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Southern Expressway in Sri Lanka: A Cost Benefit Analysis

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1. Introduction

1.1 The Background of the study: Road Transportation in Sri Lanka

Sri Lanka is an island country in the Northern Indian Ocean and it has a population of 21 million and a land area of about 65,610 square kilometer. Sri Lanka's transport network was primarily developed during the Colonial period for their business and administrative purposes, mainly to connect the towns and goods collection centres with the administrative capital of Colombo. The current road network of Sri Lanka which has a total length of 91,907 Km includes motorways, highways, main or national roads, secondary or regional roads, urban roads and rural roads (Source: Glossary of Transport Statistics, 2003). All the major intercity connections running through busy towns are experiencing high traffic congestion and hence travel time on these roads has become enormously high. This travel time may also be drastically changed due to frequent unexpected situations on the roads such as motor accidents, lane closing for repair and maintenance, use of roads for public activities and functions. As for planning, roads are conceived as a network. The current demand for passenger travel is around 80 billion passenger kilometers per year, at which road transport accounts for 93% and 98% of freight distribution, and thus plays an extremely important role in the country's socio-economic activities.

In Sri Lanka, highways can be viewed against multiple factors:

a. The entire transportation and transit systems are not efficient and not up to the present day standards. Currently such systems are limited and they restrict to provide choices and options for those needs. Whereas in ideal situations the system would includes local transit (bus, streetcar), rapid or express transit (subway, BRT, LRT) with limited access and increased speed, and commuter or regional transit (commuter train, highway express bus) for long distance. Other than the ground transportation systems, water and air transport systems are rarely used in Sri Lanka.

b. The existing road network within cities and in-between cities does not have the adequate carrying capacity for the demands generated. According to Motor Traffic Department, there is a 48.5% of increase of total registered vehicles of cars, three wheelers and motor cycles during the first ten months of the 2011 as compared to the same period last year. The potentials to upgrade the existing roads by means of road widening would not only costs, but also lead to serious socio-cultural and political conflicts.

c. Our social system is such that vehicle owners prefer travelling by their own vehicles rather than taking public transport. They are further discouraged to use public transport again due to its inefficiency, unattractiveness, safety issues (9.1 fatalities per 10,000 vehicles; UNESCAP report Status of Road Safety in Asia, 2006) and non-reliability.

d. The efficient ways of goods and products distribution and transportation will be a prime need with the change of our economies especially with the establishment of industrial zones and production centres in distant locations in the country and other economic activities such as tourism.

e. The connectivity is one of the primary factors that direct the pattern of urbanization. Efficient connectivity will help to control the social and economic polarization and urban agglomeration which is currently seen in Sri Lankan towns as against to living and working in high populated cities as peoples one and only choice.

f. Effective transport leads to improved social development and economic growth while improved mobility has a major positive impact on the poverty. It is seen that many remote hamlets in the southern interiors along the Southern Expressway are now being transformed into significant sub-urban service centres.

However, while the number of registered vehicles in Sri Lanka as a whole grew by an average of 8.2% a year (2001-2005), the average annual increase in the extent of the country's road network remained at only 1.7% in the same period. Sri Lanka's road infrastructure is thus unable to keep up with the increasing traffic volume, which is a major factor behind the chronic traffic congestion on the main trunk roads. Furthermore, in addition to this problem, inadequate operation and maintenance of the existing roads, outdated structural criteria including excessively narrow roads, aging roads and lack of road networks connecting major cities are acting as obstacles to efficient distribution in the country.

1.2 Rationale and Project Objectives

In south western province of the country all economic and social activities are confined to the coastal belt which is served by the highly congested Colombo-Galle-Matara road known as A2. Southern coastal area as a whole experience high traffic congestion in many sections and has limited potential for capacity expansion due to many development projects in the area and limitations on acquisition of land along the coastal road where most of the urban centers are concentrated in a linear pattern. This linear form of transport network deployment has proved inefficient and uneconomical in terms of the provision of infrastructure services and parking facilities resulting in high traffic congestion, high rates of accidents and a prolonged travel time to about 4-5 hours between Matara and Colombo. Therefore, high-capacity expressway connecting the capital city to the southern region has been the need of hour

Hence, the Southern Express Highway, numbered as E-01, connecting country's capital city and the Southern Provincial city, Matara via major cities of Western and Southern Provinces has been proposed as the first highway of the country's proposed highway network system. It aims to integrate the Southern region in to the country's economic mainstream by improving access as well as reducing the travel time to the capital city of Colombo.

The expressway is envisaged as an access-restricted four-lane road. This allows Sri Lankans to travel between Colombo and southern town of Matara in less than two hours, which is less than half of the present travel time along the narrow coastal highway, A2. The project will promote economic growth of the Southern region by improving access to the more developed Western province, especially with Colombo and other important facilities such as international port and airport.

