50 percent of total trips) is personal needs, one of the travel categories typically defined as featuring no significant economic value and/or potential. A similarly low volume of work trips, ranging from 15-35 percent of total trips, was adopted by a previous study conducted in Viet Nam[1]. For purposes of the current study, it is also conservatively postulated that 20-40 percent of passenger time features, depending on mode, economic value.

6.2.3 VOC Profile

Vehicle costs, time value and operating parameter are combined to estimate financial and economic VOC (Table 6.4). The economic VOC for composite vehicle classes are presented as running costs, both on a distance basis and fixed cost (time) basis, as well as value of passenger time (incurred on a time basis) (Table 6.5).

Table 6.5 - 1996 Economic Vehicle Operating Cost

Vehicle Type	1996 VOC (US cents)[4]		
	Running Costs		Time Costs
	Per Kilometer	Per Minute	Per Minute[5]
Motorcycle	2.6	0.1	0.3
Passenger Car (1)	16.1	10.7	1.7
Small/Medium Bus	16.5	6.7	1.9
Large Bus	20.6	8.3	3.8
Pick-Up Truck	12.8	4.5	0.5
Light/Medium Truck (2)	15.8	8.8	0.0
Heavy Truck (3)	25.6	11.0	0.0

[1] Sedans and Vans
[2] Two axle trucks, excluding pick-ups
[3] Trucks with three or more axles, and truck-trailer combinations
[4] VOC applicable to inter-zonal vehicle trips. VOC reflective of free-flow speed and good road conditions
[5] Passenger time value. Crew costs included in vehicle running costs.

The unit VOC costs suggest that the value of passenger time will play only a marginal role in the economic viability process. This is due to several reasons:

- The average income, even within the framework assumed by the current study, remains modest especially when compared to vehicle and vehicle component prices.
- Only a low share (20-40 percent) of inter-zonal trips are likely to feature economic value; that is, are undertaken for work or professional business purposes.
- Trucks, which exhibit a very low passenger time savings potential, represent a dominant portion of the inter-zonal traffic stream (crew costs are reflected as a component of running costs, not passenger time savings).

The various VOC components are further illustrated by an annualized summary of vehicle costs (Figure 6.1):

- The "human" component (crew cost and passenger time) is noticeable only in the case of buses: some 10 percent of the total VOC.
- Fuel, lubricants and tires represent 35-45 percent of VOC for trucks larger than pick-ups.

[1] "Feasibility Study on the Highway No. 18 Improvement in Viet Nam", op. cit.

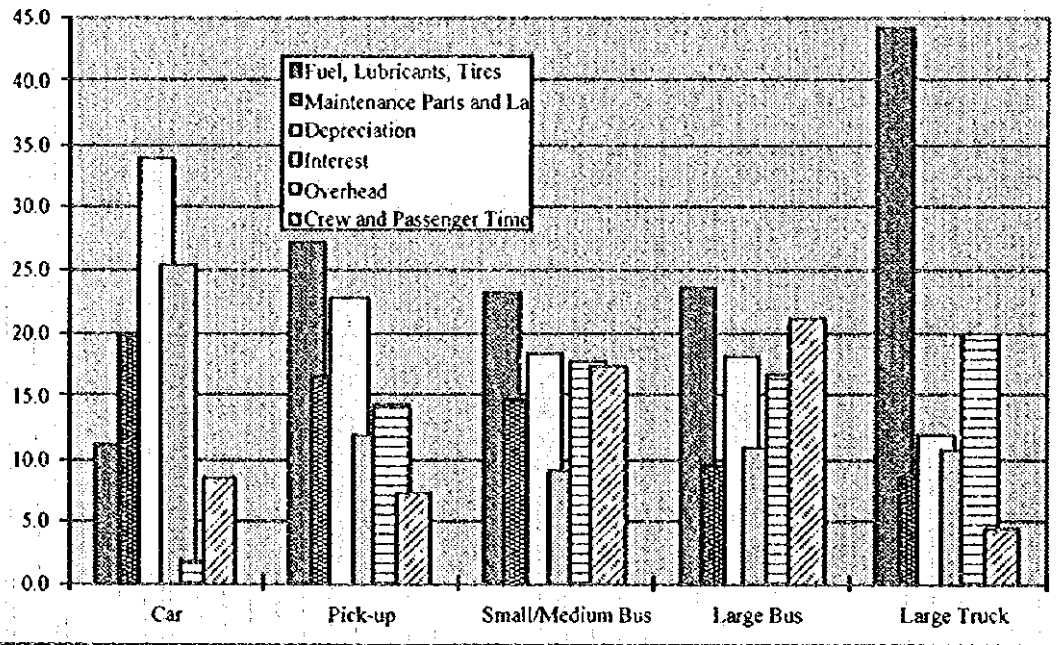
Table 6.4 DERIVATION OF 1996 UNIT VEHICLE OPERATING COST

CALCULATION OF VOC (1996 US $) BY VEHICLE TYPES	CAR	VANS	PICK-UPS	MOTOR CYCLES	SMALL BUSES	MEDIUM BUSES	LARGE BUSES	TRUCKS (LIGHT)	TRUCKS (MEDIUM)	TRUCKS (HEAVY)
Vehicle Price (Excl.Tires)Financial	32,300	58,000	26,500	2,200	56,800	65,600	88,800	47,300	49,400	61,800
Vehicle Price (Excl.Tires) Economic	29,300	27,400	17,400	1,900	31,200	45,200	61,200	31,000	38,200	47,850
Vehicle Life - Years	10	10	7	8	6	7	8	8	12	12
Vehicle Life - Kilometres	250,000	250,000	350,000	120,000	600,000	700,000	800,000	480,000	960,000	960,000
Vehicle Annual Kilometrage	25,000	25,000	50,000	15,000	100,000	100,000	100,000	60,000	80,000	80,000
Vehicle Life Operating Hours	6,000	6,000	10,500	16,000	18,000	21,000	24,000	12,000	24,000	24,000
Vehicle Annual Operating Hours	600	600	1,500	2,000	3,000	3,000	3,000	1,500	2,000	2,000
Fuel Price Financial - Cost/Litre	0	0	0	0	0	0	0	0	0	0
Fuel Price Economic - Cost/Litre	0	0	0	0	0	0	0	0	0	0
Fuel Consumption - Litres/km	0	0	0	0	0	0	0	0	0	0
Tire Unit Price Fin - Cost/Pcs	80	80	80	70	150	150	210	150	210	210
Tire Unit Price Econ - Cost/Pcs	73	73	73	64	136	136	190	136	190	190
Tire Percent Recapped	15	15	15	15	25	25	35	25	35	35
Recapping Costs Financial	32	32	32	28	60	60	84	60	84	84
Recapping Costs Economic	29	29	29	26	54	54	76	54	76	76
Number of Tires	4	4	4	2	4	5	6	4	7	14
Tire Life - Kilometres	25,000	25,000	25,000	30,000	25,000	35,000	35,000	35,000	35,000	35,000
Lubricants Price Fin - Cost/Litre	1	1	1	1	1	1	1	1	1	1
Lubricants Price Econ - Cost/Litre	1	1	1	1	1	1	1	1	1	1
Lubr. Oil Cons. - Litres/1000 km	2	2	2	0	3	3	4	3	4	4
Maintenance Spares/1000 km - % of (2)	0	0	0	0	0	0	0	0	0	0
Maintenance Labour - Hours/1000 km	2	2	3	1	5	6	8	5	6	7
Maint Unit Labour Costs F-Cost/Hour	1	1	1	1	1	1	1	1	1	1
Maint Unit Labour Costs E-Cost/Hour	1	1	1	1	1	1	1	1	1	1
Depreciation, Distance Related - %	50	50	65	60	65	85	85	65	65	65
Depreciation, Time Related - %	50	50	35	40	35	15	15	35	35	35
Opportunity Cost of Capital(Half)-%	8	8	8	-	8	8	8	8	8	8
Overhead, % of total VOC	-	5	15	-	20	20	20	20	20	20
Overhead alloted to Econ cost (1=Yes)	1	1	1	1	1	1	1	1	1	1
Crew Costs Fin - Cost/Hour	0	0	0	-	0	0	0	0	0	0
Crew Costs Econ - Cost/Hour	0	0	0	-	0	0	0	0	0	0
Passengers - Number	3	3	1	2	10	20	30	0	0	0
Percent of Pass Trips Work or Business	40	40	40	20	30	30	30	30	30	30
Passenger Unit Costs - Cost/Hour	1	1	1	1	0	0	0	0	0	0
Passengers Carried (% of Trips)	100	100	70	100	85	85	85	20	20	20
Average Crew Size	1	1	1	-	2	2	2	2	2	2
Total Vehicle Occupancy	3	3	2	2	12	22	32	3	3	3
FINANCIAL RUNNING COSTS :										
Fuel Costs	0.035	0.035	0.065	0.011	0.064	0.079	0.094	0.071	0.105	0.163
Lubricant Costs	0.003	0.003	0.003	0.000	0.003	0.004	0.005	0.003	0.005	0.005
Tire Costs	0.012	0.012	0.012	0.004	0.020	0.018	0.028	0.015	0.033	0.066
Maintenance Spares Cost	0.166	0.133	0.053	0.004	0.085	0.059	0.053	0.052	0.055	0.043
Maintenance Labor Costs	0.001	0.001	0.002	0.001	0.003	0.004	0.005	0.004	0.004	0.005
Depreciation Costs	0.145	0.116	0.049	0.011	0.062	0.080	0.094	0.064	0.033	0.042
TOTAL COSTS/VEHICLE-KM	0.361	0.299	0.183	0.032	0.238	0.243	0.280	0.209	0.214	0.324
FINANCIAL FIXED COSTS :										
Depreciation	6.025	4.833	0.883	0.055	1.104	0.469	0.555	1.380	0.720	0.901
Opportunity Cost of Capital	9.038	7.250	1.325	0.000	1.430	1.640	2.220	2.365	1.853	2.318
Crew Cost	0.204	0.204	0.204	0.000	0.680	0.680	0.680	0.748	0.748	0.748
Overhead	0.000	1.303	1.502	0.000	2.783	2.725	3.196	3.211	2.975	4.232
TOTAL COSTS/VEHICLE-HOUR	15.267	13.590	3.915	0.055	5.987	5.513	6.651	7.704	6.296	8.198
ECONOMIC RUNNING COSTS :										
Fuel Costs	0.025	0.025	0.047	0.008	0.046	0.059	0.071	0.054	0.079	0.123
Lubricant Costs	0.002	0.002	0.002	0.000	0.002	0.003	0.003	0.002	0.003	0.003
Tire Costs	0.011	0.011	0.011	0.004	0.018	0.017	0.026	0.013	0.030	0.060
Maintenance Spares Cost	0.067	0.063	0.025	0.004	0.047	0.041	0.037	0.024	0.027	0.033
Maintenance Labor Costs	0.001	0.001	0.001	0.001	0.002	0.003	0.004	0.003	0.003	0.004
Depreciation Costs	0.059	0.055	0.032	0.010	0.034	0.055	0.065	0.042	0.026	0.032
TOTAL COSTS/VEHICLE-KM	0.164	0.156	0.128	0.026	0.152	0.177	0.206	0.148	0.168	0.256
BASIC ECONOMIC FIXED COSTS :										
Depreciation	2.442	2.283	0.580	0.048	0.607	0.324	0.383	0.904	0.557	0.697
Opportunity Cost of Capital	3.663	3.425	0.870	0.000	0.780	1.133	1.533	1.550	1.433	1.793
Crew Cost	0.204	0.204	0.204	0.000	0.680	0.680	0.680	0.748	0.748	0.748
Overhead	0.000	0.653	1.043	0.000	1.784	2.010	2.362	2.250	2.361	3.365
TOTAL COSTS/VEHICLE-HOUR	6.308	6.566	2.697	0.048	3.851	4.146	4.957	5.482	5.098	6.603
PASSENGER TIME COSTS : TOTAL COSTS/VEHICLE-HOUR	1.100	0.800	0.314	0.477	0.765	1.530	2.295	0.005	0.005	0.005

- Depreciation is pronounced only in the case of passenger cars totaling near 25 percent of VOC.
- Overhead costs are estimated to comprise some 15-20 percent of bus and truck VOC.

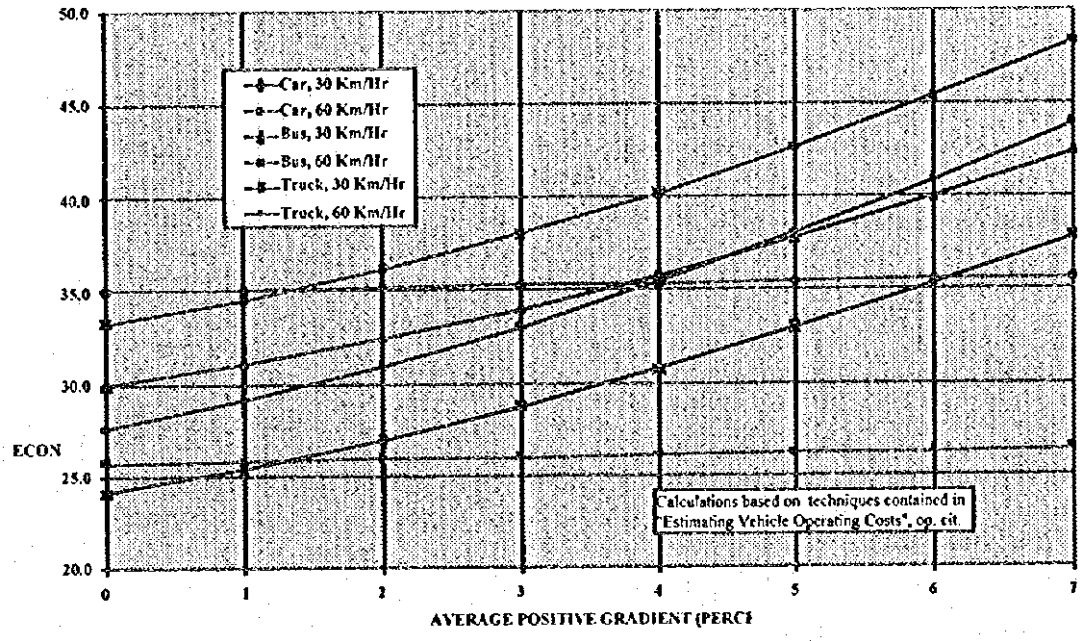
These relationship reflect, as indicated previously, free-flow speed and smooth pavement conditions. The computerized modeling process which is sensitive to the interaction of traffic speed, volume and capacity, replicates changes in operating speed as congestion gradually increases on the road network. The capabilities of HDM-VOC[1] were consequently utilized to

Figure 6.1 ANNUALIZED ECONOMIC OPERATING COST BY VEHICI



[1] "Estimating Vehicle Operating Costs", op. cit.

Figure 6.2 INTERACTION OF VEHICLE OPERATING COST, SPEED AND



adjust free-flow VOC to a variety of speed, grade and horizontal curvature conditions. Thus, as speed decreases, and/or vertical grade increases, VOC will correspondingly increase, particularly in the case of trucks (Figure 6.2). VOC is also sensitive to road roughness; that is, a poorly surfaced road will increase VOC due to slower operating speed and higher consumption of vehicle parts.

6.3 IMPROVEMENT COSTS

Improvement costs considered in the economic analysis are one-time project implementation costs (construction, contingencies, engineering design, construction supervision, and land), periodic maintenance (overlays every 7-10 years after opening of the facility), and annual maintenance costs. Improvement costs are economic costs; that is, net of taxes and duties.

Economic project costs for the Hai Van pass segment of the HDH are drawn from that projects pre-feasibility study[1]. For remaining sections of the HDH (Hue Bypass, Lang Co-Chan May, Da Nang Bypass), and for improvement of Highways 14B, 24 and 49, costing specialists were dispatched to the study area to examine each corridor at a pre-feasibility level of detail. Unit costs were derived from recently-completed road design/construction projects, augmented by discussions with representatives of the MOT and province Peoples Committee's. While the computation of engineering-related costs proved to be a relatively straight-forward process, the estimation of land costs was more problematic. Land, in the local context, is not a commercially traded commodity since ownership is restricted. Instead, the value of land is generally measured in terms of its economic production potential. Pending finalization of road project

[1] "Pre-feasibility Study of Hai Van Pass Tunnel of Highway No. 1", op. cit.

design, it is not practical to attempt a detailed land settlement/use analysis of road corridors designated at a Master Plan level of accuracy. Two precedents were accordingly utilized:

- The recently-completed Highway 18 design project[1] developed detailed estimates of land costs based on outlays for land acquisition/compensation (inhabited land along existing road; inhabited land in rural area; cultivated land; and, forest area); crop compensation (rice); resettlement (permanent house; temporary house); and, household relocation assistance. Findings indicate that land costs average near 10 percent of project cost.

- Costing guidelines[2] suggest that, for the type of project considered and likely corridor alignments, land compensation should range from $100 - $150 per hectare per year of use, plus resettlement costs.

The upgrading of Highways 14B, 24 and 49 should incur only few site-specific land costs, with exception of the proposed Highway 49 Bypass near Hue. The HDH, with a suggested 50 meter right-of-way, well incur considerable land costs - on the order of $10 million depending on assumptions of unit cost and land tenure. To maintain a conservative approach, it is deemed prudent to allocate some 15 percent of HDH cost (near $14 million) and 7.5 percent of east-west highways cost (some $6 million) for land rights outlays.

The estimated economic project cost for the new Hue-Da Nang Highway is some $240 million, near 60 percent thereof being allocated to the Hai Van pass section. Unit cost varies from $527,000 per kilometer (Da Nang Bypass) to almost $10 million per kilometer for the Hai Van section. In addition, some $25 million is budgeted for improving and/or constructing HDH access roads and/or intersection facilities (Table 6.6).

Table 6.6 Economic 1996 Project Cost New Hue-Da Nang Highway

Item	Units	Hue Bypass	Lang Co-Chan May	Hai Van Pass	Da Nang Bypass	Total
Construction	Million $	24.215	34.353	112.158	15.529	186.255
Contingency	@ 10%	2.421	3.435	12.032	1.553	19.442
Engineering/Supvsn	@ 10%	2.664	3.779	12.281	1.708	20.432
Land	@ 15% (1)	4.395	6.235	0.490	2.819	13.939
Total	Million $	33.695	47.803	136.961	21.609	240.068
Length	Km	39.0	32.0	13.9	41.0	125.9
Unit Project Cost	Mill $/Km	0.864	1.494	9.853	0.527	1.907
Access Facilities (2)	Million $	5.400	5.400	4.900	9.500 (3)	25.200
Grand Total	Million %	39.095	53.203	141.861	31.109	265.268

(1) Except Hai Van section.
(2) Upgrading/construction of access roads, flyovers and toll booths.
(3) Includes multi/lane Highway 14B between HDH and Highway 1.

Economic project costs for upgrading east-west highways (considerable portions of which are in mountainous terrain) are expected to total some $85 million. Unit cost is similar for all facilities averaging near $430,000/kilometer (Table 6.7).

[1] "Feasibility Study on the Highway No. 18 Improvement in Viet Nam", op. cit.

[2] "Asia Handbook-1994", published by the Bank of Tokyo, Japan, 1995.

Table 6.7 Economic 1996 Project Cost Upgrading of East-West Highways

Item	Units	Highway 24(1)	Highway 49	Highway 14B	Total
Construction	Million $	21.269	22.390	21.692	65.351
Contingency	@ 10%	2.127	2.239	2.169	6.535
Engng/Supvsn	@ 10%	2.340	2.463	2.386	7.189
Land	@ 7.5%	1.930	2.032	1.969	5.931
Total	Million $	27.666	29.123	28.216	85.005
Length	Km	65.0	70.0	62.9	197.9
Unit Project Cost	Mill $/Km	0.426	0.416	0.449	0.430

(1) Portion of Highway 24 located within the study area.

Discussions with representatives of the MOT reveal that maintenance outlays on national roads throughout Viet Nam averaged some $3,200 per kilometer in 1995, and are expected to reach $3,300 per kilometer in 1996. However, this includes all forms of maintenance, with an estimated 25 percent (roughly $800 per km) being allocated to routine, annual functions; the remainder not only to recurring and periodic maintenance functions but also emergency repairs caused by flood damage and upkeep of staff quarters. The MOT recognizes the inadequacy of this outlay, and feels a more realistic total would be some $1,700 per kilometer per year for routine functions, and $5,000 per kilometer per year for recurring functions.

