

The Jamaica 2005 Highway Project

1. The Project

The Government of Jamaica is considering a plan to construct a 4-lane high speed, limited access highway network of some 233 kilometers in length, linking Kingston to Montego Bay and Ocho Rios. The project is to be undertaken in two stages. Stage 1 will begin in 2005 and will complete the section between Kingston and Spanish Town (85 Km) by the end of 2008. Stage 2 will complete the two stretches of highway between Spanish Town and Montego Bay (85 Km west), and to Ocho Rios (63 Km north) to be constructed between 2008 and 2010. The routes are illustrated in Figure 1.

Figure 1: Map of Jamaica Showing Route of Planned Highway



It is proposed that this project will be undertaken as a Public-Private Partnership (PPP) in terms of which the private contractor ('concessionaire') will operate the project under a BOT Scheme which is the acronym for a **Build-Operate-Transfer** Scheme. In the case of Highway 2005 the concessionaire will be responsible for building the highway and also for operating and maintaining it. It is proposed that this will be operated as a toll road through which the concessionaire is expected to recoup its share of the capital investment and operating and maintenance costs. The concessionaire will operate the highway for 15-years after completion of Stage 2 of the project (2011 to 2025) after which it will hand over the project to the Government, at no charge. Thereafter the Government's National Road Operating and Constructing Company Limited (NROCC) assumes responsibility for operations and maintenance until the end of 2050, the assumed end of the project's life.

You are required to undertake a comprehensive cost-benefit analysis of the project from the perspective of Jamaica and the concessionaire. All calculations should be done in millions of US dollars, rounded to one decimal place and expressed in constant 2005 prices. Note that all values reported in this project summary are at 2005 prices. Assume an exchange rate of J\$40 = US\$1.

2. Investment Costs

2.1 Highway Construction

The investment costs are given in Table 1 which shows the year-by-year breakdown, the allocation between the private and public sectors, and, the composition of inputs.

Table 1 **Composition of Capital Costs**
(all values in J\$ millions)

Year	Concessionaire	NROCC*	Composition of Construction Costs (Excluding Land Costs)					
			Labour**		Materials+		Equipment+	
			L	F	L	F	L	F
2005	2000	2000	320	320	240	480	160	880
2006	2000	2000	480	560	400	1120	320	1120
2007	2000	2000	480	560	400	1120	320	1120
2008	4000	4000	1000	400	400	1600	600	800
2009	4000	4000	2000	1000	400	2400	800	1400
2010		6000	2400	400	1200	1200	400	400

* Included in capital costs are land purchases by GOJ of J\$1,600 million in 2005 and J\$3,200 in 2008. Assume 80% land redemption and 20% transactions costs; ie. surveys, conveyancing and resettlement assistance.

** Assume local labour costs consist of 50% unskilled wages and 50% skilled/managerial, and foreign labour is 100% skilled/managerial. The shadow price of unskilled labour is 20% of the wage. Foreign workers remit overseas 75% of their wages.

+ Assume that all local materials and equipment prices are inclusive of a sales tax of 10% paid to central government, and all imported materials and equipment costs include a 5% import duty. Note that no sales tax is levied on imports.

The land purchased for the highway has an opportunity cost estimated at approximately 50% of the redemption cost paid to the previous occupants.

2.2 Toll System Infrastructure

The toll system will require the construction of 6 toll plazas to be installed as new sections of the road are completed. The capital cost of each plaza is estimated at J\$75 million (2005 prices). The composition of this cost is: 40% imported materials, including duties 5% duties; 40% local materials including 10% sales taxes; 10% skilled labour; and, 10% unskilled labour. The first two plazas will be installed in 2008, another two in 2009 and two more in 2010.

3. Operating and Maintenance Costs and Salvage Value

3.1 Highway

It should be assumed that expenditure on highway maintenance (excluding the tolling facilities) will amount to J\$150 million per annum, beginning in 2008. Assume also

the same composition as with total capital construction costs over the period 2005-2010 as shown in Table 1.

3.2 Toll System

Operation of the toll system will require regular maintenance and periodic rehabilitation equal to 5% of the total initial capital cost of the toll utilities, beginning in 2011. For the purpose of efficiency pricing assume the same composition as for the initial capital costs of the toll plazas.

3.3 Salvage Values

The salvage value of the highway and toll utilities will be approximately 50% of the initial capital cost. For the efficiency analysis assume that the benefits of all salvage values are equal to their value at market prices. If at the end of the 15-year concession NROCC/GOJ decide to scrap the toll, allow for the 50% salvage value at the end of 2025, otherwise at the end of 2050. The salvage value of the toll plazas will accrue to GOJ/NROCC.