Objectives of the Project

a. Improve transport facilities for future development of Southern region.

b. Produce a sustainable and quantifiable reduction in the country's very high road accident rate.

c. Provide highway to act as a catalyst in encouraging and attracting industries and services for the economic and social development of the region.

d. To promote inter-regional transport facilities by developing this road, considering it as a major component of the proposed expressway network

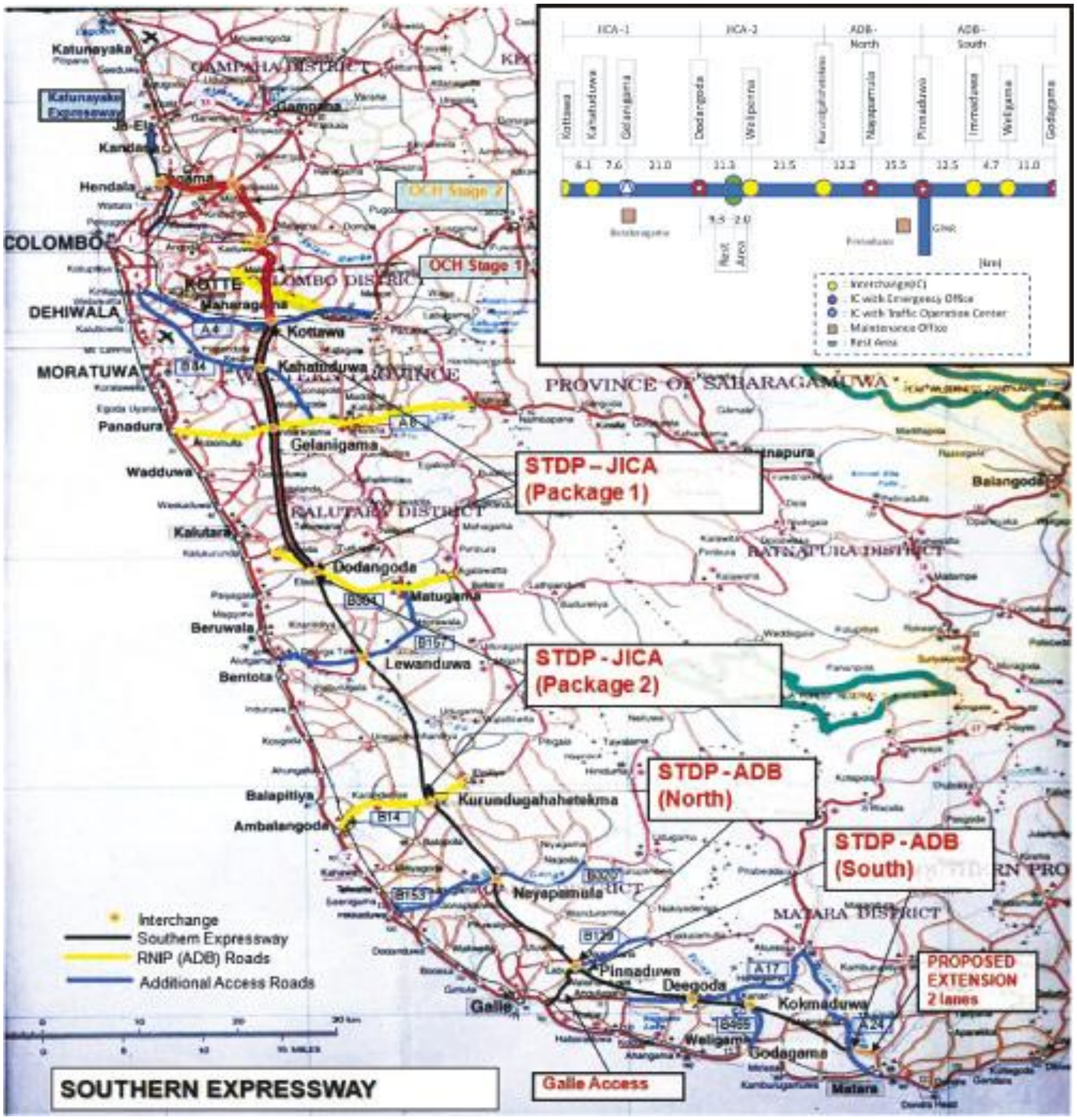

Figure 1: Map of the Southern Expressway

1.3 Design, funding and construction of the Project

The Southern Transport Development is a 125 km long dual carriageway Expressway between Colombo and Matara and financed through foreign and domestic funds. The expressway between Kottawa and Kurundugahahetekma is 65km long and this section is divided into two parts: The JBIC –funded section, 34 Km long Package 1 is from Kottawa to Dodangoda and the Package 2 extends 31Km from Dodangoda to Kurundugahahetekma. From Kurundugahahetekma to Pinnaduwa is mainly funded through ADB (29km). The section from there to Godagama in Matara is to be mainly funded through Chinese EXIM Bank (31km).

The entire project from Kottawa to Matara consists of 11 interchanges located at Kottawa, Kahathuduwa, Galenigama, Dodangoda, Welipenna, Kurundugahahetekma, Nayapamula, Pinnaduwa, Imaduwa, Weligama and Godagama Though certain highway standards such as emergency lane and shoulder widths and distance from the drive lane to the road centre separator are scaled down, mainly to cut down the cost of the project, the Southern Expressway construction generally follows most of the key features seen in other modern international highways.

2. Major Cost components

Being the first limited access highway project in Sri Lanka, the highway authorities have limited experience in the design, construction, management and implementation of limited access highway projects. Some of the locations which have being identified for interchanges are basically very rural areas consisting of jungles or rubber estates which have no urban characteristics. Hence cost estimates for the Project were prepared keeping in view of the need for heavy investment needed to develop such areas for urban activities.

In the following section we have summarized the total economic cost of construction and maintenance for the Project Highway. The economic costs are considered to be 90% of the financial costs and does not involve taxes and tolls. The major cost components involve construction and maintenance costs.

2.1 Construction Cost

The estimated economic cost of construction includes costs of **civil works, Land and Resettlement, Consultancy Services, Project Management, Road Safety Component and Contingencies** and it considered to be 90% of the financial cost based on the BECA study.

2.2 Maintenance Cost

Maintenance costs are based on the feasibility study estimates for routine and periodic maintenance for two-lane roads in Sri Lanka. The costs are assumed to be double for a four-lane road. An overlay, spread over three years, is assumed to be needed after 12 years of operation of the expressway.