Maintenance costs adopted for the economic analysis total:

- Routine annual maintenance is set at 2,500 1996 US dollars per kilometer per year. This amount exceeds the MOT estimate, but is more consistent with the Indonesian Integrated Road Management System (IRMS) which suggests that, to maintain good surface quality on a major, paved road, outlays of $2,000 - $2,500 per kilometer per year are required for facilities carrying up to more than 10,000 vehicles per day.

- Periodic maintenance consisting mainly of minor repairs and overlays applied every seven to 10 years after facility opening, is assigned an economic cost of $60,000 per kilometer per event.

An exception is the Hai Van section which requires complex maintenance procedures due to the presence of three tunnels. The Hai Van per-feasibility study estimates the economic cost at $861,000 per year, or some $62,000 per kilometer per year, averaged over the 13.9 kilometer section.

6.4 IMPLICATIONS OF FORECAST DEMAND

Previous chapters describe the development of computerized transport models as well as techniques and methodologies employed in forecasting future demand. These involve, in summary, the estimation of years 2000, 2005 and 2010 trip matrixes, and their assignment onto future road networks containing alternative types of improvements. These forecast can essentially be viewed as unconstrained demand, that is, the allocation of a given number of trips between a series of origins and destinations. However, economic analysis algorithms require enhanced sensitivity in that the cost and benefit streams are determined via a comparison of "with improvement" and "without improvement" scenarios. Thus, a narrow (say 6 meter) "without" road will reach saturation capacity earlier than an enhanced (say 7.2 meter) "with" road. Likewise, the HDH improvement will invariably offer vastly higher capacity in the Hue-Da Nang corridor.

A series of screening steps were therefore instituted which reflect capacity constraints unique to the "with" and "without" scenarios.

- The current study's planning horizon extends to year 2010; however, the economic analysis period extends beyond year 2010. Traffic growth during the post-2010 period has therefore simplistically been set at one-half the established pre-2010 growth rate.

- The "without" maximum capacity is, in case of the east-west highways, based on existing facility conditions. In the Hue-Da Nang corridor, "without" maximum capacity incorporates Highway 1 improvements proposed by on-going IBRD/ADB projects.

- The "with" maximum capacity for east-west highways reflects upgrading to a Class III design standard, while, in the Hue-Da Nang corridor, the HDH is introduced in the form of a high-order, two-lane, access-controlled facility. The "with" scenario also includes upgraded feeder roads between the HDH and Highway 1, to include multi-laning of Highway 14B.

Results mirror, as expected, conclusions of the sufficiency analysis previously presented in *Chapter 5*. In case of the Hue-Da Nang corridor, upgrading of Highway 1 in line with IBRD/ADB proposals will be adequate for the near-term future; however, all upgraded corridor sections are expected to saturate in vicinity of year 2005. The introduction of the HDH will suffice for about ten years thereafter before multi-laning of the HDH will be required (Table 6.8). Demand growth along the east-west highways will be substantial in a relative sense, although absolute capacity is likely to be sufficient for the foreseeable future (Table 6.9).

The varying demand patterns carry implications for the economic analysis process. In case of the east-west highways, benefits (VOC and time savings) will be catalyzed by road conditions. That is, the "with" case embodies a wider, smoother and paved road, which translates to faster (cheaper) vehicle operation. In case of the HDH, however, the economic analysis period must be stratified into three elements (Figure 6.3).

- Prior to saturation of Highway 1, both the HDH and Highway 1 continue to absorb additional volume; benefits catalyzed by the HDH are similar in nature to east-west highway analogies. That is, the HDH is a better and faster road, particularly as Highway 1 gradually approaches saturation.

- Following saturation of Highway 1, continued growth in traffic is theoretically not possible under the "without" scenario, with possible resulting accrual of indirect disbenefits (such as stunted regional economic growth). However, the "with" HDH scenario provides additional capacity which can continue to accommodate traffic growth and support continued regional development. A very conservative approach has been used to compensate for the inability to carry added traffic beyond the "without" saturation capacity. Foregone traffic (forecast demand less maximum "without" capacity) is, for each year after reaching the "without" saturation capacity, multiplied by one-half the average VOC benefit achieved during years prior to reaching the "without" saturation capacity, and introduced into the economic analysis process as an external project benefit. This approach mirrors a surplus benefit analogy in which decreased trip cost or enhanced capacity results in increasing mobility benefits for the general society.

- As the corridor (HDH plus Highway 1) reaches saturation, additional road improvements (such as multi-laning the HDH, refer Section 5.6) are required. However, as the purpose of the economic analysis is to assess the viability of a two-lane road, no additional benefits are permitted to accrue once the corridor reaches saturation.

Findings of the economic review are presented in the subsequent section.

6.5 ECONOMIC VIABILITY

Economic evaluations typically include two measures of viability:

- Internal rate of return (IRR), or that rate at which the project net present value is zero. IRR is commonly used as a comparative index of project economic return vis-à-vis some exogenous rate such as societal opportunity cost of capital or financial cost of market capital.

- Net present value (NPV) is the discounted present value of the net project benefit stream (20 year horizon) based on an assumed monetary value (for the current study, 10 percent, 12 percent and 15 percent are used). NPV is considered a more stable indicator of project performance, and that, all things being equal, higher NPV implies superior performance. Negative NPV would suggest, in an economic decision-marking framework, that the project should be rejected.

It must be understood that NPV and IRR measures can produce conflicting results[1]. IRR is, for example, very sensitive to the temporal allocation of costs or benefits, particularly so during early years of the economic evaluation period. Furthermore, if negative and positive cash flows alternate over the life of the project, multiple IRR solutions are possible[2]. Both the IRR and NPV fail to recognize the varying sizes of investment required to achieve a given yield. Thus, at face value, two projects with equal NPV's may be assumed to be equal in terms of implementation desirability. However, actual risk may be much higher for one of the projects if implementation cost is significantly higher.

It must be assumed that, in the case of Viet Nam, investment funds are limited, and that all projects are related through a common budget constraint. In other words, it is likely that the number of projects will, at any given time, exceed the availability of funds for implementation. Thus, it is judged imperative that any review of projects be sensitive to required capital investment. A suggested approach is therefore to include a benefit-cost ratio, that is, the relationship of the discounted benefit stream to the discounted initial investment, in the analysis. This index can also be alternatively termed the present value index[3] or profitability index[4]. B/C ratios were, subsequently, developed for 10 percent, 12 percent and 15 percent discount rates.

6.5.1 Hue-Da Nang Highway

The analysis is structured to reflect a common, four-year construction period, with opening of the entire HDH by year 2004. Results indicate that the HDH, being located in a high-volume, rapidly growing corridor, achieves attractive rates of return. On a composite basis, the HDH IRR is 22.4 percent, at a B/C of 2.03 (12 percent discount rate) (Table 6.10). Hai Van pass is the critical link with an IRR of 14.5 percent, and B/C ratio of 1.21 (12 percent discount rate). This is not surprising given the massive construction cost of the Hai Van tunnels. A sensitivity analysis confirms that while performance of the other three HDH segments remains robust under a wide range of changing cost or benefit scenarios, only a 15 percent decrease in benefits, or 15 percent increase in cost, is sufficient to lower the Hai Van B/C to near unity (Table 6.11).

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[1] "Guidelines for Calculating Financial and Economic Rates of Return for DFC Projects", J. Duvigneau and R. Prasad, World Bank Technical Paper 33, The World Bank, Washington DC, USA.

[2] "Corporate Financial Analysis", D. Harrington and B. Wilson, Topan Press, Tokyo, Japan.

[3] Ibid.

[4] "Chief Financial Officer - Decision Making Tools for Executives", J. Shim and J. Siegel, Prentice Hall Publishers, New Jersey, USA.

Table 6.8 FORECAST CONSTRAINED DEMAND (PCU/DAY)
HUE - DA NANG HIGHWAY CORRIDOR

	HUE BYPASS			LANG CO - CHAN MAY			HAI VAN PASS			DA NANG BYPASS		
	Without HDH	With HDH		Without HDH	With HDH		Without HDH	With HDH		Without HDH	With HDH	
YEAR	Highway 1	HDH	Corridor	Highway 1	HDH	Corridor	Highway 1	HDH	Corridor	Highway 1	HDH	Corridor
1995	6,621			4,741			4,427			11,815		
1996	7,590			5,697			5,363			13,239		
1997	8,701			6,845			6,496			14,834		
1998	9,975			8,225			7,870			16,622		
1999	11,434			9,883			9,533			18,625		
2000	13,108	4,810	13,117	11,876	6,029	11,876	11,548	6,056	11,549	20,869	4,221	20,869
2001	15,542	6,018	15,485	14,078	7,580	13,933	13,680	7,628	13,511	24,448	5,777	23,946
2002	18,429	7,530	18,319	16,688	9,530	16,434	16,206	9,609	15,908	28,640	7,906	27,735
2003	21,851	9,422	21,718	19,781	11,981	19,483	19,197	12,104	18,849	29,546	10,821	32,461
2004	25,909	11,789	25,802	23,449	15,063	23,215	22,742	15,246	22,470	29,546	14,810	38,427
2005	30,369	14,750	30,720	27,796	18,938	27,796	26,940	19,205	26,940	29,546	20,269	46,044
2006	30,369	17,649	36,336	30,406	22,050	32,790	31,734	22,240	31,695	29,546	25,713	53,628
2007	30,369	21,117	42,983	30,406	25,675	38,695	32,150	25,756	37,312	29,546	27,743	62,462
2008	30,369	25,267	50,853	30,406	29,894	45,679	32,150	29,826	43,952	29,546	32,458	72,752
2009	30,369	30,233	60,171	30,406	34,807	53,945	32,150	34,541	51,806	29,546	37,974	74,766
2010	30,369	36,175	71,206	30,406	40,528	63,730	32,150	40,000	61,103	29,546	44,427	74,766
2011	30,369	40,219	75,589	30,406	44,781	69,757	32,150	40,933	66,944	29,546	45,220	74,766
2012	30,369	44,714	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2013	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2014	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2015	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2016	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2017	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2018	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2019	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2020	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2021	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2022	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2023	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2024	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766
2025	30,369	45,220	75,589	30,406	45,220	75,626	32,150	40,933	73,083	29,546	45,220	74,766

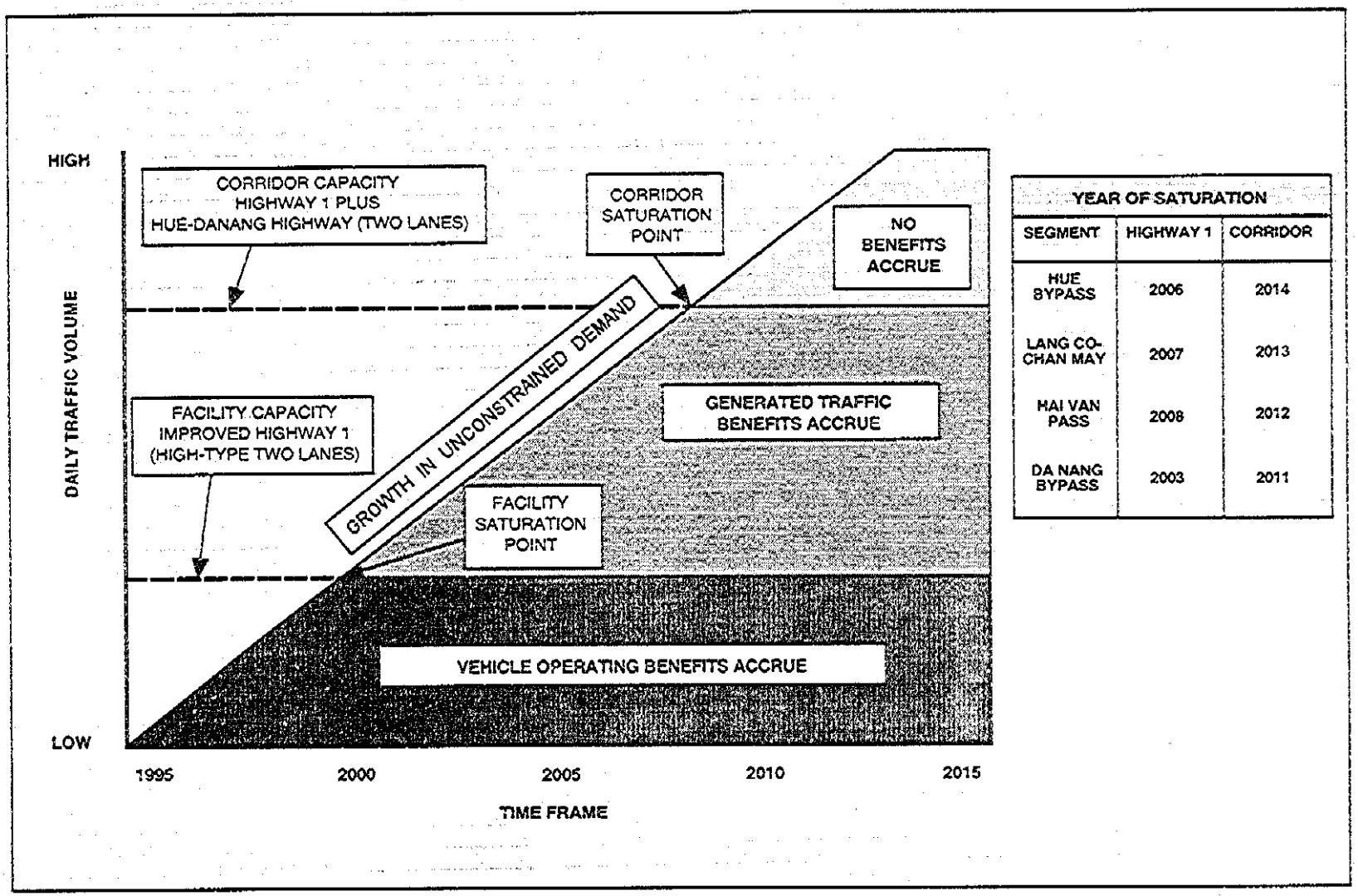
Note: Unconstrained demand derived from assignment of future year demand onto future year network. Growth beyond year 2010 (limit of planning horizon) adopted as one-half of preceeding relative growth rate. Unconstrained demand constrained by maximum capacity. Indicated years are for temporal flow analysis only. Volume and demand reflect section average.

Table 6.9 FORECAST CONSTRAINED DEMAND (PCU/DAY) EAST-WEST HIGHWAYS

YEAR	HIGHWAY 24		HIGHWAY 49		HIGHWAY 14B	
	Not Improved	Improved	Not Improved	Improved	Not Improved	Improved
1995	1,039	1,039	732	732	1,676	1,676
1996	1,135	1,135	855	855	1,855	1,855
1997	1,240	1,240	1,003	1,003	2,064	2,064
1998	1,357	1,357	1,183	1,183	2,306	2,306
1999	1,486	1,486	1,401	1,401	2,588	2,588
2000	1,629	1,629	1,666	1,666	2,916	2,916
2001	1,898	1,898	1,928	1,928	3,208	3,208
2002	2,218	2,218	2,237	2,237	3,541	3,541
2003	2,598	2,598	2,601	2,601	3,919	3,919
2004	3,050	3,050	3,031	3,031	4,348	4,348
2005	3,585	3,585	3,536	3,536	4,836	4,836
2006	4,143	4,143	4,209	4,209	5,516	5,516
2007	4,792	4,792	5,017	5,017	6,306	6,306
2008	5,550	5,550	5,985	5,985	7,224	7,224
2009	6,434	6,434	7,146	7,146	8,291	8,291
2010	7,465	7,465	8,538	8,538	9,531	9,531
2011	8,021	8,021	9,363	9,363	10,211	10,211
2012	8,620	8,620	10,269	10,269	10,942	10,942
2013	9,264	9,264	11,265	11,265	11,729	11,729
2014	9,957	9,957	12,360	12,360	12,577	12,577
2015	10,703	10,703	13,563	13,563	13,489	13,489
2016	11,507	11,507	14,886	14,886	14,470	14,470
2017	12,372	12,372	16,339	16,339	15,527	15,527
2018	13,303	13,303	17,938	17,938	16,664	16,664
2019	14,306	14,306	17,938	19,695	17,889	17,889
2020	15,385	15,385	17,938	21,626	19,207	19,207
2021	16,548	16,548	17,938	23,751	20,626	20,626
2022	17,799	17,799	17,938	26,087	22,154	22,154
2023	19,147	19,147	17,938	28,656	22,154	23,799
2024	20,599	20,599	17,938	28,656	22,154	25,571
2025	20,599	22,162	17,938	28,656	22,154	27,479

Note: Unconstrained demand derived from assignment of future year demand onto future year network. Growth beyond year 2010 (limit of planning horizon) adopted as one-half of preceeding relative growth rate. Unconstrained demand constrained by maximum capacity. Indicated years are for temporal flow analysis only. All highways reflect upgrading to Class III standard.

Figure 6.3 Overview of Demand Structuring for Hue-Da Nang Inter-city Highway Corridor



YEAR OF SATURATION		
SEGMENT	HIGHWAY 1	CORRIDOR
HUE BYPASS	2006	2014
LANG CO-CHAN MAY	2007	2013
HAI VAN PASS	2008	2012
DA NANG BYPASS	2003	2011

Table 6.11 IRR AND B/C RATIO SENSITIVITY ANALYSIS
NEW HUE-DA NANG HIGHWAY

HDH SEGMENT	CHANGE IN COST	INTERNAL RATE OF RETURN (PERCENT) CHANGE IN DEMAND (BENEFITS)					BENEFIT/COST RATIO (12 PERCENT) (1) CHANGE IN DEMAND (BENEFITS)				
		Base	- 15 %	- 30 %	- 45 %	- 60%	Base	- 15 %	- 30 %	- 45 %	- 60%
Hue Bypass	Base	29.2	26.1	22.6	18.6	13.7	2.92	2.48	2.03	1.58	1.14
	15 %	26.5	23.6	20.3	16.4	11.7	2.54	2.15	1.76	1.37	0.98
	30 %	24.3	21.5	18.3	14.6	10.1	2.24	1.89	1.55	1.20	0.86
	45 %	22.4	19.6	16.5	13.0	8.6	2.00	1.69	1.38	1.07	0.77
	60 %	20.7	18.0	15.1	11.6	7.3	1.81	1.53	1.25	0.97	0.69
Lang Co - Chan May	Base	25.5	22.7	19.6	15.9	11.4	2.44	2.07	1.70	1.33	0.98
	15 %	23.1	20.4	17.4	13.9	9.6	2.12	1.80	1.47	1.15	0.82
	30 %	21.1	18.5	15.6	12.2	8.0	1.87	1.59	1.30	1.01	0.71
	45 %	19.3	16.9	14.0	10.7	*	1.67	1.42	1.16	0.90	0.63
	60 %	17.8	15.4	12.7	9.4	*	1.51	1.28	1.05	0.81	0.57
Hai Van Pass	Base	14.5	12.3	9.7	6.6	1.2	1.21	1.02	0.82	0.62	0.42
	15 %	12.6	10.4	7.9	*	*	1.04	0.85	0.67	0.50	0.33
	30 %	10.9	8.8	6.3	*	*	0.89	0.72	0.56	0.41	0.27
	45 %	9.5	7.4	*	*	*	0.76	0.61	0.47	0.34	0.22
	60 %	8.2	6.2	*	*	*	0.65	0.51	0.39	0.28	0.18
Da Nang Bypass	Base	40.3	36.0	31.3	25.9	19.6	4.19	3.54	2.90	2.26	1.62
	15 %	36.6	32.6	28.1	23.1	17.1	3.63	3.07	2.51	1.95	1.40
	30 %	33.6	29.7	25.5	20.7	15.0	3.20	2.71	2.21	1.72	1.22
	45 %	31.0	27.3	23.3	18.7	13.2	2.86	2.42	1.97	1.53	1.09
	60 %	28.7	25.2	21.3	16.9	11.7	2.58	2.18	1.78	1.38	0.98

(1) Shaded area implies economic non-viability since benefit/cost ratio (discounted at 12 percent) is below unity.

