project, one-year delay and two years delay.

5 Results of microeconomic analysis

Here we present the results for each bridge separately and for all bridges as a package. We thereby take into account user costs and the investment costs that are applicable to each bridge respectively. Common investment costs (the on-costs) are taken into account only for assessment of all bridges as a package.

The user costs and the variable investment costs are calculated for each of the four situations. The sum of user costs and investment costs for each situation is called total cost.

Results are presented on two pages for each single bridge. Finally we present the results for all bridges taken together. The results are presented in form of two diagrams and one table.

The first diagram presents an overview of investment costs, total costs (investment plus user costs) and the net benefits of the actual project undertaken (situation 1) versus alternative situations. The net benefits are calculated as the total cost of situation 2, 3 and 4 respectively, minus the total cost of the actual scheme applied (situation 1). The net benefit also reflects how much lower the investment cost of alternative 2, 3 and 4 respectively would have had to be to make it equivalent to the actual scheme applied.

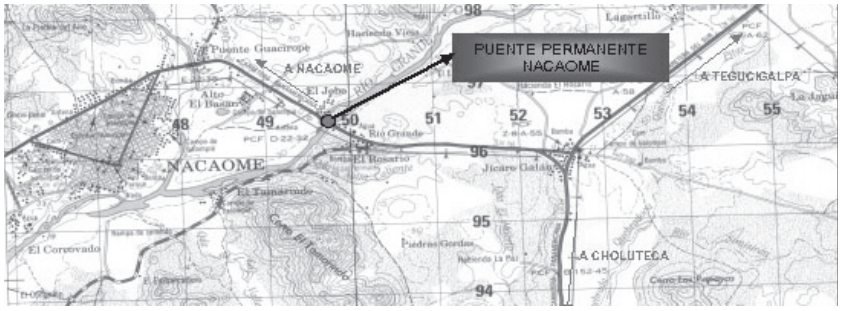
The table includes separation of user costs into freight costs and passenger costs. It also includes the net benefit of the actual project, as defined above, but here provided in monetary terms.

When comparing the results between bridges we notice significant differences between user costs, investment costs and net benefit depending. Construction costs certainly differ due to different circumstances for each bridge and consequently to the construction scheme that had to be undertaken for each bridge. One should bear in mind that for most bridges user costs have been underestimated in many cases due to lack of data on traffic flows, especially with respect to pedestrians, bicyclists and taxi passengers. Thus the net benefit of the scheme actually chosen, compared to the other alternatives, has certainly been under-estimated for most bridges.

The second diagram describes the distribution of the benefits of the actual scheme to the five socio-economic groups, for separate values of time and for a common, average, value of time. With respect to these distributions one must be cautious with interpretations due to one important aspect: the poor probably travel less than the rich do.

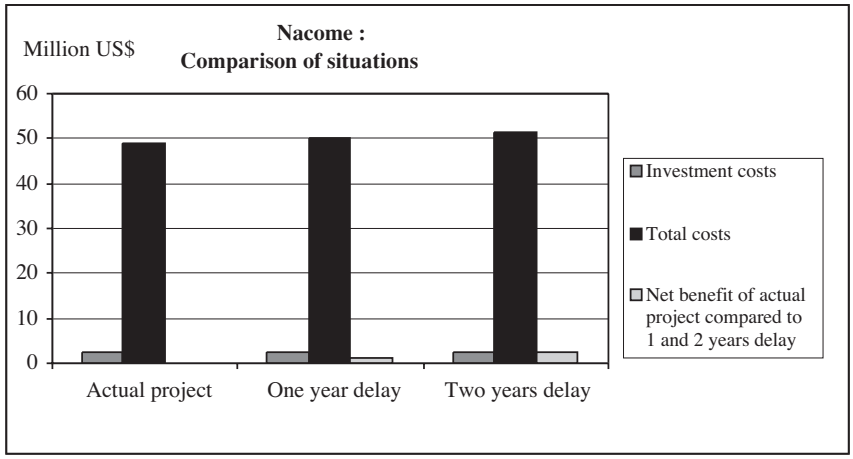
The number of journeys per group is dependent on the two sources: a) the traffic counts and b) our assumptions on choice of mode per group. It will be found in the results that the number of journeys is not equally distributed between the groups, given the two sources above. If our assumptions on choice of mode are more or less correct the results indicate that the poor travel much less than the rich, especially with motorised transport means. The reason why the poor travel less is that they cannot afford to travel by bus, or buses may be overcrowded, or it takes prohibitively long time to walk or cycle. In turn this means that poor standard and/or high price of bus service constitutes a barrier for a more equalised development and then also for increased productivity and economic development in general.

5.1 Bridge Nacaome



Position of the Nacaome bridge – an important link in the Panamerican Highway (CA1), used for import and export transports as well as for transfers between surrounding countries.

Diagram 5.1.1 Nacaome: Cost and benefit comparisons



For Nacaome bridge the investment costs constitute a very small part, 6%, of the user costs. In other words, the investment is paid off 16 times already within the project time.

The table below gives some more details on user costs (divided between freight costs and passenger costs), investment costs, total costs and the net benefits of the actual scheme (situation 1) compared to situation 2, 3 and 4 respectively.

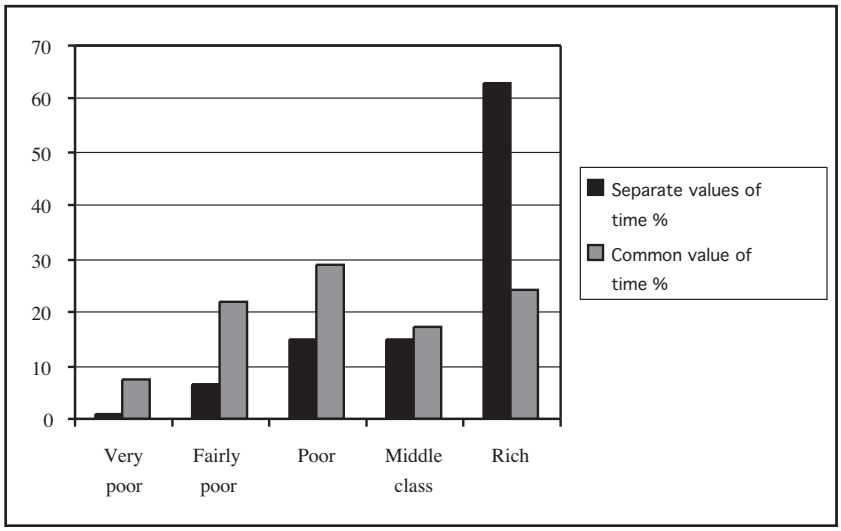
Table 5.1 Nacaome: Costs plus net benefits of actual project compared to alternative situations

	User costs			Investment costs	Total costs	Net benefits
	freight million US$	pax time million US$	total million US$	million US$	million US$	million US$
Situation 1	43,6	2,8	46,4	2,6	49,0	
Situation 2	44,1	3,6	47,7	2,5	50,3	1,2
Situation 3	44,6	4,4	49,0	2,4	51,5	2,4
Situation 4	55,0	23,2	78,2	0,6	78,8	29,8

The net benefit of the actual scheme compared to situation 2 and 3 would be US$ 1.2 million and 2.4 million respectively. In other words, in order to make one and two years delay more beneficial than the actual scheme applied, the investments costs would have had to be 48% (1.2/2.5) and 100% (2.4/2.4) cheaper respectively compared to the cost of the actual scheme. We shall then keep in mind that the lack of data on number of taxis means an underestimation of the net benefits.

In the diagram below we describe the distribution of travel-time savings of the actual scheme applied (situation 1), for separate values of time per group and for a common value of time for all passengers passing the bridge.

Diagram 5.1.2 Nacaome: Distribution of passenger time savings

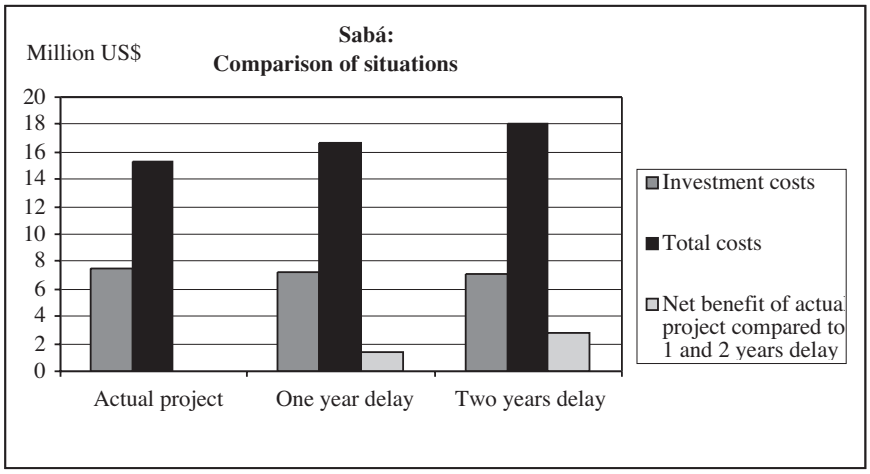


If separate values are applied the poor groups' share of the travel-time savings is 23% of the total savings. If a common value is used the poor group' share would be 59%.

5.2 Bridge Sabá

The Sabá and Monga bridges 75 kilometres south east of La Ceiba in the Aguan valley, one of the important banana districts.

Diagram 5.2.1 Sabá: Cost and benefit comparisons



For Sabá bridge the investment costs are a little smaller than the user costs. In other words one could say that the investment is almost paid off already within the project time.

The table below gives some more details on user costs (divided between freight costs and passenger costs), investment costs, total costs and the net benefits of the actual scheme (situation 1) compared to situation 2, 3 and 4 respectively.

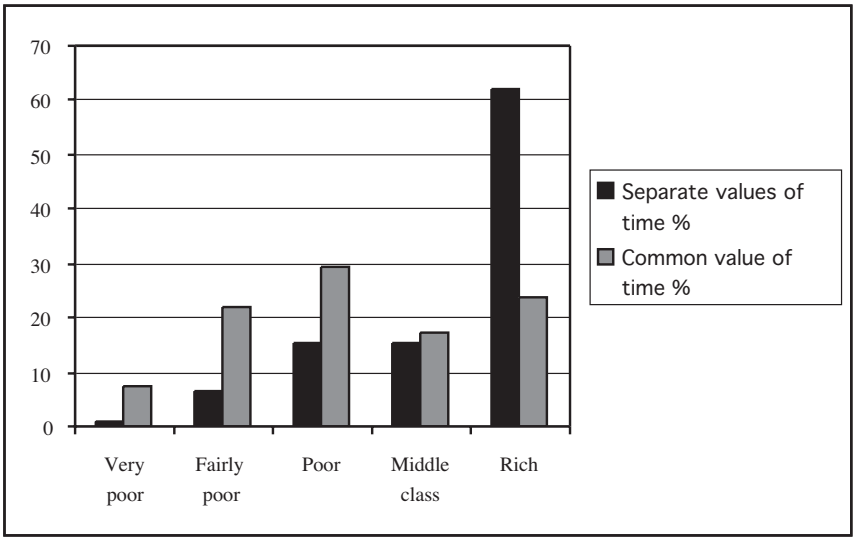
Table 5.2 Sabá: Cost plus net benefits of actual project compared to alternative situations

	User costs			Investment costs	Total costs	Net benefits
	freight million US$	pax time million US$	total million US$	million US$	million US$	million US$
Situation 1	4,2	3,6	7,7	7,5	15,3	
Situation 2	4,8	4,7	9,4	7,3	16,7	1,4
Situation 3	5,4	5,7	11,1	7,0	18,1	2,8
Situation 4	18,8	29,8	48,6	0,6	49,2	33,9

The net benefit of the actual scheme compared to situation 2 and 3 is calculated to be US$ 1.4 million and 2.8 million respectively. In other words, in order to make situation 2 and 3 more beneficial than the actual scheme applied, the investments costs would have had to be 20% (1.4/7.3) and 40% (2.8/7.0) cheaper respectively compared to the actual scheme. However, the lack of data on number of taxis means an underestimation of the net benefits.

In the diagram below we describe the distribution of travel-time savings of the actual scheme applied (situation 1), for separate values of time per group and for a common value of time for all passengers passing the bridge.

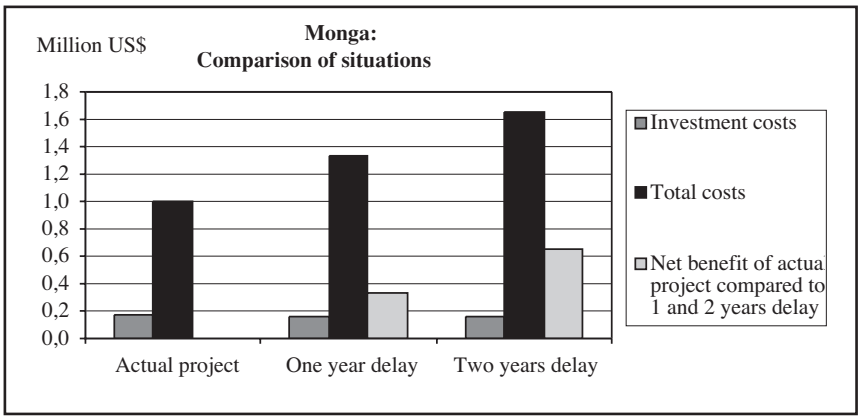
Diagram 5.2.2 Sabá: Distribution of passenger time savings



If separate values are applied the poor groups' share of the travel-time savings is 24% of the total savings. If a common value is used the poor group' share would be 61%.

5.3 Bridge Monga

Diagram 5.3.1 Monga: Cost and benefit comparisons



For Monga bridge the investment costs constitute a small part, 25%, of the user costs. In other words the investment was paid four times already before the project was finished.

The table below gives some more details on user costs (divided between freight costs and passenger costs), investment costs, total costs and the net benefits of the actual scheme (situation 1) compared to situation 2, 3 and 4 respectively.

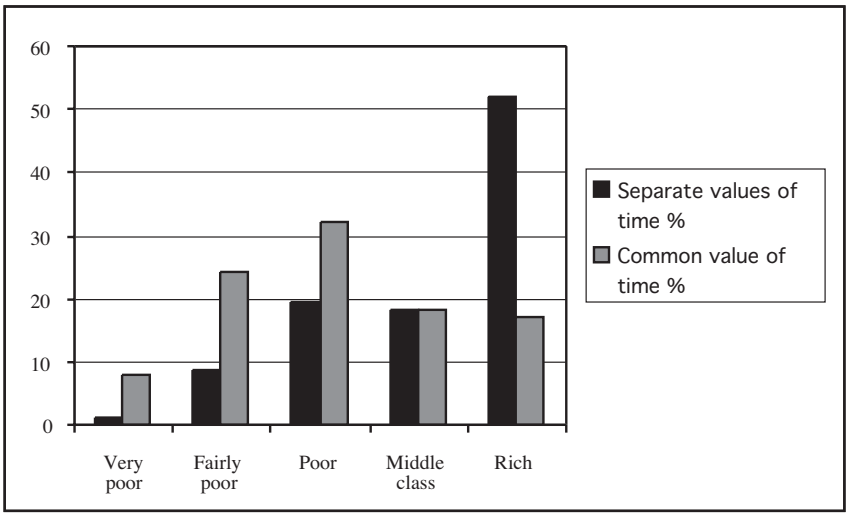
Table 5.3 Monga: Costs plus net benefits of actual project compared to alternative situations

	User costs			Investment costs	Total costs	Net benefits
	freight million US$	pax time million US$	total million US$	million US$	million US$	million US$
Situation 1	0,4	0,4	0,8	0,2	1,0	0,0
Situation 2	0,6	0,5	1,2	0,2	1,3	0,3
Situation 3	0,8	0,7	1,5	0,2	1,7	0,7
Situation 4	4,6	4,3	8,9	0,0	8,9	7,9

The choice of a speedy implementation scheme here seems very beneficial, when compared to the investment cost even though data on the number of taxis is missing. Not even if the investment costs had been zero for alternative 2 and 3 would they have been better than the actual project undertaken. One reason is of course the fairly low investment cost compared to the user costs.

In the diagram below we describe the distribution of travel-time savings of the actual scheme applied (situation 1), for separate values of time per group and for a common value of time for all passengers passing the bridge.

Diagram 5.3.2 Monga: Distribution of passenger time savings

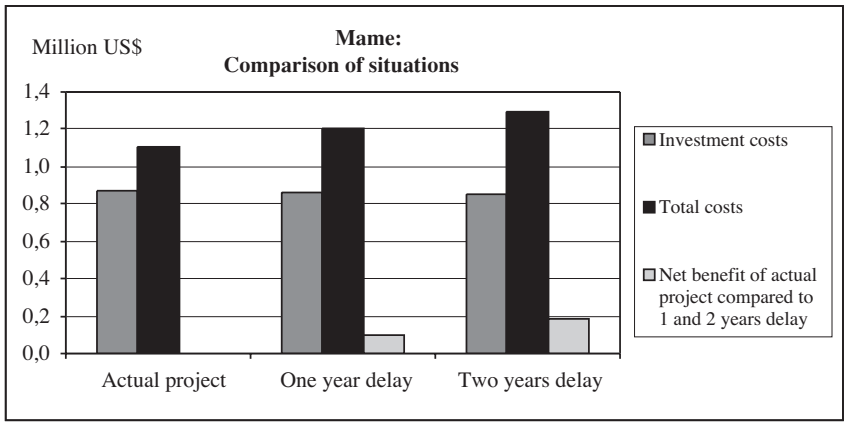


If separate values are applied the poor groups' share of the travel-time savings is 30% of the total savings. If a common value is used the poor group' share would be 65%.

5.4 Bridge Mame

The Mame bridge about 30 kilometres wets of Saba, also in the Aguan valley.

Diagram 5.4.1 Mame: Cost and benefit comparisons



For the Mame bridge the investment costs are fairly high compared to the user costs. It would take a few years to pay off the investment cost.

The table below gives some more details on user costs (divided between freight costs and passenger costs), investment costs, total costs and the net benefits of the actual scheme (situation 1) compared to situation 2, 3 and 4 respectively.