Table 1 shows summary of the estimated values for each of the cost components. Present Value (PV) of economic cost of construction for the Project is estimated to be SLRs. 46,646 Million when discounted at a rate of 12% while PV of the total maintenance cost is calculated to be SLRs. 1,095 Million with the same discount rate.

Table 1: Economic cost of Project Highway (SLR Million)

Cost Component	Economic Value	Discounted Economic Value (PV)
Construction	50,204	46,646
Maintenance	5,553	1,095
Total (in Mn)	**55,757**	**47,741**

Source: ADB

3. Analysis of Primary Market

In the analysis we have used road transport sector as the primary market as the Project exerts most significant impact of this sector.

3.1 ‘With’ and ‘Without’ Scenarios

With the Project: The Project envisages to establish 126 km long four-lane, high-capacity, limited access express highway connecting Colombo with Matara through Galle. With the commissioning of the Project a portion of existing A2 traffic would use the project highway taking advantage of higher speeds, shorter duration of travel, lower Vehicle Operating Costs and reduced Road Accident Risks. Hence average travel speed and average distance travelled on A2 would improve ‘with’ the Project, which are depicted below.

Avg. Distance Travelled on A2 (per Vehicle) with Project, in Km	73.2
Avg. Speed on A2 with Project (per Vehicle) in km/hour	32
Avg. Travel Time Spent on A2 with the Project (per Vehicle), in hours	2.29
Avg. Distance Travelled on Project Highway (per Vehicle) in Km	68
Avg. Speed on Project Highway (per Vehicle) in km/hour	100
Avg. Travel Time on Project Highway (per Vehicle), in hours	0.68

Without the Project: Without the Southern Highway Project in place, almost all of the medium and long distance traffic between Colombo and southern regions would be bound to use the existing congested coastal National Highway A2.

Avg. Distance Travelled on A2 without Project (per Vehicle), in Km	75
Avg. Speed on A2 (per Vehicle) in km/hour	30
Avg. Travel Time on A2 (per Vehicle) without Project, in hours	2.49

3.2 Traffic Projections

Traffic growth rate on A2 'without the project' is predicted to increase at an average rate of 7% per annum during the first five years of the project, based on previous surveys and anticipated growth rate of economy etc. After the first five years ending at 2017, the traffic growth rate would start reducing due to severe capacity constraints on A2 and resultant higher accident risks and travel time. Hence in the ensuing five years, traffic would grow at a rate of 5%, beyond which the rate would further decline to 3% and 2% respectively.

With the Project, there would be significant traffic diversion from capacity-limited and congested A2 to the Project highway due to an overall perception of the higher speed and safer travel on the four-lane access-restricted standard highway. Estimates of traffic diversion are derived using the traffic-routing model which simulates routing decisions of road users for different Origin-Destination pairs based on the defined road characteristics and estimates of vehicle speeds and VOCs. Estimations derived by ADB in this regard is used for our analysis. It is assumed that once the project is commissioned, the remaining traffic on A2 (after diversion) would grow at an average rate of 4% per annum over the entire duration of the Project life-span.

The Project Highway would cater to the traffic diverted from A2 as well as an additional generated traffic. It is assumed that the additional that additional traffic generation would be directly proportional to the transport cost savings (assuming a price elasticity of 'one') which is roughly equivalent to 20%.

Anticipated average annual traffic flow on Project Highway (a result of Traffic diversion from A2 and additional generated traffic) and on A2 in both 'without' and 'with Project' scenarios are projected in the table below.

Table 2: Average Annual Traffic Flow

Year	A2 without the Project	A2 with the Project	Project Highway
2013	186,16,277	150,05,422	70,25,010
2014	197,33,254	154,55,585	75,87,011
2015	209,17,249	159,19,252	81,93,972
2016	221,72,284	163,96,830	88,49,490
2017	230,59,175	168,88,735	95,57,449
2018	239,81,542	173,95,397	103,22,045
2019	249,40,804	179,17,258	109,92,978
2020	259,38,436	184,54,776	117,07,521
2021	269,75,974	190,08,420	124,68,510
2022	275,15,493	195,78,672	132,78,963
2023	280,65,803	201,66,032	141,42,096
2024	286,27,119	207,71,013	148,49,201
2025	291,99,661	213,94,144	155,91,661
2026	297,83,655	220,35,968	163,71,244
2027	300,81,491	226,97,047	171,89,806
2028	303,82,306	233,77,958	178,77,398
2029	306,86,129	240,79,297	185,92,494

2030	309,92,990	248,01,676	193,36,194
2031	313,02,920	255,45,726	201,09,642
2032	316,15,950	263,12,098	209,14,027
	5345,88,514	**4032,01,306**	**2749,56,712**

3.3 Benefit Analysis for Primary Market

Following three major benefit components are identified with respect to the primary market, for calculating total benefits due to the project. ‘Total benefits due to the Project’ or ‘Total Benefits with the Project’ imply the sum of ‘Benefits accrued on the Project Highway’ and ‘Benefits on A2 with the Project’. The benefits are projected over the 20 year life span of the project starting from (and including) 2013 to 2032 and discounted with a Social Discounting Rate of 12%.

3.3.1 Passenger Travel Time Savings

Travel time between Colombo and Matara reduced from 4-5 hours to 1.5-2 hours by utilizing the project highway. Therefore, the most significant benefit to passengers of the highway will be the value of their time saving. A study conducted by Beca International Consultant Ltd for Road Development Authority calculated the value of travel time for different vehicle types in Sri Lanka.

It has been found that ‘weighted average value of an hour of travel time for any vehicle’ is 424 SLR. We used this value to derive Travel Time Savings for both Project Highway and A2.