Table 6.10 Measures of Economic Viability New Hue-Da Nang Highway

PARAMETER		SEGMENT				
Item	Units	Hue Bypass	Lang Co-Chan May	Hai Van Pass	Da Nang Bypass	Total HDH [4]
IRR [1]	Percent	29.2	25.5	14.5	40.3	22.4
NPV [2]	Million US$ (at 10%)	67.295	70.587	44.048	86.091	268.022
	Million US$ (at 12%)	50.258	51.573	21.120	66.980	189.931
	Million US$ (at 15%)	32.110	31.283	-3.119	46.352	106.626
B/C [3]	Ratio (at 10%)	3.42	2.85	1.41	4.85	2.37
	Ratio (at 12%)	2.92	2.44	1.21	4.19	2.03
	Ratio (at 15%)	2.35	1.96	0.97	3.41	1.63

[1] Economic Internal Rate of Return
[2] Net Present Value discounted at rates of 10, 12 and 15 percent
[3] Ratio of Benefit to Cost stream,, both discounted at rates of 10, 12 and 15 percent.
[4] Based on summed cost and benefit streams calculated for each of four segments.

Hai Van pass is the critical link with an IRR of 14.5 percent, and B/C ratio of 1.21 (12 percent discount rate). This is not surprising given the massive construction cost of the Hai Van tunnels. A sensitivity analysis confirms that while performance of the other three HDH segments remains robust under a wide range of changing cost or benefit scenarios, only a 15 percent decrease in benefits, or 15 percent increase in cost, is sufficient to lower the Hai Van B/C to near unity.

However, in spite of the apparently modest economic yield, the importance of the Hai Van segment should not be overlooked. It is a critical constriction point for the entire Hue-Da Nang corridor, and a failure to provide an upgraded road facility though this area is expected to negate many of the benefits achieved by flanking sections of the HDH since the amount of traffic flowing across the Thua Thien-Hue and Quang Nam-Da Nang provinces border would be constrained to the capacity of an upgraded Highway 1. Thus, the long term (post 2005) economic viability of the entire Hue-Da Nang corridor might be compromised if a flow constriction is permitted to exist in its midst. Hai Van pass has historically also evolved as a major impediment to full integration of not only the central region, but also northern and southern precincts of the nation. The Government of Viet Nam has confirmed that it places great value on the removal of this impediment.

6.5.2 East-West Highways

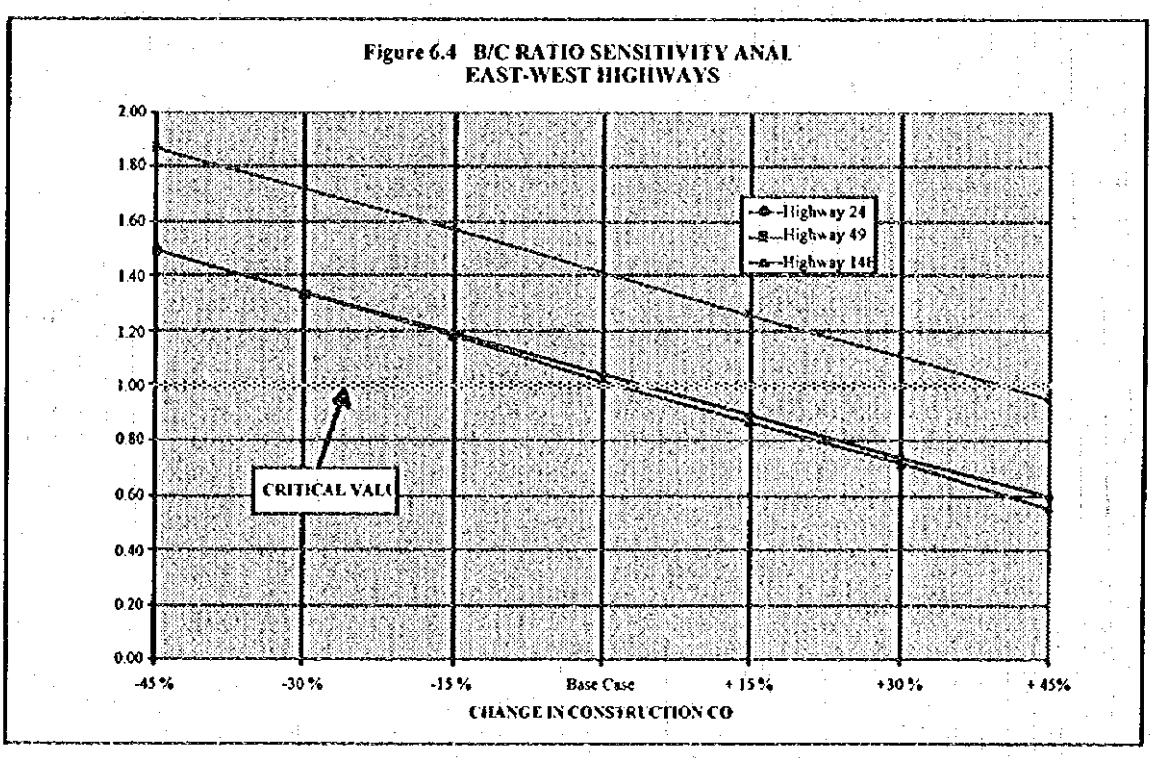
The analysis is structured to reflect a common, three-year construction period, with completion of work during year 2003. The economic performance of the east-west highways is more modest than that of the HDH. This is not surprising given the reduced traffic volumes and not inconsiderable project cost (considerable portions of the east-west highways are located in mountainous terrain). On a composite basis, the IRR reaches 13.3 percent, and B/C ratio 1.16 (12 percent discount rate) (Table 6.12).

Table 6.12 Measures of Economic Viability East-West Highways

PARAMETER		FACILITY			
Item	Units	Hwy. 24	Hwy. 49	Hwy. 14B	Total [4]
IRR [1]	Percent	12.4	15.0	12.2	13.3
NPV [2]	Million US$ (at 10%)	5.720	16.072	6.019	27.810
	Million US$ (at 12%)	0.732	7.694	0.421	8.847
	Million US$ (at 15%)	-3.740	0.070	-4.487	-8.158
B/C [3]	Ratio (at 10%)	1.30	1.80	1.31	1.48
	Ratio (at 12%)	1.04	1.41	1.02	1.16
	Ratio (at 15%)	0.77	1.00	0.72	0.83

[1] Economic Internal Rate of Return
[2] Net Present Value discounted at rates of 10, 12 and 15 percent.
[3] Ratio of Benefit to Cost stream, both discounted at rates of 10, 12 and 15 percent.
[4] Based on summed cost and benefit streams calculated for each of three facilities.

A sensitivity analysis identifies Highway 49 as the most robust element in the east-west highways grouping. Only modest increases in project cost appear, however, to be sufficient to push the B/C ratios for Highway 24 and 14B to below unity (Figure 6.4).



The economic review process, as indicated in Section 6.1, is limited to transport-related benefits catalyzed by savings in VOC and passenger time. No account is taken of indirect transport, or non-transport, benefits spawned by the east-west highways broader function; that is, improve accessibility to the impoverished highlands area[1] and enhance road links between

[1] Mountainous parts of the study area have officially been labeled as "difficult to develop" by the DSI, largely as a result of inadequate road access.

regional and district centers of activity. The importance of roads is undeniable. Recent conclusions of the Viet Nam poverty assessment program[1] are that access to roads:

- Enhances agricultural productivity and is associated with the development of off-farm income opportunities and greater participation in the market economy;
- Appears to affect labor mobility, which is significantly related to economic status;
- Associates with the existence of permanent markets, enterprises, as well as economic diversification; and,
- Contributes positively toward crop and livestock output, crop area and yield as well as fertilizer demand.

The UNDP poverty elimination program[2] concludes that *The need for rural infrastructure, especially roads, is clear. If the type of road is appropriate to its uses, environmentally sound and costs are kept reasonable, it will prove to be economically justified. Rural areas will also have major social impacts, increasing access to health and education. If local people are employed and paid wages for the building, operation and maintenance of such infrastructure, this will in itself be a major anti-poverty activity.*

The Master Plan Team supports these views and urges they be considered as part of any decision-making process related to the upgrading of Highways 24, 49 and 14B.

6.6 ROAD MAINTENANCE ISSUES

The current study has identified two key road sector priority projects which call for the provision of a major new highway between Hue and Da Nang, as well as upgrading Highways 24, 49 and 14B to Class III standard. These proposals have been supported by economic viability reviews, and it is likely that funding for construction will be made available from a variety of domestic and foreign sources. However, a key question remains:

- Once completed, how can these projects be properly maintained given the historic inability of the MOT to maintain roads due to a chronic lack of funding, exacerbated by the absence of a rigorous road maintenance procedure framework?

The timing of road maintenance is critical. Rough pavements increase fuel use, cause excessive wear and tear on vehicles and reduce vehicle productivity due to low travel speeds. Year 1995 maintenance expenditures in Viet Nam totaled some $3,200 per national road kilometer; this includes approximately $800 allocated to routine maintenance, with the remainder being spent on periodic maintenance, emergency repairs and disparate items such as maintaining repair crew quarters. MOT estimates the maintenance budget should increase by a factor of two to three, but funding is unavailable. Yet, as maintenance is delayed, deterioration accelerates quickly; and, if pavements (or non-paved roads) deteriorate too far, they are expensive to restore. Research has shown that actual costs over a 15 year period are roughly three times as high if the road is reconstructed once, as opposed to applying adequate maintenance on an annual basis[3].

In case of the nominated road sector priority projects, two diverse conditions apply:

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[1] "Viet Nam Poverty Assessment and Strategy", The World Bank, January 1995.

[2] "Poverty Elimination in Viet Nam", United Nations Development Program in association with United Nations Population Fund (UNFPA) and United Nations Children's Fund (UNICEF), October 1995.

[3] "Management and Financing of Roads: An Agenda for Reform", SSATP Working Paper No. 8, World Bank, March 1994.

- The HDH is likely to evolve as a tolled road, probably via the participation of the private sector and a BOT arrangement. Thus, annual and periodic maintenance of the HDH is not a problem as requisite funding will be drawn from toll revenue.

- Highways 14B, 24 and 49 will, on the other hand, be improved under supervision of the MOT who will, in turn, assume responsibility for subsequent maintenance. The source of adequate maintenance funds therefore emerges as a critical issue.

It is unlikely that a solution can be formed on purely a regional basis; instead, policy changes must likely be instituted at the national level.

In the first instance, it must be recognized which vehicle types are the principal contributors to road deterioration. Pavements wear with the passage of each axle: the heavier the axle, the greater the wear. Moreover, pavements tend to deteriorate exponentially with increasing axle loads. Empirical research has found that a curve based on an exponent of four ($y = x^4$) provides the best fit between increases in axle loads and pavement wear. The "fourth-power rule" is generally used to adjust for different axle loads. This means a doubling of axle load increases the pavement wear 16-fold. The unit of wear is the equivalent standard axle (ESA) taken to be 8.2 tons on a twin-tired single axle. Single tired axles and multiple axles can be reduced to ESA's using conversion factors.

Two consequences of the fourth-power rule deserve special mention. First, virtually all pavement damage is caused by trucks. As an example, it is of interest to examine the Indonesian ESA data base which was derived from a sampling of 827,000 vehicles at 312 survey sites in 22 provinces. Findings confirm that ESA's for trucks range up to almost five; by comparison, light vehicles rarely exceed 0.003, and buses 0.2 (Table 6.13). These data suggest that some 1,500 cars (ESA = 0.002) cause a similar degree of pavement damage than a single truck with ESA of 3.0. Secondly, overloading of commercial vehicles dramatically increases ESA due to the exponential nature of the damage factor. Extreme overloading is a common problem in Viet Nam as it is in Indonesia and important to control since this is the major cause of road deterioration. A survey of axle weights in Viet Nam, carried out in 1991 at four sites along Highway 1[1], found 80 percent of the traffic stream consisted of heavy vehicles (albeit with wide variations in the ESA's per vehicle). ESA's per heavy vehicle were higher in the south, partly because trucks and buses are larger but also because of more frequent overloading. The survey also singled out vehicles with axles of 10 tons or more, calculated their ESA's and found that while they represented less than eight percent of the total axles, they accounted for 88 percent of total ESA's . This shows that just a small number of heavy vehicles contributes a disproportionate amount to pavement wear. The Government needs to deal with this problem urgently so that funds for road maintenance and improvements are spent efficiently.

[1] "Weigh-In-Motion Surveys, Hanoi-Vinh & Ho Chi Minh City-Can Tho", by C.P. Corne & Associates Ltd., for TESI, April 1991.

Table 6.13 Vehicle Damage Factors Republic of Indonesia

ISLAND	PROVINCE	EQUIVALENT STANDARD AXLES [1]			
		Light Vehicle [2]	Medium Truck [3]	Heavy Truck [4]	Bus [5]
Java	West Java	0.0027	2.0791	3.8504	0.0921
	Central Java	0.0026	1.1609	4.4112	0.1557
	Yogyakarta	0.0024	1.1479	4.1072	0.0893
	East Java	0.0020	1.8384	4.7637	0.1502
Sumatra	Aceh	0.0027	2.1846	1.5887	0.0469
	North Sumatra	0.0020	1.8547	1.9524	0.1049
	Riau	0.0016	2.7699	2.5268	0.0669
	West Sumatra	0.0041	2.1573	2.3388	0.2204
	Bengkulu	0.0009	1.5113	0.9312	0.0398
	Jambi	0.0025	2.6555	4.3773	0.1233
	South Sumatra	0.0020	3.5763	4.8295	0.1401
	Lampung	0.0012	2.8104	2.7609	0.0863
Sulawesi	South Sulawesi	0.0025	2.1211	3.2778	0.2211
	North Sulawesi	0.0032	1.2115	1.3953	0.0815
	Central Sulawesi	0.0015	0.5521	1.5730	0.0321
Kalimantan	East Kalimantan	0.0008	0.3966	0.7344	0.1010
	West Kalimantan	0.0018	0.2064	0.7622	0.0142
	South Kalimantan	0.0006	0.6321	0.6136	0.0342

[1] ESA values based on data obtained from files of "Consulting Services, Central Weighbridge Unit" study, conducted for Government of Indonesia, Directorate General of Highways, by Kinhill Engineers in association with PT Arkonin, final report dated December, 1993. ESA values apply to major road systems.
[2] Includes cars and similar light vehicles.
[3] Includes two axle rigid goods - carrying vehicles with maximum permitted weights of up to 16 tons.
[4] Includes three axle rigid and all articulated goods vehicles with maximum permitted weights of up to 52 tons.
[5] Includes bus, coach and super coach vehicle types.

Therefore, as an initial step to improving maintenance, two key national initiatives must be launched:

- The MOT agencies concerned with roads prepare annual and five-year maintenance plans. However, only the yearly plan tends to be reasonably pursued. The reason is that systematic planning for road maintenance has proven largely impossible, mainly because the agencies have to operate on minimal budgets, most of which is spent on emergency repairs. In addition, policies on road maintenance need to be revised because they are based on outdated manuals which do not address the economic dimensions of the problem. Instead, Viet Nam's future road maintenance strategies should be based on the total cost of the roads which includes the cost of operating vehicles on the roads and the (discounted life-cycle) costs of constructing and maintaining roads. Such calculations would enable authorities (who allocate and spend the funds) to gauge the true cost of neglecting road maintenance and design cost-effective strategies to carry it out.

- To prevent overloading, explicit axle-load limits must be introduced and enforced impartially, along with the maximum gross weight limits. The existing truck fleet would thus be limited to appropriate loads, instead of regularly being overloaded.

Previous discussions[1] between the IBRD and the Government of Viet Nam confirm that the Government recognizes the need for maintenance, and that this need should be self-supporting from a financial point of view. The Bank, in response, proposed a scheme designed to provide

[1] "Viet Nam Transport Sector Review", op. cit.

additional (to existing sources) and adequate maintenance funding which relies on two key elements:

- The marginal cost of road use, that is, wear and tear catalyzed by vehicles, should be borne by heavy commercial vehicles. This should be accomplished via a fee which is sensitive to the likely ESA impact of differing truck configurations. The fee should be based on a vehicle's weight and the number of its axles, and designed to recover the weight-related costs and provide an incentive to use less road-damaging models. For example, a 10-ton two-axle truck, the typical heavy vehicle in Viet Nam, would, according to the Bank's plan, pay a traffic fee one-third higher than at present. However, vehicles with more axles (which cause less wear to the road) would benefit because the proposed formula would pass the savings (from less road wear) on to truck owners: for example, adding a third axle and assuming a constant 10-ton vehicle weight, the truck owner would save 70 percent in fees.

- The basic cost of road maintenance, that is, not related to the volume of traffic, should be borne equally by all road users. For this the Bank recommended a fuel tax to be levied equally on gasoline and diesel fuels which, in 1993, was suggested to total 1,500 VD per liter.

Besides raising revenue, these charges also signal to road users the cost implications of their choice of transport and to transport operators the cost consequences of vehicle choice, notably the axle configuration that spreads the load on the pavement. Raising sufficient revenue is of immediate concern because it is the only way to provide decent roads and maintain them.

The Study Team supports these recommendations, and urges that a legislative framework be enacted at the earliest opportune moment to support the creation of such a highway maintenance funding scheme.

CHAPTER 7

INITIAL ENVIRONMENTAL EXAMINATION

CHAPTER 7 INITIAL ENVIRONMENTAL EXAMINATION

The initial environmental examination (IEE) process was applied to the two road sector priority projects: construction of a new Hue-Da Nang Highway (HDH) as well as upgrading of East-West Highways (Highways 14B, 24, 49) to Class III standard.

7.1 HUE - DA NANG HIGHWAY

The HDH is conceived as a high-order, two-lane road, constructed entirely within a new alignment and extending from north of Hue city to south of Da Nang city. A number of alternative alignments were reviewed, and it is noted that a principal input to selection of the preferred route is sensitivity towards cultural, historical and environmentally sensitive areas (refer Chapter 5 for detailed discussion of route selection process).

7.1.1 Environmental Items

The IEE examines a series of environmental items which may be impacted by project implementation not only in the HDH corridor, but also surrounding areas which may be directly or indirectly affected during the construction and operation stages. The screening and scoping of environmental items potentially impacted by the HDH have been completed and seventeen items were selected for inclusion in the IEE process (Table 7.1). The comprehensive IEE listing includes 23 items; however, it is judged that six environmental items will not be impacted by the HDH and are thus excluded from further examination (Table 7.2).

Table 7.2 Excluded Environmental Items Hue-Da Nang Highway IEE Process

Environmental Item	Reason for Exclusion
Public Health Condition	The HDH, being a road project, is not expected to generate garbage and increase the vermin population to such a degree so as to deteriorate public health and sanitary conditions.
Hydrological Situation	This project is a linear development. It is not expected that any landfill activities and drainage inflow will adversely impact river discharge and riverbed condition.
Coastal Zone	This project site is not located in a coastal area; therefore landfill or change in marine condition will not impact coastal erosion and sedimentation.
Meteorology	This project has no large-scale land reclamation and building construction, thus changes of temperature, precipitation or wind patterns are not expected.
Soil Contamination	The HDH, being a road construction project, is not expected to generate adverse levels of soil contamination.
Offensive Odor	The HDH, being a road construction project, is not expected to generate adverse levels of offensive odor.

Table 7.1 Relationship of Activities and Environmental Items Hue-Da Nang Highway IEE Process

	Major Facilities/Activities	Roads / Roadside Facilities / Construction Roads				
		Construction Stage		Operation Stage		
	Activities Which May Cause Impacts	Land Acquisition, Reclamation	Operation of Construction Equipment	Spatial Occupancy	Operation of Vehicles	Accumulation of People and Goods
	Social Environment					
1	Resettlement	⊙				
2	Economic Activities			O		O
3	Traffic and Public Facilities				O	
4	Split of Communities			O		
5	Cultural Properties	O			O	O
6	Water Rights/Common Rights	O				
7	Public Health Condition					
8	Waste	O				O
9	Hazards (Risk)	O				
	Natural Environment					
10	Topography and Geology	O				
11	Soil Erosion	O				
12	Groundwater	⊙				
13	Hydrological Situation					
14	Coastal Zone					
15	Flora and Fauna	⊙	O	⊙	O	
16	Meteorology					
17	Aesthetics			O		
	Pollution					
18	Air Pollution		O		⊙	
19	Water Pollution	O			O	
20	Soil Contamination					
21	Noise and Vibration		O		⊙	
22	Land Subsidence	⊙				
23	Offensive Odor					

Legend:

⊙: Environmental items to which special attention has to be paid. They might cause serious impacts that may affect the project formulation depending on the magnitude of the impacts and the possibility of the measures.

O: Environmental items which may have a significant impact depending on the scale of the project and site conditions.

No mark: Environmental items requiring no impact assessment since the anticipated impacts are, in general, not significant.