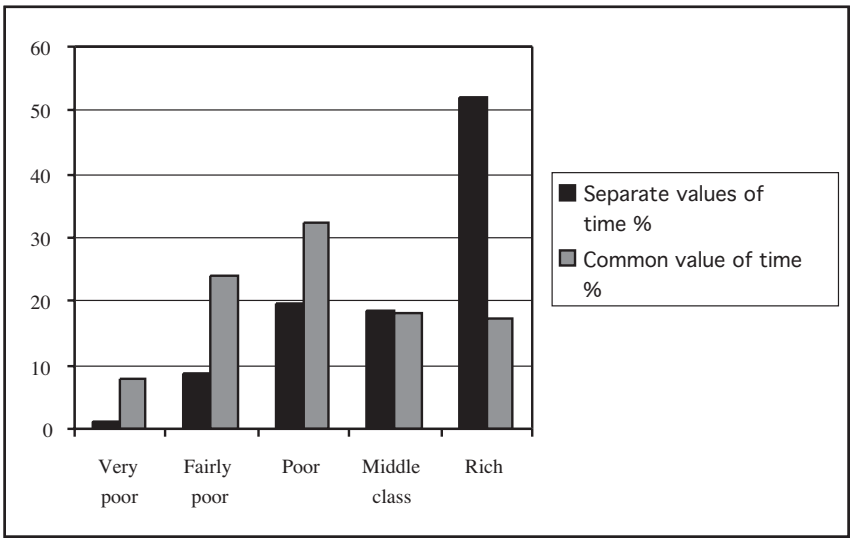
Table 5.4 Mame: Costs plus net benefits of actual project compared to alternative situations

	User costs			Investment costs	Total costs	Net benefits
	freight million US$	pax time million US$	total million US$	million US$	million US$	million US$
Situation 1	0,1	0,1	0,2	0,9	1,1	0,0
Situation 2	0,2	0,2	0,3	0,9	1,2	0,1
Situation 3	0,2	0,2	0,4	0,9	1,3	0,2
Situation 4	1,5	1,4	2,8	0,6	3,4	2,3

The fairly low net benefits are probably due to the missing data concerning the number taxis, and most of all, on the number of pedestrians and cyclists. Ignoring these missing benefits we can see that situation 1 would have been as good as the actual scheme if the investment costs had been 11% (0.1/0.9) lower. Situation 2 would have been as good as the actual scheme if the investment costs had been 22% (0.1/0.9) lower.

In the diagram below we describe the distribution of travel-time savings of the actual scheme applied (situation 1), for separate values of time per group and for a common value of time for all passengers passing the bridge.

Diagram 5.4.2 Mame: Distribution of passenger time savings

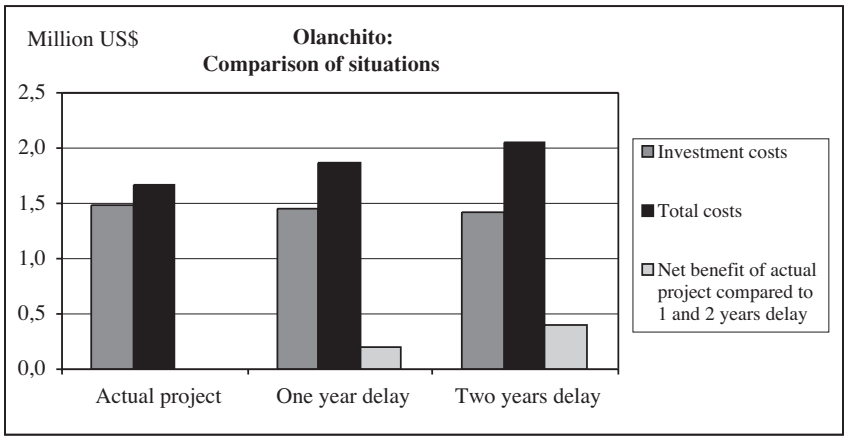


If separate values are applied the poor groups' share of the travel-time savings is 30% of the total savings. If a common value is used the poor group' share would be 65%.

5.5 Bridge Olanchito

The Olanchito bridge, about 5 kilometres west of the Mame bridge, in the Aguan valley.

Diagram 5.5.1 Olanchito: Cost and benefit comparisons



Also for the Olanchito bridge the investment costs are fairly high compared to the user costs. It would take a few years to pay off the investment cost.

The table below gives some more details on user costs (divided between freight costs and passenger costs), investment costs, total costs and the net benefits of the actual scheme (situation 1) compared to situation 2, 3 and 4 respectively.

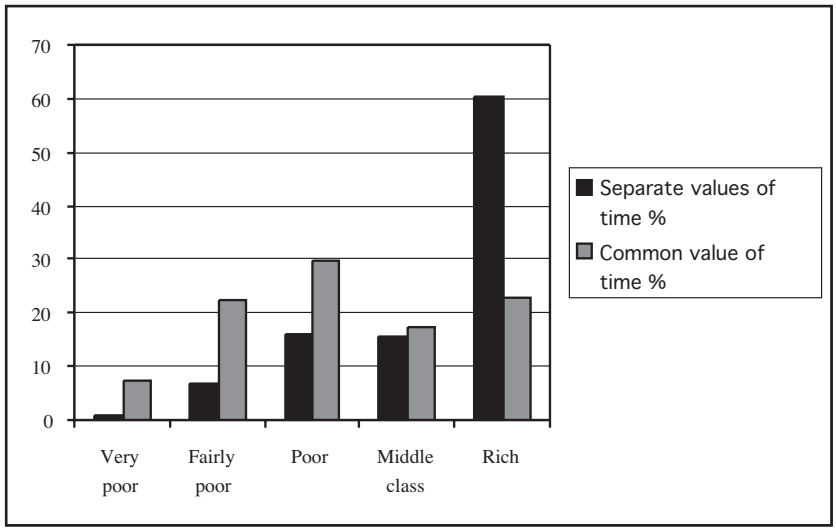
Table 5.5 Olanchito: Costs plus net benefits of actual project compared to alternative situations

	User costs			Investment costs	Total costs	Net benefits
	freight million US$	pax time million US$	total million US$	million US$	million US$	million US$
Situation 1	0,1	0,1	0,2	1,5	1,7	0,0
Situation 2	0,2	0,3	0,4	1,4	1,9	0,2
Situation 3	0,2	0,4	0,6	1,4	2,1	0,4
Situation 4	2,2	3,6	5,8	0,6	6,4	4,8

The fairly low net benefits are probably due to the missing data on number taxis, and most of all, on the number of pedestrians and cyclists. Ignoring these missing benefits we can see that situation 1 would have been as good as the actual scheme if the investment costs had been 14% (0.2/1.4) lower. Situation 2 would have been as good as the actual scheme if the investment costs had been 29% (0.4/1.4) lower.

In the diagram below we describe the distribution of travel-time savings of the actual scheme applied (situation 1), for separate values of time per group and for a common value of time for all passengers passing the bridge.

Diagram 5.5.2 Olanchito: Distribution of passenger time savings

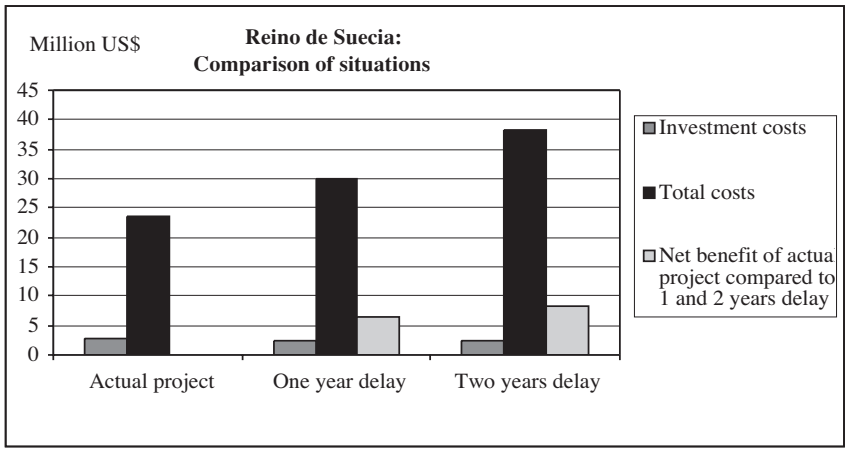


If separate values are applied the three poor groups' share of the travel-time savings is 23% of the total savings. If a common value is used the poor groups' share would be 60%.

5.6 Bridge Reino de Suecia

The Reino de Suecia and Saopin bridges – crucial for the City of La Ceiba. Reino de Suecia, before the catastrophe named Cangrejal, was originally a railway bridge only, built by Standard Fruit for banana transports out of the Aguan valley. After reconstruction the bridge is wider and used for road vehicles and pedestrians, mainly as an important urban link.

Diagram 5.6.1 Reino de Suecia: Cost and benefit comparisons



For Reino de Suecia the investment costs constitute a very small part, 13%, of the user costs. In other words the user costs until the project was finished were 8 times the investment cost.

The table below gives some more details on user costs (divided between freight costs and passenger costs), investment costs, total costs and the net benefits of the actual scheme (situation 1) compared to situation 2, 3 and 4 respectively.

Table 5.6 Reino de Suecia: Costs plus net benefits of actual project compared to alternative situations

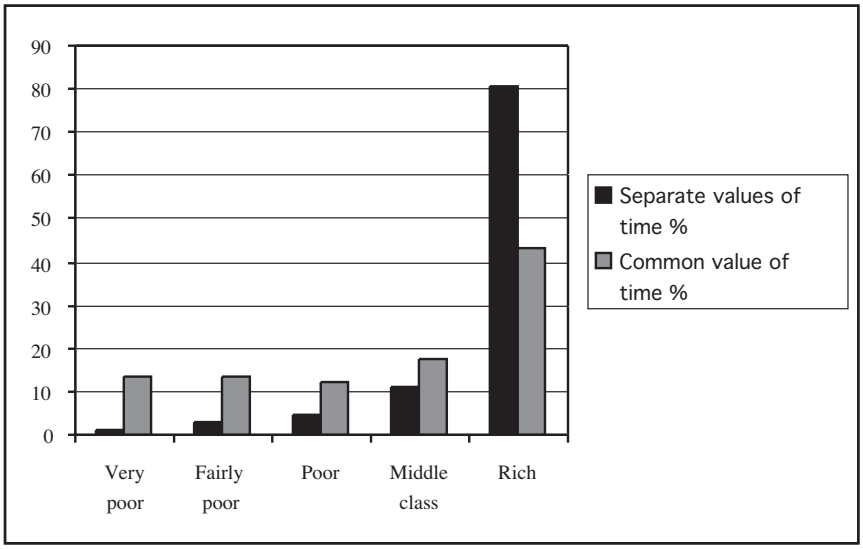
	User costs			Investment costs	Total costs	Net benefits
	freight million US$	pax time million US$	total million US$	million US$	million US$	million US$
Situation 1	8,2	12,9	21,0	2,7	23,7	0,0
Situation 2	8,9	18,6	27,5	2,5	30,0	6,3
Situation 3	11,7	24,1	35,7	2,5	38,2	8,2
Situation 4	73,8	145,6	219,4	0,0	219,4	181,2

The benefit of the actual scheme applied is very large for Reino de Suecia. This is so in spite of the fact that we have only taken into account the benefits of pedestrians, cyclists and cars that were able use the

old Reino de Suecia before Mitch. Not even if the investment costs had been zero for alternatives 2 and 3 would they have been better than the actual project undertaken. We have then neither taken into account the extra benefits of the fact that the new Reino de Suecia also allows buses and trucks. These extra benefits are probably quite large.

In the diagram below we describe the distribution of travel-time savings of the actual scheme applied (situation 1), for separate values of time per group and for a common value of time for all passengers passing the bridge.

Diagram 5.6.2 Reino de Suecia: Distribution of passenger time savings



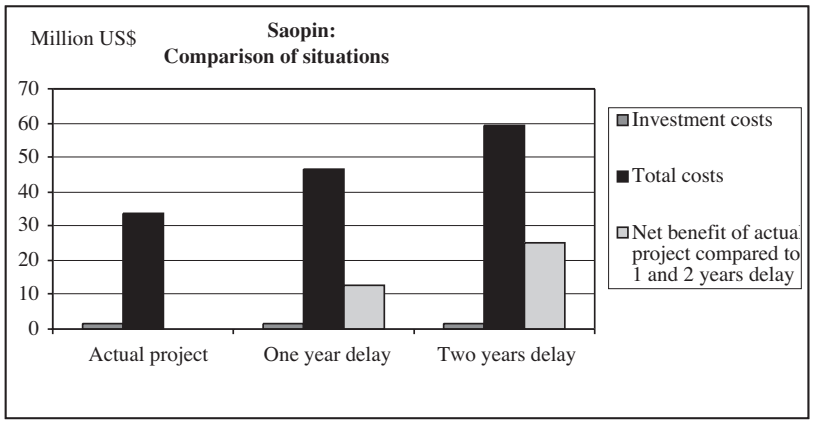
If separate values are applied the poor groups' share of the travel-time savings is 9% of the total savings. If a common value is used the poor group' share would be 39%. Apparently the very low supply of bus transport facilities over the bridge implies that the bridge gives relatively low benefits to the poor part of the population.

Some more important aspects on this bridge are discussed in section 7.3 "The unfinished" bridge.

5.7 Bridge Saopin

Saopin is located a bit south of Reino de Suecia along highway CA3, an important link to the port of the city Trujillo and the Aguan valley.

Diagram 5.7.1 Saopin: Cost and benefit comparisons



Also for Saopin the investment costs constitute a very small part, 5%, of the user costs. In other words the user costs until the project was finished were 20 times the investment cost.

The table below gives some more details on user costs (divided between freight costs and passenger costs), investment costs, total costs and the net benefits of the actual scheme (situation 1) compared to situation 2, 3 and 4 respectively.

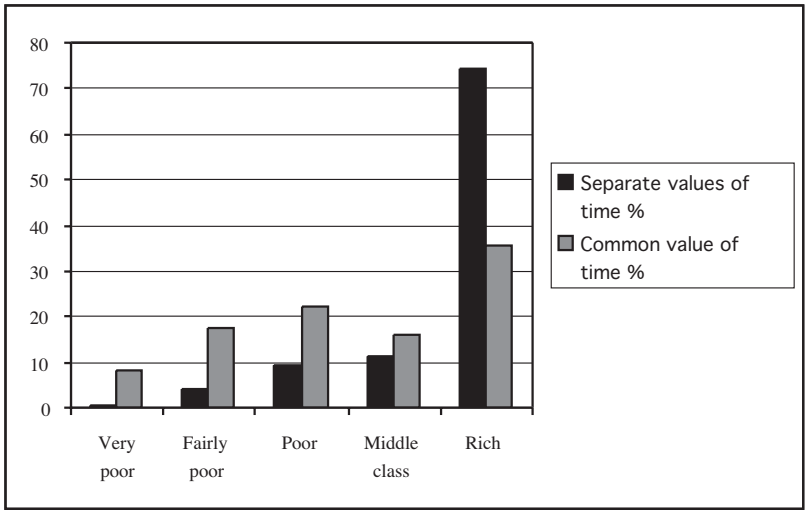
Table 5.7 Saopin: Costs plus net benefits of actual project compared to alternative situations

	User costs			Investment costs	Total costs	Net benefits
	freight million US$	pax time million US$	total million US$	million US$	million US$	million US$
Situation 1	10,0	22,5	32,5	1,5	33,9	0,0
Situation 2	12,7	32,4	45,1	1,4	46,5	12,6
Situation 3	15,7	42,0	57,7	1,4	59,1	25,2
Situation 4	84,8	262,3	347,1	0,6	347,8	313,9

The speedy reconstruction of Saopin, the other bridge in La Ceiba, seems even more beneficial than Reino de Suecia. Not even if the schemes according to situation 2 and 3 had been free of investment costs would they have been socially better than the actual scheme applied.

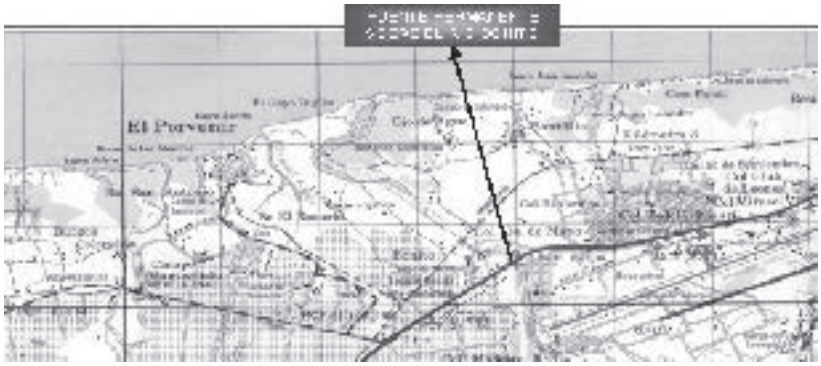
In the diagram below we describe the distribution of travel-time savings of the actual scheme applied (situation 1), for separate values of time per group and for a common value of time for all passengers passing the bridge.

Diagram 5.7.2 Saopin: Distribution of passenger time savings



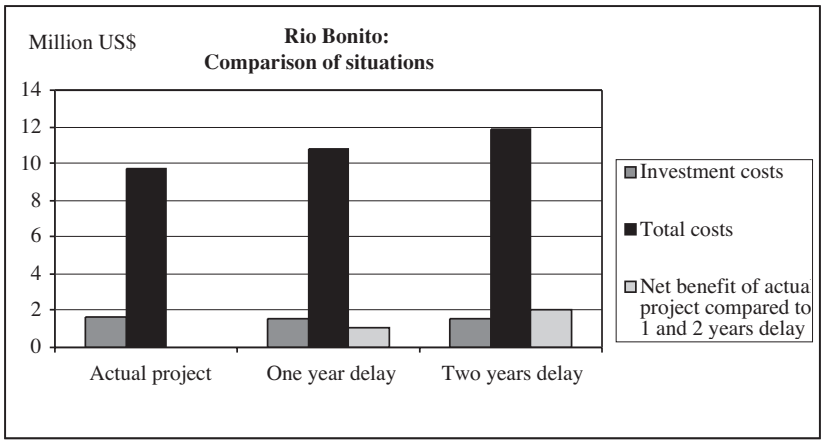
If separate values are applied the poor groups' share of the travel-time savings is 15% of the total savings. If a common value is used the poor group' share would be 46%.

5.8 Bridge Rio Bonito



Rio Bonito, located about 4 kilometres west of La Ceiba, along the main Atlantic highway CA3.

Diagram 5.8.1 Rio Bonito: Cost and benefit comparisons



For Rio Bonito the investment costs constitute a very small part, 20%, of the user costs. In other words the investment cots are paid back 5 times already before the project was finished.

The table below gives some more details on user costs (divided between freight costs and passenger costs), investment costs, total costs and the net benefits of the actual scheme (situation 1) compared to situation 2, 3 and 4 respectively.