‘Total Travel Time Saving’ is calculated as the sum of Travel Time Saving on the Project Highway and Travel Time Saving on A2 with the Project.

Saving in Travel Time Costs for the Project Highway is calculated as:

*‘Avg. Hours Saved on Project Highway per Vehicle * Avg. Value of an Hour of Travel Time * Avg. Annual Traffic on Project Highway.*

Average Hours Saved on Project Highway per Vehicle is calculated as the difference between 'Avg. Travel Time Spent on A2 per Vehicle without the Project' and 'Avg. Travel Time Spent on Project Highway per Vehicle', the values of which have been depicted in a previous section.

With the introduction of the Project Highway, there would be savings in the travel time cost on A2, as a result of diversion of certain percentage of medium to long distance traffic, from A2 to the Highway.

Savings in Travel Time Cost on A2 is calculated as:

Travel Time Cost on A2 'without' the Project – Travel Time Cost on A2 'with' the Project; where

Travel Time Cost on A2 without the Project =
'Avg. Travel Time Spent on A2 per Vehicle without the Project * Avg. Value of an Hour of Travel Time * Avg. Annual Traffic on A2 without the Project'; and

Travel Time Cost on A2 with the Project =
'Avg. Travel Time Spent on A2 per vehicle with the Project * Avg. Value of an Hour of Travel Time * Avg. Annual Traffic on A2 with the Project'

Table 3: Travel Time Savings (SLR)

Year	Travel Time Savings for Project Highway	Travel Time Savings for A2
2013	34199,42,155	32247,78,297
2014	32978,01,363	32997,68,123
2015	31800,22,743	33508,32,492
2016	30664,50,502	33808,52,886
2017	29569,34,413	32035,94,095
2018	28513,29,613	30338,35,251

2019	27113,08,962	28714,55,398
2020	25781,64,325	27163,08,892
2021	24515,58,042	25682,29,841
2022	23311,69,031	22966,72,442
2023	22166,91,980	20527,56,422
2024	20781,48,731	18337,40,973
2025	19482,64,436	16371,51,927
2026	18264,97,908	14607,56,185
2027	17123,41,789	12617,03,155
2028	15900,31,661	10866,66,701
2029	14764,57,971	9329,29,118
2030	13709,96,688	7980,68,463
2031	12730,68,353	6799,27,186
2032	11821,34,899	5765,84,035
Total	**455193,15,565**	**422666,11,884**

3.3.2 Vehicle Operating Cost Savings

Two road types were considered by RDA for identifying VOCs:

a. existing rural sections with a width of 6.7 meters having no shoulders and 0.65 side friction.

b. four –lane Project highway with two 2m shoulders and 1.0 side friction.

For each road type indicated above, VOC estimates were prepared for three types of vehicles for different range of relevant traffic levels. VOC values thus identified by the RDA is used for calculating vehicle operating cost savings for both Project Highway and A2.

Table 4: Economic Vehicle Operating Costs - A2

	Volume of Traffic (vehicles per day)							
From - To	0 – 11,000	11,000– 17,000	17,000– 23,000	23,000– 29,000	29,000 - 35,000	35,000 – 41,000	41,000- 47,000	47,000 – above
Vehicle type	**Vehicle Operating Cost (SLRs/km/Vehicle)**							
Car	15.02	15.27	15.51	16.03	16.87	17.29	20.60	21.13
Bus	27.77	28.77	29.43	30.59	32.92	33.92	41.74	42.40
Trucks	33.51	33.78	33.87	34.40	35.58	36.93	40.68	41.48

Source: Road Development Authority. Road Master Plan 2007, Colombo

Table 5: Economic Vehicle Operating Costs-Highway 4 lanes

	Volume of Traffic (vehicles per day)				
From – To	0 – 11,000	11,000 – 17,000	17,000 – 23,000	23,000 – 29,000	29,000 -- above
Vehicle	**VOC (SLR/Km/Vehicle)**				
Car	13.20	13.28	13.45	13.53	13.70
Bus	22.78	23.11	23.44	23.78	24.44
Truck	33.14	33.18	33.17	33.18	33.20

Source: Road Development Authority, Road Master Plan 2007, Colombo

With the commissioning of the Project a portion of the existing traffic on A2 would be diverted on to the Project and would result in decongestion on A2. Decongestion on the road would lead to constant speed of vehicle which would translate into lesser VOC for those vehicles still plying on A2 after the Project is commissioned.

VOC Savings for both the Project Highway as well as for A2 with the Project are calculated and summed up to identify Total Savings in VOC due to the Project.

VOC Saving on Project Highway is captured as:

*VOC Saving per Vehicle per km on Project Highway * Avg. Distance Travelled (in km) per Vehicle on Project Highway* Avg. Annual Traffic on the Highway;* where

VOC Saving per Vehicle per km on Project Highway = VOC per Vehicle per km on A2 - VOC per Vehicle per km on Project Highway.

VOC Saving for A2 is captured as:
VOC on A2 without Project – VOC on A2 with Project; where

VOC on A2 without Project
= VOC per Vehicle per km on A2 without the Project * Avg. Distance Travelled per Vehicle on A2 without the Project* Avg. Annual Traffic on A2 without the Project; and

VOC on A2 with the Project
= VOC per Vehicle per km on A2 with the Project * Avg. Distance Travelled (in km) per Vehicle on A2 with the Project* Avg. Annual Traffic on the A2 with the Project.

Vehicle Operating Cost (per vehicle per km) on A2 for ‘without’ and ‘with Project’ scenarios would be different due to difference in applicable traffic densities.