4. Benefits from the Highway

Five main categories of project benefit should be considered in the project appraisal. These are: (i) reduction in vehicle operating costs to road users due to improved road surface; (ii) value of time saved by passengers and drivers; (iii) reduction in road maintenance costs on existing roads due to lower traffic volumes; (iv) reduction of accident costs due to improved safety; (v) reduced pollution due to efficiency gains in vehicle use; and, (vi) toll revenues received by the concessionaire. Table 2 shows the forecast traffic volume on Jamaica's road network.

Table 2 Details of Road Usage

	Distance (Km Approx.)	Forecast Total 2009 Traffic (000 veh.)*
Kingston - Spanish Town	85	5,000
Spanish Town - Montego Bay	85	2,000
Spanish Town – Ocho Rios	63	1,000

Notes: * total in both directions on existing road and highway combined.

It has been estimated that with the toll, 60% of the forecast traffic between the towns along the route of the highway will use the highway, with the other 40% continuing to use the existing road network. Based on recent trends it should be assumed that this forecasted traffic volume will increase by 4% each year, starting with year 2010, until the end of the project's life. It should also be assumed that when Stage 1 begins operations in 2009 the highway will cover a distance of 85 km which is equivalent to 36% of the completed highway's 233 kilometers. Assume therefore that in 2009 and 2010 the usage of the highway is equal to 36% of the forecast total volume of traffic for the complete highway. In 2011 when Stage 2 opens, the highway will operate at 100% of the forecast volume of highway traffic from the first year onwards; ie. 60% of total forecast traffic between the towns along the route of the highway.

The following sub-sections outline the details necessary for calculation of each component of project benefit.

4.1 Reduced vehicle operating costs (VOCs)

For the purpose of this study it will be assumed that under the ‘without-project’ scenario the existing road network will remain unchanged. It will also be assumed that the total vehicle and passenger kilometers traveled is the same with and without the new highway. Of this traffic volume approximately 60% is expected to be passenger vehicles (private cars, motorbikes, taxis, minibuses and larger buses) and 40% trucks. The expected VOC saving (in 2005 efficiency prices) is J\$1.60 per km for passenger vehicles and J\$9.00 per km for trucks. For all other components of VOC assume that the efficiency price is the same as the market price. Treat VOC savings as external benefits in the project and private analysis.

4.2 Value of Time Saving

Each passenger vehicle is expected to carry, on average, 16 passengers including the driver and each truck carries on average 1.5 passengers including the driver. Passengers travel for different reasons; work, commuting and leisure activities. It has been estimated that time spent traveling on Jamaica’s highways can be broken down as follows: 15% work; 52% commuting, and, 33% leisure. (These proportions apply to passenger vehicles only.) Assume trucks’ drivers and passengers travel exclusively for work purposes. Estimates of the time opportunity cost per person-kilometer on existing roads for the three categories of passenger are: J\$3, J\$2.5, and J\$2 respectively (2005 prices). All travel time saved should be treated as external (non-financial) benefits (ie. should be omitted from the project and private analyses) and should be priced at the appropriate shadow prices in the efficiency and referent group non-financial benefits accounts. It has been estimated that the new highway will reduce travel time by 70% for passenger vehicles and 45% for trucks.

4.3 Reduced Maintenance Costs on Existing Road Network

Since 60% of the traffic moving between the places to be connected by the new highway is expected to shift from the existing roads on to the toll highway, the lower volume of traffic remaining on the existing roads implies both the need for less maintenance and the opportunity to defer scheduled rehabilitation works. It has been estimated that, in the absence of the new highway, annual maintenance costs on these sections of Jamaica’s roads would be J\$2,000 million per annum (in 2005 prices) with effect from 2009. These consist of 95% capital works and 5% operating expenses. It is expected that the lower traffic load will reduce annual capital works by 10% and annual operating expenses by 20%. For the purpose of the efficiency analysis it should be assumed that the efficiency prices of capital and operating costs are the same as for new highway construction and operating costs. Treat all reduced maintenance costs as benefits to NROCC/GOJ in both the private and efficiency analyses.

4.4 Reduced Accident Costs

It has been estimated that total annual costs associated with road accidents amounted to approximately J\$2,000 million per annum in 2005 and that these costs can be expected to rise proportionately with the increase in traffic volume, *ceteris paribus*. If these costs are apportioned over Jamaica’s entire road network, it can be estimated that 6.6% of the total traffic accident costs are incurred on the sections of the road network where the new highway is to be located. With 60% of the traffic expected to shift to the safer highway, it has been estimated that accidents over this section of the

network will be reduced by 33%; ie. 33% of 6.6% of the annual forecast total cost of traffic accidents. For the purpose of the efficiency analysis it should be assumed that the shadow price of the cost of accidents is the same as the market price. Treat all benefits from reduced accidents as external to the project and private analysis.