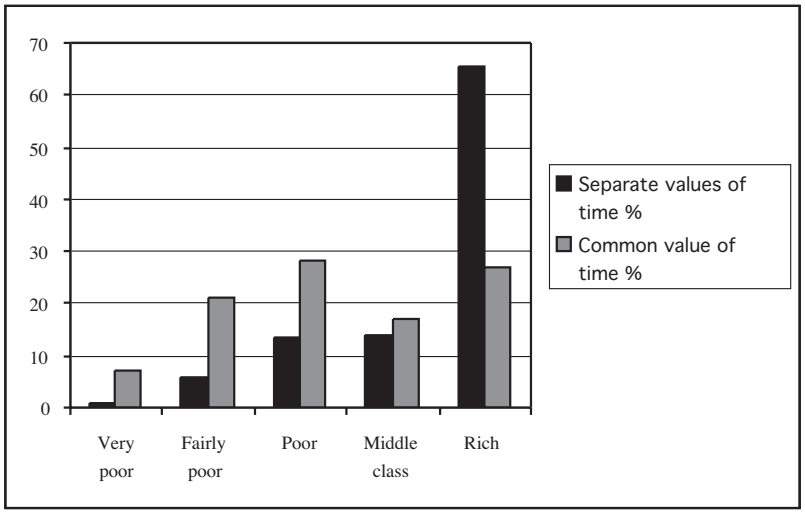
Table 5.8 Rio Bonito: Costs plus net benefits of actual project compared to alternative situations

	User costs			Investment costs	Total costs	Net benefits
	freight million US$	pax time million US$	total million US$	million US$	million US$	million US$
Situation 1	5,5	2,6	8,1	1,6	9,8	
Situation 2	6,0	3,2	9,2	1,6	10,8	1,0
Situation 3	6,4	3,8	10,2	1,6	11,8	2,1
Situation 4	16,3	17,6	34,0	0,6	34,6	24,8

The net benefits appear to be fairly high, although underestimated due to the missing data on the number of taxis, pedestrians and cyclists. Situation 1 would have been as good as the actual scheme if the investment costs had been 62% (1.0/1.6) lower. Situation 2 would not have been better even if the bridges had been free to construct

In the diagram below we describe the distribution of travel-time savings of the actual scheme applied (situation 1), for separate values of time per group and for a common value of time for all passengers passing the bridge.

Diagram 5.8.2 Rio Bonito: Distribution of passenger time savings

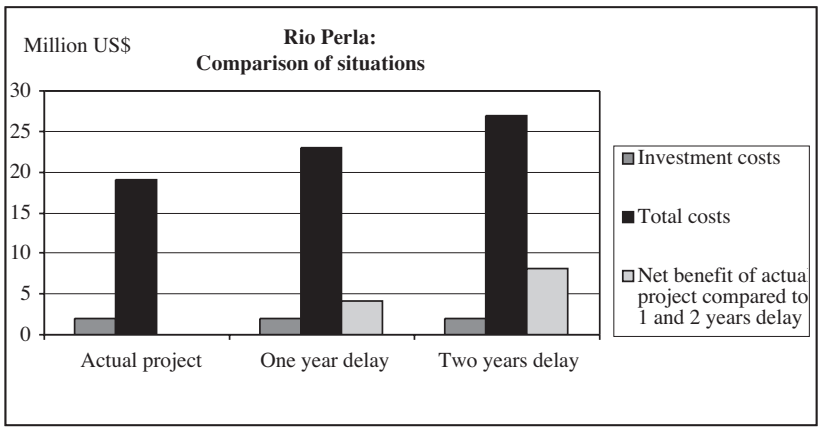


If separate values are applied the poor groups' share of the travel-time savings is 20% of the total savings. If a common value is used the poor group' share would be 56%.

5.9 Bridge Rio Perla

Rio Perla, located about 10 kilometres west of La Ceiba, along the main Atlantic highway CA3.

Diagram 5.9.1 Rio Perla: Cost and benefit comparisons



For Rio Perla the investment costs constitute a very small part, 12%, of the user costs. In other words the investment cots are paid back 8 times already before the project was finished.

The table below gives some more details on user costs (divided between freight costs and passenger costs), investment costs, total costs and the net benefits of the actual scheme (situation 1) compared to situation 2, 3 and 4 respectively.

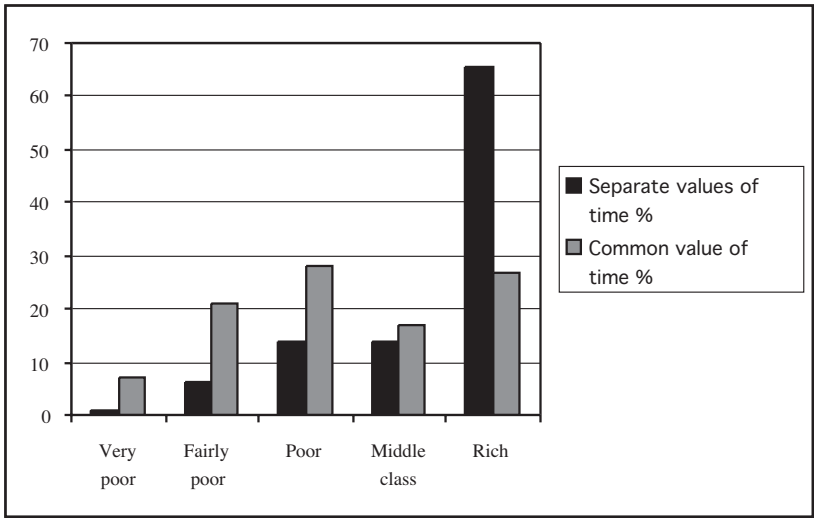
Table 5.9 Rio Perla: Costs plus net benefits of actual project compared to alternative situations

	User costs			Investment costs	Total costs	Net benefits
	freight million US$	pax time million US$	total million US$	million US$	million US$	million US$
Situation 1	8,5	8,4	17,0	2,0	19,0	
Situation 2	10,1	11,1	21,1	2,0	23,1	4,1
Situation 3	11,6	13,6	25,1	1,9	27,0	8,0
Situation 4	45,7	71,2	116,9	0,0	116,9	97,9

The benefit cost ratio is very high in spite of the missing data regarding the number taxis pedestrians and cyclists. Not even if the schemes according to situation 2 and 3 had been free of investment costs would they have been socially better than the actual scheme applied.

In the diagram below we describe the distribution of travel-time savings of the actual scheme applied (situation 1), for separate values of time per group and for a common value of time for all passengers passing the bridge.

Diagram 5.9.2 Rio Perla: Distribution of passenger time savings

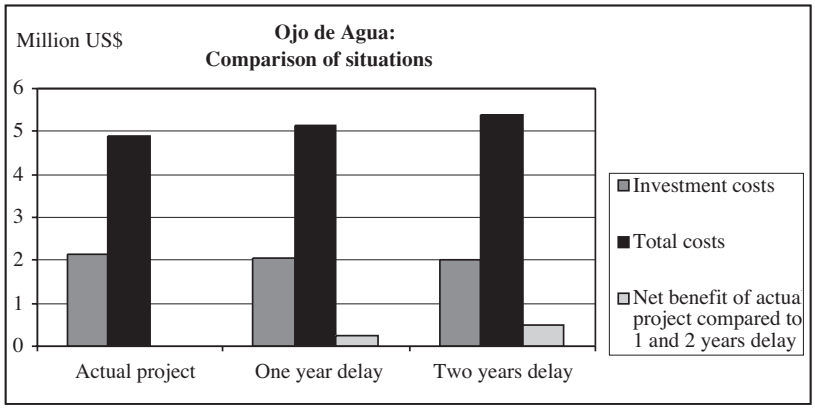


If separate values are applied the poor groups' share of the travel-time savings is 20% of the total savings. If a common value is used the poor group' share would be 56%.

5.10 Bridge Ojo de Agua

Ojo de Agua (on the map named El Guayabo), located some 70 kilometres east of Tegucigalpa and important for transports to Nicaragua.

Diagram 5.10.1 Ojo de Agua: Cost and benefit comparisons



For Ojo de Agua the investment costs are relatively large compared to the user costs. The investment would be paid off only after some years.

The table below gives some more details on user costs (divided between freight costs and passenger costs), investment costs, total costs and the net benefits of the actual scheme (situation 1) compared to situation 2, 3 and 4 respectively.

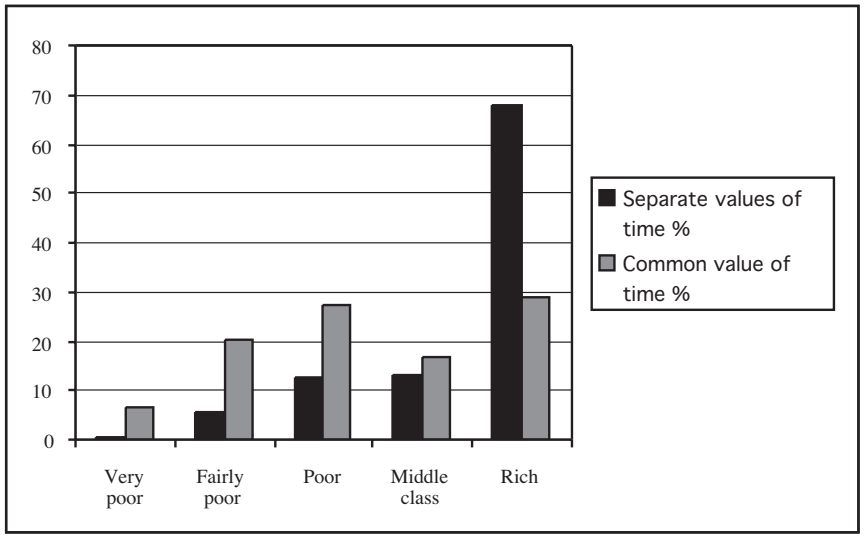
Table 5.10 Ojo de Agua: Costs plus net benefits of actual project compared to alternative situations

	User costs			Investment costs	Total costs	Net benefits
	freight million US$	pax time million US$	total million US$	million US$	million US$	million US$
Situation 1	1,8	1,0	2,8	2,1	4,9	
Situation 2	1,9	1,1	3,1	2,1	5,2	0,2
Situation 3	2,1	1,3	3,4	2,0	5,4	0,5
Situation 4	4,8	5,3	10,1	0,6	10,7	5,8

For this bridge the net benefit of the actual scheme compared to the other two situations seems to be the lowest compared to the other bridges. In order to make situation 2 and 3 more beneficial than the actual scheme applied, the investments costs would have had to be 10% (0,2/2.1) and 25% (0.5/2.0) cheaper respectively compared to the actual scheme. One reason is the fairly high investment cost relative the traffic flow we have information about. A complementary reason is then of course the missing data regarding the number of taxis, pedestrians and cyclists.

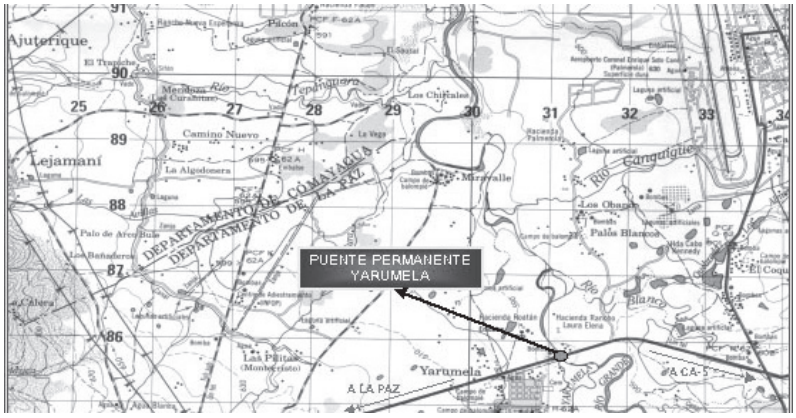
In the diagram below we describe the distribution of travel-time savings of the actual scheme applied (situation 1), for separate values of time per group and for a common value of time for all passengers passing the bridge.

Diagram 5.10.2 Ojo de Agua: Distribution of passenger time savings



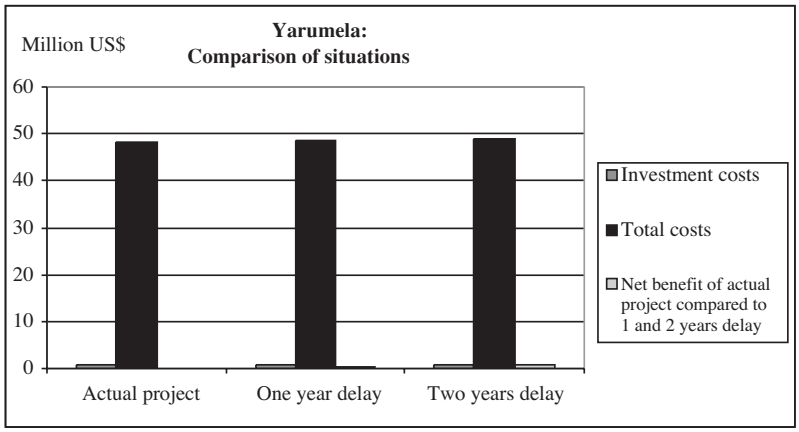
If separate values are applied the poor groups' share of the travel-time savings is 19% of the total savings. If a common value is used the poor group' share would be 54%.

5.11 Bridge Yarumela



Yarumela, located 80 kilometres north west of Tegucigalpa near the city of La Paz.

Diagram 5.11.1 Yarumela: Cost and benefit comparisons



For Yarumela bridge the investment costs constitute a very small part, 2%, of the user costs. In other words the user costs until the project was finished were 50 times the investment cost.

The table below gives some more details on user costs (divided between freight costs and passenger costs), investment costs, total costs and the net benefits of the actual scheme (situation 1) compared to situation 2, 3 and 4 respectively.

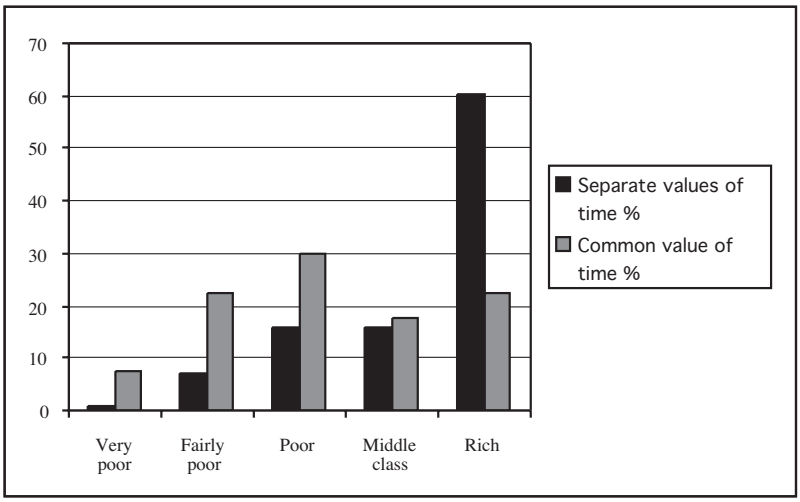
Table 5.11 Yarumela: Costs plus net benefits of actual project compared to alternative situations

	User costs			Investment costs	Total costs	Net benefits
	freight million US$	pax time million US$	total million US$	million US$	million US$	million US$
Situation 1	34,3	12,9	47,2	0,9	48,0	
Situation 2	34,4	13,2	47,6	0,8	48,5	0,4
Situation 3	34,6	13,5	48,1	0,8	48,9	0,9
Situation 4	38,1	20,2	58,3	0,0	58,3	10,3

The net benefits are fairly high but underestimated due to the missing data on the number taxis, pedestrians and cyclists. In order to make situation 2 more beneficial than the actual scheme applied, the investments costs would have had to be 50% (0.4/0.8) lower. Situation 3 would not have been better even if the bridge had been free to construct.

In the diagram below we describe the distribution of travel-time savings of the actual scheme applied (situation 1), for separate values of time per group and for a common value of time for all passengers passing the bridge.

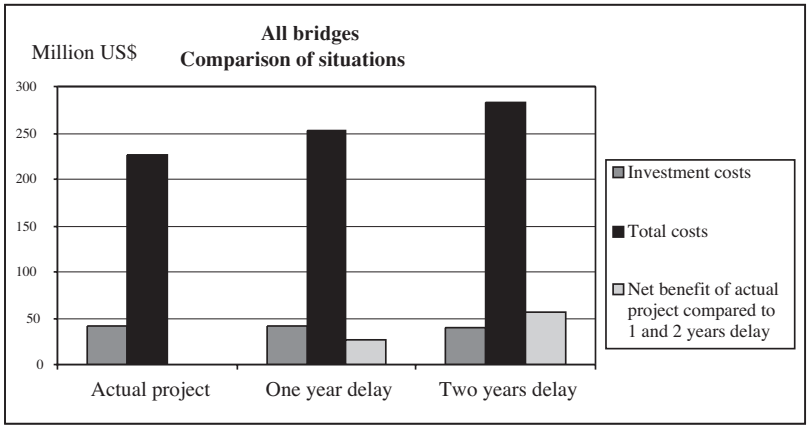
Diagram 5.11.2 Yarumela: Distribution of passenger time savings



If separate values are applied the poor groups' share of the travel-time savings is 24% of the total savings. If a common value is used the poor group' share would be 60%.

5.12 All eleven bridges

Diagram 5.12.1 All eleven bridges: Cost and benefit comparisons



In total the investment costs constitute about 20% of the user costs. In other words, the bridges are paid off 5 times already when the project was finished.

The table below gives some more details on user costs (divided between freight costs and passenger costs), investment costs, total costs and the net benefits of the actual scheme (situation 1) compared to situation 2, 3 and 4 respectively.