Table 6: VOC Savings (SLR)

Year	VOC Savings for Project Highway	VOC Savings for A2
2013	29724,24,520	68571,39,772
2014	28662,66,502	71329,97,205
2015	27638,99,841	73423,90,509
2016	26651,89,132	74930,33,606
2017	25700,03,806	71245,74,363
2018	24782,17,956	67690,33,486
2019	23565,19,753	64265,65,031
2020	22407,97,801	60972,25,525
2021	21307,58,623	57809,87,880
2022	20261,23,155	51551,34,661
2023	19266,26,036	45939,75,857
2024	18062,11,908	40910,26,859
2025	16933,23,664	36404,38,962
2026	15874,90,935	31014,62,224
2027	14882,72,752	26501,21,522
2028	13819,67,555	22548,99,954
2029	12832,55,587	19093,38,326
2030	11915,94,474	16076,87,966
2031	11064,80,583	13448,34,824
2032	10274,46,255	11162,31,518
Total	**395628,70,838**	**924891,00,051**

3.3.3 Road Accident Cost Savings

Values for accident rates and their costs on A2 before the Project are taken from the national statistics conducted by the Planning Division of Road Development Authority. For A2, it is assumed that the rate of accidents would continue at the current rates while for the Project Highway it is deemed that the accident rates would reduce by 50% due to restricted access to the four-lane highway. This would seem reasonable as nearly 80% of the existing accidents on the national highway A2 involve pedestrians and two-wheelers and these categories would be denied access to the Project highway.

Table 7: Accident Rates for A2 and Project

(per million vehicle kilometer)

Accident type	**Accident rates**	
	RDA estimated for A2	ADB estimated for the Project
Fatal	0.360	0.180
Serious	0.835	0.418
Minor	2.417	1.209
Damage only	3.646	1.823

Source: Road Development Authority & ADB

Table 8: Accident Costs (SLR)

Accident type	**Compensation/Accident**
Fatal	19, 88,709
Serious	10,72,064
Minor	1,55,715
Damage only	1,36,011

Source: ADB

Similar to the calculations in previous two benefit categories, **Accident Cost Savings due to the Project is calculated as the sum of Accident Cost Savings on Project Highway and Accident Cost Savings on A2 with the Project**.

Accident Cost Savings on Project Highway is arrived at using the formula:

*'Improvement in Accident Rates for the Project Highway (in Million Vehicle Km) * Weighted Avg. of the Compensation Values * Avg. Annual Traffic Flow on Project Highway (in Million Vehicle Km)'.*

Though accident rates on A2 is considered to remain the same before and after the Project there would still be savings in accident cost on A2 after the Project, due to reduction in traffic flow on A2 with the deployment of the Project.

Accident Cost Savings on A2 is arrived at using the formula:
*Accident Cost on A2 without the Project – Accident Cost on A2 with the Project***;** where

Accident Cost on A2 without the Project =

Accident Rates for A2 (in Million Vehicle Km) * Weighted Avg. of the Compensation Values * Avg. Annual Traffic Flow on A2 without the Project (in Million Vehicle Km).

Similarly 'Accident Cost on A2 with the Project' was calculated using Average Annual Traffic Flow on A2 with the Project.

Table 9: Accident Cost Savings (SLR)

Year	VOC Savings for Project Highway	VOC Savings for A2
2013	3771,46,014	4582,80,927
2014	3636,76,513	4801,63,672
2015	3506,88,066	4971,42,863
2016	3381,63,493	5097,81,024
2017	3260,86,225	4854,06,468
2018	3144,40,288	4618,05,583

2019	2989,99,024	4390,00,841
2020	2843,16,036	4170,06,863
2021	2703,54,088	3958,31,481
2022	2570,77,771	3525,70,503
2023	2444,53,417	3138,08,451
2024	2291,75,078	2790,92,500
2025	2148,51,636	2480,14,367
2026	2014,23,408	2202,06,000
2027	1888,34,445	1881,60,493
2028	1753,46,271	1600,99,483
2029	1628,21,537	1355,64,364
2030	1511,91,427	1141,46,977
2031	1403,92,040	954,84,219
2032	1303,64,037	792,53,223
Total	**50198,00,815**	**63308,20,302**

3.4 Estimation of NPV and BCR:

Costs spent on the Project are spread over a period of 24 years which encompasses a four year construction period from 2009 till 2012 and a project life-span of 20 years starting from 2013 to 2032 during which the maintenance costs are incurred. Benefits from the Project, estimated as outlined in the previous sections, are accrued since commissioning of the Project in 2013 till 2032, for a period of 20 years, which is the life-span of the Project. Economic benefit and cost streams were then discounted at a Social Discount Rate of 12% to arrive at Net Present Value (NPV) of Benefits as shown in Table 11 below. A residual value of 25% of the construction cost is assumed in year 2032 while identifying the NPV. Further, Benefit Cost Ratio (BCR) of the Project was calculated by diving the total discounted benefits (Present Value of benefits) with total discounted costs.

3.5 Calculation of Economical Internal Rate of Return (EIRR):

Economic Internal Rate of Return (EIRR) is the value of interest rate applying which total discounted economic benefits over the analysis period becomes equal to the total cost streams. By deploying trial and error method the EIRR is derived as 15%. Final values of NPV, BCR and EIRR are depicted in the table below.