7.1.2 Evaluation of Environmental Impacts

The IEE evaluation process is, as is the case with all reviews associated with the Master Plan study, conducted at the pre-feasibility level of detail. A key conclusion is whether or not a comprehensive Environmental Impact Assessment (EIA) is required at a later stage as part of more detailed feasibility and/or detailed design activities.

1) Construction Stage

(1) Impact by Reclamation

a) Impact to Social Environment

(a) Resettlement

Resettlement may be caused by land acquisition for road construction and transfer of rights to residence and land ownership in some areas, particularly those located in highly populated area in or around Hue and Da Nang cities. It may catalyze impacts such as: 1) loss of living foundation of inhabitants to be resettled, 2) social and cultural inadaptability to the new resettlement site, 3) conflicts between permanent residents and resettlers over social and economic burden, and 4) deterioration of living standard after resettlement in case of inadequate compensation or the status of illegal occupants. Resettlement may exert significant impacts in case of 1) inhabitants who live in the special environmental resource areas of the project site, such as fishery grounds and agricultural land, 2) inhabitants who are currently well-off, such as those operating retail shops along the existing road, 3) no favorable resettlement site in the surrounding area, and 4) existence of racial or tribal problems.

Land acquisition for this project will be not be overly extensive since this project is a linear development largely outside of currently populated areas, so that the number of resettlers is not expected to be large. However, it is expected that problems associated with resettlement may become significant. Therefore, the establishment of countermeasures and conduct of an EIA on the impact by resettlement due to land acquisition at the HDH construction stage are required.

(b) Cultural Properties

The damage to and loss of the value of cultural properties such as churches, temples, shrines and archaeological remains and other cultural properties may be caused by: 1) land reclamation for road construction, 2) increase in traffic of people owing to development of the road, and 3) noise and air pollution caused by vehicles. Correlated impacts could include 1) damage to tourism business opportunities which depend on cultural properties, and 2) the aggravation of inhabitants' feeling caused by the loss of precious cultural properties in the area. Significant impacts could be catalyzed in case of 1) the existence of cultural properties which are recognized officially and historically as being culturally important from a global viewpoint or unique to the area, 2) the existence of the cultural properties with longer and prominent histories such as the Nguyen Dynasty in Hue, and 3) the existence of buildings and other facilities in unique communities.

At present, it is not fully clear to what degree cultural properties exist in and around the road corridor; in those cases where a major presence has already been clearly confirmed, the proposed alignment of the HDH has correspondingly been adjusted (such as in vicinity of Hue and southwest of Da Nang). If the presence of additional cultural properties is confirmed, it is required that countermeasures be implemented. Therefore, the implementation of an EIA on the impact to cultural properties due to land acquisition at construction stage is needed.

(c) Water Rights /Rights of Common

The obstruction of fishing rights in rivers, water rights and land use rights may be caused by 1) use of arable land and forests for road construction, and 2) obstruction or alteration of fishing grounds at the points where the road traverses. It may exert impacts such as: 1) effect on people who have utilized the common land if the route passes through the common land, and 2) effect to fishery due to the occupancy of the fishing ground. The magnitude of the impact depends on the scale of change to the waterway. Significant impacts may result in case of 1) the existence of established communities likely to have common forests or land, and 2) existence of the water intake facilities, navigation facilities and charcoal-burner sheds which have water rights or land use rights.

Therefore, countermeasures such as the payment of sufficient compensation are required. The implementation of these countermeasures can protect water rights and rights of common, therefore the implementation of an EIA on the impact to water rights and rights of common due to land acquisition at the construction stage is not required.

(d) Waste

Site clearance and construction activities is likely to generate demolition waste, debris, and logs and could thus catalyze impacts such as diminution of aesthetic values, change of vegetation, and soil contamination or water pollution. Exposed waste could cause impacts on aquatic life and birds due to the inflow of polluted water into rivers, lakes, ponds and canals, such as wetlands, especially Tam Giang - Ha Truong and Lang Co lagoons, as well as environmental degradation due to inadequate and/or illegal waste disposal. Therefore, adequate countermeasures such as a functional waste management plan are required. This project will likely not generate excessive amounts of waste, and, since the implementation of countermeasures can likely mitigate potential waste problems, conduct of an EIA on the impact by waste due to reclamation at construction stage is not required.

(e) Hazards (Risk)

An increase in risk due to landslides, cave-ins and accidents may be caused by cut and fill operations as well as land reclamation during road construction. Possible impacts include 1) a change in soil balance and creation of land cave-ins or upheavals by large-scale cutting, and 2) damage to land and houses as well as compromised safety of the inhabitants due to landslides and similar soil failures. Significant impacts may occur in case of 1) high landslide probability in steep hills with soft soil featuring high porosity, and 2) intense rainfalls over short time periods. The HDH project has considerable tunnel construction in the Hai Van pass section and likely some tunnel construction along the Lang Co-Chan May section. Since extensive rainfall is experienced annually, detailed studies on 1) topography and geology, 2) meteorology, and 3) case studies of past natural disasters are required, as is the implementation of an EIA on the impact by hazards (risk) due to reclamation.

b) Impact on Natural Environment

(a) Topography and Geology

Changes to topography and geology may be caused by excavation and land reclamation for road construction, especially tunnel construction along the Hai Van pass section. Resultant impacts could include the occurrence of landslides or soil erosion. Significant impacts may be generated in case of 1) the existence of important topography and or geology, 2) the existence of steep hills of soft soil with high porosity, and 3) the existence of areas which have rainfall of high intensity. The HDH intersects several rivers, passes near some lagoons and wetlands, and, along the Hai Van Pass section, tunnels under Bac Ma National Park. The latter features a valuable ecosystem and much rainfall. Therefore detailed studies on 1) topography and geology, 2) meteorology, and 3) land use are required, as is the implementation of an EIA to topography and geology.

(b) Soil Erosion

Topsoil erosion due to rainfall may be caused by 1) exposure of topsoil following land reclamation or removal of vegetation during road construction, and 2) rainfall and floods during construction. Impacts include 1) influencing the growth of plants and animals, agriculture and forestry due to the loss of topsoil by surface runoff or wind, and 2) creation of water turgidity, impact to aquatic life, and river discharge in downstream areas caused by sediment. Significant impacts could result in case of 1) the existence of steep topography with sandy soil (such as the Hai Van Pass alignment) and wetlands, 2) heavy or intense rainfall, or strong wind, and 3) the existence of scarce vegetation coverage. Therefore detailed studies on 1) soil, topography and geology, 2) meteorology, and 3) land use are required, as is the conduct of an EIA on soil erosion.

(c) Groundwater

Changes in the distribution of groundwater may, in the Hai Van tunnel section, be caused by: 1) the disruption of groundwater flow by large-scale excavation which would bring about turgidity of groundwater, 2) the decrease of groundwater recharge function due to change of outflow rate by clear cutting of vegetation, and 3) the extraction of a large quantity of groundwater because of an increased water demand for the operation of large service areas and cleaning of roads. It may catalyze impacts such as: 1) lowering of the groundwater level and exhaustion of wells which may further affect groundwater use in surrounding area, 2) land degradation on alluvial or clay soil layers due to lowering of the groundwater level, and 3) water pollution during construction and saltwater intrusion in the coastal areas which would deteriorate the water quality and affect water use. Significant impacts would result in case of 1) shallow wells which use unconfined groundwater, 2) areas where groundwater level has a tendency to decline or land degradation has already progressed in the surrounding area, and 3) areas which already experience saltwater intrusion.

The cutting of any groundwater vein will likely lower the groundwater table and degrade groundwater quality, possibly leading to the exhaustion of springs and wells and thereby impacting both people's livelihood and valuable flora and fauna (such as found in Bac Ma National Park). The groundwater might also be contaminated by leachate from the road corridor containing organic substances which infiltrates the soil. Groundwater impacts may therefore become significant, and detailed studies on 1) hydrogeology, 2) pumping tests, and 3) water use are required, as is the establishment of the countermeasures and the conduct of an EIA on groundwater impacts.

(d) Flora and Fauna

The obstruction of breeding and extinction of species caused by change of habitat condition could be caused by the removal of vegetation and degradation of living environment of animals due to the construction of roads and related facilities. Impacts could include 1) a decrease in useful creatures for human activities or extinction of valuable species, 2) the threat on livelihood of people, including the hunting of animals and collection of forest products, 3) a decrease of recreational value, and 4) a change in the balance of nature resulting in numeric changes in (and possible extinction of some) species and a potential rapid multiplication of pests and harmful insects. Significant impacts are possible due to 1) the existence of the vulnerable ecosystem, such as primary forests at Bac Ma National Park, and swamp forests near Tam Giang - Ha Truong lagoons, 2) the existence of species peculiar to the region, 3) the presence of many people whose livelihood depends on hunting and fishing, 4) the existence of the endangered or rare species listed in files of the international union for conservation of nature and natural resources (IUCN), and 5) enforcement of the bilateral and multilateral conventions on wildlife.

It is expected that the impacts on flora and fauna may become significant. Therefore detailed studies on 1) existing vegetation, topography and geology, 2) distribution of animals, 3) affiliation of conventions concerning wildlife protection, and 4) livelihood of inhabitants are required, as is the establishment of countermeasures and conduct of an EIA.

c) Impact by Pollution

(a) Water Pollution

The pollution by inflow of silt, sand and effluent into rivers and groundwater may be caused by 1) disturbance of sediments during construction of piers at points where the HDH passes over lakes, streams and rivers, and 2) erosion caused by changes of vegetation and topography. Other impacts such as the effect on aquatic life by turbid water, especially suspended solids, and the contamination of water by herbicides would affect aquatic life and the health of inhabitants who use the water. Significant impacts are likely in case of 1) water used by inhabitants or businesses in the downstream area, and 2) important aquatic species. Turbid water will cause significant impact, especially during heavy rains during the monsoon season. Therefore, countermeasures are needed and it is recommended that an EIA on the impact of water pollution be conducted.

(b) Land Subsidence

The deformation of land due to lowering of the groundwater table may result in the Hai Van Pass section; to wit 1) land subsidence caused by the compaction and contraction of the clay layer, and 2) expansion of the flood area as the result of the deterioration of the drainage function caused by land subsidence. Significant impacts could result in areas where 1) the groundwater table exhibits a recent tendency of lowering, 2) the clay layer is thick, 3) existing wells are already being exhausted, and 4) land subsidence has already occurred. It is expected that the impact of land subsidence could become significant. Therefore detailed studies on 1) hydrogeology, especially groundwater capacity, 2) water utilization, 3) the organizations and laws and regulations related to water resources and environment, and 4) geology are required. A countermeasures program should be established, and an EIA on the impact of land subsidence is required.

(2) Impacts Due to Operation of Construction Equipment

a) Impact on Natural Environment

The obstruction of breeding and extinction of species could be caused by changes in habitat due to exhaust gases and noise from construction equipment and vehicles. The potential impacts are the same as previously described for activities at the construction stage. It is expected that impacts on flora and fauna may become significant. Therefore a detailed study is required, as is the establishment of countermeasures and conduct of an EIA regarding impacts on flora and fauna.

b) Impact of Pollution

(a) Air Pollution

Pollution due to exhaust gases, toxic gases and dust could be generated by construction equipment and vehicles, particularly during the dry season. This could, in turn, impacts the health of people, plants and animals along the designated HDH corridor. Significant impacts may result in vicinity of densely populated housing area, such as those found near Hue and Da Nang cities. Material transportation by dump trucks, especially borrow soil, will occur along existing roads and temporary construction roads. The traffic volumes of the material transportation will be considerable in some cases, therefore countermeasures such as the designation of an adequate construction management plan are required. However, as the HDH corridor is typically not located in highly populated areas, and that the construction term is temporary, the conduct of an EIA on the impact by air pollution due to the operation of construction equipment is not required.

(b) Noise and Vibration

Noise and vibration may be caused by the operation of construction equipment, vehicles and blasting detonations. Impacts include 1) excessive noise near specialized land uses such as hospitals and schools, as well as disturbance of sleep due to night-time operation of vehicles, 2) interruption of cattle breeding cycles and dispersion of wildlife, and 3) structural damage to buildings constructed on soft ground due to vibration. Significant impacts may occur in case of 1) facilities requiring noise-abated environments or densely populated areas, 2) cattle industry, 3) habitats of valuable wildlife, especially Bac Ma National Park and lagoons, and 4) weak ground such as filled land or clay soil layers. Therefore, appropriate countermeasures are required as is the conduct of an EIA.

2) Operation Stage

(1) Impact on Spatial Occupancy

a) Social Environment

(a) Economic Activities

Disruption to foci of economic activity, such as land, can be catalyzed by a loss of arable land and forests as well as land reclamation and change in land use. Disruption of the regional economy can also result due to a decrease in agriculture, forestry and fishery production or loss of arable land, forests and fishery ground, as well as changes in population distribution caused by revised land uses. Even basic activities such as pedestrians crossing a street can play a role. Since significant impacts such as industrial relocation will also impact the local population and economy, effective countermeasures are required. It is therefore recommended that an EIA on the impact to economic activities due to the spatial occupation be conducted.

(b) Community Separation

Communities may be separated due to interruptions posed by the construction of new roads, or a loss of movement linkages traditionally used by inhabitants. The daily activities of inhabitants will therefore be inconvenienced and could, in fact, result in pockets of isolated residential and/or commercial areas. The latter is particularly significant in cases where the existing community has traditional customs or practices, and is tightly united via an ethnic and/or tribal social structure. Therefore, countermeasures are required as is conduct of an EIA.

b) Natural Environment

(a) Flora and Fauna

Obstruction of breeding patterns, changes in migratory routings and the possible extinction of species due to habitat changes could be catalyzed by roads and related facilities. The potential impacts are similar to those discussed for flora and fauna impacts during the construction stage. At the lagoons, these impacts could catalyze a decrease (or extinction) in biomass of seaweed, fish, benthos and birds because of the alteration of established habitats caused by vegetation and substrate changes. Vegetation of the sites will be removed, and may consequently bring about a loss of animal habitat. It is expected that the impact to flora and fauna may well be significant. Detailed studies are therefore needed, as is the introduction of an effective countermeasure program. An EIA on the impact to flora and fauna due to spatial occupation is required.

(b) Aesthetics

A change of topography and vegetation by land reclamation, and the deterioration of aesthetic harmony, could be caused by the construction of new facilities such as roads, tunnels, and their ancillary facilities, as well as vehicles operating thereon. Likely impacts can include 1) damage

to natural scenery by changes in the landscape which may jeopardize cultural values or the harmony of local people, especially events of religious importance, and 2) damage to tourism and local people's lifestyle. Significant impacts could result in case particularly sensitive areas such as Bac Ma National Park and Lang Co. It is further anticipated that the impact to aesthetics may be considerable, especially at Lang Co at which a Tourism Promotion Zone (TPZ) is planned. It is therefore recommended that an EIA on the impact of aesthetics be conducted..

(2) Operation of Vehicles

a) Impact to Social Environment

(a) Traffic and Public Facilities

Impacts on schools, hospitals and present traffic conditions, such as increased traffic congestion and accidents can be caused by the replacement of traditional transport means by road traffic, and the emergence and increase of vehicular traffic. Impacts could further include 1) changes in existing traffic patterns due to the new road, 2) an increase in traffic accidents, congestion and other traffic problems caused by an increase in traffic, 3) negative effect of traffic noise on schools, hospitals, places of religious worship and other public facilities, especially in urban areas. Potential countermeasures include the 1) creation of regional development plans such as the current Master Plan study, 2) monitoring of project contents, 3) rehabilitation of the existing traffic system, 4) installation of traffic safety facilities, 5) environmental protection measures for public facilities, and traffic safety education and training for local people. The implementation of these countermeasures can minimize the impact of traffic on public facilities; therefore, it is concluded that the implementation of an EIA on the impact of traffic on public facilities is not required.

(b) Cultural Properties

Cultural assets such as churches, temples, shrines and archaeological remains may be impacted by noise and air pollution caused by vehicles. These impacts are largely the same as those identified at for construction stage. At present, it is not clear whether or not cultural assets exist in the HDH corridor. If a presence is confirmed, then countermeasures along with an EIA are required.

b) Impact on Natural Environment

(a) Flora and Fauna

The obstruction of breeding patterns and extinction of species could be caused by exhaust gases and noise from running vehicles. The impacts are similar to those discussed for the construction stage. In the case of the Hai Van tunnels, air pollutants will concentrate at the tunnel ventilation shaft outflow which will be located in Bac Ma National Park, a flora and fauna-sensitive area. Vegetation at the exhaust point may have to be removed, which could bring about a loss of animal habitat. It is expected that the impact to flora and fauna may become significant. Therefore detailed studies on 1) existing vegetation, topography and geology, 2) distribution of animals, and 3) affiliation of conventions concerning wildlife protection are required, as is an EIA on the impact to flora and fauna due to the operation of vehicles.

c) Impact by Pollution

(a) Air Pollution

The pollution caused by exhaust gases, toxic gases and dust may impact the health of people, plants and animals along the HDH corridor. Significant impacts could result 1) in or near densely populated areas, especially Hue and Da Nang cities, 2) due to significant increases in

the number of vehicles, and 3) near severe slope gradients at which concentrations of exhaust gases will be higher. As considerable traffic volumes are forecast, the establishment of the countermeasures and conduct of an EIA are required.

(b) Water Pollution

Rivers and groundwater experience increased pollution due to an inflow of herbicides as well as dust and oil washed from the road surface by rain. Such pollutants could affect the aquatic life and the health of inhabitants who use the water. Impact may prove to be significant in case of water used by inhabitants or businesses in the downstream area, and in case of important aquatic species. Therefore, countermeasures are required. The implementation of these countermeasures can protect the impact by water pollution, therefore the implementation of an EIA on the impact to traffic and public facilities due to the operation of vehicles at the operation stage is not required.

(c) Noise and Vibration

Noise and vibration will be caused by the operation of vehicles. The impacts are similar to those discussed for the construction stage. It is expected that this impact may become significant. Therefore detailed studies are required, as is the establishment of countermeasures and conduct of an EIA.

(3) Accumulation of People and Goods

a) Impact to Social Environment

(a) Economic Activities

Losses incurred by economic assets and changes in the economic structure could be caused due to modifications in the inflow and outflow of population and goods resulting from road construction. Impacts include 1) effects on the regional economy because of the change of commercial activities and job opportunities, 2) increase of cash income by the adoption of cash crops, and 3) exacerbation of the gap between the rich and poor caused by rise in land value along the route. Significant impacts may result through 1) the effect on the economy caused by the inflow of people and commodities in self-sufficient areas, and 2) the effect of relocation on the local economy and employment for important industries. Therefore, countermeasures are required as is conduct of an EIA.

(b) Cultural Properties

Damages to cultural assets such as churches, temples, shrines and archaeological remains may be caused by the increase in traffic generated by road development. Impacts could include 1) increased possibility of theft, 2) damage to tourism business opportunities which depend on cultural properties, and 3) aggravation of inhabitants' feelings caused by the loss of precious cultural properties. Significant impacts are likely in case of 1) cultural properties which are recognized officially and historically as being culturally important from a global perspective, 2) cultural properties with longer and established histories such as Nguyen Dynasty in Hue, and 3) buildings and other facilities unique to the area.

At present, it is not clear whether or not cultural properties exist in the HDH corridor. If their presence is confirmed, effective countermeasures are needed. Therefore, the conduct of an EIA regarding the impact on cultural properties is required.

(c) Waste

The generation of general waste may causes impacts such as 1) diminution of aesthetic values, changes of vegetation, and pollution of soil and water by the exposed waste, and 2) diminution of aesthetic values and occurrence of sanitary problems due to dumping from vehicles along the route. In case of illegal disposal, hygienic condition and aesthetic value of sensitive natural

areas will deteriorate, and an outbreak of pathogenic insects and animals would aggravate sanitary conditions of the area. The HDH passes beside or near some lagoons, such as Tam Giang - Ha Truong and Lang Co, so it is anticipated that waste water from waste will be discharged into these lagoons. Therefore, adequate management of waste will be required. If this management is provided adequately, there will be minimal problems at the operation stage, so that the conduct of an EIA is not required.

7.1.3 Recommendations

1) Implementation of EIA

It is recommended that following environmental items be further addressed within the framework of an EIA.