Table 5.12 All eleven bridges: Costs plus net benefits of actual project compared to alternative situations

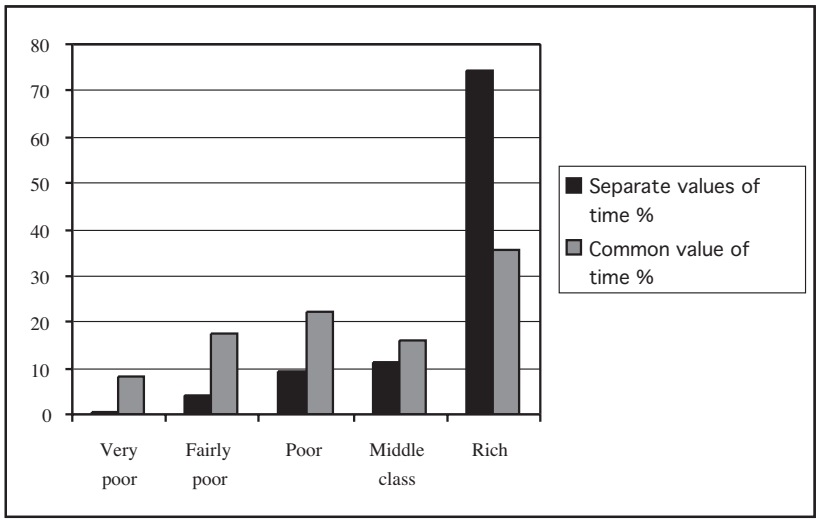
	User costs			Investment costs	Total costs	Net benefits
	freight million US$	pax time million US$	total million US$	million US$	million US$	million US$
Situation 1	117	67	184	42	226	
Situation 2	124	89	213	41	254	27
Situation 3	133	110	243	40	282	56
Situation 4	346	584	930	4	935	708

The user cost of situation 1, 184 million US$, can be interpreted as our estimation of the total cost to the society caused by the fall down of these eleven bridges. We shall bear in mind that this estimation is uncertain, mainly dependent on the difficulty to make assumptions on the costs when bridges could not be crossed, for example the assumption on the total value lost in relation to the transport costs (discussed in section 4.7). Anyway, the estimation of this total cost is not the focus of this study, but instead the value reconstruction at various points of time, and then the total cost is the same for all points of time and consequently irrelevant.

If the freight transport cost over the Nacaome bridge were low before reconstruction the benefit of the actual scheme comprising all bridges is still substantial. Assuming that reconstruction had been finished one year later (situation 2), the investments costs would have had to be 67% (27.3/40,9) lower in order to make it better than the actual project undertaken. If reconstruction had been finished two years later (situation 3), this alternative had not even been better if the bridges had been free to construct.

It is not always the case that individuals' preferences are politically accepted. The crucial concern is that willingness to pay is related to ability to pay. From a distribution or fairness point of view politicians may conclude that the values reflected by willingness to pay should be modified with respect to income or other individual resources. We therefore present the estimations of timesaving obtained by the actual reconstruction scheme undertaken, based on separate values of time as well as on one common, average, value of time. The diagram below shows the distribution of this timesaving, between five socio-economic groups, three of which, including 60% of the population, are considered poor at various degrees.

Diagram 5.12.2 All eleven bridges: Distribution of passenger time savings



By applying a separate value of time for each group it becomes clear that the benefits of the bridges mostly go to the middle class and the rich. According to the calculations the three poor groups obtain

only 15% of the benefits. On the other hand, if benefits of each time unit saved were valued the same for all groups, the benefits of the three poor groups would comprise 46% of the total benefits.

Note, then, that the distribution of timesaving when a common value of time is used merely reflects the distribution of number of journeys made, based on traffic counts and our estimations of choice of mode of each socio-economic group. Provided that our assumptions on choice of mode are correct, one can also draw the conclusion that the rich travel more than the poor do, and the poor certainly use motorised transport less than the rich. This, in turn, may reflect that the poor cannot afford to travel or that it is too time consuming to walk or cycle long distances to, to a better job for example. One should then bear in mind, however, that the missing information on number of pedestrians and cyclists over most bridges, results in underestimating the amount of travel and the benefits of the new bridges that go to the poor. In reality, if pedestrians and cyclists were properly represented, the benefits of the poor are larger than calculated here, both for separate values of time and a common value of time.

In total, for all eleven bridges the quantified calculations indicate that:

- Compared to no reconstruction of permanent bridges, the actual scheme applied, situation 1, turns out to be, self-evidently, very beneficial. The construction costs could have been 20 times higher and still being socially worthwhile. Bear in mind, however, that this calculation is less meaningful also since many aspects have not been quantified so the real gains may be much larger.
- Compared to a one-year delay of construction of permanent bridges, the actual scheme applied has meant a net benefit of 27 million US$ according to the calculations. In other words, with a one-year delay the bridges should have cost only a third of the actual cost to construct in order to make this delay socially preferable.
- Compared to two years delay the calculations indicate a net benefit of 56 million US$ of the actual scheme applied. In other words, since the investment cost is around 40 million US$, the bridges should have had to be free to construct in order to make a two years delay socially preferable.

6 Macroeconomic analysis

6.1 Introduction

The microeconomic analysis will ideally provide indications on the effects on individuals and businesses and the aggregate welfare impacts by the fall and rise of the eleven bridges. The disaster and the reconstruction of these eleven bridges have also affected the economy of the country as a whole. Furthermore, the reconstruction of some other 90 bridges plus roads and other infrastructure has affected the economic situation.

In this project it is therefore believed to be fruitful to try to trace a connection between reconstruction work in general and economic development in general. Ideally this effort may result in an overall assessment of the welfare effects. One might then also indirectly assess the partial effects of reconstruction of the eleven bridges. The assessment can thus be done in two alternative ways in order to cross-check the validity of the microeconomic analysis.

6.2 Results of macroeconomic analysis

Honduras has one of the lowest income per capita levels in America, around 850 US$ dollars. The agricultural sector accounts for 15-20 percent of GDP, and two thirds of the population live in rural areas. The economy is markedly export oriented, with exports of goods and services corresponding to 40 percent of GDP. Major export commodities are bananas, coffee and seafood.

In the five years before Mitch (1993-1997), GDP in Honduras increased at an average rate of 3.5 percent per year, as compared to 3.2 percent per year for the preceding 10-year period. The growth rate for the Agriculture and Fisheries sector was somewhat lower than average (3.1 percent) while manufacturing grew by 4 percent per year.

In the following table, those growth rates are compared to what has happened to production in 1998 and the two years after Mitch (the figures for 2000 are early estimates).

Table 6.2.1 Production levels and production growth

	1993-97	1998	1999	2000e
Real growth rates, percent				
Agriculture and Fisheries	3.1	-1.9	-8.5	7.6
Manufacturing	4.0	3.4	2.6	4.9
Construction	-4.4	5.3	10.5	4.2
Total GDP, at factor prices	3.5	2.6	-1.0	5.7

The negative effect on GDP indicated by the growth rates of 2.6 and -1 percent respectively in 1998 and 1999 appears very limited. They indicate a negative deviation from trend (as a sum over those two years) by only some 4,5 percent (or US$ 250 million). But, as discussed earlier, the GDP figures give very limited information on macroeconomic impact and they probably under-estimate substantially the actual social costs. GDP estimates for 2000 are still very preliminary, and estimated growth rates vary between different sources from 4.8 to 6 percent. However they all indicate a substantial recovery in macroeconomic terms during the first phase of the reconstruction period.

The figures also indicate that the negative impact was most pronounced in agriculture, where production decreased considerably during 1998-99. The effect on manufacturing appears to have been relatively limited. For production in the Construction sector, reconstruction efforts led to an upswing from a very low activity level immediately before Mitch.

If, instead we look at the economy from the user side, we get the following picture, especially regarding private consumption and exports.

Table 6.2.2 Expenditure on Gross domestic product

	1993-97	1998	1999	2000
Real growth rates, percent				
Private consumption	3.0	5.2	-0.6	4.4
Public consumption	-2.7	15.4	9.8	9.1
Gross investment	7.4	10.3	6.3	-4.7
Exports, goods and services	2.1	1.6	-11.2	4.9
Imports, goods and services	2.1	7.5	4.3	4.4

The impact on private consumption reflected here is rather limited, but as discussed earlier it does not picture, in a comprehensive or meaningful way, the effect on household's living standard. The same holds for the figures regarding public consumption. The figure for 1993–1997 here reflects attempts to reduce the size of the public sector and public consumption. Substantial increases in the last three years are probably due to emergency measures leading to increased employment in the public sector.

The most striking feature is the decrease in exports by more than 11 percent in 1999, which is in part attributable to the loss of transport and other infrastructure. At the same time, imports of goods and services increased substantially. As a result, the trade balance has increased dramatically – from 5.8 percent of GDP in 1997 to 14.2 percent in 1999. At the same time, however, transfers from the rest of the world increased sharply – from US$ 312 million in 1997 to US$ 737 million in 1999. The total effect on the current account balance was therefore limited. The deficit in the current account balance had increased sharply in the early 1990s. Following a marked improvement between 1994 and 1998, the deficit has again tended to increase during the last two years. The following table shows the changes in the current account and external public debt since 1991.

Table 6.2.3 Current account deficit and external public debt (US$ million)

	Current Account deficit	External public debt
1991	170	3 081
1992	258	3 409
1993	327	3 693
1994	352	3 744
1995	177	3 997
1996	194	3 885
1997	183	3 786
1998	149	3 825
1999	200	4 188
2000	204	4 202

Honduras' external public debt increased sharply between 1991 and 1995, by 30 percent in US$ (current prices). A marked improvement occurred in the following three years, and in 1997–98 the debt was around 5 percent lower than in 1995. However, the impact of Mitch on the debt level as well as on the current account deficit is clearly visible.

The discussion so far has centred mainly on the general economic background and the visible initial macroeconomic effects of the Mitch disaster. The main purpose of the project, however is to try and assess the effects of the reconstruction effort – total effects and effects of the Swedish part of the programme. We have already mentioned the major difficulties and limitations that are unavoidable in such an assessment. It must also be stressed that at this early stage, much of the necessary information is not yet available.

Some indications on the general level can be extracted from the tables above, however:

- The estimated recovery in total production (GDP) in 2000 is substantial. Although, in part, it reflects the direct activities of reconstruction investments, it also indicates recovery in other sectors in the economy.
- Production in the agriculture sector has increased by more than 7 percent. Even though the production level is still some 3 percent lower than in 1997, this must be seen as a substantial improvement.
- The figures also indicate a strong recovery in private consumption growth.
- Exports of goods and services have increased by around 5 percent. This means, however, that most of the losses in 1999 are still to be recovered.
- The situation regarding the current account balance and external government debt appears to have stabilised in 2000.

It is very difficult, at this early stage to assess the macroeconomic effects of the speed in which the reconstruction efforts are implemented. But as an illustration of the amounts that can be involved for the total, international and domestic, reconstruction program, a numerical example may give some indication. Let us compare two cases, where a complete recovery of GDP to trend is achieved, one of them in three years (2000–2002), the other in four years (2000–2003). In the second case, GDP growth in 2000 is assumed to have been only at 2.5 percent as compared to the actual estimate of 5.7 percent in the first case. We compare those two alternatives to a growth trend situation "without Mitch" with 3,5 percent growth for the years 1998–2002.

Table 6.2.4 Three hypothetical growth scenarios; GDP in million US dollars.

	"Without Mitch"	2 year recovery	3 year recovery
Growth rates, percent			
1998	3.5	2.6	2.7
1999	3.5	-1.0	-1.0
2000	3.5	5.7	2.5
2001	3.5	5.2	5.7
2002	3.5	5.2	5.7
2003	3.5	3.5	5.7
GDP, US$ million			
1998	4 865	4 822	4 822
1999	5 035	4 774	4 774
2000	5 211	5 046	4 893
2001	5 393	5 308	5 172
2002	5 582	5 582	5 467
2003	5 777	5 777	5 777

The (undiscounted) GDP losses in US$, compared to the trend case, can be calculated at 554 million in the three-year recovery case as opposed to 960 million in the four-year alternative. The difference – some 400 million US$ can be seen as a measure of the benefits from speedy implementation of the

recovery efforts. This is of course only a numerical example, intended to illustrate the kind of macro-economic effects involved, when delays occur in the implementation of reconstruction programs. Still, it underlines the possibility that the socio-economic benefits from speedy implementation can be very high. Also, as explained earlier, macroeconomic analyses based on GDP-data tend to seriously under-estimate the social benefits from the speedy reconstruction of infrastructure. This is mainly the result of weaknesses the measurement of public consumption, but also of the fact that some important aspects of timesaving are not part of GDP as a measure of economic welfare. The tendency for under-estimation should be kept in mind especially when trying to compare the results to those in the microeconomic assessment of specific projects. And it needs to be stressed once again that we see microeconomic analysis as the most accurate basis for evaluating the socio-economic effects of the reconstruction programme.

From the micro-economic and macro-economic quantified assessments made here we feel confident to conclude that the actual gain of the speedy implementation is socially justified.

Our conclusion that the scheme actually applied by Sida seems superior to the alternative, conventional, schemes that would mean delays refer to this specific project. We have no basis for a conclusion that this unconventional scheme applied is generally superior.

7 Social assessment

This section of the report was originally anticipated to contain a socio-economical analysis based on observations on living conditions in areas close to the bridges. We had hoped to be able to describe the effects of the fall and rise of the bridges on ordinary local people and to assess the degree to which the poor were affected. This ambition was only partly successful, but instead it was felt that the section might serve to offer some general observations and conclusions that we were able to make during the relatively limited visit in Honduras. This section will therefore not claim to be "scientific" but more a subjective reflection of the impressions of the consultants involved.

7.1 General impact on poverty

As has been mentioned before, it is not easy to separate the impact of the reconstruction of the eleven "Swedish" bridges on the whole economic and social fabric of Honduras and to measure this in any quantified way. It is not even easy to describe what the total impact of Mitch was in terms of poverty and social effects.

Honduras uses various methods to assess poverty (see IDA-IMF, 2001), such as Poverty Line (PL), Unsatisfied Basic Needs (UBN) and Human Development Index (HDI). Although their results may differ somewhat, it seems that poverty, as a result of Mitch, increased by some 3 percent units as the percentage of indigent households went from 45 to 48 (HDI) and the number of poor people increased by 300 000 from 55 to 58% (PL). This halted the positive trend during the 1990:s according to which Honduras, although still one of the poorest countries in the Latin American and Caribbean region, could be said to be more or less on the right track when the hurricane struck.

An observation in one of the recent studies (Paes de Barros, 2000) dealing with the poverty issue in Honduras is that the main reason for the poverty increase after Mitch was a reduction of total resources in society rather than an increased degree of inequality. In fact the Gini coefficient[1] for decreased from 58,0 to 56,3 indicating that the hurricane actually made Honduras somewhat more equal. This would mean that rich people lost more from Mitch than poor people did, which, in its turn, would indicate that the notion that Mitch hit the poorest people hardest is not as obvious as it might have seemed. Rather, according to these results, more people became poor than before but for the ones who were already among the poorest, the effects of Mitch were limited.

While this analysis may be correct in terms of overall economical statistics, it is still obvious that Mitch brought a lot of suffering among individual poor people. Only fragments of factual evidence (or even interviews) were available during the visit and it is likely that most stories will remain undocumented. Some newspaper articles from the time immediately after Mitch, however, can provide some understanding of the magnitude of the disaster on the local level. The newspaper Tiempo from 9 – 11 November 1998, for example, reports from the municipality of Tela of a thousand houses destroyed and 15.000 homeless people. Health problems were acute as skin diseases, respiratory problems and malaria affected 90% people. The damage on small farming was incalculable but high, especially in Ramal del Tigre, where all cattle, pigs, chicken, turkeys and horses were lost. Transportation was certainly one of the main problems. Health care was difficult because of lack of medicine and of means of distributing it into local communities. 10 bridges were reported damaged (presumably small rural ones) and assessment of damage and establishing of local priorities was difficult because of lack of access as most roads were damaged.

[1] The Gini coefficient ranges from 0 for equal distribution to 100 when one person has all income

In rural areas, access between many villages became impossible or prohibitively expensive. Buses stopped at the rivers and people had to board new ones and pay twice on the other side. A major city like La Ceiba became both isolated and divided, paralysing normal work activities and pushing the prize of a banana up from 1 Lempira to 7. People who had used the Municipal bridge for walking and bicycle access to the city from the eastern side now had to make a detour of some 4 kilometres to pass over the Saopin bridge.

Por destrucción de puentes

Incomunicada La Ceiba con sectores de Colón, Gracias a Dios y La Mosquitia

La gente busca de cualquier forma atravesar el Río Cangrejal para llegar a sus comunidades, incluso poniendo en peligro su vida

LA CEIBA. La destrucción de los puentes Cangrejal y Saopín mantiene incomunicada a esta ciudad con los sectores de Colón, Gracias a Dios, La Mosquitia y parte de Yoro, lo que ha suspendido el transporte terrestre por tiempo indefinido debido a la magnitud de los daños causados a la infraestructura vial por el huracán Mitch.

La gente que ha quedado incomunicada busca de cualquier forma atravesar el río Cangrejal para llegar a sus comunidades, incluso poniendo en peligro su propia vida, para lo cual utiliza canoas, lanchas y vehículos preferiblemente altos y de doble tracción.

Mucha de esta gente es trasladada al otro lado del río en una canasta de metal deslizada por cables de acero que ha sido atada de un extremo a otro del puente Saopín y la que fue facilitada por la Standar Fruit Company.

Ayer eran largas filas de adultos, niños y ancianos que esperaban ser trasladados en la canasta, cuya transportación es sumamente lenta ya que el aparato sólo tiene capacidad para unas cuatro o cinco personas.

La destrucción de ambos puentes, el Cangrejal y el Saopín, los cuales están sobre el mismo río y los separa una distancia de apenas medio kilómetro, ocurrió la madrugada del miércoles anterior cuando el río Cangrejal se convirtió en una tromba huracanada que arrastró piedras, troncos de árboles y pedazos de viviendas que arrasaba a su paso.

La embestida hizo añicos los dos puentes, cuyos pedazos fueron arrastrados por la tromba, quedando esparcidos a ambos lados del río y atrapados entre las rocas y troncos de árboles a varios metros del lugar.

"Esa madrugada que se cayó el puente se sintió un fuerte temblor en toda esta zona que nos sobresaltó a todos", relató un vecino del lugar refiriéndose al puente Cangrejal, el cual era una sólida mole de hierro y concreto que fue construido en 1912 por la United Fruit Company para el paso del ferrocarril.

La avalancha destruyó sólo en ese sector unas 12 casas y una fábrica maquiladora que estaban localizadas en la margen derecha del río, arrasando además toda la colonia Los Bomberos, también llamada "El Chorizo", cuyo número de viviendas destruidas hasta ayer no había sido precisado por las autoridades del Comité de Emergencia Regional [illegible] (CODER).

En ese mismo sector, las aguas se desbordaron provocando además inundaciones a decenas de viviendas de las colonias Pizate, Sierra Pinto y San Miguel.