Table 10: NPV (SLR), BCR and EIRR

PV of Total Cost	**(477410,62,032)**
PV of Total Benefits	**2321146,32,087**
Net PV of Total Project Benefits	**1843735,70,055**
EIRR	**15%**
BCR of the Project	**4.86**

Table 11: PV of Costs and Benefits

Year	Cost After Discounting		Benefits After Discounting			NPV of Benefits
	Construction Cost	Maintenance Cost	Total Travel Time Savings	Total VOC Savings	Total Accident Cost Savings	
2009	(212200,00,000)					(212200,00,000)
2010	(127190,00,000)					(127190,00,000)
2011	(105500,63,776)					(105500,63,776)
2012	(21574,05,931)	(199,29,847)				(21773,35,778)
2013		(235,14,169)	66447,20,452	98295,64,293	8354,26,941	172861,97,516
2014		(209,94,794)	65975,69,487	99992,63,707	8438,40,185	174196,78,585
2015		(187,45,351)	65308,55,235	101062,90,350	8478,30,929	174662,31,163
2016		(167,36,921)	64473,03,389	101582,22,738	8479,44,516	174367,33,722
2017		(149,43,679)	61605,28,509	96945,78,169	8114,92,693	166516,55,692
2018		(133,42,571)	58851,64,864	92472,51,442	7762,45,871	158953,19,606
2019		(119,13,010)	55827,64,360	87830,84,784	7379,99,865	150919,36,000
2020		(106,36,616)	52944,73,218	83380,23,326	7013,22,899	143231,82,827
2021		(94,96,978)	50197,87,883	79117,46,503	6661,85,570	135882,22,977
2022		(84,79,445)	46278,41,472	71812,57,816	6096,48,274	124102,68,117
2023		(3339,39,534)	42694,48,402	65206,01,892	5582,61,867	110143,72,627
2024		(2981,60,298)	39118,89,704	58972,38,768	5082,67,578	100192,35,752
2025		(2662,14,552)	35854,16,363	53337,62,626	4628,66,003	91158,30,440
2026		(53,88,841)	32872,54,094	46889,53,159	4216,29,408	83924,47,821
2027		(48,11,465)	29740,44,944	41383,94,274	3769,94,938	74846,22,691
2028		(42,95,951)	26766,98,362	36368,67,509	3354,45,754	66447,15,674
2029		(38,35,670)	24093,87,089	31925,93,913	2983,85,901	58965,31,233
2030		(34,24,706)	21690,65,150	27992,82,439	2653,38,404	52302,61,288
2031		(30,57,773)	19529,95,539	24513,15,407	2358,76,258	46371,29,431
2032	9261,12,632	(27,30,154)	17587,18,934	21436,77,773	2096,17,260	50353,96,445
Total	**(466464,69,707)**	**(10945,92,325)**	**877859,27,449**	**1320519,70,889**	**113506,21,117**	**1843735,70,055**

3.6 Estimation of Social Cost:

Social Costs are computed for the entire life-span of the Project. Social Costs 'with' and 'without' the Project are calculated separately as the sum of 'User Costs (excluding Taxes and Tolls)' and 'External Costs' under respective scenarios. User Costs incorporate 'Travel Time Costs' and 'Vehicle Operating Costs' while External Costs include 'Accident Costs'.

Social Cost without the Project = Social Cost on A2 without the Project

Social Cost with the Project = Social Cost on Highway + Social Cost on A2 with the Project

Table 12: Social Cost on A2 without the Project (SLR)

Year	Travel Time Cost	VOC	Accident Cost	Total Social Cost on A2 without Project
2013	124739,55,066	308700,96,817	21917,98,592	455358,50,475
2014	118057,07,473	292163,41,630	20743,80,811	430964,29,914
2015	111732,58,858	276511,80,471	19632,53,267	407876,92,597
2016	105746,91,419	261698,67,232	18580,78,985	386026,37,636
2017	98193,56,318	243005,91,001	17253,59,058	358453,06,376
2018	91179,73,724	225648,34,501	16021,19,125	332849,27,350
2019	84666,89,886	209530,60,608	14876,82,045	309074,32,539
2020	78619,26,323	194564,13,422	13814,19,041	286997,58,786
2021	73003,60,157	180666,69,606	12827,46,253	266497,76,016
2022	66485,42,286	164535,74,105	11682,15,337	242703,31,729
2023	60549,22,439	149845,04,989	10639,10,396	221033,37,824
2024	55143,04,364	136466,02,758	9689,18,397	201298,25,519
2025	50219,55,760	124281,56,083	8824,07,826	183325,19,669
2026	45735,66,853	113184,99,290	8036,21,413	166956,87,555
2027	41243,77,251	102068,60,967	7246,94,310	150559,32,528
2028	37193,04,486	92044,01,407	6535,18,976	135772,24,869

2029	33540,15,652	83003,97,698	5893,34,076	122437,47,426
2030	30246,03,401	74851,80,067	5314,53,051	110412,36,518
2031	27275,44,138	67500,28,453	4792,56,769	99568,29,360
2032	24596,60,339	60870,79,230	4321,86,908	89789,26,477
Total	**1358167,16,193**	**3361143,40,333**	**238643,54,635**	**4957954,11,161**

Table 13: Social Cost on A2 with the Project (SLR)