4.5 Reduced Pollution Costs

The main form of pollution caused by traffic is air pollution, the main pollutants being: carbon dioxide (CO₂), carbon monoxide (CO), hydrocarbons (HC), nitrous oxide (NO), sulphur oxide (SO) and particulates (PM). Drawing on estimates of the costs of these pollutants from studies undertaken in other countries, and, given the composition of Jamaica's traffic fleet by type of vehicle, it has been estimated that the pollution cost savings from the new highway will amount to, in efficiency prices, J\$0.10 per vehicle kilometer traveled by passenger vehicles on the new highway and J\$0.20 per vehicle kilometer traveled by trucks on the new highway. For the purpose of the efficiency and referent group analysis it should be assumed that the full cost of this externality is borne by residents of Jamaica. Treat all benefits from reduced pollution as external to the project and private analysis.

4.6 Revenues from Tolls

Toll charges are expected to set at J\$5 per kilometer for passenger vehicles and J\$10 per vehicle kilometer for trucks, in 2005 prices, and indexed for inflation. There is no sales tax on the toll, the concessionaire retains all the proceeds from the tolls until the end of its concession (at the end of 2025).

5. Tax and Financing Arrangements

The concessionaire is required to pay 25% company tax on its earnings. While interest payments on loans can be treated as a tax deductible cost, no provision is made for depreciation allowances as a deduction against income for tax purposes.

The concessionaire will finance its share of the initial capital cost with loans from international banks of US\$100 million drawn in 2008 and repayable over the next 15 years at 3% (real) interest rate. The balance of its investment is financed from its own funds (equity) held by its parent company in France. The other investor is the Government of Jamaica (GOJ) which, together with NROCC (a state enterprise), borrows the equivalent of US\$300 million domestically at 4.5% (real) interest rate in 2008, repayable over 40 years, and finances the balance of its expenditure from its own funds.

6. Arrangements on Termination of the Concession

On termination of the concession at the end of 2025 the highway and its maintenance is handed over to and become the full responsibility of NROCC/GOJ. There will be no payment to the concessionaire. Assume that the road is operated for a further 25 years (ie. until the end of year 2050) and that the salvage value is 50% of the initial highway capital cost.

A decision has to be made as to whether the highway should be managed with or without a toll system from 2026 onwards. It has been predicted that removal of the toll would result in a 30% increase of the total forecast traffic flow using the highway.

The toll utilities have a salvage value of 50% of initial cost, and will be scrapped either at the end of 2025, if NROCC/GOJ decides not to continue the toll, or at the end of 2050 if they do. (In either case the salvage value will accrue to NROCC/GOJ.)

It should be assumed that if the toll is removed in 2026 all benefits, with the exception of the reduced maintenance costs on existing roads (item 4.3 above), increase proportionately with the increase in traffic volume; ie. by 30%, including avoided accident costs (item 4.4 above).

7. Referent Group Definition

For the purpose of the analysis assume that all stakeholders with the exception of the concessionaire and foreign lender are part of the referent group. However, for purposes of negotiations with the concessionaire GOJ also wishes to know what its net benefits are under the alternative scenarios. (The private BCA should show the returns on equity of both the private concessionaire and NROCC/GOJ.)

8. Your Task

Your task is to undertake a complete benefit-cost analysis of the proposed project as detailed above, with and without the toll after 2025. The results of the project, private, efficiency and referent group analysis should be calculated and discussed. You should structure your spreadsheet analysis as indicated by the template which will be made available at the lab sessions.

While GOJ uses a 6% discount rate (real) for public sector investment decision making, you should also undertake a sensitivity analysis at 9% and 12%. It is understood that the concessionaire requires a minimum return of 12% (real) on its equity. Your report should advise the government on whether the project is worthwhile and which scenario (tolls or no tolls after 2025) you consider the best, giving reasons. You should also report the sensitivity of the results to the traffic forecasts reported in Table 2.

In your discussion of your findings you should identify (in 100 words or less) what other variables might be selected for further sensitivity analysis, and explain why.

9. The Format of the Report

The report is to be presented in a format similar to that of the ICP Case Study reported in Chapter 14 of the text. It should begin with an executive summary of approximately one page in length. The main body of the report should not be more than 10 pages in length (1.5 spacing, font size 12) including your summary tables of results. The printouts of the spreadsheets, including the Input Data should be in a separate appendix. You should only print the spreadsheets for the base case scenario. To save paper you need only print the cash flows for the first 21 years of the project (ie up to and including 2026) and the last two years (2049 and 2050). Try to condense these so

all years fit on one A4 page (landscape). You must also enclose a floppy disk containing all your *Excel* spreadsheets, with each file clearly labeled.

***Please Note:** This case study, which was developed for teaching purposes at the University of Queensland, is based on a report prepared by Dessau Soprin International Inc for the Development Bank of Jamaica (“**Highway 2000 Project: Economic Cost-Benefit Analysis**”, July 2000). The details of the project and its financing as specified here are hypothetical and do not necessarily correspond to those of the original report. For a downloadable copy of the original report see:*

<http://www.h2kjamaica.com/agreements/pdf1/Economic%20Cost-Benefit%20Analysis.pdf>

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