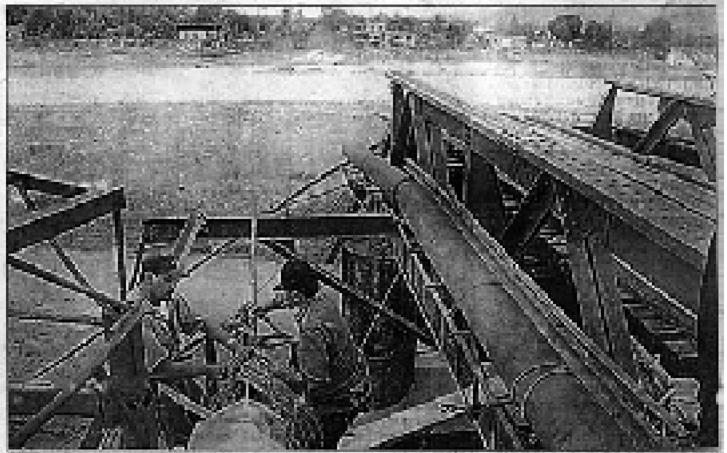
Colonias marginales como La Pradera, Zelaya, Bella Vista, Alvarado y otras que están en la misma situación en ese sector, al margen izquierdo del río Cangrejal, se salvaron de ser arrasadas ya que el río estuvo a punto de rebasar el muro de contención que protege esas comunidades.

En esta ciudad además fueron inundadas muchas viviendas de los barrios La Julia, Inglés, colonia Miramar, Danto y otras localizadas en el sector este.

Hasta ayer las autoridades del CODER estimaban en 40 las personas muertas en los sectores insular y atlántico del país, así como un total de 3,000 las viviendas destruidas.

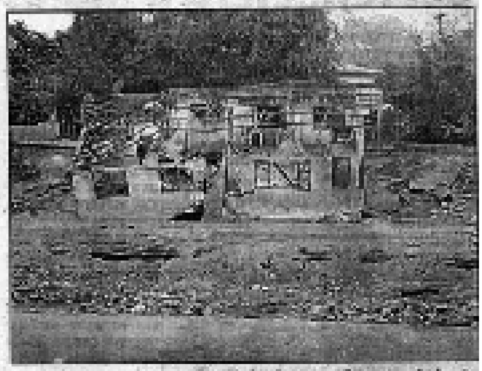
Según el despacho, en esta ciudad se reportaron 10 muertos y dos desaparecidos, en El Porvenir 2, en Jutiapa 2, en Guanaja 12, y en Roatán 27.

La cifra de viviendas destruidas se desglosa así: 900 en La Ceiba, 86 en El Porvenir, 12 en San Francisco, 171 en Esparta, 72 en Arizona, 399 en Jutiapa, 167 en Balfate, 200 en Guanaja, 6 en Roatán, y 2000 en [illegible], donde prácticamente fue arrasada toda una



Empleados de la Empresa Hondureña de Telecomunicaciones (HONDUTEL) [illegible] en el puente Cangrejal [illegible] La Ceiba con los sectores de Colón, Gracias a Dios, La Mosquitia y parte de Yoro.

El puente Cangrejal, por donde pasaba el ferrocarril de la Standard Fruit Company, quedó destruido en un 70 por ciento pese a que era una sólida mole de hierro y concreto.



Aquí se observa una de las dos [illegible] de las bases por la misma avalancha que llevó los puentes Cangrejal y Saopín.

Tiempo 9 November 1998

Thousands of people lost everything and had to find new ways to make a living. A dramatic increase of child labour was observed. As more people were pushed down into destitution, the competition for improvised and informal jobs increased.

HONDURAS

Otra herencia de Mitch

Damnificados "reciclan basura" para poder comer

SAN PEDRO SULA.

Article from Tiempo, 11 November 1998

7.2 The banana industry

After Mitch, the banana industry found itself in a situation where considerable investments would have to be made in order to replace what was lost. It was far from evident that these investments would be made by the shareholders outside of Honduras and in this situation the risk was imminent that a large part of the country´s core industry would become lost. The absolute request was that the strategic bridges in the North could be guaranteed being replaced, but confidence in the domestic construction industry was insufficient. Only after the commitment of the Government and Sida that Swedish companies would reconstruct these bridges did it become credible enough.

According to several interviews, in particular with the fruit industry, the Swedish project played an instrumental role in the saving of the industry. According to a representative of the Dole company (more known as Standard Fruit while the other giant, Chiquita, is owned by Teller), the investments in this way secured were in the range of 50 MUSD. This saved 6 500 relatively well paid jobs - since a banana worker at Dole makes about 100 Lempiras (approximately 7 US$) a day plus 35% in social contributions this must have been an important contribution for a large number of people. It should be noted also that although permanent workers usually live in the relatively affluent North, many season workers come from other, poorer, parts of the country and send money back home.

In the attempt to attract and maintain investments, Honduras faces increasingly tough competition from other countries, e.g Ecuador, where labour is cheaper. It was also pointed out that the speed of the

reconstruction of the bridges was a crucial factor since a production delay beyond the present 18 months would have meant more market shares taken by countries like Malaysia and Indonesia. The fruit industry was certainly not permanently "saved", and is likely to meet more challenges in the future. It is hard to avoid the impression, however, that the Swedish bridge project had a very substantial and concrete impact on the country's economy and on a large number of individuals during a difficult time.

7.3 The unfinished bridge

Of all the bridges that were restored under the Swedish project, the former Municipal Bridge, now renamed as Reino de Suecia ("Kingdom of Sweden"), in the city of la Ceiba, was fundamentally different. There are many reasons for this. First, the other bridges were situated in the national road network, while the la Ceiba bridge was purely urban. An urban bridge, of course, has a much higher potential to play an important role in the everyday life of a large number of people. Second, the construction of the Reino de Suecia bridge did not merely restore the previous situation but provided something new that was not there before. The previous bridge had originally been constructed for the banana railway, and later been converted into a primitive bridge for pedestrians, bicycles and, to some extent, cars. The provision of a high-class bridge with capacity for private cars as well as buses and bicycles provided new opportunities for the function of the city and thus had a higher potential for development than the other bridges.

At the same time, this bridge is perhaps the "least completed" one of the "Swedish" bridges. Sweco and Skanska built a good bridge exactly in line with the intentions, but the project as such is still incomplete in wider sense, seen beyond the actual project. Although the bridge itself is of high quality, the access roads from both sides are not yet paved (see picture below). It is understood that this was supposedly a responsibility of the city but for various reasons it has not been fulfilled.

The following observation is essential. The potential of the new Reino de Suecia as a bridge for local bus services seems very under-utilised. One indication of this is the large number of taxis passing over the bridge; another is the small number of buses. From table 4.3.1 it became clear that the number of taxis per month is 102 000 while the number of buses is 2 400 and the number of passengers in taxis is estimated to be the double of the number of passengers in buses. Also, the number of taxis is 6-7 times the number of private cars. In total the number of passengers in taxis is estimated to be almost double the number of passengers in buses. One reason for the small number of buses might be the non-paved and very rough condition of the entrances to the bridge. Another more general reason is the lack of proper bus transport planning. From spontaneous interviews of people in La Ceiba it appeared that bus service was considered to be in a poor state. Officers at the Municipality of La Ceiba said they often had to take a taxi when no bus appeared or were full.

Apart from poor access roads, it is of some concern that the high potential of the new bridge may not become fully utilised. Normally, an infrastructure project of this kind should have been proceeded by a planning effort in order to evaluate how the new asset should be best used for the development of the city´s transport and land use system. For example, the bridge would make it possible to restructure and rationalise the public transport system. Since techniques and capacity for urban land use and transportation planning are almost completely lacking in La Ceiba, the city now finds itself with a donation which has a risk to become sub-utilised.

The Reino de Suecia bridge with bicycle facilities

Unpaved access road to the new Reino de Suecia bridge in La Ceiba

7.4 Impact of the Swedish bridges

The Swedish intervention was not to rebuild many, small-scale constructions out in the rural areas but rather to construct a small number of large, strategic and technically complex bridges in the main road network. Although many of these are important also for the local community, their main roles are for long distance transportation; in particular goods. Also, the area in the north where most of the Swedish bridges were built does not belong to the poorest parts of Honduras. It could therefore be said that the Swedish contribution was not specifically directed to the poorest strata of the population but more aimed at restoring the economy. If this is so, it probably reflected the priorities of the Government as it was simply felt that the best use of the Swedish resources would be to rebuild the most important bridges for the country to come back to normal as quickly as possible. A restored economy will of course benefit also the poor. It is in addition worth to mention that the Swedish intervention had the effect to make more resources available among the local industry for smaller, local construction works, which, under the circumstances, was probably a correct priority.

Although the restoring of the bridges themselves was the main focus, the Swedish involvement had an impact far beyond the technical reconstruction of them. The Swedish work force demonstrated a way of doing things that was new to many hondureños. One thing was the technology – and, according to our informants at SWECO and SKANSKA, many engineers and construction companies did learn new methods. Another dimension was the efficient way of working and the transparent and ethical approach that was demonstrated. Our interviews without no doubt concluded that many people in different positions were impressed by the professionalism of the Swedish companies and agencies.

7.5 "Mitch was the best that happened to Honduras for 50 years".

This somewhat unexpected remark came not from a profiteer on natural disasters but from an Irish catholic organisation (TROCAIRE) with a long history in Honduras– long before Mitch. The spokeswoman did not mean, of course, that the great suffering imposed on people was "good". What she meant, rather, as explained in the conversation, was that Honduras for the first time was on the map other than for the international fruit companies. The disaster was bad, but help came and new kinds of relations were established between the Honduran people and the world. With them came the strengthening of ideas of democratisation, poverty reduction, protection of minority population groups, environmental concern and corruption fighting. Thus, what Mitch brought was not only misery but also a potential catalyst for a new development of the country.

8 Conclusions

The conclusions drawn here are partly stemming directly from the results of our primary task. But we will also take the opportunity to make some final comments that look forward.

8.1 Direct results of the study

Our analysis has clearly shown that reconstruction of the eleven bridges is socially beneficial compared to no reconstruction, something that is quite self-evident. More interesting is the result that the unconventional procedure – and consequently the speedy implementation – is socially beneficial. In fact it would appear even more beneficial if data had existed on number of pedestrians and cyclists for all bridges. That this procedure is worthwhile thus leaves no doubt for this bridge project. As a matter of course we cannot say anything in general on whether such an unconventional procedure is beneficial in other projects.

We believe that the estimated benefits of the project have been underestimated in several respects and one should therefor add the following aspects:

- Data on number of cyclists and pedestrians would have increased the benefit measure, especially with respect to the poor.
- Data on the production value of the informal sector would have increased the benefit measure
- The speedy implementation has reduced the accident risks and the environmental costs.
- The speedy implementation has reduced the social costs in terms of abnormal high prices and feelings of uncertainty with respect to reliable and fast communications with schools, hospitals etc.

With respect to distribution of the positive effects the majority of the benefits accrue to the more wealthy part of the society, if we assume a specific valuation of timesaving for each socio-economic group. This is quite self-evident since such values are based on willingness to pay of each group, which in turn are based on the income of each group. If, on the other hand, one applies one common, average, value for every group, it appears that the poor part of the population would gain relatively more. If we had had the data on number of pedestrians and cyclists (predominantly poor people) for all bridges this tendency would be enhanced. But still the study indicates that the poor part of the population travels much less than the rich part. In turn this indicates that poor and expensive bus services constitute a barrier for the poor in their potential to find suitable jobs at longer distances.

8.2 Final comments

We will here use our experience from this project and experience from other developing countries, in order to point out our personal view of the roles of bridges, roads and the transport sector for further development, and maybe for future support to Honduras.

Nutrition and basic health care for the whole population is the necessary base for all development. Needless to say, then the most important factor is education, and education *for all*.

We are then convinced that fairly equal opportunities for mobility is the next most important factor. The only way to obtain such equal opportunities is to produce decent public transport service. This is something that is often ignored, both by decision-makers in developing countries and international aid organisations. One reason is that decision-makers and experts from aid organisations rarely use public transport. And the irony is that one reason for this is the poor level of public transport service. So, the

people who could actually do something about the problem often simply do not notice or are not aware of the problem. If public transport is regarded as something for the poor only, the society is caught in a trap. Only when public transport is a real part of the ordinary transport system, like in most industrialised countries, also the more affluent parts of the society are involved in the issue and strive for high quality public transport.

To aggravate the problem, public transport is often not even suitable for the poor, due to inefficient planning and management and high fares. In the majority of developing countries the poor have to walk or cycle, sometimes for hours, in order to reach their school or work place. Some of those who can afford a bus ticket sometimes have to wait a very long time until they find a bus that is not already overcrowded. Besides the inconvenience caused, many productive hours, months and years are now spoilt, but that could be extremely useful for development and well-being if public transport worked properly.

To reconstruct bridges, like in this Honduran project, is shown to be a beneficial transport measure and a good first step in order to facilitate mobility for all. But it is only a first necessary step forward. With respect to transport matters this project has detected the mentioned problems related to use of and availability of modes for the various socio-economic groups. The poor part of the Honduran population walk, cycle, and to some extent use buses, for their journeys. Bridge and road construction is necessary for mobility, but are not sufficient, especially if the focus is on the welfare of the poor.

The situation in La Ceiba provides a good example of this transport issue.

Special facilities for cycling, such as bicycle lanes, are examples found in La Ceiba of tools that would benefit the poor, both from travel time and safety points of view. The new Swedish built "Reino de Suecia" bridge is also equipped with a lane for walking and cycling, even though without a safety railing or barrier. The road westward (CA3) from the city centre has some stones that form a barrier between cars and bicycles.

Even if walking and cycling can be suitable for many people we found several indications of insufficient bus services. The very large amount of people who are walking and cycling is one such sign. Another sign is the extraordinary large amount of taxis. One explanation for this is poor bus service, something that was also confirmed in interviews with mid-range civil servants in the La Ceiba municipality. That is, those who can afford it, take a taxi when the wait for a bus that is not already full is too long. Taxi is thus an alternative for a few. The poor are left with an expensive, unreliable and under-supplied bus service. We are convinced that development of a well organised bus service, reasonably priced, would attract a large share of those that are now walking and cycling and that this would mean a substantial increase of the living standard as well as of the productivity in schools and industry.

La Ceiba also provides an example of poor organisation of bus service. The new Reino de Suecia bridge links the city centre with a large dwelling area, populated by a mix of poor and relatively wealthy people. There are buses crossing the bridge, but the service frequency is surprisingly low under these circumstances. According to the traffic counts we have used in this project less then a sixth of passenger trips are made by bus. Taxi is used twice as much as bus. The number who walks or cycle is 50% higher than the number who use buses. The interpretation can be nothing else than insufficient bus service. One reason for the poor level of service, that we learnt from Mauricio Rojas, responsible for land use planning in La Ceiba, is the power of the private bus firms. Even though in principle the city should decide on routes and frequencies, it is in practice the private operators that decide.

If Sweden and other donors withdraw completely from Honduras now that the material damage has been repaired, it would be a missed opportunity. If there is any negative comment at all to make re-

garding the whole Swedish effort, it is perhaps that the Swedish engagement in Honduras was so short and one-sided. It would be a pity if it were not possible in some way to continue the relation. One such way that might be recommended for continued future support is development of a decent public transport service, comprising institutional organisation, planning and financing. La Ceiba constitutes an example of a city with a great potential for bus service improvement, including appropriate use of the new bridge Reino de Suecia.

Annex 1

Terms of Reference

Evaluation of Socio-Economic Impact as a Result of the Swedish Financed Bridge Programme in Honduras – 5 April 2001

Introduction

When Hurricane Mitch struck Central America in the autumn of 1998 it caused severe damages and loss of lives and property. As a result of the physical damages the roadway network was rendered useless because of the many bridges destroyed and as a result economic and social activities were interrupted.

Sweden offered to help the reconstruction efforts by providing assistance for the rehabilitation of a number of bridges located on the main highways. A detailed description of the Swedish supported Bridge Rehabilitation Programme is contained in annex.

Due to the urgency of re-establishing the major transport corridors in Honduras, the Swedish financed bridge programme was undertaken without the normal studies on socio-economic impact.

In general, availability and access are preconditions for the satisfaction of almost any need, especially physical, and therefore location, communication and transport provide central integrating concepts with which to grasp the complex interactions between subsistence, economic and social needs. Without the availability of efficient transport infrastructure and transport service there will be limited incentive to invest in modern production facilities using economies of scale and specialisation. The rehabilitation or improvements in infrastructure and transport services therefore contribute to recreate and develop production and marketing as well as improve access to health, education and other facilities.

Transport can contribute positively to reducing the time spent on fetching water, fuel woods and other household services. Good roads and bridges also allow consumers to utilise a broader area of opportunities to select from when deciding on or developing a strategy for acquiring provisions. Women are often responsible for these activities. Improved communication may thus make more time available for other activities.

To learn more about the socio-economic impact of the Swedish supported bridge programme in Honduras, Sida wishes to undertake evaluation studies.

Objective and purpose

The objective of the study is to assess the socio-economic impact of the bridges. This can be done by determining the impact of the bridges on population groups in the nearby surrounding of the bridges as well as on a regional and national level including their impact as international arteries connecting to international ports or to neighbouring countries.

The role of the bridges for local, regional, national and international transport shall be established by the proposed study. The emphasis is to highlight the function and impact the rehabilitated bridges have on people compared to the situation before Mitch and the situation after Mitch but before the completion of the rehabilitation. Consideration should also be given to bridges with substantive improvement compared to the pre-Mitch standard.

The study will shed light as to whether the installed infrastructure solves the transport needs for all groups in the societies studied or whether some groups are left out. The study will further explore what

groups in general benefit from the bridges. The study will address and disaggregate men's and women's transport needs.

In addition, the study will assess the impact of prolonged reduced access and the consequences to peoples' strategies for production, social welfare and other aspects in respect of the time period between Hurricane Mitch and the completion of the rehabilitation works. In this way prolonged reduced access to river crossings should thus be evaluated.

A macro-economic assessment in terms of public budgetary implications shall be made comparing the Swedish financing grant with more traditional loan financing.

A last objective is to assess any impact the construction work has had on staff and workers locally employed by SWECO and Skanska.