Table 7.3 Environmental Items Recommended for Further EIA Analysis Hue-Da Nang Highway

Stage	Cause	Category	Environmental Item
Construction Stage	Land Acquisition and Reclamation	Social Environment	Resettlement Cultural Properties Hazards (Risk)
		Natural Environment	Topography and Geology Soil Erosion Groundwater Flora and Fauna
		Pollution	Water Pollution Land Subsidence
	Operation of Construction Equipment	Social Environment	None
		Natural Environment	Flora and Fauna
		Pollution	Noise and Vibration
Operation Stage	Spatial Occupancy	Social Environment	Economic Activities Split of Communities
		Natural Environment	Flora and Fauna Aesthetics
		Pollution	None
	Operation of Vehicles	Social Environment Natural Environment Pollution	Cultural Properties Flora and Fauna Air Pollution Noise and Vibration
	Accumulation of People and Goods	Social Environment	Economic Activities Cultural Properties
		Natural Environment	None
		Pollution	None

2) Environmental Countermeasures

Following environmental countermeasures are required as part of subsequent, more detailed feasibility or detailed design efforts.

Table 7.4 Proposed Environmental Countermeasures Hue-Da Nang Highway

Environmental Item	Countermeasure
Resettlement Program	Meetings with target population Provision of necessary information system Careful resettlement site selection Improved living/economic conditions at resettlement site Sufficient compensation system Provisions of job training and guidance
Detailed Design	Careful route selection Examination of project components
Construction and Maintenance Plan	Establishment of construction and maintenance plan Examination of construction/maintenance methods and schedule Establishment of proper waste collection and disposal systems Establishment of adequate drainage system Establishment of temporary flood control ponds Establishment of fencing to control muddy water Use of reduced noise and vibration construction equipment Establishment of temporary acoustic walls and buffer zone Establishment of sprinkling water system Establishment of traffic safety system Establishment of monitoring system
Land Use Plan	Restriction of land use in the surrounding area Examination of regional development plan Water resource use plan

7.2 EAST-WEST HIGHWAYS

Three east-west facilities (Highways 14B, 24 and 49) are slated for upgrading to Class III standard as part of this project.

7.2.1 Environmental Items

The IEE examines a series of environmental items which may be impacted by project implementation not only along the East-West Highways, but also surrounding areas which may be directly or indirectly affected during the construction and operation stages. The screening and scoping of environmental items potentially impacted by the project have been completed and eight items were selected for inclusion in the IEE process (Table 7.5). The comprehensive IEE listing includes 23 items; however, it is judged that 15 environmental items will not be impacted by the project and are thus excluded from further examination (Table 7.6).

Table 7.5 Relationship of Activities and Environmental Items East-West Highways IEE Process

	Major Facilities/Activities	Roads / Roadside Facilities / Construction Roads				
		Construction Stage		Operation Stage		
	Activities Which May Cause Impacts	Land Acquisition, Reclamation	Operation of Construction Equipment	Spatial Occupancy	Operation of Vehicles	Accumulation of People and Goods
	Social Environment					
1	Resettlement	O				
2	Economic Activities					O
3	Traffic and Public Facilities				O	
4	Split of Communities					
5	Cultural Properties	O				
6	Water Rights/Common Rights	O				
7	Public Health Condition					
8	Waste					
9	Hazards (Risk)					
	Natural Environment					
10	Topography and Geology					
11	Soil Erosion					
12	Groundwater					
13	Hydrological Situation					
14	Coastal Zone					
15	Flora and Fauna	O				
16	Meteorology					
17	Aesthetics					
	Pollution					
18	Air Pollution				O	
19	Water Pollution					
20	Soil Contamination					
21	Noise and Vibration				O	
22	Land Subsidence					
23	Offensive Odor					

Legend:

⊙: Environmental items to which special attention has to be paid. They might cause serious impacts that may affect the project formulation depending on the magnitude of the impacts and the possibility of the measures.

O: Environmental items which may have a significant impact depending on the scale of the project and site conditions.

No mark: Environmental items requiring no impact assessment since the anticipated impacts are, in general, not significant.

Table 7.6 Excluded Environmental Items East-West Highways IEE Process

Environmental Item	Reason for Exclusion
Split of Communities	This project is mainly for rehabilitation, and it is consequently not expected that a split of communities would occur.
Cultural Property	The land acquisition for this project is very small since this is mainly a rehabilitation project. It is not expected that the damage to or loss of cultural properties would occur.
Water Rights/Common Rights	Being a rehabilitation project, only small amounts of land acquisition are expected , and obstruction of fishing rights, water rights or rights of common is highly unlikely.
Public Health Condition	Road projects typically do not generate vast amounts of garbage nor cause an increase of vermin capable of catalyzing a deterioration of public health and sanitary conditions.
Waste	The project is of relatively small scale and is not expected that large-scale generation of waste will occur.
Hazards (Risk)	This project has no large-scale reclamation component, so it is not expected that increased risk of landslides, cave-ins and similar accidents will result.
Topography and Geology	This project has no large-scale reclamation component, so it is not expected that changes in topography and geology would occur.
Soil Erosion	This project is rehabilitation oriented. It is consequently not expected that topsoil erosion after rainfall due to reclamation and vegetation removal would occur.
Groundwater	This project has no large-scale reclamation component, and it is not expected that any changes in the distribution of groundwater would occur.
Hydrological Situation	This project is linear and mainly rehabilitation oriented, so that it is not expected that changes of river discharge and riverbed condition would occur.
Coastal Zone	This project sites are not located in coastal areas. Therefore, no landfill or change in marine conditions would affect coastal erosion and sedimentation.
Meteorology	This project has no large-scale reclamation and building construction component, and no resultant changes in temperature, precipitation or wind are expected.
Aesthetics	This project is mainly rehabilitation, and it is not expected that any deterioration of aesthetics will occur.
Water Pollution	This project is mainly rehabilitation, and it is not expected that pollution due to inflow of silt, sand and effluent into rivers or groundwater will occur.
Soil Contamination	As road improvement project, soil contamination is not expected.
Land Subsidence	This project has no large-scale reclamation component, thus no deformation of land and land subsidence is expected.
Offensive Odor	Road construction is not expected to generate offensive odor.

7.2.2 Evaluation of Environmental Impacts

The IEE evaluation process is, as is the case with all reviews associated with the Master Plan study, conducted at the pre-feasibility level of detail. A key conclusion is whether or not a comprehensive Environmental Impact Assessment (EIA) is required at a later stage as part of more detailed feasibility and/or detailed design activities.

1) Construction Stage

(1) Impact of Reclamation

a) Impact on Social Environment

(a) Resettlement

Resettlement may be caused by land acquisition for road construction and transfer of rights of residence and land ownership. Impacts could include 1) loss of living foundation of inhabitants to be resettled, and 2) deterioration of living standard after resettlement in case of poor compensation system or the status of illegal occupants. Significant impacts are possible for 1) inhabitants who are currently well-off, such as retail shops along the existing road, and 2) areas with strong racial or tribal ties. Land acquisition for these projects will be small since the focus is road rehabilitation. However, it is expected that problems on resettlement could become significant. Therefore, countermeasures for compensation and treatment of ethnic minorities are needed. The implementation of these countermeasures can mitigate the problem of resettlement, so that the conduct of an EIA is not required.

(b) Cultural Properties

The damage to and loss of value of cultural assets such as churches, temples, shrines and archaeological remains could be catalyzed by land reclamation for road construction. Impacts could include 1) cultural properties which are recognized officially and historically as being culturally important from a global viewpoint, and 2) buildings and other facilities unique to local communities. At present, it is not clear if any cultural properties exist in the project impact area. If presence is confirmed, countermeasures are required to mitigate adverse impacts on cultural properties. In such a case, an EIA on the impact to cultural properties due to land acquisition is not required.

(c) Water Rights /Rights of Common

The obstruction of fishing rights in rivers, water rights and land use rights can be cause by the use of arable land and forests for road construction. Significant impacts may result in case of water intake facilities, navigation facilities and charcoal-burner sheds which have pre-existing water rights or land use rights. Therefore, countermeasures such as the allocation of sufficient compensation are required. The implementation of these countermeasures can protect water rights and rights of common, therefore the conduct of an EIA is not required.

b) Impact to Natural Environment

(a) Flora and Fauna

The obstruction of breeding and extinction of species caused by change of habitat condition may be caused by removal of vegetation due to construction of roads and related facilities. It may include impacts such as 1) a decrease in animal life judged useful to human activity or extinction of valuable species, and 2) decrease of the recreational potential. Significant impacts may occur in case of 1) vulnerable ecosystems, and 2) species peculiar to the region, and 3) endangered or rare species. It is expected that the impact to flora and fauna may become significant. Therefore detailed studies are required, as is the establishment of effective

countermeasures and conduct of an EIA to evaluate the impact upon flora and fauna due to reclamation.

2) Operation Stage

(1) Impact of Vehicle Operation

a) Impact on Social Environment

(a) Traffic and Public Facilities

Impacts on schools, hospitals and present traffic conditions may be caused by an increase in vehicular traffic and concurrent noise generated by vehicles. Therefore, countermeasures such as 1) rehabilitation of existing traffic systems, 2) installation of traffic safety facilities, 3) environmental protection measures for public facilities, and 4) traffic safety education and training for local people, are required. The implementation of these countermeasures can mitigate the impact of traffic. Thus, conduct of an EIA is not required.

b) Impact of Pollution

(a) Air Pollution

Pollution in the form of exhaust gases, toxic gases and dust may be caused by running vehicles, particularly during the dry season. It could impact the health of people, plants and animals. Significant impacts are likely in case of 1) dense residential areas, and 2) near slopes with pronounced gradients at which the concentration of exhaust fumes is likely to be more dense. It is expected that air pollution may become significant, since traffic volumes are forecast to increase in future. The establishment of countermeasures and the conduct of an EIA are therefore recommended..

(b) Noise and Vibration

Noise and vibration may be caused by the operation of vehicles and could catalyze impacts on 1) hospitals and schools due to noise, or the disturbance of sleep by vehicles operating at night in populated areas, 2) modification of cattle breeding cycles, and 3) possible dispersion of wildlife. Significant impacts could apply in case of 1) facilities which require calm circumstance, or densely populated areas, 2) important cattle industry, 3) habitats of valuable wildlife, and 4) weak ground consisting of filled land or clay soil layers. It is expected that noise and vibration may become significant. Therefore detailed studies are required, as are the establishment of the countermeasures and conduct of an EIA.

(2) Impact from Accumulation of People and Goods

a) Impact on Social Environment

(a) Economic Activities

Changes in the economic structure and shifts in industrial activity may be catalyzed by the inflow and outflow of population and goods resulting from the road improvements. However, the impact on economic activities will be overwhelmingly positive in the mountainous areas, which, at present, are very underdeveloped. Therefore, the conduct of an EIA on the impact to economic activities is not required.

7.2.3 Recommendations

1) Implementation of EIA

It is recommended that following environmental items be further addressed within the framework of an EIA.

Table 7.7 Environmental Items Recommended for Further EIA Analysis East-West Highways

Stage	Cause	Category	Environmental Item
Construction Stage	Land Acquisition and Reclamation	Social Environment	None
		Natural Environment	Flora and Fauna
		Pollution	None
	Operation of Construction Equipment	Social Environment	None
		Natural Environment	None
		Pollution	None
Operation Stage	Spatial Occupancy	Social Environment	None
		Natural Environment	None
		Pollution	None
	Operation of Vehicles	Social Environment	None
		Natural Environment	None
		Pollution	Air Pollution
			Noise and Vibration
	Accumulation of People and Goods	Social Environment	None
		Natural Environment	None
		Pollution	None

2) Environmental Countermeasures

Following environmental countermeasures are required as part of subsequent, more detailed feasibility or detailed design efforts.

Table 7.8 Proposed Environmental Countermeasures East-West Highways

Environmental Item	Countermeasure
Resettlement Program	Meetings with target population Provision of necessary information system Careful resettlement site selection Improved living/economic conditions at resettlement site Sufficient compensation system Provisions for job training and guidance
Detailed Design	Examination of project components
Construction and Maintenance Plan	Establishment of construction and maintenance plan Establishment of traffic safety system
Land Use Plan	Restriction of land use in the surrounding area

CHAPTER 8

IMPLEMENTATION AND FINANCING STRATEGIES

CHAPTER 8 IMPLEMENTATION AND FINANCING STRATEGIES

Previous sections of the report have intimated that the Hue-Da Nang Highway (HDH) should function as a tolled facility; furthermore, economic viability of the HDH has been established (refer *Chapter 6*) regardless of whether or not a toll will be levied. This is an important point since a road should not be contemplated only as a toll road, per se, if it is not economically justifiable as a non-toll road. Thus, the remaining challenge is to review a potential implementation strategy involving the private sector, possibly within the framework of a BOT (build, operate, transfer) scheme.

This chapter presents techniques, methodologies and findings of reviews which evaluate the financial viability of HDH construction, operation and maintenance. The financial viability is first tested by the financial rate of return and net present value efficiency measures, which are computed according to the conventional discounted cash flow methodology. Secondly, the cash flow and debt service analysis establishes the capital fund and loan requirements, the annual debt service requirements and the need for short-term loans to cover operational deficits in the early years of operation. Lastly, the results of the analysis are presented in comparison to sensitivity test results.

It is recognized that, at present, numerous political, legal, financial and investment constraints exist in Viet Nam which must first be resolved through protracted and complex negotiated agreements if road infrastructure BOT projects are indeed to proceed. Since these issues cannot be resolved at present, it is necessary to base key financial parameters used in the analysis upon realistic and practical experiences of other Southeast Asian nations which have successfully implemented road BOT projects (but which also boast more refined investment and financial systems). The current analysis should therefore be viewed as a "beginning point", whose various elements can be fine-tuned and amplified as negotiated agreements are gradually achieved.

8.1 FINANCIAL PERSPECTIVE

The Government of Viet Nam must try to achieve an efficient balance of national investment between the public and private sectors, and then allocate public investment efficiently between competing demands, including highways. If government is not able to do this, there may arise a genuine lack of investment in, for example, road infrastructure, and a case for trying to attract more funds from the private sector. The main advantage of involving a private company in the operation of tolled roads is that it will usually manage a project more efficiently. In addition, it will likely bear the risk, which consists mainly of two elements: first, that the cost of construction may prove greater than expected, which is often the consequence of delays in construction or land acquisition; and secondly, that the revenues from the road may fail to meet expectations.

Experience has show that private companies are prepared to accept BOT conditions, which means that they will accept the right of exploitation for a limited period, after which the toll road becomes public property. A feature of toll road investments is that they take many years to achieve payback on the initial investment, after which profits mount rapidly. The year of transfer to government is therefore of critical importance to the company; a 20-30 year concessionaire period is not uncommon.

If a toll road is to be financed and managed by a private company, the project must obviously be financially attractive, which implies certain essential conditions. Uncertainties regarding construction, especially land acquisition and feeder road links with the public network, must be minimal. There should be a clear understanding about the scale and timing of other road improvements in the area, as these could affect the traffic using, and resultant revenue of, the toll road. The private company must either have freedom to determine the level of tolls and, preferably, the structure of tolls between different classes of vehicles, or be guaranteed a minimum return on its investment. Currency (Vietnamese Dong) stability will remain a key concern; while "exchange rate creep" can be offset via gradual adjustments of the toll structure, a quantum currency devaluation would have dramatic impacts on debt service, particularly if loans are predominately foreign-sourced.

The difficulties of determining a toll strategy which meets both the investors financial cash-flow needs as well as Governments perceived social and political obligations cannot be understated. In a general sense, two financial scenarios can exist within a BOT arrangement:

- Revenue is adequate to recover the full cost of building, operating and maintaining the road, generate sufficient funds for debt service, and provide a reasonable return to the investor.

- Revenue is not sufficient to cover the full cost stream, possibly as a result of very high construction costs, excessive loan premiums, or constrained toll rates.

In the latter case, the BOT arrangement can still be viable and attract private investment if Government commits to making a financial contributions which off-sets or mitigates high construction/land/loan costs and/or directly supports a politically determined toll structure.

It should not, however, be assumed in any case that unabated increases in toll levels will necessarily yield increased revenue. It is, in this regard, of interest to examine some outputs of the modeling process conducted within the framework of the current study. The toll diversion analogy embedded in the assignment process is sensitive to travel time saved by using the HDH and aggregate amount of toll incurred. Three composite unit toll rates were tested during the course of the assignment process: a unit rate of five 1996 cents per kilometer which can be justified based on savings in financial vehicle operating cost achieved when using the HDH, as well as arbitrarily higher values of 7.5 and 10 cents per kilometer (Table 8.1):

- The assignment of year 2000 demand to the future network is for analytical purposes only as the HDH is unlikely to exist until about year 2005. However, for the indicated level of demand, operations along both the HDH and Highway 1 are shown as being at acceptable volume to capacity ratios. Thus, the toll diversion analogy will, by and large, function in a "choice" mode largely free of "forced" diversion catalyzed by congestion. Results suggest a sensitivity of about 0.5; that is, 50 and 33 percent increases in toll rate (from 5 to 7.5 cents, and from 7.5 to 10 cents) catalyze decreases in HDH utilization of 23 and 17 percent, respectively.

- Net revenue is still shown as increasing, but at a diminishing rate: 17 percent for the 5 to 7.5 cent increase, and 12 percent for the 7.5 to 10 cent increase.

- The application of years 2005 and 2010 demand levels results in increasing congestion as both the HDH and Highway 1 approach and/or exceed their respective capacities. Thus, diversion is increasingly less of a choice as trips are forced onto any facility offering least travel impedance. Revenue forecasts, particularly for year 2010 conditions, should therefore be treated with caution until use patterns are re-assessed under more realistic operating conditions.

These data highlight two important issues in toll road operation; namely, that an "optimum" toll rate which maximizes revenue is unlikely to coincide with an "acceptable" toll rate, and that any significant change in Highway 1 capacity ("competitor" to the HDH) will directly impact utilization of the HDH.

Table 8.1 IMPACT OF TOLL STRUCTURE ON ROAD UTILIZATION AND REVENUE HUE - DA NANG HIGHWAY

YEAR	FACILITY	ITEM	UNIT TOLL RATE (US $/KM)			PERCENT CHANGE	
			0.05	0.075	0.10	5 TO 7.5 C	7.5 TO 10 C
2000	Highway 1	Daily Volume (pcu)(1)	36,924	40,939	43,685	10.9%	6.7%
		Daily Volume (Vehicles)(2)	42,127	46,673	49,252	10.8%	5.5%
		Volume/Capacity Ratio (3)	0.42	0.47	0.50	11.9%	6.4%
	HDH	Daily Volume (pcu)	21,107	16,332	13,598	-22.6%	-16.7%
		Diversion Ratio (4)	0.36	0.29	0.24	-21.6%	-16.8%
		Daily Volume (Vehicles)	10,967	8,479	7,050	-22.7%	-16.9%
		Volume/Capacity Ratio	0.15	0.12	0.10	-20.0%	-16.7%
		Toll per Kilometer ($)(5)	0.05	0.075	0.10	50.0%	33.3%
		Potential Revenue (Mill $)(6)	5.631	6.566	7.376	16.6%	12.3%
2005	Highway 1	Daily Volume (pcu)(1)	58,337	62,253	66,005	6.7%	6.0%
		Daily Volume (Vehicles)(2)	85,389	90,690	95,759	6.2%	5.6%
		Volume/Capacity Ratio (3)	0.69	0.73	0.77	5.8%	5.5%
	HDH	Daily Volume (pcu)	73,162	68,722	64,617	-6.1%	-6.0%
		Diversion Ratio (4)	0.56	0.52	0.49	-5.7%	-5.7%
		Daily Volume (Vehicles)	36,804	34,554	32,476	-6.1%	-6.0%
		Volume/Capacity Ratio	0.54	0.51	0.48	-5.6%	-5.9%
		Toll per Kilometer ($)(5)	0.05	0.075	0.10	50.0%	33.3%
		Potential Revenue (Mill $)(6)	19.465	27.51	34.59	41.3%	25.7%
2010	Highway 1	Daily Volume (pcu)(1)	133,611	135,459	135,548	1.4%	0.1%
		Daily Volume (Vehicles)(2)	192,982	195,434	195,791	1.3%	0.2%
		Volume/Capacity Ratio (3)	1.55	1.57	1.57	1.3%	0.0%
	HDH	Daily Volume (pcu)	161,129	158,664	157,879	-1.5%	-0.5%
		Diversion Ratio (4)	0.55	0.54	0.54	-1.3%	-0.3%
		Daily Volume (Vehicles)	77,601	76,404	76,032	-1.5%	-0.5%
		Volume/Capacity Ratio	1.20	1.18	1.18	-1.7%	0.0%
		Toll per Kilometer ($)(5)	0.05	0.075	0.10	50.0%	33.3%
		Potential Revenue (Mill $)(6)	41.440	61.288	81.167	47.9%	32.4%

(1) Summed average pcu's/kilometer (unconstrained demand) for each of four sub-sections (Hue Bypass, Lang Co, Hai Van and Da Nang Bypass). Modes include cars, buses, trucks and motorcycles for Highway 1, and cars, long-distance buses and trucks for HDH.