Year	Travel Time Cost	VOC	Accident Cost	Total Social Cost on A2 with Project
2013	92491,76,769	240129,57,044	17335,17,665	349956,51,478
2014	85059,39,350	220833,44,425	15942,17,139	321835,00,913
2015	78224,26,366	203087,89,962	14661,10,404	295973,26,733
2016	71938,38,533	186768,33,626	13482,97,961	272189,70,120
2017	66157,62,222	171760,16,638	12399,52,589	250317,31,450
2018	60841,38,472	157958,01,015	11403,13,542	230202,53,030
2019	55952,34,488	145264,95,577	10486,81,204	211704,11,268
2020	51456,17,431	133591,87,896	9644,12,178	194692,17,506
2021	47321,30,316	122856,81,726	8869,14,771	179047,26,813
2022	43518,69,844	112984,39,445	8156,44,834	164659,54,123
2023	40021,66,017	103905,29,132	7501,01,946	151427,97,095
2024	36805,63,391	95555,75,898	6898,25,897	139259,65,186
2025	33848,03,833	87877,17,121	6343,93,458	128069,14,412
2026	31128,10,668	82170,37,066	5834,15,413	119132,63,146
2027	28626,74,096	75567,39,444	5365,33,817	109559,47,358
2028	26326,37,785	69495,01,453	4934,19,492	100755,58,731
2029	24210,86,534	63910,59,372	4537,69,712	92659,15,618
2030	22265,34,938	58774,92,101	4173,06,074	85213,33,113
2031	20476,16,952	54051,93,629	3837,72,550	78365,83,131
2032	18830,76,304	49708,47,712	3529,33,685	72068,57,701
Total	**935501,04,309**	**2436252,40,282**	**175335,34,333**	**3547088,78,925**

Table 14: Social Cost on Project Highway (SLR)

Year	Travel Time Cost for Project Highway	VOC for Project Highway	Accident Cost for the Project	Total Social Cost for the Project
2013	12872,10,700	65872,40,041	3771,46,014	82515,96,755
2014	12412,38,890	63519,81,468	3636,76,513	79568,96,871
2015	11969,08,929	61251,24,987	3506,88,066	76727,21,983
2016	11541,62,182	59063,70,523	3381,63,493	73986,96,198
2017	11129,42,104	56954,28,719	3260,86,225	71344,57,048
2018	10731,94,172	54920,20,550	3144,40,288	68796,55,010
2019	10204,92,672	52223,23,113	2989,99,024	65418,14,809
2020	9703,79,193	49658,69,746	2843,16,036	62205,64,975
2021	9227,26,643	47220,10,071	2703,54,088	59150,90,802
2022	8774,14,174	44901,25,647	2570,77,771	56246,17,593
2023	8343,26,871	42696,28,406	2444,53,417	53484,08,693
2024	7821,81,441	40027,76,630	2291,75,078	50141,33,150
2025	7332,95,101	37526,03,091	2148,51,636	47007,49,828
2026	6874,64,157	35180,65,398	2014,23,408	44069,52,964
2027	6444,97,648	32981,86,311	1888,34,445	41315,18,403
2028	5984,62,101	30626,01,574	1753,46,271	38364,09,946
2029	5557,14,808	28438,44,319	1628,21,537	35623,80,664
2030	5160,20,893	26407,12,582	1511,91,427	33079,24,902
2031	4791,62,258	24520,90,254	1403,92,040	30716,44,552
2032	4449,36,383	22769,40,951	1303,64,037	28522,41,370
Total	**171327,31,320**	**876759,44,381**	**50198,00,815**	**1098284,76,516**

Table 15: Social Cost (Mn SLR)

Cost Components	Values in Million SLR	
	With the Project (Cost on Project Highway + Cost on A2 with the Project)	**Without the Project** (Cost on A2 without the Project)
A. User Costs (excluding taxes & tolls) = 1+2	**4,41,984**	**4,71,931**
1. **Travel Time Costs**	1,10,683	1,35,817
2. **Vehicle Operating Costs**	3,31,301	3,36,114
B. External Costs	**22,553**	**23,864**
1. **Accident Costs**	22,553	23,864
Social Cost = (A+B)	**4,64,537**	**4,95,795**

3.7 Estimation of Change in Social Surplus:

Change in Social Surplus is the difference between change in Gross Consumer Surplus and change in Social Cost.

ΔSocial Surplus = ΔGross Consumer Surplus - ΔSocial Cost.

Change in Social Cost was estimated from Table 15, while Change in Gross Consumner Surplus was derived as the area of the Trapezoid 'ABCD' shown in the figure below. Gross Consumer Surplus denotes the total amount of WTP (Willingness to Pay) by the consumers. For calculating change in Gross Consumer Surplus due to the Project , the following steps were pursued:

a. 'Generalised Cost per Vehicle' for 'with' and 'without' Project scenarios were estimated as, **Generalised Cost = User Costs (sum of Travel time Cost and VOC) + Toll Charges**. Hence, Generalised Cost per Vehicle with the Project = User Cost per Vehicle on A2 with Project + User Cost/Vehicle on Project Highway + Toll Charges on Project Highway. Toll Charges on Project Highway was estimated at a Toll Rate of 4 SLR per km per vehicle.

   On similar lines, Generalised Cost per Vehicle without the Project = User Cost per Vehicle on A2 without the Project

b. Those values were summed up

c. 'Total Traffic' (over the entire life-span of Project) for 'with' and 'without' Project scenarios were identified.

d. Change in Total Traffic was calculated.

e. Finally Change in Gross Consumer Surplus was calculated as

   ΔGross Consumer Surplus = 0.5 * Result of step b * Result of step d, which is equal to the area of the trapezoid 'ABCD' shown below.