Approach

The bridge objects can be divided into groups based on their similar characteristics:

- The Olanchito and Mamé bridges form part of countryside bridges on the highway between Sabá and Olanchito in an area rich in agriculture production.
- Sabá and Monga comprise one group and they are important for fruit plantations.
- The Perla and Bonito bridges will be grouped together because of agriculture production and nearness to the commercial centre La Ceiba on the northern coast of Honduras.
- The two bridges in La Ceiba, Reino de Suecia and Saopin, because of their importance for the development of the town itself and as principal thoroughfares.
- Nacaome is on the important Pan-American Highway No 1
- Yarumela, connects a rich agriculture region and regional capital with the main highway.
- Ojo de Aqua caters to regional as well as international traffic.

The study will be carried out in stages in accordance with the completion of the rehabilitation works. The first stage of the study will form a pilot study and will focus initially on the completed bridges of Olanchito and Mamé as one group and the Nacaome Bridge as another object. When evaluating the other groups or individual bridges the experience gained during the pilot stage should be considered.

The importance of access to the regional, national and international transport grids has to be evaluated in respect of the population defined for each bridge site.

In terms of gender aspects and data, all reporting shall to the extent possible be presented disaggregated.

After research and investigations of available secondary material, the consultant mustn the fieldwork.

The evaluative approach is to include poverty aspects seen as a multi-dimensional problem. The approach should also include an evaluation of the sustained development of the modern growth sectors and their possibilities of reducing poverty.

Methods

The Consultant shall review and make use of secondary sources such as available mapping material. Stistics on land use and crop production, demography, health, education and other social services should be gathered from relevant authorities. Other studies on transport traffic counts and Origin – Destination (OD) studies should be identified and considered.

Further, the Consultant will conduct extensive field observations at different hours of the day. For each site studied the consultant may also conduct limited traffic counts and OD surveys supplemented by

interviews of the bridge users. Through participatory methods, community assessments and observations information about agricultural production, markets, health and education will be supplemented and verified.

Scope of Work

- Available mapping material will be identified and studied. Settlements and clusters of housing as well as local roads connecting to the highway should be identified in order to determine the local influence areas of the bridge sites.
- Agriculture maps or other information should be studied to determine land use, crops and cropping pattern to determine the type of goods or commodities produced locally. Marketing or distribution patterns for cash crops should be established. The marketing or distribution pattern should identify local markets, regional markets and international markets. The purpose is to establish flow and direction of commodities.
- An investigation should be carried out to establish to what extent the agro production and industry as well as domestic and international marketing were hampered after Mitch and when normal production level was achieved.
- The study should show to what extent insufficient infrastructure impacted on production, marketing and delivery of social services in general.
- Other facilities e.g. for tourism, worshipping, recreation, supply of raw material, commercial centres, transportation facilities (ports, airports, warehouses) should be identified and assessed.
- An investigation should be made to find out if the road rehabilitation programmes including the Swedish bridges contribute to technically up-grade the main transport corridors. The investigation will also show to what extent this may have resulted in the use of heavier but more cost efficient vehicle combinations.
- An investigation should be carried out on the development of the freight and passenger tariffs before Mitch, after Mitch and after reconstruction.
- Passenger traffic, local, regional, national and international should be assessed as to pre-Mitch conditions, post-Mitch and after completion of rehabilitation works of transport infrastructure.
- An assessment should be carried out of budgetary implications on the Government of Honduras comparing grant financing with traditional loan financing. The assessment shall also include analyses of the socio-economic benefits being generated according to the "Swedish model" compared to more traditional organisation of civil-engineering construction.
- An investigation shall be carried out regarding impact and experience gained from staff and workers locally employed by SWECO and Skanska as well as from local enterprises providing material and services.

Regarding local populations, the evaluation should analyse the bridge(s) in terms of their impact on natural capital (land, water soils, pollution, exploitation), social capital (contacts, information, sharing, services), human capital (skills, knowledge, health, education), physical capita, (infrastructure, shelter, transport, energy, technology, water) and financial capital (savings, credits, remittances). Below follows some points that need to be highlighted;

- The Consultant should investigate to what extent the bridges may facilitate more efficient farm management including production and marketing on both sides of a bridge.
- The location of residential areas and places of work such as factories, plantations or other should be established. Access routes for merchandise should be established and compared before and after the bridge construction. The number of workers using the bridge should be calculated or assessed. The mode of transport should be assessed, walking, horseback riding, bicycling, driving (private or public).

- Information regarding health care delivery points should be established for each bridge site studied. Interviews should be conducted to verify or supplement information regarding what health facilities local population takes advantage of. To what extent does the bridge play a role for easier access to water supplies?
- Information regarding provision of water supply and local transports should be established. To what extent does the bridge play a role for easier access to water supplies?
- Information regarding educational facilities should be established and the role of the bridge in increasing access to the facilities evaluated.

Reporting

After general studies but before the field studies commence, an Interim Report shall be prepared. The report will cover the general findings and pinpoint areas, which need further studies. The report will also provide an outline of the fieldwork in terms of planning and preparation of interviews and surveys including traffic counts.

On completion of the studies, the Consultant will prepare a draft final report. The report will provide a brief account of the studies in general. For each bridge site or group of bridges the report will individually present a map and a brief description of the area of influence, highlight major production sites (plantations), residential areas, health delivery facilities, educational facilities and other significant installations. In addition, for each site, a description of the generation of major impacts will be presented. The result will be summarised in tables.

The report will also contain a summary of the findings.

Annex 2

Offert och preliminär plan för studie av svenskfinansierat broprogram i Honduras

010726
Kjell Jansson

Med hänsyn till den sedermera reducerade ambitionsnivån i förhållande till ”Terms of Reference” från 5 april 2001, måste arbetet fokusera på de mest angelägna frågeställningarna.

Därmed krävs en hård prioritering av insatser. Generellt kan sägas att fokus bör ligga på mätning och värdering av effekter på transportarbete, produktion och konsumtionsmöjligheter av broarnas förstörelse och på mätning och värdering av motsvarande effekter av broarnas återuppbyggnad. I möjligaste mån bör analysen bygga på (eller anknytas till) mätning och värdering av tidsvinster. För olika individgrupper, för företagssektorn eller industribranscher som helhet. Mindre vikt läggs på konsekvenser för enskilda företag.

Nedan följer utkast till arbetsprocess respektive analysmetodik. Sist redovisas förslag på lämplig konsultgrupp för att utföra arbetet samt offererat pris.

1 Arbetsprocess

1.1 Data från Honduranska myndigheter

- Detaljerade kartor med väg- och järnvägsförbindelser, samt angivande av alternativa trafikleder när broarna ej var i funktion.
- Statistik om start-målpunkter för persontransporter gående, cyklande, med motorcykel, bil och buss samt för godstransporter, som trafikerar broarna idag och/eller före Mitch 1997–98.
- Trafikräkningar över de olika transportsätt som används över varje bro.
- Eventuellt befintligt material om olika gruppers värderingar av restid.
- Eventuellt befintligt material om kostnader för olika godstransporter. Till dessa kostnader hör kapitalkostnader, fordonsdriftkostnader och förarlöner.
- Inkomster och inkomstfördelning under åren 1990–2000, segmenterat på kön och i bästa fall specificerat för de regioner som är mest berörda av broarna.
- Bruttonationalprodukt under åren 1990 2000, fördelad på produktionssektorer.
- Statistik över utrikeshandel för samma period, fördelad på varugrupper.
- Om möjligt kartskisser som översiktligt visar befolknings- och ekonomisk struktur i broarnas närområde före och efter Mich. Har strukturförändringar skett och är de reversibla?
- Tidningsartiklar mm, speciellt från Honduras, som sökt beskriva Mitch’ konsekvenser.

Befintliga data bör samlas in snarast och i god tid före vårt besök i Honduras. Dels måste en bild erhållas av den information som finns tillgänglig omedelbart, dels måste vårt besök för att vara effektivt kunna förberedas noggrant.

En grundförutsättning är att vi omedelbart har tillgång till telefon- och e-postadresser till relevanta Honduranska myndigheter.

1.2 Kompletterande initial datainsamling

När data erhållits från Honduranska myndigheter bedömer vi behovet av kompletterande data.

Framför allt är det viktigt att i god tid före vårt besök om så behövs komplettera uppgifter om kartor, start-målpunkter och trafikflöden. Vi sänder i detta syfte riktlinjer för sådana kompletterande studier som därefter genomförs av Honduranska myndigheter.

Andra kompletterande uppgifter kan insamlas på plats i Honduras, men berörda myndigheter förbereds via e-post på de uppgifter vi är ute efter.

Representanter för SWECO och Skanska intervjuas i Sverige.

Vi betonar vikten av informationsinsamlingen före besöket i Honduras för att göra detta så effektivt som möjligt.

1.3 Datainsamling och analyser i Honduras

På plats i Honduras genomförs följande aktiviteter under cirka två till tre manveckor:

- Insamling av kompletterande data.
- Besök i åtminstone några av områdena omkring broarna, där ett urval berörda företagsrepresentanter intervjuas liksom lokalbefolkning.
- Utkast till analyser produceras och diskuteras med myndigheter.
- Om behov bedöms finnas och om praktiskt/ekonomiskt möjligt, kan kanske någon typ av begränsad survey göras, (t.ex vägkantsintervjuer) under någon dag.

1.4 Huvudsakligt analysarbete

Det slutliga analysarbetet genomförs i Sverige efter besöket i Honduras.

Eventuellt genomförs ytterligare intervjuer med representanter för SWECO och Skanska.

Utkast till slutrapport avlämnas till SIDA för kommentarer.

2 Analysmetod

I huvudsak är analysen av mikroekonomisk karaktär. Med detta avses här att de samhällsekonomiska och sociala konsekvenserna bedöms med hjälp av effekter på res/transportmöjligheter och restider med respektive utan broarna. Motivet till detta är att ekonomi kan betraktas som hushållning med mänskliga tidsresurser, till arbete, vila, resor etc. Till detta kommer att just transportförbättringar i högsta grad motiveras av minskad tidsåtgång, d v s av att tidsbesparingar kan användas till alternativa produktiva aktiviteter eller till vila.

Det är därför viktigt att söka mäta, kvantifiera och värdera tidsåtgång för olika hushållsgrupper och företagsbranscher med och utan broarna.

För u-länder som typiskt sett utmärks av bl. a bristfällig infrastruktur och stora sociala och inkomstmässiga skillnader är det extra väsentligt att uppmärksamma effekter för mindre priviligierade grupper. För att få till stånd ekonomisk utveckling är en väsentlig grundförutsättning att de basala behoven av vatten och föda kan tillgodoses med liten insats av kraft och tid. De fattiga, och inte minst kvinnorna, tvingas idag ofta ägna mycken kraft och tid till de basala behoven, vilket i sin tur lämnar lite kraft och tid över till annat än reproduktiv produktion och konsumtion.

I länder med stor andel fattiga är det svårt eller omöjligt att såsom i den industrialiserade världen genomföra meningsfulla studier av hur människor värderar restid, åtminstone bland de fattigaste. Detta

projekt kan ej heller innehålla dylika studier av budgetskäl, men i den mån det redan finns tidsvärdestudier utförda i Honduras kan dessa bedömas och eventuellt delvis utnyttjas. I detta projekt får vi i stället i huvudsak förlita oss på indirekta uppskattningar av tidsvärden. En framkomlig väg kan vara att härleda värdering av tid utifrån den inkomst människorna idealt skulle kunna erhålla om de kunde arbeta den tid som åtgår för förflyttningar, till fots, med cykel, med motorcykel eller buss. I den industrialiserade världen tillämpas traditionellt med denna metod en värdering som utgörs av en andel av nettoinkomsten efter skatt, en värdering som grovt sett överensstämmer med de värderingar som erhålls från direkta restdisvärdestudier. I u-länder är det rimligare att anta att värderingen hos de fattiga ligger närmare 100% av inkomsten. Skälet är att ”den marginella nytta” som fattiga erhåller av extra konsumtion utöver den basala är väsentligt högre än för de välmående, som i stället ser fritid och fritidsaktiviteter som starkt substitut till ytterligare materiell konsumtion.

För denna indirekta uppskattning av värderingar av restidsvinster för privatpersoner är det väsentligt att inte beakta arbetslöshet, d v s att inte beakta att människor kanske inte skulle kunna utnyttja restidsvinster till produktivt arbete eftersom arbetstillfällen saknas. Här måste ett dynamiskt och långsiktigt perspektiv anläggas. Broar är förhoppningsvis långlivade och tidsperspektivet bör vara omkring 50 år (härvid bör Skanska rådfrågas angående status och förväntad livslängd på de reparerade broarna). Vi måste därför anta att varje tidsbesparing inom denna långa tidshorisont har ett produktivt alternativutnyttjandevärde samt anta viss realinkomstutveckling som i sin tur påverkar värderingen och värdet av broarna

Den mikroekonomiska analysen syftar till att avkasta sammanlagd nytta för samhället under en lång period, en nytta som jämförs med kostnaderna för reparationerna, d v s en nytto-kostnadsanalys. Analysen syftar också till att så långt möjligt bedöma fördelningsperspektivet, d v s bedöma fördelningen av nytta mellan olika grupper.

En mindre del av analysarbetet ägnas åt makroekonomiska bedömningar. Med detta menas här hur förbättrade förbindelser och restidsvinster på sikt kan påverka produktionstillväxt, utrikeshandel, inkomstfördelning och regional fördelning.

Huruvida den mikroekonomiska analysen förmår omfatta samtliga 11 broar eller ett urval är för tidigt att säga. Detta beror i hög grad på tillgängliga data och på de data som hinner samlas in. Även om vi tvingas koncentrera oss på ett urval av broar är ambitionen att kunna göra översiktliga bedömningar angående effekter av samtliga broar, bl. a baserat på analyserna av urvalet.

Även om tidsvinst/förlust är den mest kvantifierbara faktorn i sammanhanget finns det skäl att föra en diskussion kring andra aspekter som också är relevanta. En sådan faktor är tillgänglighet som har ett värde även när den inte utnyttjas. En beskrivning bör kunna göras av i hur hög grad frånvaron av broarna skapat barriärer i människor vardagsliv och vilka effekter detta kan ha. Det skulle t.ex. kunna vara så att människor blir avskurna från potentiella arbetsplatser, skolor, etc. i sitt närområde och för att komma tillbaka till tidigare nivå måste antingen människor flytta (social kostnad) eller nyetableringar göras. Slutligen bör observeras att miljöeffekter utgör en komponent i den samhällsekonomiska kalkylen, en komponent som hänger nära samman med transporttid och transportarbete med respektive utan broar.

Huvudstudien inriktas på konsekvenser av broarna så som de blev konstruerade och finansierade, med nyttor och kostnader. Till denna läggs två sidoperspektiv. Det ena gäller en översiktlig bedömning av konsekvenserna om Honduranska företag hade konstruerat broarna. Det andra gäller en översiktlig bedömning av konsekvenserna om man hade satsat på provisoriska broar. Såväl för huvudstudien som för sidoperspektiven måste en diskussion föras om tidsperspektivet. Vad hade hänt om broarna aldrig byggts upp, om det skett om 10 år eller, som nu, att det skedde snart, d v s hur mycket hade varje nytt år

utan broar kostat? Detta kan delvis besvara frågan om huruvida Sidas okonventionella och snabba hantering av problemet varit befogad.

Av naturliga skäl går det inte nu att avgöra hur långt analyserna når och hur detaljerad studien kan vara, eftersom detta är så beroende av tillgänglig information. Ambitionen är att nå så långt som möjligt inom anvisad budget. De frågeställningar som inte kan eller hinner belysas anges och prioriteras i en bilaga. En ambition är också att denna studie utformas så att den kan fungera som vägledning för liknande transportinriktade analyser i Honduras eller andra u-länder.

3 Konsultgrupp

Kjell Jansson är projektledare och har huvudansvar för arbetets uppläggning, datainsamling, samhällsekonomisk mikroanalys och rapport. Kjell Jansson har enskild firma, KJ Samhällsekonomi, med organisationsnummer 471111-6451. Innehar F-skattebevis.

Hans Örn har delansvar för arbetets uppläggning, datainsamling och rapportering.

Alf Carling har huvudansvar för makroekonomisk analys samt deltar i mikroekonomisk analys.

I Honduras svarar Kjell Jansson och Hans Örn för kompletterande datainsamling och genomför intervjuer med främst myndigheter och i några fall med företag eller representanter för företagarorganisation. Delanalyser diskuteras på plats med relevanta myndighetspersoner för snabb och effektiv hantering inför fortsatt analysarbete.

Alf Carling deltar på avstånd, via e-postkontakt och telefon. Carling befinner sig under uppdraget i Namibia.

Slutrapporten sammanställs i Sverige av Kjell Jansson och Hans Örn, efter att SIDA har lämnat synpunkter på utkast till slutrapport.

4 Kostnader

Arbetsinsatser

Arvodet för samtliga tre deltagare är 800 kr per timme, exklusive moms. Budgeten räcker till sex manveckors arbete.

	Arbetstid, timmar	Arbetskostnad, kronor
Kjell Jansson	130	104 000
Hans Örn	80	64 000
Alf Carling	30	24 000
Summa	240	192 000

De sex manveckorna fördelas preliminärt på 1–2 veckor före besöket i Honduras, 2–3 veckor i Honduras och två veckor efter besöket i Honduras.

Expenser

Här uppskattas maximala belopp för kostnader vid sidan om kostnader för arbetsinsatser.

	Kronor
Resor Kjell Jansson och Hans Örn t.o.r. Stockholm Stockholm-Honduras	30 000
Traktamenten, 24 dagar	9 960
Hotell 24 dagar	24 000
Lokalresor i Honduras	10 000
Material, fältpersonal, etc i Honduras	8 000
Omkostnader i Sverige (kommunikationer, resor, rapportering, etc)	10 000
Övrigt	5 000
Summa	96 960

Total kostnad

Totalt offereras arbetet för ett maximalt pris på 288 960 kr.

Ersättning för arbete och utgifter utbetalas av SIDA månadsvis i efterskott.

Stockholm 26 juli 2001

Kjell Jansson

Annex 3

A1 Benefits of reconstruction – basic principles

For consequences that are considered possible to express in quantitative and monetary terms and to be comparable between individuals, the aim is to compare the welfare level of the various situations in the common currency unit.

A critical issue is of course how the valuations by individuals of benefits and costs have been derived or assumed. The theoretical fundament of microeconomics manifest that values should be based on each individual's preferences, and only measures that improve the level of welfare without making any single individual worse off are considered "efficient".

In practice, and most of all from political point of view, there are several difficulties related to this strict efficiency concept (the Pareto criterion).