(2) Summed average vehicless/kilometer (unconstrained demand) for each of four sub-sections (Hue Bypass, Lang Co, Hai Van and Da Nang Bypass). Modes include cars, buses, trucks and motorcycles for Highway 1, and cars, long-distance buses and trucks for HDH.

(3) Ratio of summed pcu's per kilometer to summed assignment capacity.

(4) Ratio of corridor pcu's diverting to HDH. Diversion of cars and trucks considerably higher since motorcycles and (local) buses are not HDH users.

(5) Average unit toll of 5, 7.5 and 10 cents per vehicle kilometer as applied to toll diversion model.

(6) Annual HDH revenue derived by multiplying vehicle kilometers, unit toll rate and 340 equivalent days per year.

8.2 FINANCIAL PARAMETERS

The derivation of financial viability measures rests upon a framework of parameters which govern inputs to, and outflows from, the projects annual cash-flow stream.

8.2.1 Analysis Period

The HDH is, in accordance with guidelines presented in *Chapter 5,* conceived as a two-lane facility. A 30 year concessionaire period (including construction) is adopted which extends from year 1998 (beginning of outlay for engineering design) to year 2028. At completion of the concessionaire period, ownership of the HDH would revert to the Government of Viet Nam.

8.2.2 Implementation Costs

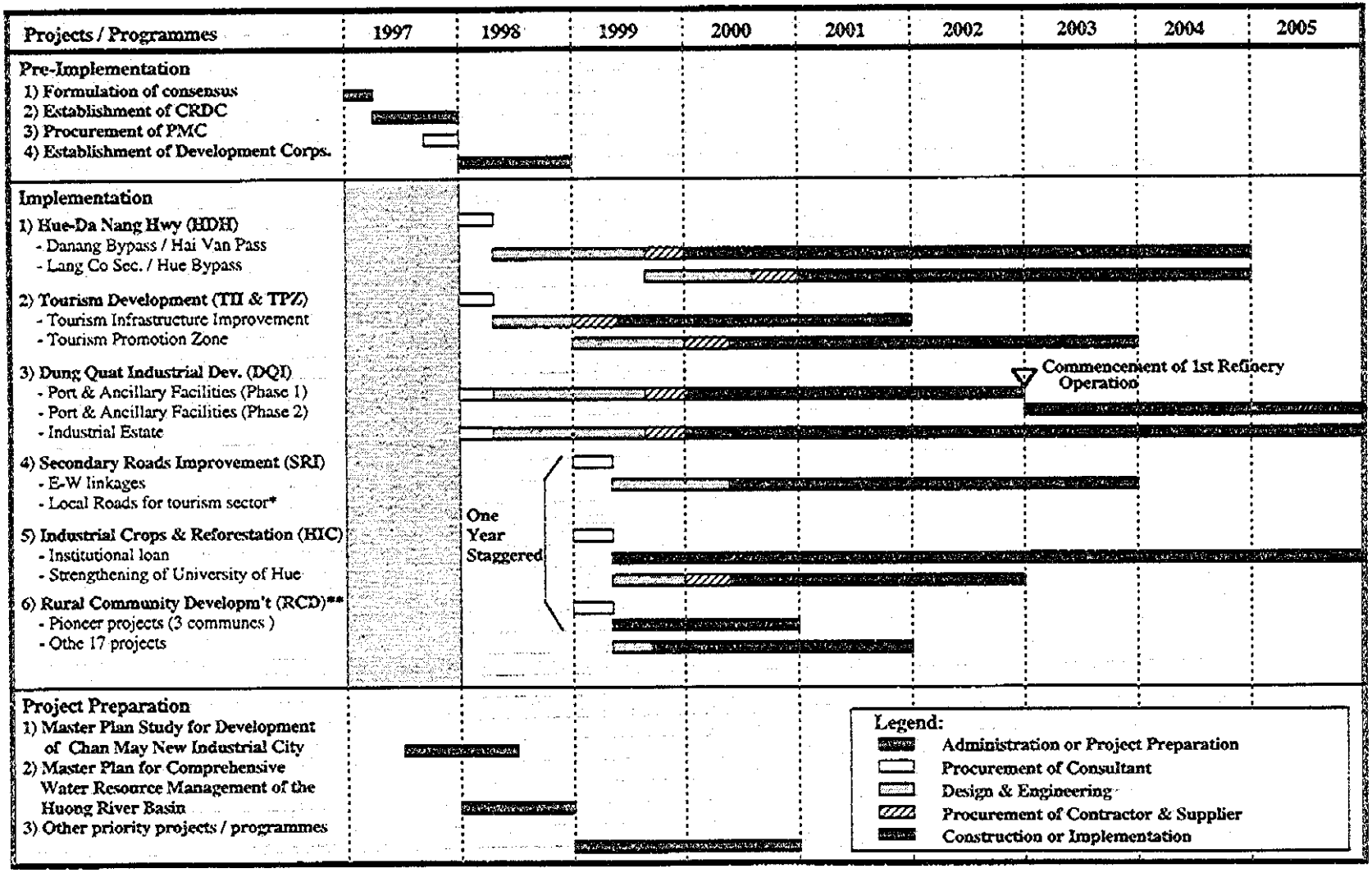
The estimated HDH project cost was previously presented in the *Main Report,* along with a suggested implementation schedule which incorporates all priority projects designated by the current study. This schedule suggests that, following completion of engineering design, construction of the Hai Van Pass and Da Nang Bypass segments of the HDH should begin in year 2000 and be completed in year 2004. Construction of the Hue Bypass and Lang Co-Chan May segments would extend from year 2001 to year 2004, thus ensuring that the entire HDH is open to traffic by year 2005 (Figure 8.1).

The financial cost of the HDH, to include design, construction, engineering supervision, contingencies and land, is set at 289.2 million 1996 US Dollars. These costs were escalated at eight percent per year to estimate the project cost in current prices. Results indicate that the HDH will escalate to some 450.1 million current US Dollars (Table 8.2).

Table 8.2 Hue-Da Nang Highway Project Costs

	MILLION CONSTANT 1996 US DOLLARS							
SEGMENT	1998	1999	2000	2001	2002	2003	2004	Total
Hue Bypass	-	1.284	7.277	8.561	8.561	8.561	8.561	42.805
Lang Co	-	1.748	9.902	11.652	11.652	11.652	11.652	58.258
Hai Van Pass	7.706	23.112	24.652	24.652	24.652	24.652	24.652	154.078
Da Nang Bypass	-	1.703	5.109	6.814	6.814	6.814	6.814	34.068
Total	7.706	27.847	46.940	51.679	51.679	51.679	51.679	289.209
Percent	2.7	9.6	16.2	17.9	17.9	17.9	17.9	100.0
	MILLION CURRENT US DOLLARS							
SEGMENT	1998	1999	2000	2001	2002	2003	2004	Total
Hue Bypass	-	1.618	9.900	12.579	13.585	14.672	15.846	68.200
Lang Co	-	2.202	13.473	17.120	18.490	19.969	21.566	92.820
Hai Van Pass	8.986	29.114	33.539	36.223	39.120	42.250	45.630	234.862
Da Nang Bypass	-	2.146	6.952	10.011	10.812	11.677	12.611	54.211
Total	8.986	35.082	63.864	75.933	82.007	88.568	95.653	450.093
Percent	2.0	7.8	14.2	16.9	18.2	19.7	21.3	100.0

Figure 8.1 Implementation Schedule and Investment Outlay up to 2005



Note: * This component will be carried out under the TII. ** The part of institutional loan will be included in the HIC.

The 1996 annual maintenance cost of the Hai Van Pass segment has been calculated at some $68,000 per kilometer per year[1]. Adopting a unit cost of $2,500 for road maintenance along other sections results in a weighted HDH average 1996 cost of $1.23 million per annum. Periodic maintenance (resurfacing) will likely be required every 10 years after opening (years 2015 and 2025) and has been calculated, based on a unit 1996 rate of $60,000 per kilometer, at $7.5 million per event. Maintenance costs are, like project costs, escalated at eight percent per annum (Table 8.3).

Table 8.3 Representative Operating and Maintenance Costs Hue-Da Nang Highway

Year	Million Constant 1996 US$			Million Current $
	Routine	Periodic	Total	
2005	1.230	0	1.230	2.458
2010	1.230	0	1.230	3.611
2015	0	7.500	7.500	32.368
2020	1.230	0	1.230	7.797
2025	0	7.500	7.500	69.880

8.2.3 Toll Rates

The development of a toll structure is influenced by many factors. Technical considerations including facility patronage, average toll levels, and typical yields should be balanced against social and political aspects. Typically, the estimation of a toll structure is based on the premise that the toll rates should be established within the limits of the financial benefits obtained by toll road users, and is therefore not based on an optimized toll structure intended to yield maximum revenue.

The establishment of the toll rates within the limits of the financial benefits obtained by toll road users is based on the savings in vehicle operating costs which would be realized by toll road users when comparing their vehicle operating costs on the toll road and arterial roads. Operating cost is defined as including outlay for fuel, oil, tires, routine maintenance, depreciation, interest, insurance and, in the case of commercial vehicles, crew wages and overheads. The average benefit per vehicle using the HDH has been estimated at some six-seven cents per kilometer, thus suggesting that a reasonable and justifiable toll levy would be five 1996 cents per composite vehicle per kilometer (refer Section 5.5.1 for a more complete discussion). This figure has been adopted for revenue estimation purposes.

Escalation to derive future toll levies in current monetary units is set at an average of nine percent per annum. This rate is less than forecast growth in study area GDP/capita which has been set at some 10-11 percent per annum (post-year 2000) in the Master Plan study's macro-economic frame. Thus, increases in toll payments lag increases in unit income thus, in relative terms, usage of the HDH will become increasingly cheaper. It is further assumed that, following opening of the HDH, the actual toll structure will only be modified every three years.

The demand forecasting process suggests that a two-lane HDH will reach capacity roughly near year 2015 (refer Section 6.4). Toll revenue (i.e. vehicles using the HDH) will therefore remain constant from that point forward when expressed in constant monetary terms. However, revenue will continue to increase in current terms due to the average annual escalation of the toll rate applied every three years (Table 8.4).

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[1] "Pre-Feasibility Study of Hai Van Pass Tunnel of Highway 1", op. cit. Costs include those directly attributable to tunnel maintenance (staffing, electrical/mechanical systems, power, ventilation) as well as traditional road maintenance costs.

Table 8.4 Representative Annual Income Hue-Da Nang Highway

Year	Toll Revenue (Million US $)	
	Constant	Current
2005	26.247	52.300
2010	48.113	160.781
2015	49.154	212.720
2020	49.154	356.753
2025	49.154	598.310

8.2.4 Equity

It is likely that the final BOT consortium will include, in addition to the investor, Government and, possibly, select individuals, with the latter desiring to participate in the project on a venture-capital basis. Government, as a consortium partner, must therefore provide a pre-negotiated contribution toward initial investment (project) cost. This would surely include land costs, and possible some, part or all of the capital-intensive Hai Van pass tunnels. In the latter case, the Government might be able to secure a government-to-government ODA loan under very favorable conditions. This, in turn, could be reflected in the project cash flow as a lumped sum equity contribution (regardless of source or Government's financing arrangement) from the Government partner.

Equity participation in the project is conservatively set at 30 percent of the initial investment (project cost), applied proportionally to investment expenditure. Total equity input, whether by Government, private individuals or both, is consequently calculated at 135.0 million current US Dollars.

8.2.5 Management Fee

The Government of Viet Nam is anticipated to eventually designate a national entity (possibly the MOT, possibly not) whose sole purpose will be the coordination, supervision and operation of all tolled roads. This agency would progressively expand in responsibility as tollroads are gradually implemented throughout Viet Nam. It is likely that the HDH, and possibly motorway-class facilities near Hanoi and HCMC, will form the initial elements under the jurisdiction of this agency. Ultimately, the entire Hanoi-HCMC motorway would be included.

The HDH is correspondingly assessed a management fee equivalent to two percent of annual gross revenue. This fee would (likely) be targeted for the national tollroad agency with some funds being internally allocated to agency support, but primarily intended to form a "seed money" pool from which future equity share in other tollroad ventures could be financed. It is, of course, assumed that similar management fee arrangements would, in the interests of fairness, also be applied to all other tollroads under the agency's jurisdiction.

8.2.6 Corporate Tax

A specific tax structure appropriate to road BOT ventures does not exist at present; however, based on rates prescribed for somewhat similar undertakings, a tax equivalent to 35 percent of corporate profits seems plausible. It is further accepted that, for taxation purposes, the investor will be permitted to straight-line depreciate 80 percent of the initial investment over a 25 year period, with compensated carry-over of losses incurred during years of negative cash flow.

8.2.7 Loan Structure

The arrangement and structuring of loans to support implementation costs (after deduction of equity contribution) will likely emerge as a principal hurdle to the HDH venture. The reasons

are manifold. At this juncture, Viet Nam does not possess a viable long-term financing market; the maximum loan period currently available is two years. And, in a broader sense, a functioning financial sector, with requisite securities market, legal framework and unencumbered international currency transactions, is not yet established. Thus, sizable portions of the HDH venture must likely be financed from overseas commercial sources, an action which in itself is not a straightforward process given the current Vietnamese approach to monetary controls. However, foreign lenders will insist, and understandably so, that venture risk be shared domestically via both front-end equity contribution and domestic loans. Further, international commercial sources will likely require collateral or guarantees for any loan, particularly so in a high-risk nation (one risk being stability of the Dong) such as Viet Nam. Who will provide such guarantees?

The Republic's economy and financial sectors are changing almost on a daily basis, supported by new laws and agreements designed to facilitate the perceived attractiveness of Viet Nam as a stable (and profitable) place of business. Thus, assuming a viable domestic banking sector emerges, following loan structures are deemed reasonable given current conditions in Southeast Asia (Table 8.5):

- 70 percent of long-term loan requirement is foreign-sourced, in the form of two equal loans. Conditions are 12% and 15% interest, grace on repayment of principal of five years, equal principal repayment periods of 20 and 15 years; interest capitalized during construction.
- 30 percent of long-term loan requirement is domestic-sourced at 18% interest, grace on repayment of principal of three years, equal repayment of interest and principal over 10 years.
- 100 percent of short-term bridging loans are domestic one-year loans at 20 percent interest.

Table 8.5 Potential Loan Structuring

Loan Origin		Loan	Percent	Repayment	Grace
Source	Share (%)	Splits	Interest	Period (Years)	Period (Years)
Long-Term Loan					
Foreign	70	50	12	20	5
		50	15	15	5
Domestic	30	100	18	10	3
Short-Term Loan					
Domestic	100		20	1	0

8.3 FINANCIAL VIABILITY

The composite result of HDH cash-flow, loan requirements and debt service analysis is presented in Table 8.6. A series of additional tabulations present supporting calculations for Table 8.6 entries. These are Table 8.7 (debt service analysis for foreign-sourced long-term loans), Table 8.8 (debt service analysis for domestic long-term loan), Table 8.9 (derivation of corporate tax payment), and Table 8.10 (short-term loan analysis).

It may, from the findings, be cautiously inferred that the HDH venture is, based on financial parameters presented in the previous section, viable.

- The first two measures of financial viability are based on net cash flow obtained from setting the estimated revenue against incurred costs. In other words, net cash-flow of all resources engaged by the investor before financing and taxes. The

financial internal rate of return (FIRR) is calculated at 19.5 percent, with a net present value (NPV) of some 88.5 million current US Dollars. The NPV is based on a discount rate of 16.4 percent - this rate represents the investors "value of money" and is based on a weighted combination of the long-term loan portfolio plus 1.5 percent.

- The total project cost is, as previously discussed, some 450.1 million current US Dollars. With equity contributing 30 percent of this total, the long-term loan obligation aggregates to 817.0 million current US Dollars, including principal and interest repayment.

- Corporate tax payments over the life of the venture total some 2.04 trillion (1,000 million) current US Dollars.

- Short-term bridging loans are required to cover temporary negative cash flow during years 1999-2006. The maximum outstanding short-term loan balance reaches some 220 million current US Dollars, with complete pay-off of the short-term loan obligation during year 2013.

The venture is expected to experience positive cash flow by year 2007, but will not reach cumulative positive cash flow (profit) until year 2013, some eight years after opening of the HDH, and 15 years after initiating the venture.

Demand forecasts indicate that capacity of the two-lane HDH is reached near year 2015. This is reflected in the current analysis by holding HDH traffic at constant levels from the saturation year onwards. From a transport perspective, the HDH should be expanded to multi-lane status near year 2015; thus, additional users catalyzed by expanded capacity would generate additional revenue. However, financing of this improvement (constructing an additional two lanes) is problematic as HDH cash flow begins to build a surplus only at roughly the same time as capacity expansion is needed.

8.4 SENSITIVITY ANALYSIS

To further evaluate the financial feasibility of the project, as indicated by the above results, a series of sensitivity tests were conducted. The results show that the financial viability of the project is relatively stable over a reasonable range of conditions (Table 8.11). For instance, a 10 percent decrease in revenue would reduce the rate of return by about one percent, and delay achievement of an accumulated surplus by two years. A 10 percent increase in project cost would also reduce the rate of return by about one percent and would similarly delay the year of an accumulated surplus by two years.

A more severe test consisting of a 20 percent reduction in revenue and 10 percent increase in project cost suggests that financial viability of the HDH venture is, under indicated conditions, jeopardized. The rate of return has decreased to 16.4 percent, or virtually the same as the investors "value of money" (weighted portfolio of long-term loans plus 1.5 percent). Furthermore, the first year of accumulated surplus is delayed to year 2022, or only some six years from the end of the concessionaire period.