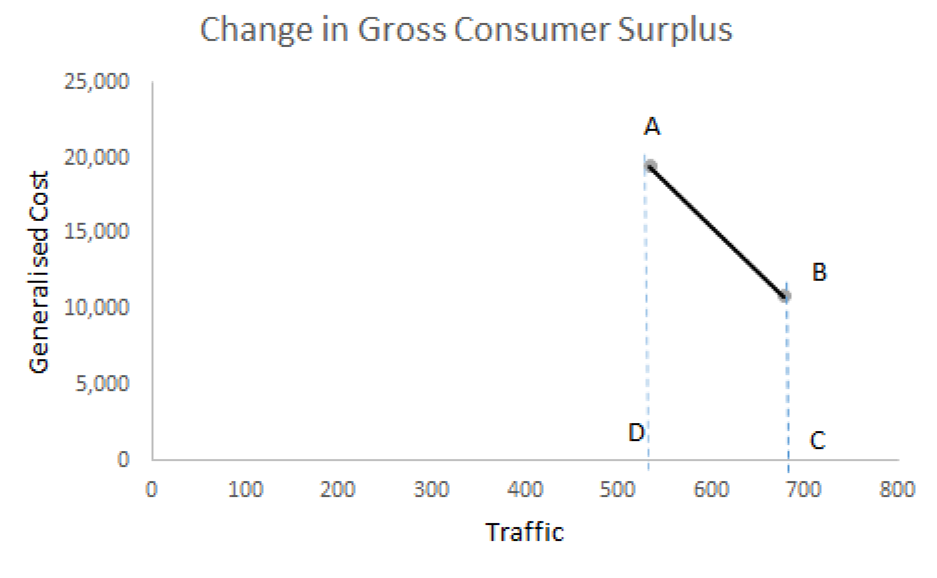

Table 16: Calculation of Social Cost

Indicator	Value
A. Total Traffic 'without' the project in Mn Vehicles	535
B. Total Traffic 'with' the project in Mn Vehicles	678
C. Change in Total Traffic in Mn Vehicles (= B-A)	144
D. Generalized Cost (per vehicle) 'without' the Project in SLR	19,478
E. Generalized Cost (per vehicle) 'with' the Project in SLR	10,823
F. Sum of Generalized Costs (=D+E)	30,301
G. Change in Gross Consumer Surplus in Mn SLR (=0.5*F*C)	**21,75,178**
H. Change in Social Cost in Mn SLR (= Social Cost without the Project –	31,258

Social Cost with the Project)	
Change in Social Surplus in Mn SLR (= G-H)	**21,43,920**

4. Analysis of Impacts on Secondary Markets

4.1 Labor Market

The Project will bring long term solutions to unemployment among the youth and females in the southern region by providing access to education and increasing access to employment in nearby urban centers. An expansion of formal sector employment can be expected with the Project as a result of heightened activity in sectors such as tourism, manufacturing and construction due to faster and better connectivity with other domestic provinces, airports and Hambantota international port.

Existing unemployment is partly due to low paid and low skill jobs in the agriculture and plantation sector. If more attractive formal sector jobs become available in the area, it can be expected that more women and youth will wish to take the advantage. Specially, women in Sri Lanka enjoy relatively better status than women in many other developing countries with respect to educational attainment, but are yet to achieve economic equality. It is expected that the Project would have certain positive impact in reducing this inequality by creating an array of low-skilled and semi-skilled employment opportunities across Southern Region.

The projections from the development impact study suggest that with the Project, 92,000 more people will be employed in the Southern Province alone in 2013 than without the Project and unemployment will have fallen to 5.8% of the labor force with 11.3% without the Project. Further, it is anticipated that the annual employment growth rate in the Southern Region during the Project life-span of 20 years would be 1% higher than 'without' the project. Since we assume that there are no changes or distortion in the minimum wage rate applicable, any surplus obtained in the labor market is subsumed in the primary market.

4.2 Tourism Industry

The coastal tourism industry in the south, accounting for the significant portion of the total foreign tourism due to scenic views of natural beaches, stands to benefit considerably from shorter journey time from Colombo to coastal resorts. Inflow of foreign tourists would increase exponentially, as would domestic short stay tourism. However, due to limitations of data availability on the quantitative impact of the tourism industry monetization of benefits or surplus change was impossible.

5. Summary and Conclusion

The Project Highway is designed to meet the existing unmet demand as well as to cater to the exponentially growing potential future demand for medium and long-distance travel across Southern Region of the country as well as between the region and the capital city. The introduction of the Project would decrease prevalent accident rates at least by half, save a minimum of 20% VOC and reduce the travel time between the regions by 1.8 hours on an average. These savings are materialized from restricted access, improved capacity resulting from four-lanes, enhanced road-safety amenities deployed on highway etc. The performance of existing road networks, especially of A2, would also improve substantially with the Project as a result of traffic diversion from them to the Project highway.

Benefits are determined using conservative assumptions so as to reduce optimum bias. The cost estimates as prepared by various funding partners take into account the novel nature of the Project in Sri Lanka and include various contingency costs. A life span of 20 years for the Project as well as a residual value of 25% of the construction cost are assumed on the lines of similar international practices. From our Cost Benefit Analysis of the Project, we could draw the conclusion that the project is economically viable, given a 'positive' NPV, 'greater than one (>1)' BCR and an EIRR higher than the Social Discount Rate (SDR). Both EIRR and SDR are higher than the bond rate of government of Sri Lanka.

Table 17: Economic Viability of Project: A Summary

Social Discount Rate	**12%**
Project Life Span	**20 years**
PV of Construction Cost (Mn SLR)	**(46,646)**
PV of Maintenance Cost	**(1095)**
PV of Total Cost (Mn SLR)	**(47741)**
Primary Market Analysis	
PV of Total Benefits	**2321146,32,087**
Net PV of Total Project Benefits	**1843735,70,055**
BCR of the Project	**4.86**
EIRR	**15.2%**
Change in Social Cost	**31,258**
Change in Gross Consumer Surplus	**21,75,178**
Change in Social Surplus	**21,43920**

6. References

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5. *The Toll on Southern Highway*, Sunday Times, 8th November 2009.