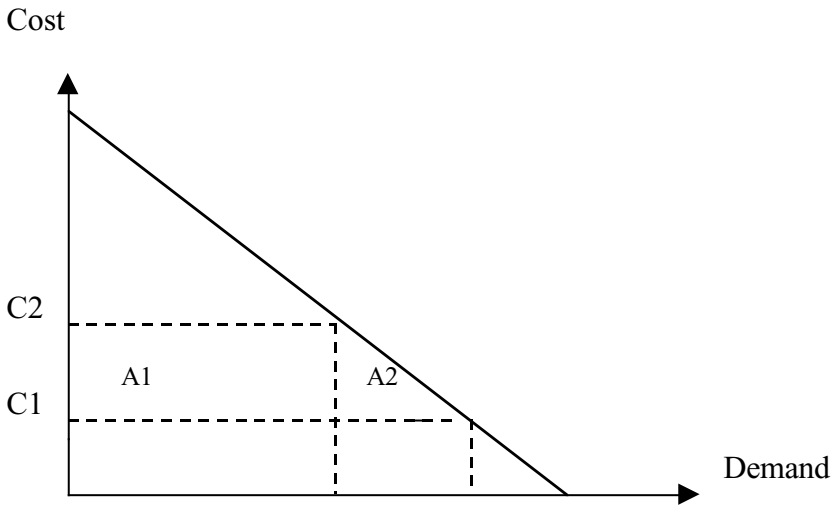
Firstly, all values cannot be found merely by watching the actual choices of consumers, so called revealed preferences. One reason is that all parameters do not have market values, for example environmental parameters. Another reason is that market failures, common in the transport sector, may mean that the prices do not reflect the real values. This means that politicians and authorities may impose what they perceive as the "correct" market values.

Secondly, it is not always the case that individuals' preferences are politically accepted. Given any set of prices of goods and services in a market economy the actual preferences are revealed by the actual choices of consumers of these goods and services, according to each individual's "willingness to pay". The crucial concern is that willingness to pay is related to ability to pay. From a distribution or fairness point of view politicians may conclude that the values reflected by willingness to pay should be modified with respect to income or other individual resources. The implication is that politicians may want to weight the utility of individuals or groups of individuals before the aggregate welfare level is calculated. In welfare economic literature this rational is expressed as that the marginal utility of extra consumption is higher for low-income than for high-income persons or households.

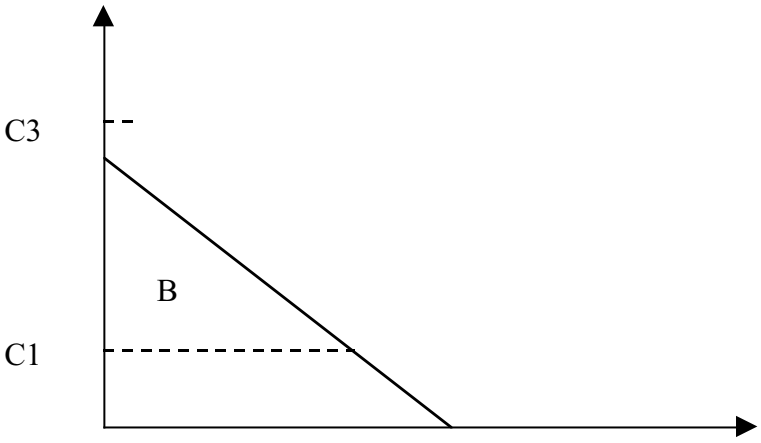
In practice there are normally no politically specified values and weights. Economists and planners who conduct welfare analyses have to interpret political signals and assume these weights. Due to uncertainty concerning the actual political values, which also differ between politicians, it is often recommendable to employ different sets of values and weights and thus produce a variety of analyses. Such sensitivity analyses can provide a spectrum of outcomes for the decision makers to consider.

To take into account this discrepancy between actual willingness to pay and ability to pay is especially relevant for poor countries with very uneven distribution of incomes.

In economic welfare terms, the situation regarding different types of consumption opportunities can be illustrated with two types of situations. In the first case (for some types of fundamental necessities), the effect implies a high but not prohibitive increase in transport time and cost. This is illustrated in Diagram X below. The initial total cost for transport of those goods – and also the cost after reconstruction - is C1 in the Diagram. After the loss of the bridges, the commodities have to be transported over an alternative route; longer, maybe by foot and perhaps also dangerous. The total cost of this alternative is given by C2. For the household in question the total effect on economic welfare (the area A1 plus A2) is a combination of increased transport cost, A1, and loss of consumer surplus, A2.



For the second type of goods, no realistic transport alternatives exist after the bridges have fallen (Diagram Y). Once again, the initial cost and the cost after reconstruction is given by C1. The loss of the bridges here increases this cost to C3, which forces the household to abstain from these types of consumption. The area B gives the loss of economic welfare (consumer surplus).



In order to try and estimate the losses of consumer surplus and incomes – and the corresponding gains from reconstruction - it is essential to obtain statistic information regarding what kind of consumption (private and public) has been affected in each of the two ways illustrated above. What has happened to the supply/consumption of basic food and water? What has happened to the access to basic education and health services in different areas? And to what extent has jobs and wage income been lost due to the loss of the bridges? And finally (connected to the discussion of the poverty problem and political preferences in section 4.3.4) how are the effects distributed among different population groups.

Apparently there is no way in practice to estimate the demand curves illustrated in the diagrams X and Y above. These demand curves are also "artificial" in the sense that they reflect a hypothetical situation that has never been observed. Here we assume instead that the demand is perfectly inelastic. In other words we assume the demand before the bridges came down as being the actual demand irrespective of status of bridge crossing possibilities. The rationale is that reconstruction of the bridges is assumed to be socially beneficial and there is therefore no reason to discuss a variety of demands at different prices and time delays. This means that all losses of time and distance or total loss of crossing possibilities is valued at current (assumed) values.

The conclusion is that we largely depend on calculations based on values of time, which is the theme of section A5.

A2 Phases before the bridges were reconstructed

The tables below show our estimations of costs of distance and time during the various phases for each bridge. The costs refer to the cost difference between a specific case and the original phase before Mitch.

Bridge: Nacaome

	Phase 1 no crossing						Phase 2 ford				Phase 3 Bailey			
	Months lost	Freight			Passengers		Paved		Not paved		Paved		Not paved	
		Km lost	speed km/h	Hours/ trip	Hours/ worktrip	Hours/ leisuretrip	Dist. km	Time hours	Dist. km	Time hours	Dist. km	Time hours	Dist. km	Time hours
Walk/bicycle	0,5	0	0	0	4	1	-0,5	-0,1	0,6	0,5	-0,5	-0,1	0,6	0,25
Car	0,5				4	1	-0,5	-0,01	0,6	0,5	-0,5	-0,01	0,6	0,25
Taxi	0,5				4	1	-0,5	-0,01	0,6	0,5	-0,5	-0,01	0,6	0,25
Buses	0,5				4	1	-0,5	-0,01	0,6	0,5	-0,5	-0,01	0,6	0,25
Pick-up	0,5	20	30	0,667	4	1	-0,5	-0,01	0,6	0,5	-0,5	-0,01	0,6	0,25
Truck 2 axles	0,5	30	40	0,75			-0,5	-0,01	0,6	0,5	-0,5	-0,01	0,6	0,25
Truck 3 axles	0,5	80	60	1,333			-0,5	-0,01	0,6	0,5	-0,5	-0,01	0,6	0,25
Truck >3 axles	0,5	850	60	14,17			850	14,2	0	0	-0,5	-0,01	0,6	0,25

Bridge: Sabá

	Phase 1 no crossing						Phase 2 other road				Phase 3 Bailey			
	Months lost	Freight			Passengers		Paved		Not paved		Paved		Not paved	
		Km lost	speed km/h	Hours/ trip	Hours/ worktrip	Hours/ leisuretrip	Dist. km	Time hours	Dist. km	Time hours	Dist. km	Time hours	Dist. km	Time hours
Walk/bicycle	0,5	0	0	0	4	1	-0,5	-0,1	0,6	0,5	-0,5	-0,1	0,6	0,5
Car	0,5	0	0	0	4	1	-0,5	-0,02	0,6	0,5	-0,5	-0,02	0,6	0,5
Taxi	0,5	0	0	0	4	1	-0,5	-0,02	0,6	0,5	-0,5	-0,02	0,6	0,5
Buses	0,5	0	0	0	4	1	-0,5	-0,02	0,6	0,5	-0,5	-0,02	0,6	0,5
Pick-up	0,5	20	30	0,7	4	1	-0,5	-0,02	0,6	0,5	-0,5	-0,02	0,6	0,5
Truck 2 axles	0,5	30	40	0,8	0	0	-0,5	-0,02	0,6	0,5	-0,5	-0,02	0,6	0,5
Truck 3 axles	0,5	80	60	1,3	0	0	-0,5	-0,02	0,6	0,5	-0,5	-0,02	0,6	0,5
Truck >3 axles	0,5	200	60	3,3	0	0	-0,5	-0,02	0,6	0,5	-0,5	-0,02	0,6	0,5

Bridge: Monga

	Phase 1 no crossing						Phase 2 old bridge				Phase 3 Ford			
	Months lost	Freight			Passengers		Paved		Not paved		Paved		Not paved	
		Km lost	speed km/h	Hours/ trip	Hours/ worktrip	Hours/ leisuretrip	Dist. km	Time hours	Dist. km	Time hours	Dist. km	Time hours	Dist. km	Time hours
Walk/bicycle	km	horas	km	horas	0	km	-0,5	-0,1	0,6	0,12	-0,5	-0,1	0,6	0,12
Car							-0,5	-0,02	0,6	0,05	-0,5	-0,01	0,6	0,05
Taxi							-0,5	-0,02	0,6	0,05	-0,5	-0,01	0,6	0,05
Buses							-0,5	-0,02	0,6	0,05	-0,5	-0,01	0,6	0,05
Pick-up							-0,5	-0,02	0,6	0,05	-0,5	-0,01	0,6	0,05
Truck 2 axles							-0,5	-0,02	0,6	0,05	-0,5	-0,01	0,6	0,05
Truck 3 axles							-0,5	-0,02	0,6	0,05	-0,5	-0,01	0,6	0,05
Truck >3 axles							-0,5	-0,02	0,6	0,05	-0,5	-0,01	0,6	0,05

Bridge: Mame

	Phase 1 no crossing						Phase 2 old bridge				Phase 3 Bailey			
	Months	Freight			Passengers		Paved		Not paved		Paved		Not paved	
	lost	Km	speed	Hours/	Hours/	Hours/	Dist.	Time	Dist.	Time	Dist.	Time	Dist.	Time
		lost	km/h	trip	worktrip	leisuretrip	km	hours	km	hours	km	hours	km	hours
Walk/bicycle							-0,5	-0,1	0,6	1,3	-0,5	-0,1	0,6	1,2
Car							-0,5	-0,01	0,6	0,06	-0,5	-0,01	0,6	0,05
Taxi							-0,5	-0,01	0,6	0,06	-0,5	-0,01	0,6	0,05
Buses							-0,5	-0,01	0,6	0,06	-0,5	-0,01	0,6	0,05
Pick-up							-0,5	-0,01	0,6	0,06	-0,5	-0,01	0,6	0,05
Truck 2 axles							-0,5	-0,01	0,6	0,06	-0,5	-0,01	0,6	0,05
Truck 3 axles							-0,5	-0,01	0,6	0,06	-0,5	-0,01	0,6	0,05
Truck >3 axles							-0,5	-0,01	0,6	0,06	-0,5	-0,01	0,6	0,05

Bridge: Olanchito

	Phase 1 no crossing						Phase 2 old bridge				Phase 3 Bailey			
	Months	Freight			Passengers		Paved		Not paved		Paved		Not paved	
	lost	Km	speed	Hours/	Hours/	Hours/	Dist.	Time	Dist.	Time	Dist.	Time	Dist.	Time
		lost	km/h	trip	worktrip	leisuretrip	km	hours	km	hours	km	hours	km	hours
Walk/bicycle	0,5				4	1					-0,5	-0,01	0,6	0,1
Car	0,5				4	1					-0,5	-0,01	0,6	0,1
Taxi	0,5				4	1					-0,5	-0,01	0,6	0,1
Buses	0,5				4	1					-0,5	-0,01	0,6	0,1
Pick-up	0,5	20	30	0,67	4	1					-0,5	-0,01	0,6	0,1
Truck 2 axles	0,5	30	40	0,75							-0,5	-0,01	0,6	0,1
Truck 3 axles	0,5	80	60	1,33							-0,5	-0,01	0,6	0,1
Truck >3 axles	0,5	200	60	3,33							-0,5	-0,01	0,6	0,1

Bridge: Reino de Suecia

	Phase 1 no crossing						Phase 2 Saopin bridge				Phase 3 Pedestrian bridge			
	Months	Freight			Passengers		Paved		Not paved		Paved		Not paved	
	lost	Km	speed	Hours/	Hours/	Hours/	Dist.	Time	Dist.	Time	Dist.	Time	Dist.	Time
		lost	km/h	trip	worktrip	leisuretrip	km	hours	km	hours	km	hours	km	hours
Walk/bicycle	0,5	0	0	0	4	1	-0,5	-0,1	4,5	1,5	1	0,2	1	0,2
Car														
Taxi														
Buses														
Pick-up														
Truck 2 axles														
Truck 3 axles														
Truck >3 axles														

Bridge: Saopin

	Phase 1 no crossing						Phase 2 Refill + bridge				Phase 3 Reino de Suecia			
	Months	Freight			Passengers		Paved		Not paved		Paved		Not paved	
	lost	Km	speed	Hours/	Hours/	Hours/	Dist.	Time	Dist.	Time	Dist.	Time	Dist.	Time
		lost	km/h	trip	worktrip	leisuretrip	km	hours	km	hours	km	hours	km	hours
Walk/bicycle	0,5				4	1	-0,5	-0,1	0,6	1,5	2	0,4	2	0,4
Car	0,5				4	1	-0,5	-0,02	0,6	1,5	2	0,1	2	0,1
Taxi	0,5				4	1	-0,5	-0,02	0,6	1,5	2	0,1	2	0,1
Buses	0,5				4	1	-0,5	-0,02	0,6	1,5	2	0,1	2	0,1
Pick-up	0,5	20	30	0,67	4	1	-0,5	-0,02	0,6	1,5	2	0,1	2	0,1
Truck 2 axles	0,5	30	40	0,75			-0,5	-0,02	0,6	1,5	2	0,1	2	0,1
Truck 3 axles	0,5	80	60	1,33			-0,5	-0,02	0,6	1,5	2	0,1	2	0,1
Truck >3 axles	0,5	200	60	3,33			-0,5	-0,02	0,6	1,5	2	0,1	2	0,1

Bridge: Rio Bonito

	Phase 1 no crossing						Phase 2 ford				Phase 3 Bailey			
	Months	Freight			Passengers		Paved		Not paved		Paved		Not paved	
	lost	Km	speed	Hours/	Hours/	Hours/	Dist.	Time	Dist.	Time	Dist.	Time	Dist.	Time
		lost	km/h	trip	worktrip	leisuretrip	km	hours	km	hours	km	hours	km	hours
Walk/bicycle	0,5				4	1	-0,5	-0,1	1,65	0,3	-0,5	-0,1	0,65	0,25
Car	0,5				4	1	-0,5	-0,02	1,65	0,3	-0,5	-0,02	0,65	0,25
Taxi	0,5				4	1	-0,5	-0,02	1,65	0,3	-0,5	-0,02	0,65	0,25
Buses	0,5				4	1	-0,5	-0,02	1,65	0,3	-0,5	-0,02	0,65	0,25
Pick-up	0,5	20	30	0,67	4	1	-0,5	-0,02	1,65	0,3	-0,5	-0,02	0,65	0,25
Truck 2 axles	0,5	30	40	0,75			-0,5	-0,02	1,65	0,3	-0,5	-0,02	0,65	0,25
Truck 3 axles	0,5	80	60	1,33			-0,5	-0,02	1,65	0,3	-0,5	-0,02	0,65	0,25
Truck >3 axles	0,5	200	60	3,33			-0,5	-0,02	1,65	0,3	-0,5	-0,02	0,65	0,25

Bridge: Rio Perla

	Phase 1 no crossing						Phase 2 ford			
	Months	Freight			Passengers		Paved		Not paved	
	lost	Km	speed	Hours/	Hours/	Hours/	Dist.	Time	Dist.	Time
		lost	km/h	trip	worktrip	leisuretrip	km	hours	km	hours
Walk/bicycle	0,5				4	1	-0,5	-0,1	0,6	1
Car	0,5				4	1	-0,5	-0,02	0,6	1
Taxi	0,5				4	1	-0,5	-0,02	0,6	1
Buses	0,5				4	1	-0,5	-0,02	0,6	1
Pick-up	0,5	20	30	0,67	4	1	-0,5	-0,02	0,6	1
Truck 2 axles	0,5	30	40	0,75			-0,5	-0,02	0,6	1
Truck 3 axles	0,5	80	60	1,33			-0,5	-0,02	0,6	1
Truck >3 axles	0,5	200	60	3,33			-0,5	-0,02	0,6	1

Bridge: Ojo de Agua

	Phase 1 no crossing						Phase 2 ford				Phase 3 Bailey			
	Months	Freight			Passengers		Paved		Not paved		Paved		Not paved	
	lost	Km	speed	Hours/	Hours/	Hours/	Dist.	Time	Dist.	Time	Dist.	Time	Dist.	Time
		lost	km/h	trip	worktrip	leisuretrip	km	hours	km	hours	km	hours	km	hours
Walk/bicycle	0,5				4	1					-0,5	-0,01	0,6	0,12
Car	0,5				4	1					-0,5	-0,01	0,6	0,12
Taxi	0,5				4	1					-0,5	-0,01	0,6	0,12
Buses	0,5				4	1					-0,5	-0,01	0,6	0,12
Pick-up	0,5	20	30	0,67	4	1					-0,5	-0,01	0,6	0,12
Truck 2 axles	0,5	30	40	0,75							-0,5	-0,01	0,6	0,12
Truck 3 axles	0,5	80	60	1,33							-0,5	-0,01	0,6	0,12
Truck >3 axles	0,5	200	60	3,33							-0,5	-0,01	0,6	0,12

Bridge: Yarumela

	Phase 1 no crossing						Phase 2 ford			
	Months	Freight			Passengers		Paved		Not paved	
	lost	Km	speed	Hours/	Hours/	Hours/	Dist.	Time	Dist.	Time
		lost	km/h	trip	worktrip	leisuretrip	km	hours	km	hours
Walk/bicycle	3				4	1	0	0	0,2	0,12
Car	3				4	1	0	0	0,2	0,12
Taxi	3				4	1	0	0	0,2	0,12
Buses	3				4	1	0	0	0,2	0,12
Pick-up	3	20	30	0,67	4	1	0	0	0,2	0,12
Truck 2 axles	3	30	40	0,75	0	0	0	0	0,2	0,12
Truck 3 axles	3	80	60	1,33	0	0	0	0	0,2	0,12
Truck >3 axles	3	200	60	3,33	0	0	0	0	0,2	0,12

A3 Demand and traffic flows

The effects of the demolition and the reconstruction of the bridges are largely related to the demand for transport over the rivers in question. Ideally one should know the origins and the destinations of various vehicles and passenger groups in order to calculate the time and kilometre losses and gains respectively.