Table 8.6

CASH FLOW AND DEBT SERVICE ANALYSIS

HUE-DANANG HIGHWAY

(CURRENT 000 US $)

YEAR	NET CASH FLOW BEFORE FINANCING						FINANCING CASH FLOW (1)								NET CASH FLOW AFTER LONG-TERM FINANCING	CORPORATE TAX (2)	NET CASH FLOW AFTER LONG-TERM FINANCING AND TAXES	BALANCE AFTER SHORT TERM (3) FINANCING
	INFLOW	OUTFLOW					INFLOW					OUTFLOW						
	SYSTEM REVENUE	INVESTMENT COST	O & M COST	MANAGMT FEE	TOTAL OUTFLOW	COMPOSITE FLOW	EQUITY	FRGN LONG-TERM LOAN	DOM LONG-TERM LOAN	TOTAL INFLOW	CUMULATIVE INFLOW	FR.L-TERM REPAYMENT	DM L-TERM REPAYMENT	TOTAL DEBT SERVICE	NET FINANCING STREAM			
1998	0.0	8,989.9	0.0	0.0	8,989.9	-8,989.9	2,697.0	4,405.1	1,887.9	8,989.9	8,989.9	0.0	0.0	0.0	8,989.9	0.0	0.0	0.0
1999	0.0	35,080.4	0.0	0.0	35,080.4	-35,080.4	10,524.1	17,189.4	7,366.9	35,080.4	44,070.3	594.7	339.8	934.5	34,145.9	-934.5	0.0	-934.5	0.0
2000	0.0	63,859.5	0.0	0.0	63,859.5	-63,859.5	19,157.8	31,291.1	13,410.5	63,859.5	107,929.8	2,915.3	1,665.9	4,581.1	59,278.4	-4,581.1	0.0	-4,581.1	0.0
2001	0.0	75,933.0	0.0	0.0	75,933.0	-75,933.0	22,779.9	37,207.2	15,945.9	75,933.0	183,862.8	7,139.6	4,079.7	11,219.3	64,713.7	-11,219.3	0.0	-11,219.3	0.0
2002	0.0	82,007.7	0.0	0.0	82,007.7	-82,007.7	24,602.3	40,183.8	17,221.6	82,007.7	265,870.5	12,162.5	7,030.3	19,192.8	62,814.9	-19,192.8	0.0	-19,192.8	0.0
2003	0.0	88,568.3	0.0	0.0	88,568.3	-88,568.3	26,570.5	43,398.5	18,599.3	88,568.3	354,438.8	17,587.3	10,443.4	28,030.7	60,537.6	-28,030.7	0.0	-28,030.7	0.0
2004	0.0	95,653.8	0.0	0.0	95,653.8	-95,653.8	28,696.1	46,870.3	20,087.3	95,653.8	450,092.6	23,446.1	14,361.4	37,807.5	57,846.2	-37,807.5	0.0	-37,807.5	0.0
2005	52,299.5	0.0	2,457.8	1,046.0	3,503.8	48,795.7	0.0	0.0	0.0	0.0	0.0	42,638.8	18,655.0	61,293.8	-61,293.8	-12,498.1	0.0	-12,498.1	0.0
2006	60,832.3	0.0	2,654.4	1,216.6	3,871.0	56,961.2	0.0	0.0	0.0	0.0	0.0	40,874.4	19,387.2	60,261.6	-60,261.6	-3,300.4	0.0	-3,300.4	0.0
2007	91,733.2	0.0	2,866.8	1,834.7	4,701.4	87,031.8	0.0	0.0	0.0	0.0	0.0	39,110.0	20,178.0	59,288.0	-59,288.0	27,743.8	0.0	27,743.8	0.0
2008	106,933.3	0.0	3,096.1	2,138.7	5,234.8	101,698.5	0.0	0.0	0.0	0.0	0.0	37,345.7	21,032.0	58,377.6	-58,377.6	43,320.9	0.0	43,320.9	0.0
2009	118,903.1	0.0	3,343.8	2,378.1	5,721.8	113,181.3	0.0	0.0	0.0	0.0	0.0	35,581.3	21,032.0	56,613.3	-56,613.3	56,568.0	0.0	56,568.0	0.0
2010	160,780.9	0.0	3,611.3	3,215.6	6,826.9	153,954.0	0.0	0.0	0.0	0.0	0.0	33,817.0	21,032.0	54,848.9	-54,848.9	99,105.1	0.0	99,105.1	0.0
2011	164,258.8	0.0	3,900.2	3,285.2	7,185.4	157,073.5	0.0	0.0	0.0	0.0	0.0	32,052.6	21,032.0	53,084.6	-53,084.6	103,988.9	28,509.7	75,479.2	0.0
2012	164,258.8	0.0	4,212.2	3,285.2	7,497.4	156,761.4	0.0	0.0	0.0	0.0	0.0	30,288.2	20,611.9	50,900.1	-50,900.1	105,861.3	32,010.4	73,850.9	0.0
2013	212,719.9	0.0	4,549.2	4,254.4	8,803.6	203,916.4	0.0	0.0	0.0	0.0	0.0	28,523.9	18,972.6	47,496.5	-47,496.5	156,419.8	49,705.9	106,713.9	45,264.5
2014	212,719.9	0.0	4,913.1	4,254.4	9,167.5	203,552.4	0.0	0.0	0.0	0.0	0.0	26,759.5	15,988.6	42,748.1	-42,748.1	160,804.3	51,240.5	109,563.8	109,563.8
2015	212,719.9	0.0	32,367.8	4,254.4	36,622.2	176,097.8	0.0	0.0	0.0	0.0	0.0	24,995.1	12,440.4	37,435.5	-37,435.5	138,662.2	43,490.7	95,171.5	95,171.5
2016	275,478.5	0.0	5,730.6	5,509.6	11,240.2	264,238.3	0.0	0.0	0.0	0.0	0.0	23,230.8	8,608.3	31,839.1	-31,839.1	232,399.1	76,298.7	156,100.5	156,100.5
2017	275,478.5	0.0	6,189.1	5,509.6	11,698.7	263,779.8	0.0	0.0	0.0	0.0	0.0	21,466.4	4,469.7	25,936.1	-25,936.1	237,843.7	78,204.2	159,639.4	159,639.4
2018	275,478.5	0.0	6,684.2	5,509.6	12,193.8	263,284.7	0.0	0.0	0.0	0.0	0.0	19,702.1	0.0	19,702.1	-19,702.1	243,582.6	80,212.9	163,369.7	163,369.7
2019	356,752.6	0.0	7,219.0	7,135.1	14,354.0	342,398.6	0.0	0.0	0.0	0.0	0.0	17,937.7	0.0	17,937.7	-17,937.7	324,460.9	108,520.3	215,940.6	215,940.6
2020	356,752.6	0.0	7,796.5	7,135.1	14,931.5	341,821.1	0.0	0.0	0.0	0.0	0.0	8,821.8	0.0	8,821.8	-8,821.8	332,999.3	111,508.7	221,490.6	221,490.6
2021	356,752.6	0.0	8,420.2	7,135.1	15,555.3	341,197.4	0.0	0.0	0.0	0.0	0.0	8,160.2	0.0	8,160.2	-8,160.2	333,037.2	111,522.0	221,515.2	221,515.2
2022	462,005.0	0.0	9,093.8	9,240.1	18,333.9	443,671.1	0.0	0.0	0.0	0.0	0.0	7,498.5	0.0	7,498.5	-7,498.5	436,172.5	147,619.3	288,553.2	288,553.2
2023	462,005.0	0.0	9,821.3	9,240.1	19,061.4	442,943.5	0.0	0.0	0.0	0.0	0.0	6,836.9	0.0	6,836.9	-6,836.9	436,106.6	147,596.3	288,510.4	288,510.4
2024	462,005.0	0.0	10,607.0	9,240.1	19,847.1	442,157.8	0.0	0.0	0.0	0.0	0.0	6,175.3	0.0	6,175.3	-6,175.3	435,982.6	147,552.9	288,429.7	288,429.7
2025	598,309.8	0.0	69,879.6	11,966.2	81,845.8	516,464.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	516,464.1	175,822.1	340,642.0	340,642.0
2026	598,309.8	0.0	12,372.0	11,966.2	24,338.2	573,971.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	573,971.6	196,342.6	377,629.0	377,629.0
2027	598,309.8	0.0	13,341.8	11,966.2	25,328.0	572,981.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	572,981.8	196,711.4	376,270.4	376,270.4
2028	774,828.6	0.0	14,430.7	15,466.6	29,927.3	744,901.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	744,901.3	257,733.7	487,167.6	487,167.6
TOTAL	7,410,625.9	450,092.6	249,578.4	148,212.5	847,883.5	6,562,742.4	135,027.8	220,545.4	94,519.4	450,092.6		555,661.7	261,360.1	817,021.8	-366,929.2	6,195,813.2	2,040,602.3	4,155,210.9	3,835,358.1

EFFICIENCY MEASURES (4):

FINANCIAL INTERNAL RATE OF RETURN TO ALL RESOURCES ENGAGED = 19.5 PERCENT NET PRESENT VALUE ($ 000) = 85,495.1 AT DISCOUNT RATE OF 16.4 PERCENT

(1) Details of long-term loan requirements and debt servicing are contained in Table 8.7 (foreign-sourced loans) and Table 8.8 (domestic loan).

(2) Details of corporate tax calculation contained in Table 8.9.

(3) Details of short-term loan requirements and debt servicing are contained in Table 8.10.

(4) Calculated from net cash flow of resources engaged by investor, before financing and taxes.

Table 8.7
DEBT SERVICE ANALYSIS
FOREIGN COMPONENT, LONG-TERM LOAN PROGRAM
HUE-DANANG HIGHWAY
(CURRENT 000 US $)

YEAR	TOTAL FOREIGN LOAN (1)	LOAN NUMBER ONE						LOAN NUMBER TWO						COMBINED DEBT SERVICE				TOTAL NET FINANCING
		RECEIPTS		DEBT SERVICE			NET FINANCING	RECEIPTS		DEBT SERVICE			NET FINANCING	YEAR END BALANCE	INTEREST	PRINCIPAL REPAYMENT	TOTAL	
		LOAN RECEIPTS	YEAR END BALANCE	INTEREST	PRINCIPAL REPAYMENT	TOTAL		LOAN RECEIPTS	YEAR END BALANCE	INTEREST	PRINCIPAL REPAYMENT	TOTAL						
1998	4,405.1	2,202.5	2,202.5	0.0	0.0	0.0	2,202.5	2,202.5	2,202.5	0.0	0.0	0.0	2,202.5	4,405.1	0.0	0.0	0.0	4,405.1
1999	17,189.4	8,594.7	10,797.2	264.3	0.0	264.3	8,330.4	8,594.7	10,797.2	330.4	0.0	330.4	8,264.3	21,594.5	594.7	0.0	594.7	16,594.7
2000	31,291.1	15,645.6	26,442.8	1,295.7	0.0	1,295.7	14,349.9	15,645.6	26,442.8	1,619.6	0.0	1,619.6	14,026.0	52,885.6	2,915.3	0.0	2,915.3	28,375.9
2001	37,207.2	18,603.6	45,046.4	3,173.1	0.0	3,173.1	15,430.5	18,603.6	45,046.4	3,966.4	0.0	3,966.4	14,637.2	90,092.8	7,139.6	0.0	7,139.6	30,067.6
2002	40,183.8	20,091.9	65,138.3	5,405.6	0.0	5,405.6	14,686.3	20,091.9	65,138.3	6,757.0	0.0	6,757.0	13,334.9	130,276.6	12,162.5	0.0	12,162.5	28,021.2
2003	43,398.5	21,699.2	86,837.5	7,816.6	0.0	7,816.6	13,882.6	21,699.2	86,837.5	9,770.7	0.0	9,770.7	11,928.5	173,675.0	17,587.3	0.0	17,587.3	25,811.1
2004	46,870.3	23,435.2	110,272.7	10,420.5	0.0	10,420.5	13,014.7	23,435.2	110,272.7	13,025.6	0.0	13,025.6	10,409.5	220,545.4	23,446.1	0.0	23,446.1	23,424.2
2005	0.0	0.0	104,759.1	13,232.7	5,513.6	18,746.4	-18,746.4	0.0	102,921.2	16,540.9	7,351.5	23,892.4	-23,892.4	207,680.2	29,773.6	12,865.1	42,638.8	-42,638.8
2006	0.0	0.0	99,245.4	12,571.1	5,513.6	18,084.7	-18,086.7	0.0	95,569.7	15,438.2	7,351.5	22,789.7	-22,789.7	194,815.1	28,009.3	12,865.1	40,874.4	-40,874.4
2007	0.0	0.0	93,731.8	11,909.5	5,513.6	17,423.1	-17,423.1	0.0	88,218.2	14,335.4	7,351.5	21,687.0	-21,687.0	181,949.9	26,244.9	12,865.1	39,110.0	-39,110.0
2008	0.0	0.0	88,218.2	11,247.8	5,513.6	16,761.4	-16,761.4	0.0	80,866.6	13,232.7	7,351.5	20,584.2	-20,584.2	169,084.8	24,480.5	12,865.1	37,345.7	-37,345.7
2009	0.0	0.0	82,704.5	10,586.2	5,513.6	16,099.8	-16,099.8	0.0	73,515.1	12,130.0	7,351.5	19,481.5	-19,481.5	156,219.6	22,716.2	12,865.1	35,581.3	-35,581.3
2010	0.0	0.0	77,190.9	9,924.5	5,513.6	15,438.2	-15,438.2	0.0	66,163.6	11,027.3	7,351.5	18,378.8	-18,378.8	143,354.5	20,951.8	12,865.1	33,817.0	-33,817.0
2011	0.0	0.0	71,677.2	9,262.9	5,513.6	14,776.5	-14,776.5	0.0	58,812.1	9,924.5	7,351.5	17,276.1	-17,276.1	130,489.3	19,187.4	12,865.1	32,052.6	-32,052.6
2012	0.0	0.0	66,163.6	8,601.3	5,513.6	14,114.9	-14,114.9	0.0	51,460.6	8,821.8	7,351.5	16,173.3	-16,173.3	117,624.2	17,423.1	12,865.1	30,288.2	-30,288.2
2013	0.0	0.0	60,650.0	7,939.6	5,513.6	13,453.3	-13,453.3	0.0	44,109.1	7,719.1	7,351.5	15,070.6	-15,070.6	104,759.1	15,658.7	12,865.1	28,523.9	-28,523.9
2014	0.0	0.0	55,136.3	7,278.0	5,513.6	12,791.6	-12,791.6	0.0	36,757.6	6,616.4	7,351.5	13,967.9	-13,967.9	91,893.9	13,894.4	12,865.1	26,759.5	-26,759.5
2015	0.0	0.0	49,622.7	6,616.4	5,513.6	12,130.0	-12,130.0	0.0	29,406.1	5,513.6	7,351.5	12,865.1	-12,865.1	79,028.8	12,130.0	12,865.1	24,995.1	-24,995.1
2016	0.0	0.0	44,109.1	5,954.7	5,513.6	11,468.4	-11,468.4	0.0	22,054.5	4,410.9	7,351.5	11,762.4	-11,762.4	66,163.6	10,365.6	12,865.1	23,230.8	-23,230.8
2017	0.0	0.0	38,595.4	5,293.1	5,513.6	10,806.7	-10,806.7	0.0	14,703.0	3,308.2	7,351.5	10,659.7	-10,659.7	53,298.5	8,601.3	12,865.1	21,466.4	-21,466.4
2018	0.0	0.0	33,081.8	4,631.5	5,513.6	10,145.1	-10,145.1	0.0	7,351.5	2,205.5	7,351.5	9,557.0	-9,557.0	40,433.3	6,836.9	12,865.1	19,702.1	-19,702.1
2019	0.0	0.0	27,568.2	3,969.8	5,513.6	9,483.5	-9,483.5	0.0	0.0	1,102.7	7,351.5	8,454.2	-8,454.2	27,568.2	5,072.5	12,865.1	17,937.7	-17,937.7
2020	0.0	0.0	22,054.5	3,308.2	5,513.6	8,821.8	-8,821.8	0.0	0.0	0.0	0.0	0.0	0.0	22,054.5	3,308.2	5,513.6	8,821.8	-8,821.8
2021	0.0	0.0	16,540.9	2,646.5	5,513.6	8,160.2	-8,160.2	0.0	0.0	0.0	0.0	0.0	0.0	16,540.9	2,646.5	5,513.6	8,160.2	-8,160.2
2022	0.0	0.0	11,027.3	1,984.9	5,513.6	7,498.5	-7,498.5	0.0	0.0	0.0	0.0	0.0	0.0	11,027.3	1,984.9	5,513.6	7,498.5	-7,498.5
2023	0.0	0.0	5,513.6	1,323.3	5,513.6	6,836.9	-6,836.9	0.0	0.0	0.0	0.0	0.0	0.0	5,513.6	1,323.3	5,513.6	6,836.9	-6,836.9
2024	0.0	0.0	0.0	661.6	5,513.6	6,175.3	-6,175.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	661.6	5,513.6	6,175.3	-6,175.3
2025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2026	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2027	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2028	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	220,545.4	110,272.7		167,319.4	110,272.7	277,592.0	-167,319.4	110,272.7		167,796.9	110,272.7	278,069.6	-167,796.9		335,116.3	220,545.4	555,661.7	-335,116.3

(1) First foreign loan represents 50% of total foreign loan requirement; interest rate 12.0 %, grace on principal of 5 years, and 20 years repayment.
Second foreign loan represents 50% of total foreign loan requirement, interest rate 15.0 %, grace on principal of 5 years, and 15 years repayment.

Table 8.8
DEBT SERVICE ANALYSIS
DOMESTIC COMPONENT, LONG-TERM LOAN PROGRAM
HUE-DANANG HIGHWAY
(CURRENT 000 US$)

YEAR	DOMESTIC LOAN RECEIPTS (1)	CUMULATIVE LOAN RECEIPTS	DEBT SERVICE: TOTAL INTEREST AND PRINCIPAL REPAYMENT OF EACH YEAR'S LOAN																TOTAL DEBT SERVICE REPAYMENTS	TOTAL NET FINANCING
			YEAR 1 LOAN	YEAR 2 LOAN	YEAR 3 LOAN	YEAR 4 LOAN	YEAR 5 LOAN	YEAR 6 LOAN	YEAR 7 LOAN	YEAR 8 LOAN	YEAR 9 LOAN	YEAR 10 LOAN	YEAR 11 LOAN	YEAR 12 LOAN	YEAR 13 LOAN	YEAR 14 LOAN	YEAR 15 LOAN	YEAR 16 LOAN	YEAR 17 LOAN	
1998	1,887.9	0.0																	0.0	1,887.9
1999	7,366.9	7,366.9	339.8																339.8	7,027.1
2000	13,410.5	20,777.4	339.8	1,326.0															1,665.9	11,744.6
2001	15,945.9	36,723.3	339.8	1,326.0	2,413.9														4,079.7	11,866.2
2002	17,221.6	53,944.9	420.1	1,326.0	2,413.9	2,870.3													7,030.3	10,191.3
2003	18,599.3	72,544.3	420.1	1,639.2	2,413.9	2,870.3	3,099.9												10,443.4	8,156.0
2004	20,087.3	92,631.6	420.1	1,639.2	2,984.0	2,870.3	3,099.9	3,347.9											14,361.4	5,725.9
2005	0.0	0.0	420.1	1,639.2	2,984.0	3,548.2	3,099.9	3,347.9	3,615.7										18,655.0	-18,655.0
2006	0.0	0.0	420.1	1,639.2	2,984.0	3,548.2	3,832.1	3,347.9	3,615.7										19,387.2	-19,387.2
2007	0.0	0.0	420.1	1,639.2	2,984.0	3,548.2	3,832.1	4,138.6	3,615.7										20,178.0	-20,178.0
2008	0.0	0.0	420.1	1,639.2	2,984.0	3,548.2	3,832.1	4,138.6	4,469.7										21,032.0	-21,032.0
2009	0.0	0.0	420.1	1,639.2	2,984.0	3,548.2	3,832.1	4,138.6	4,469.7										21,032.0	-21,032.0
2010	0.0	0.0	420.1	1,639.2	2,984.0	3,548.2	3,832.1	4,138.6	4,469.7										21,032.0	-21,032.0
2011	0.0	0.0	420.1	1,639.2	2,984.0	3,548.2	3,832.1	4,138.6	4,469.7										21,032.0	-21,032.0
2012	0.0	0.0		1,639.2	2,984.0	3,548.2	3,832.1	4,138.6	4,469.7										20,611.9	-20,611.9
2013	0.0	0.0			2,984.0	3,548.2	3,832.1	4,138.6	4,469.7										18,972.6	-18,972.6
2014	0.0	0.0				3,548.2	3,832.1	4,138.6	4,469.7										15,988.6	-15,988.6
2015	0.0	0.0					3,832.1	4,138.6	4,469.7										12,440.4	-12,440.4
2016	0.0	0.0						4,138.6	4,469.7										8,608.3	-8,608.3
2017	0.0	0.0							4,469.7										4,469.7	-4,469.7
2018	0.0	0.0																	0.0	0.0
2019	0.0	0.0																	0.0	0.0
2020	0.0	0.0																	0.0	0.0
2021	0.0	0.0																	0.0	0.0
2022	0.0	0.0																	0.0	0.0
2023	0.0	0.0																	0.0	0.0
2024	0.0	0.0																	0.0	0.0
2025	0.0	0.0																	0.0	0.0
2026	0.0	0.0																	0.0	0.0
2027	0.0	0.0																	0.0	0.0
2028	0.0	0.0																	0.0	0.0
TOTAL	94,519.4		5,220.3	20,370.5	37,082.0	44,092.9	47,620.3	51,429.9	55,544.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	261,360.1	-166,840.7

(1) Interest rate 18%, grace on principal of 3 years, 10 years equal repayment of principal and interest.

Table 8.9
DERIVATION OF CORPORATE TAX PAYMENT
HUE-DANANG HIGHWAY
(CURRENT 000 US $)

YEAR	NET CASH FLOW AFTER LONG-TERM FINANCING	ASSET(1) DEPRECIATION	NET CASH FLOW PLUS DEPRECIATION	CUMULATIVE NEGATIVE CASH FLOW	COMPENSATED POSITIVE CASH FLOW	CORPORATE TAX PAYMENTS
1998	0.0	0.0	0.0	0.0	0.0	0.0
1999	-934.5	-287.7	-1,222.2	-1,222.2	0.0	0.0
2000	-4,581.1	-1,410.2	-5,991.4	-7,213.5	0.0	0.0
2001	-11,219.3	-3,453.8	-14,673.1	-21,886.6	0.0	0.0
2002	-19,192.8	-5,883.6	-25,076.4	-46,963.0	0.0	0.0
2003	-28,030.7	-8,507.9	-36,538.6	-83,501.6	0.0	0.0
2004	-37,807.5	-11,342.0	-49,149.6	-132,651.1	0.0	0.0
2005	-12,498.1	-14,403.0	-26,901.1	-159,552.2	0.0	0.0
2006	-3,300.4	-14,403.0	-17,703.3	-177,255.6	0.0	0.0
2007	27,743.8	-14,403.0	13,340.8	0.0	0.0	0.0
2008	43,320.9	-14,403.0	28,917.9	0.0	0.0	0.0
2009	56,568.0	-14,403.0	42,165.1	0.0	0.0	0.0
2010	99,105.1	-14,403.0	84,702.2	0.0	0.0	0.0
2011	103,988.9	-14,403.0	89,585.9	0.0	81,456.3	28,509.7
2012	105,861.3	-14,403.0	91,458.4	0.0	91,458.4	32,010.4
2013	156,419.8	-14,403.0	142,016.9	0.0	142,016.9	49,705.9
2014	160,804.3	-14,403.0	146,401.3	0.0	146,401.3	51,240.5
2015	138,662.2	-14,403.0	124,259.3	0.0	124,259.3	43,490.7
2016	232,399.1	-14,403.0	217,996.2	0.0	217,996.2	76,298.7
2017	237,843.7	-14,403.0	223,440.7	0.0	223,440.7	78,204.2
2018	243,582.6	-14,403.0	229,179.7	0.0	229,179.7	80,212.9
2019	324,460.9	-14,403.0	310,057.9	0.0	310,057.9	108,520.3
2020	332,999.3	-14,403.0	318,596.3	0.0	318,596.3	111,508.7
2021	333,037.2	-14,403.0	318,634.2	0.0	318,634.2	111,522.0
2022	436,172.5	-14,403.0	421,769.5	0.0	421,769.5	147,619.3
2023	436,106.6	-14,403.0	421,703.7	0.0	421,703.7	147,596.3
2024	435,982.6	-14,403.0	421,579.6	0.0	421,579.6	147,552.9
2025	516,464.1	-14,115.3	502,348.8	0.0	502,348.8	175,822.1
2026	573,971.6	-12,992.7	560,978.9	0.0	560,978.9	196,342.6
2027	572,981.8	-10,949.2	562,032.6	0.0	562,032.6	196,711.4
2028	744,901.3	-8,519.4	736,381.9	0.0	736,381.9	257,733.7
TOTAL	6,195,813.2	-365,521.0	5,830,292.2		5,830,292.2	2,040,602.3

(1) Depreciation based on 80 percent of investment (facility) costs equally allocated over a 25 year period.

Table 8.10
SHORT-TERM LOAN ANALYSIS
HUE-DANANG HIGHWAY
(CURRENT 000 US $)

YEAR	NET CASH FLOW AFTER(1) FINANCING	SHORT TERM LOAN BALANCE(2)	SHORT-TERM LOAN REPAYMENT			NET CASH FLOW AFTER SHORT-TERM LOANS
			PRINCIPAL REPAYMENT	INTEREST PAYMENT	TOTAL PAYMENT	
1998	0.0	0.0	0.0	0.0	0.0	0.0
1999	-934.5	934.5	0.0	0.0	0.0	0.0
2000	-4,581.1	5,702.5	934.5	186.9	1,121.4	0.0
2001	-11,219.3	18,062.3	5,702.5	1,140.5	6,843.0	0.0
2002	-19,192.8	40,867.6	18,062.3	3,612.5	21,674.8	0.0
2003	-28,030.7	77,071.8	40,867.6	8,173.5	49,041.1	0.0
2004	-37,807.5	130,293.7	77,071.8	15,414.4	92,486.2	0.0
2005	-12,498.1	168,850.5	130,293.7	26,058.7	156,352.4	0.0
2006	-3,300.4	205,921.0	168,850.5	33,770.1	202,620.7	0.0
2007	27,743.8	219,361.4	205,921.0	41,184.2	247,105.2	0.0
2008	43,320.9	219,912.9	219,361.4	43,872.3	263,233.7	0.0
2009	56,568.0	207,327.4	219,912.9	43,982.6	263,895.4	0.0
2010	99,105.1	149,687.8	207,327.4	41,465.5	248,792.9	0.0
2011	75,479.2	104,146.2	149,687.8	29,937.6	179,625.3	0.0
2012	73,850.9	51,124.5	104,146.2	20,829.2	124,975.4	0.0
2013	106,713.9	0.0	51,124.5	10,224.9	61,349.4	45,364.5
2014	109,563.8	0.0	0.0	0.0	0.0	109,563.8
2015	95,171.5	0.0	0.0	0.0	0.0	95,171.5
2016	156,100.5	0.0	0.0	0.0	0.0	156,100.5
2017	159,639.4	0.0	0.0	0.0	0.0	159,639.4
2018	163,369.7	0.0	0.0	0.0	0.0	163,369.7
2019	215,940.6	0.0	0.0	0.0	0.0	215,940.6
2020	221,490.6	0.0	0.0	0.0	0.0	221,490.6
2021	221,515.2	0.0	0.0	0.0	0.0	221,515.2
2022	288,553.2	0.0	0.0	0.0	0.0	288,553.2
2023	288,510.4	0.0	0.0	0.0	0.0	288,510.4
2024	288,429.7	0.0	0.0	0.0	0.0	288,429.7
2025	340,642.0	0.0	0.0	0.0	0.0	340,642.0
2026	377,629.0	0.0	0.0	0.0	0.0	377,629.0
2027	376,270.4	0.0	0.0	0.0	0.0	376,270.4
2028	487,167.6	0.0	0.0	0.0	0.0	487,167.6
TOTAL	4,155,210.9	1,599,264.2	1,599,264.2	319,852.8	1,919,117.0	3,835,358.1

(1) Remaining requirement after servicing long-term loans and taxes.
(2) Yearly loans at 20 % interest.

Table 8.11 Financial Sensitivity Analysis Hue-Da Nang Highway

Change in Revenue Change in Project Costs	Base Case	+ 10% -	- 10% -	- + 10%	- - 10%	- 10% + 10%	- 20% + 10%
Financial Rate of Return (FIRR) (%)	19.5	20.5	18.4	18.6	20.6	17.5	16.4
NPV (Million $) (16.4% Discount Rate)	88.5	120.8	56.2	66.2	110.8	34.0	1.7
Total Long-Term Loan Obligation (Mill $)	817.0	817.0	817.0	898.7	735.3	898.7	898.7
Year of Single Year Surplus	2007	2006	2007	2007	2006	2007	2007
Year of Accumulated Surplus	2013	2012	2015	2015	2012	2017	2022
Maximum Short-Term Loan Amount (Mill $) and Year	219.9 2008	195.8 2007	265.4 2009	284.1 2009	174.9 2007	342.2 2009	471.9 2015
Accumulate Corporate Tax Payable To Year 2028 (Trillion $)	2.04	2.30	1.79	2.00	2.08	1.75	1.49

Note: All monetary values are expressed in current terms.

8.5 POLICY RECOMMENDATIONS

There exists a rapidly-growing global movement under which governments wish to involve the private sector in costly infrastructure development. While the goal is similar, motivations differ. The principal catalyst in developed economies is to pursue "small government" by transferring traditional governmental functions to the private sector. However, governments of developing nations command only limited financial resources and are frequently unable to cope with the enormous demand for enhanced infrastructure fueled by accelerated economic growth.

Viet Nam is in a similar situation to most other developing countries at similar stages of economic evolution, perhaps even more so than usual. The Government of the Republic is facing a formidable challenge to expedite the construction/upgrading of infrastructure so crucially needed by the accelerated socio-economic development of the country. But this requires a massive investment due to the enormous backlog of long-neglected and/or under-maintained facilities. Further, it is understood that only roughly 20 percent of GDP can be allocated for development budgets, of which infrastructure components represent only one part. Thus, due to both absolute and relative constraints in available funding, Government is obliged to depend increasingly on borrowing from international lending agencies at the risk of aggravating the debt service ratio of the country's macro economy.

However, according to the ADB's estimation, the funds required for infrastructure development in developing countries over the coming decade would amount to some 1 to 1.5 trillion US Dollars, and obviously lending agencies alone cannot meet such a massive fund requirement. Hence, it is widely recognized (including by lending agencies) that mobilization of private funds for revenue-producing types of infrastructure development is essential as at least a partial solution to this quandary. Under these circumstances, Viet Nam also needs to seriously consider the possibility of mobilizing private sector resources through privatized infrastructure development (PID) schemes, to include not only financial resources but technical and human resources as well. PID can take many forms, including the BOT approach intimated for implementation of the Hue-Da Nang Highway.

8.5.1 Public Sector Responsibilities

While PID schemes appear as attractive options at face value, in must be acknowledged that implementation success in developing countries is rather limited. The reason for this is direct: PID's require proper financial, institutional and legal frameworks which bind both the government or its responsible agency and the private investor into a mutually "fair" and

beneficial relationship. Such frameworks are typically not properly established in developing countries, thus, from the investors point of view, exacerbating risk and, inter alia, hindering PID formation.

PID schemes will only be viable in Viet Nam once the Government truly recognizes their necessity and institutes necessary reforms which, in turn, induce prospective investors on rational and business grounds. A frequently voiced concern is, for example, the need to create (or permit the creation of) a functioning investment/banking sector, to include a long-term financing market, and supporting legal framework.

A reasonable and legitimate "give and take" approach between Government and investors is a mandatory requirement for enabling a PID scheme. While financial matters are likely to dominate any set of negotiations, government should also ensure that public benefit is not compromised since infrastructure will always "serve" the people. Assurance of safety, affordable tariff, and environmental concerns are considered essential in this regard. A PID scheme could also jeopardize the role of infrastructure as "social capital" if implemented in a haphazard manner. Particularly the issue of "internalizing" external diseconomies such as the cost of environmental problems should be properly and jointly managed by the Government and investor.

The following represent milestone responsibilities of the Government:

- Preparation of a master plan to avoid a haphazard development of infrastructure;
- Provision of reasonable investment incentives and governmental guarantees for investors;
- Assurance that public properties used for development purposes catalyze public benefits;
- Ensuring "transparency" in the selection of investors; and,
- Formulation of national consensus regarding the role of the private sector in infrastructure development.

8.5.2. Central Region Focus

The Master Plan study confirms that infrastructure development is a key factor in achieving the accelerated socio-economic growth of the Central Region. Among the priority projects and programs proposed for immediate implementation by the current study are three projects or parts of projects considered candidates for PID implementation:

- Hue-Da Nang Highway Project;
- Thermal Power Plant Project for Dung Quat Industrial Development; and,
- Water Supply Project for Dung Quat Industrial Development

The Dung Quat thermal power plant project is expected to be more attractive to investors as this type of project has many precedent examples in international markets. Also, a reasonable pool of "individual power producers (IPP)" investors is established. However, numerous Asian precedents do not exist for the types of projects represented by the HDH and Dung Quat water supply project, although road BOT projects have been implemented in Hong Kong, Indonesia and Thailand.

In order to examine the viability of a PID scheme, and to provide an input to decision making processes within the Government of Viet Nam, a preliminary financial analysis for HDH implementation via a BOT scheme was conducted as described in previous sections of this chapter. The analysis adopted realistic financial parameters existing at present in the Southeast Asian investment/lending sector; this proved necessary due to the current immaturity of similar

Vietnamese markets. As indicated by the results, conducted within a reasonable range of tariff settings and forecast future traffic demand, financial viability can cautiously be termed as acceptable. However, this viability is also fragile and remains vulnerable vis-a -vis risks that could occur during the concessionaire period. This explicitly implies that unless substantial support by the Government is made available, it may be difficult to implement the project purely on a PID basis. Investor support could take the following forms in that the Government:

- guarantees to acquire the necessary right-of-way within a predetermined time period;
- provides irrevocable investment incentives which include, among others, tax holiday, accelerated depreciation, tariff setting and cash-flow basically linked with hard currency, and assistance to acquire soft loans from international lending agencies;
- endeavors to provide a reasonable time of concession, and assumes responsibility for the project thereafter;
- provides opportunity for the investor to participate in concessions involving ancillary HDH functions (such as rest stops) and possibly the development and operation of commercial, industrial or recreational land uses on property abutting the HDH; and,
- reasonably shares unforeseen risks inherent to project costs, demands or currency exchange rates.

8.5.3 PID Task Force

Each PID scheme requires innovative approaches tailored to the project in question, while being fully sensitive to the terms and conditions attached to the project. Should the Government be truly keen in pursuing PID approaches for the three Central Region projects designated above, then it is strongly recommended that a task force to carry out an advance study for the relevant PID project should be established as soon as possible under the umbrella of the Ministry of Planning and Investment. Obviously, many things must be accomplished as part of a PID preparatory process. This includes, in the first instance, formulation of consensus within the administration regarding participation of the private sector in infrastructure development programs. This first and important step, as well as the development of requisite background and supporting information, should be immediately addressed by the task force following initial mobilization..

APPENDIX A

SYNOPSIS OF POTENTIAL IMPROVEMENT PROJECTS

SYNOPSIS OF POTENTIAL IMPROVEMENT PROJECTS

Study Team representatives met on a number of occasions during 1996 with representatives of national, regional and commune governmental entities; mixed-sector enterprises and institutes; international financing institutions; donor agencies as well as technical consulting firms to discuss the condition of existing transport infrastructure, the status of committed improvement projects as well as perceived need for additional improvements. As a result of these discussions, a "long list" of potential road improvement projects emerged which, in a general sense, can be described as being highly sensitive to local needs. This listing served as a key input to the transportation planning process and functioned in a contributory role relative to the formation of the road improvement strategy presented in Chapter 5.

For completeness, the "long list" is compiled in this appendix, based on the same generic road categories employed in earlier sections of this report.

A.1 INTERURBAN ROADS

Comments received from regional governmental entities regarding road projects were frequently stratified into interurban roads (national and province ownership) and roads located within urban areas. This distinction is, for presentation purposes, maintained in this appendix.

A.1.1 The North-South Spine (Highway 1, Highway 9)

- Highway 1 is currently being studied by the ADB (between Dong Ha and southern study area boundary) as well as the IBRD (between Dong Ha and northern study area boundary). Focus of efforts is upgrading to Class III status within the existing right-of-way. Widening to multi-lane status, or provision of urban bypasses, is not included. Funding is limited, with allocation priorities having been apparently given to other parts of the nation.

- Highway 9 is being studied by the ADB as part of the Thailand - Lao PDR -Viet Nam landbridge. Final recommendations are expected in the very near future, however, expectations are that a Class III-type road will be the preferred choice. Extensive governmental negotiations involving Viet Nam, Lao PDR and Thailand have been concluded with a recent agreement confirming the status of the Highway 9 corridor and that Thailand and Lao PDR will construct, by year 2003, a second Mekong River bridge (the first being the "Thai - Lao Friendship Bridge" at Nong Kai/Vientiane) at Mukdahan/Savannakhet.

- TEDI has also completed a feasibility study for Highway 9, which involves upgrading to Class III status, an urban bypass north of Dong Ha, and an extension east of Highway 1 to Cua Viet port. The extension is now (mid-1996) under construction and should be completed by early 1997. Some alignment work for the Dong Ha bypass (which coincides with Province Highway 71) will begin in 1996.

- The Study Team has also been advised by DSI that the Government has long-term plans for the construction of a Hanoi - HCMC motorway along an alignment approximately three-10 kilometers west of Highway 1.

- Improvement of the Hai Van pass segment of Highway 1 is a topical subject. The on-going ADB Highway 1 study is considering only safety-related improvements in their work. TEDI is now conducting a feasibility study for upgrading Highway 1 in

this area, but efforts focus on improving curve radii. The Express Highway Research Foundation of Japan has, for the IBRD and Government of Viet Nam, recently (May, 1996) completed a pre-feasibility study which assesses alternative Hai Van pass road improvement strategies, to include the construction of new tunnel segments.

A.1.2 The Highlands Corridor (Highway 14, Highway 15)

- Highway 14 and Highway 15 have been identified by Quang Tri Province as priority projects in terms of improving nationally-owned roads under province jurisdiction. Thua Thien-Hue Province also identifies Highway 14 as a priority under the same conditions. Quang Nam-Da Nang Province does not directly identify Highway 14, possibly since Highway 14 is, within the province, a national responsibility.

- The Government has committed to upgrading of Highway 14 over its entirety to Class III or, in some cases, Class IV standard. While upgrading in vicinity of Kon Tum has already been initiated, implementation schedules within the study area remain uncertain due to funding limitations.

A.1.3 The East-West Linkages (Highway 14B, Highway 24, Highway 49)

- The improvement of Highway 9 is viewed by Quang Tri Province as the top priority for a nationally-owned road. Please also refer to above Highway 9 discussion included as part of the *North-South Spine* projects.

- Thua Thien-Hue Province indicates that Highway 49 is a priority for improvement in terms of nationally-owned roads. The province would also like to complete a two kilometer extension of the existing Highway 49 spur west of Highway 14 near Quang Tri province to the Lao PDR border (Savannaket province in Lao has apparently already built a connection on the Lao PDR side). This extension is contingent upon "official" establishment of a border post at this location.

- TEDI has developed plans for complete upgrading of Highway 14B in Quang Nam-Da Nang Province to Class III status. While province authorities support this project, a priority label was not intimated, possibly because work is under national control and/or proposed improvements have already been completed in vicinity of Da Nang city.

- Highway 24 is rated by province authorities as the absolute top priority for any road improvement in Quang Ngai Province. TEDI has completed plans for upgrading Highway 24 to Class III status, and some improvements are already underway. However, on-going (mid-1996) work will not attain full Class III status (width averages only 5-6 meters), and, west of Ba To, appears to only entail a crushed rock surface.

A.1.4 Rural Road Network (Province, District and Commune Roads)

The list of priorities received from province authorities invariably is limited to province-owned roads. General statements regarding the condition of district and commune roads were received, but no mention (with one exception) of project-specific improvements for these lower-order roads.

- Quang Tri Province

    * Province Highway 68 (Highway 1 to Thua Thien-Hue Province, linking with Hue Province Highway 68A)

    * Province Highway 64 (south side of Cua Viet to Highway 1)
    * Un-numbered province road linking Highway 1 with Vinh Moc tunnels
    * Province Highway 75 (Highway 15 to Highway 1 and continuing to the Highway 9 extension). Province Highway 75 is the current very poor access to Cua Viet port.

- Thua Thien-Hue Province
    * Province Highway 4 (between Hue city and Quang Tri Province)
    * Province Highway 10A (between Huong Thuy and lagoon area)
    * Province Highway 68A and Province Highway 68B, both being coastal roads and each involving a new bridge.
    * Province Highway 14B, particularly 20 or so kilometers closest to Highway 1.
- Quang Nam-Da Nang Province
    * Province Highway 606 (provisionally labeled Highway 14C) should be extended some 40 km west of the current terminus to the Lao PDR border. Sekong province in Lao has apparently agreed to build 20 or so kilometers on the Lao PDR side if the extension plans proceed, and if an "official" border post is established.
    * Province Highway 612 (between Highway 1 and Highway 14)
    * Province Highway 616 (between Highway 1 and Pac Po)
    * Province Highway 604 (between Highway 1 and Highway 14)
- Quang Ngai Province
    * District road linking Highway 24 west of Ba To with Province Highway 623 and continuing to Tra Khe in northwest of province.
    * Access roads for Dung Quat development and for Van Tuong new town. The province has identified the secondary access road to Dung Quat (near Chau O) as being a spur of Highway 24. The principal access point near Nui Thanh has been designed by TEDI and will be built by the Ministry of Transport.

The IBRD has initiated a Rural Transport Project in Viet Nam which involves the upgrading of district and commune roads in 15 provinces. Implementation will proceed on a trial basis in a limited number of provinces. None of the four provinces in the study area are included in the IBRD study.

A.2 URBAN ROADS

Discussions with province road authorities yielded several comments regarding urban road facilities. These include:

- Quang Tri Province indicates a need for general improvement of Dong Ha roads, most of which are now earth-surfaced.

- Thua Thien-Hue Province suggests, in terms of nationally-owned road priorities, that Highway 1 be widened in towns, and that a southern bypass of Hue city should be built. Road facilities within Hue city should be improved not only in terms of road quality, but also to counteract the annual impact of flooding within the citadel.

- Quang Nam-Da Nang Province places a pronounced priority on several site-specific improvements in Da Nang city. These are (a) Tieu La Road, (b) Lien Chieu - Nam O - Thuan Phuoc Road, (c) Tuyen Son bridge, (d) Dong Da Road, and (e) Bach Dang Dong Road.

- Quang Ngai Province has indicated a need to enhance traffic flow in Quang Ngai city (and the urban complexes surrounding the proposed Dung Quat complex).