Within the scope of this project there has been no opportunity to conduct an origin-destination survey. We are dependent on traffic counts made on some bridges or nearby the bridges. The fact that we have no full origin-destination data is less severe since typically there have been no long deviations in order to cross the bridges, but possible to pass nearby the demolished bridge over a ford or a provisional bridge. However, during the periods when there was no possibility to cross one should have had data on the distance of the transports in order to calculate values lost.

More severe is the fact that most traffic counts refer to the period when neither the old nor the new bridges were in function. We have also detected the seriousness of the fact that SOPTRAVI has not counted pedestrians and cyclists, since where we have made our own small 5 to 15 minutes counts these modes of transport have appeared to comprise a substantial part. With our own counts we also detected the unexpectedly high share of taxis, a fact that should affect the values of losses and gains. Fortunately SWECO has conducted a few counts on the bridges Reino de Suecia, Saopin and Sabá after the reconstructions, including pedestrians and cyclists, but not separating taxis, but for most bridges we have to use SOPTRRAVI's counts. We have to some degree also used our own mini-counts in order to cross-check and get a magnitude of taxi shares for four bridges. In total we have laid a jigsaw puzzle of the following information.

Table A3.1 Sources of traffic counts

	SOPTRAVI	SWECO	Own counts
Nacaome	Cars, trucks 1998		Small counts, all modes, 2000
Sabá		All modes except taxis, 2001	
Monga	Cars, trucks 1997		
Mame	Cars, trucks 1997		
Olanchito	Cars, trucks 1998		
Reino de Suecia	Cars, trucks 1998	All modes except taxis, 2001	Small counts, all modes, 2001
Saopin	Cars, trucks 1997	All modes except taxis, 2001	All modes all modes, 2001
Rio Bonito	Cars, trucks 1998		Small counts, all modes, 2001
Rio Perla	Cars, trucks 1998		
Ojo de Agua	Cars, trucks 1998		
Yarumela	Cars, trucks 1998		

The data from our own small counts were only used where no other information existed. This concerns the number of pedestrians and cyclists in the counts by SOPTRAVI and the proportion of taxis and private cars since the generic name cars had been used in all other counts. The merging of the various data sources has resulted in the following assumptions on the average number of vehicles and passengers across the bridges per month.

Table A3.2 Estimated demand in terms of number of vehicles and passengers per month and bridge

No. of vehicles per month											
	Nacaome	Sabá	Olanchito	R de Suecia	Saopin	Mame	Perla	Yarumela	Bonito	Monga	Ojo de Agua
Car	15 060	2 700	6 990	16 800	28 800	2 847	10 050	18 090	10 050	9 180	7 080
Taxi	0	0	0	102 000	18 000	0	0	0	0	0	0
Buses	7 410	4 950	3 690	2 400	8 400	3 480	5 430	6 030	5 430	11 220	3 060
Pick-up	44 880	35 490	19 710	62 400	96 000	14 805	39 630	25 140	39 630	47 730	24 240
Truck 2 axles	12 420	8 430	5 580	5 116	9 849	3 815	15 060	9 270	15 060	12 300	6 990
Truck 3 axles	690	3 450	540	147	740	2 354	1 290	870	1 290	7 590	480
Truck >3 axles	9 090	4 020	1 350	737	2 611	2 308	9 420	4 080	9 420	7 440	3 090
Sum	89 550	59 040	37 860	189 600	164 400	29 610	80 880	63 480	80 880	95 460	44 940
No. of passengers per month											
Walk/bicycle	3 600	29 670	0	192 000	51 600	0	0	0	0	0	0
Car	30 120	5 400	13 980	33 600	57 600	5 695	20 100	36 180	20 100	18 360	14 160
Taxi	0	0	0	204 000	36 000	0	0	0	0	0	0
Buses	318 630	212 850	158 670	103 200	361 200	149 651	233 490	259 290	233 490	482 460	131 580
Pick-up	89 760	70 980	39 420	124 800	192 000	29 610	79 260	50 280	79 260	95 460	48 480
Sum	442 110	318 900	212 070	657 600	698 400	184 955	332 850	345 750	332 850	596 280	194 220

A4 Variable construction costs

Table A4.1 Timing of actual variable construction costs

	Nacaome	Sabá	Olanchito	R de suecia	Saopin	Mame	Perla	Yarumela	Bonito	Monga	Ojo de Agua	All bridges
	US$	US$	US$	US$	US$	US$	US$	US$	US$	US$	US$	US$
nov-99	0,10	0,11										
dec-99	0,11	0,11	0,02	0,07	0,01							
jan-00	0,10	0,12	0,02	0,10	0,01							
feb-00	0,23	0,06	0,01	0,07	0,00	0,06						
mar-00	0,23	0,21	0,00	0,13	0,00	0,02						
apr-00	0,31	0,46	0,00	0,02	0,02	0,01						
maj-00	0,30	0,27	0,00	0,25	0,07	0,04						
jun-00	0,26	0,38	0,11	0,49	0,00	0,02						
jul-00	0,08	0,56	0,04	0,39	0,01	0,00						
aug-00	0,04	0,98	0,13	0,36	0,08	0,07			0,01		0,06	
sep-00	0,11	0,65	0,10	0,25	0,04	0,01			0,00		0,25	
okt-00		0,44	0,05	0,05	0,01				0,01		0,01	
nov-00		0,51	0,04	0,23	0,01		0,19		0,00		0,02	
dec-00		0,36	0,08	0,04	0,17		0,05	0,08	0,00		0,05	
jan-01		0,25	0,10	0,00	0,15		0,08	0,02	0,00		0,07	
feb-01		0,21	0,01	0,04	0,12		0,14	0,10	0,05	0,06	0,08	
mar-01		0,07	0,00	0,02	0,05		0,14	0,12	0,08	0,04	0,12	
apr-01		0,07	0,02		0,01		0,32	0,20	0,11	0,02	0,04	
maj-01	0,02	0,10	0,00		0,01		0,39	0,15	0,20	0,00	0,15	
jun-01		0,34	0,10				0,29	0,11	0,30	0,01	0,14	
jul-01		0,02	0,00				0,11	0,00	0,06	0,00	0,24	
aug-01		0,19	0,00				0,14	0,05	0,02	0,04	0,11	
sep-01		0,10			0,10		0,12	0,01	0,14		0,12	
Sum	1,87	6,58	0,82	2,50	0,88	0,24	1,97	0,84	0,99	0,17	1,46	18,32

A5 Values of time – passenger transport

Values of time are presented in the report by SOPTRAVI (1999). These values are in principle based on hourly salaries. For work trips the value is calculated as the salary multiplied plus the social cost 35%. For other purposes the value is assumed to be 25% of the net salary.

The problem with these calculations are mainly the figures on salary, ranging from US$5.19 – 5.68 per hour. Since this information cannot be true, we made our own estimations based on other sources for income.

One of the sources on income and its distribution is an e-mail information sent by Humberto Lopez from the World Bank. Our interpretation is that these figures reflect GNP per capita.

Since GNP has grown since 1998 we use our estimation of GNP for 2001, which is 850 US$ per capita.

We have combined this information with figures presented in Barros (2000), which reflected income per person employed and number of persons in work force, which is reported to be 2.4 million of 6.2 million inhabitants, that is 38.7%. By dividing the incomes given by the assumed GNP and the distribution given by the World Bank, and by use of the proportion in work force, 38.7%; we arrived at hourly incomes close to those in Barros (2000).

The table below shows the outcome of the merging of these two sources.

Table A5.1 Estimation of monthly and hourly salaries

Estimated GNP per deciles					Estimated incomes per working person						
Deciles	Lps/m	US$/m	Lps/h	US$/h	Lps/m	US$/m	Lps/h	US$/h	Quintiles	Lps/h	US$/h
1	42	2,8	0,21	0,01	108	7,2	0,6	0,04	1	1,16	0,08
2	134	8,9	0,68	0,05	346	23,1	1,8	0,12	2	3,43	0,23
3	215	14,4	1,10	0,07	556	37,1	2,8	0,19	3	6,14	0,41
4	305	20,3	1,56	0,10	788	52,5	4,0	0,27	4	10,66	0,71
5	406	27,1	2,07	0,14	1050	70,0	5,4	0,36	5	31,75	2,12
6	525	35,0	2,68	0,18	1357	90,4	6,9	0,46			
7	687	45,8	3,51	0,23	1775	118,3	9,1	0,60			
8	930	62,0	4,75	0,32	2403	160,2	12,3	0,82			
9	1391	92,8	7,10	0,47	3595	239,6	18,3	1,22			
10	3427	228,5	17,48	1,17	8853	590,2	45,2	3,01			
Average	806	53,8	4,11	0,27	2083	138,9	10,6	0,71		10,63	0,71

The average income assumed in this report is thus US$0.71. The highest quintile earns about 25 times the lowest quintile.

For estimations of values of time we have to make assumptions for each socio-economic group:

- Part of journeys with work purpose
- Part of journeys with other purpose
- Gross income per hour
- The value of time for work purpose as proportion of income INC
- The value of time for other than work purpose as proportion of income INC

In order to get values per mode of transport when we have assumed values per socio-economic group we have to make assumptions about choice of mode per group. To this end we have no information whatsoever, but make qualified guesses, based on the belief that poor people walk, cycle and use buses to a larger extent that rich people and that the middle class and the rich are the only groups that go by car or taxi. We have made assumptions according to the table below.

Table A5.2 Assumed choice of modes per group

	walk/bicycle	car	taxi	bus	pick-up
Very poor	0,40	0,00	0,00	0,10	0,00
Fairly poor	0,30	0,00	0,00	0,30	0,00
Poor	0,20	0,00	0,00	0,40	0,00
Middle class	0,10	0,10	0,30	0,20	0,10
Rich	0,00	0,90	0,70	0,00	0,90

In the table below we have combined the assumptions on choice of mode and calculated values of time in order to arrive at average value of time per mode.

Table A5.3 Assumed value of time per mode.

	Total value	Leisure value	Work value
	US$/h	US$/h	US$/h
Walk/bicycle	0,19	0,07	0,25
Car	1,38	0,98	1,98
Taxi	1,19	0,83	1,69
Bus	0,28	0,12	0,38
Pick-up	1,38	0,98	1,98
Average	0,88	0,60	1,26

Finally we have assumed that values of time are 10% higher on non-paved compared to paved roads and we have added the information from SOPTRAVI (1999) on the average occupancy rate per mode, according to the table below.

Table A5.4 Value of time and occupancy rate per mode

	Passengers/ mode
Walk/bicycle	1
Car	2
Taxi	2
Bus	43
Pick-up	2

Below some further details on the methodology for calculation of cost of time lost are provided.

Notation

PV	Gross income per hour, based on GNP
W	Part of journeys with work purpose
O	Part of journeys with other purpose
VO	Value of time for other purposes as ratio of income INC
VL	Value of part dedicated to leisure
VW	Value of time dedicated to work
CV	Combined value of time for work and leisure

The following functions are used in order to calculate the values of time lost or gained.

(1) $VL = PV * O * VO$

(2) $VW = PV * VW$

(3) $CV = PV * (O * VO + VW)$

The two tables below show assumed parameters and calculated values for journeys with assumed work purpose.

Table A5.5 Estimated values of time for leisure, work and both, in US$.

	GNP-	Leisure purpose			Work purpose			Both
	based	leisure	v L	Value	work	v W	Value	Sum
	value/h	part	of inc	leisure	part	of INC	work	value
	PV	O	VO	VL	W	V	VW	CV
	US$/h			US$/h		US$/h	US$/h	US$/h
Very poor	0,08	0,2	0,10	0,01	0,8	1,00	0,08	0,06
Fairly poor	0,23	0,3	0,20	0,05	0,7	1,00	0,23	0,17
Poor	0,41	0,4	0,30	0,12	0,6	1,00	0,41	0,29
Middle class	0,71	0,5	0,40	0,28	0,5	1,00	0,71	0,50
Rich	2,12	0,6	0,50	1,06	0,4	1,00	2,12	1,48
Averages	0,71	0,40	0,30	0,30	0,60	1,00	0,71	0,55

A6 Interest rate and future economic development

The real interest rate applied in economic analysis should reflect the relative value of consumption at various points of time. Future costs and benefits are thus discounted by an interest rate that is supposed to reflect the individuals' trade-off between consumption today and next year respectively.

One problem is that all individuals do not have the same time-related preferences. This problem is aggravated by poverty. It may be meaningless to apply time-related preferences for people who have to consume whatever possible today in order to survive. Theoretically this situation could be reflected by a very high interest rate but it may be unethical. If the economic growth will be slow the interest rate should on the other hand be low in order to care for the welfare of future generations. This is thus a dilemma.

If, however, the economic growth will be high in the future one can motivate a high interest rate since future generations will benefit from this growth and be more prosperous than today. Believing in fast economic growth thus reduces the dilemma of applying a high interest rate that is also motivated by the poverty today.

A high interest rate could also be motivated if there is competition between various projects with different rates of return. If there is a budget constraint, in for example financial aid schemes from international organisations, one is sometimes forced to choose among projects and pick the ones with the highest rates of return, which might be far above the socially motivated discount rate. This argument for a high interest rate is, however, not relevant for the bridge project since the prerequisite was to assist in reconstruction in one way or another, and consequently no competition between projects are to be taken into account.

With respect to the immediate period after Mitch, say November 1998 to December 2001, it seems appropriate to apply a very high interest rate since each day earlier that a connection functions is very valuable for those who suffer.

The reasoning above implies that one could employ a high interest rate, x%, for the period November 1998 to December 2001, and two different interest rates, y% and z% respectively, for the period 2002 – 2062, in order to illustrate the uncertainty. In this study we will, however, employ a common rate, 4%, for all periods of time.

In this study we have assumed the real discount rate 4% for all periods of time. Costs are taken into account within a 60 years period of time, related to the expected economic life length of bridges.

The perspective is from 1 January 2001, i.e., all costs are valued at, discounted to, the date 1 January 2002.

In order to illustrate the effect of a higher discount rate, for example 12%, we demonstrate the difference in results for 4% and 12% interest rate respectively, for the bridge Saopin that has the largest net benefit. Below we show the net benefit of the actual project undertaken (situation 1) compared to situations 2, 3 and 4.

Net benefit of actual project compared to	Rate 4% Million US$	Rate 12% Million US$
Situation 2 – one year delay	12.6	13.1
Situation 3 – two years delay	25.2	25.1
Situation 4 – no reconstruction	313.9	130.3

The reason why the net benefit is larger for 4% than 12% interest rate when actual project is compared with situation 2 is that costs are valued at 1 January 2001, that is, after the actual reconstruction work. Note that the difference is small. In case we had made the valuation at a point of time before the construction work started we would also get a small difference, but in the other direction. If no reconstruction were assumed the difference in net benefit for the two alternative assumptions on discount rate would self-evidently be large since we deal with a 60 years long period, but the benefit of the actual scheme undertaken would still be huge with the higher interest rate.

To conclude we state that the choice of discount interest rate has no significance with respect to the alternative schemes in focus: actual project, one-year delay and two years delay.

Annex 4

List of References

Literature

Arias, C H, Plan de acción para mejorar el transporte colectivo urbano en Honduras, Banco Interamericano de desarollo, October 2000

Skanska, Montly Progress Report to SWECO-ASDI-SOPTRAVI, Reparir and Rehabilitation of Bridges Damaged by Hurricane Mitch, July 2001

Rudqvist Anders, Social and Socio-economic Impacts of Bridge Investment in Tegucigalpa, Uppsala, May 2001-10-10

Martínez, Fernando Bier, Aspectos socioeconomicos, urbanisticos y de transporte en la ciudad de Tegucigalpa, M.D.C. – Informe final, May 2001

Sida and SWECO International, Comprehensive study on bridge investment in Tegucigalpa, volume 2 Appendices, draft May 2001

Frühling, Pierre, Halvtidsöversyn avseende Sveriges stöd till Centralamerika efter katastrofen MITCH, on behalf of Sida, October 2000

Frühling, Pierre, MITCH and after – Swedish Contributions to Reconstruction and Transformation in Central America, on behalf of Sida, January 2001

IDA-IMF, The Republic of Honduras – Poverty Reduction Strategy Paper, staff assessment, 2001

Kihlbom, A and Steenberg, F, Controlling a development aid Project in Honduras – Estimating final cost with the earned value method, June 2001

Paes de Barros, Ricardo, Honduras – un diagnostico social, IPEA, 2000

Inseco S. De R.L. de C.V., Costos de operactión de vehículos, SOPTRAVI, June 1999

Republica de Honduras, La reconstrución y transformación de Honduras, October 2000

Erikson, C-H, Identification of projects of re-establishing the infrastructure damaged by the hurricane MITCH, December 1998

Sida, Utvecklingssamarbetet med Honduras – halvårsrapport juli - december 2000

Sida, Utvecklingssamarbetet med Honduras – årsrapport juni 1999 - juni 2000

Sida, Svenskt bistånd till Centralamerika efter orkanen Mitch – skrivelse från Sida till Sveriges regering, 16 December 1998

Sida, Svenskt stöd till ekonomiska reformer i Honduras för år 2000 promemoria, 19 December 1999

Lindblad, S and Wissting E, The municipal bridge in La Ceiba – and its economic effects on the city

Tiempo, 9 November 1998

Tiempo, 10 November 1998

Tiempo, 11 November 1998

La Tribuna, 1 December 1998

La Tribuna, 2 December 1998

La Tribuna, 19 June 1999

El Heraldo, 10 June 1999

Poverty data, civil society position, Foro social de deuda externa y desarollo, March 2001-10-25

Report Honduras 2000, UNDP

Interviews

In Sweden July – 12 October 2001

Ana-Karin Municio, Sida,

Claes Leijon, Sida,

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Charlie Eriksson, Sida consultant

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In Honduras 15–26 October 2001

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