ASIAN DEVELOPMENT BANK **PPA: SRI 19190**

PROJECT PERFORMANCE AUDIT REPORT

ON THE

SECOND ROAD IMPROVEMENT PROJECT
(Loan 864-SRI[SF])

IN

SRI LANKA

June 2000

CURRENCY EQUIVALENTS

Currency Unit – Sri Lanka Rupee/s (SLRe/SLRs)

At Appraisal (September 1987)			At Project Completion (December 1996)	At Operations Evaluation (November 1999)
SLRe1.00	=	$0.0332	$0.0182	$0.0139
$1.00	=	SLRs30.17	SLRs54.84	SLRs71.95

ABBREVIATIONS

ADB	–	Asian Development Bank
EIRR	–	economic internal rate of return
IRI	–	international roughness index
km	–	kilometer
OEM	–	Operations Evaluation Mission
PCR	–	project completion report
RCDC	–	Road Construction and Development Corporation
RDA	–	Road Development Authority
SDR	–	special drawing rights
TA	–	technical assistance
VOC	–	vehicle operating cost

NOTES

(i) The fiscal year (FY) of the Government ends on 31 December.
(ii) In this report, "$" refers to US dollars.

Operations Evaluation Office, PE-545

CONTENTS

Page

BASIC DATA
Second Road Improvement Project (Loan 864-SRI[SF])

PROJECT PREPARATION/INSTITUTION BUILDING

TA No.	TA Project Name	Type	Person-Months	Amount	Approval Date
792	Second Road Improvement	PP	31	350,000	27 Aug 1986
922	Third Road Improvement	PP	18	150,000	24 Nov 1987

KEY PROJECT DATA ($ million)	As per ADB Loan Documents	Actual
Total Project Cost	45.65	56.15
Foreign Exchange Cost	30.05	35.22
Local Currency Cost	15.60	20.93
ADB Loan Amount/Utilization	36.50[1]	40.59 [1]
ADB Loan Amount/Cancellation		nil

KEY DATES	Expected	Actual
Appraisal		16-31 Jul 1987
Loan Negotiations		19-21 Oct 1987
Board Approval		24 Nov 1987
Loan Agreement		11 Feb 1988
Loan Effectiveness	22 Feb 1988	8 Apr 1988
Project Completion	30 Jun 1991	31 Mar 1996
Loan Closing	31 Dec 1991	29 Nov 1996
Months (effectiveness to completion)	40	96

KEY PERFORMANCE INDICATORS (%)

	Appraisal	PCR	PPAR
Economic Internal Rate of Return	22.5	20.3	17.1
Avissawella-Ratnapura	—	—	16.2
Avissawella-Hatton	—	—	12.9
Homagama-Avissawella	—	—	17.6
Avissawella-Nuwara Eliya	22.5	—	—
Belangoda-Bandarawela	16.4	—	—
Homagama-Belangoda	27.3	—	—
Welimada-Badulla	19.8	—	—
Wellawaya-Monaregala	16.2	—	—
Financial Internal Rate of Return	—	—	—

BORROWER Democratic Socialist Republic of Sri Lanka

EXECUTING AGENCY Road Development Authority

MISSION DATA
Type of Mission

	Missions (no.)	Person-Days (no.)
Appraisal	1	13

— = not calculated, ADB = Asian Development Bank, PCR = project completion report, PPAR = project performance audit report, TA = technical assistance.

[1] The loan amount was the equivalent of SDR28.34 million and was fully disbursed at the time of loan closing.

Project Administration		
Review	15	109
Special Loan Administration	2	6
Project Completion	1	15
Operations Evaluation	1	22

EXECUTIVE SUMMARY

Maintenance—The Road to Success

The Project was to contribute to the Government's efforts to improve the main national road network, and thus facilitate economic development. To achieve this, the Project aimed to (i) improve 390 kilometers (km) of roads and bridges to a level where they would be economically maintainable and provide reliable transport at reduced cost, and (ii) increase the efficiency and quality of road maintenance. The latter involved developing the local road maintenance contracting industry, providing equipment, and institutionalizing maintenance training. The inputs comprised civil works, construction supervision consultants, maintenance equipment, training consultants, training aids, and overseas fellowships. Consultants were provided to prepare a possible follow-on project. The appraised cost of the Project was $45.65 million, and on 24 November 1987, the Asian Development Bank (ADB) approved a loan of SDR28.34 million, then equivalent to $36.5 million. The Executing Agency was the Road Development Authority (RDA).

The Project was greatly affected by problems associated with the tendering and award of contracts for the roadworks, and by changes in Government policy for road maintenance. The former problems comprised delays resulting from the Government's wish to award one contract to a nonprequalified Government-owned corporation, administrative delays, and lack of interest and high bid prices by contractors because of prior civil unrest in the project area. These problems resulted in cancellation of the first round of bidding, a substantial increase in unit construction costs and a consequent reduction in the roadworks to 147 km, and a 3-year delay in the start of construction. Government policy for road maintenance was changed in favor of having all road maintenance done by its own road construction corporation, thereby excluding small contractors and rendering most of the maintenance improvement components redundant.

Further delays occurred during road construction because of (i) the contractor's management, and (ii) local residents' objections to quarry operations; these were subsequently resolved. The 147 km of roadworks were completed and the quality of the construction was found to be satisfactory. The maintenance training program was abandoned soon after establishment, and the maintenance equipment was placed in the general pool of equipment used by the Government-owned construction corporation. Some consultant inputs were reallocated from maintenance training to improving RDA's contract management, and not all of the overseas training was utilized. Despite delays due to civil unrest and some initial errors in details of the design, a follow-on project was prepared by consultants as planned. The Project was deemed complete in early 1996 with a delay of over 4.5 years. The total project cost was $56.15 million; the loan, equivalent to $40.59 million, was fully disbursed. The unit costs for the roadworks were 156 percent higher than expected due to price escalation during the delay period; some increase in quantities of materials; increased taxes; and most significantly, premiums applied by the contractor, presumably to cover the risk of renewed civil disturbances in the area.

The Project was successful in improving the riding quality of 147 km of roads; this led to reductions in vehicle operating costs of around 25 percent and travel times of about 20 percent. Compared with before the Project, transport companies are able to keep to schedules better and make better use of their existing fleets in providing additional trips along both the project roads and other roads. Transport is more reliable. The impact of these improvements on the general economy of the area could not be determined due to the lack of data. However, traffic volume on the project roads has increased more rapidly than expected at appraisal. At the time of operations evaluation, the improved roads had been in service for 3-5 years and the improvements in travel time, reliability, and cost were still apparent. Nevertheless, little expenditure has been made on maintaining the road surface, and cracks and other defects are beginning to appear. The roads are in a precarious position; if maintenance efforts are not increased, it is probable that rapid deterioration and loss of benefits will soon occur.

The success with the road improvements was not repeated for the maintenance components because of the change in Government policy and abandonment of the maintenance training. The equipment was used, but overall comprised a small proportion of the total equipment of the Government-owned corporation. Neither the equipment nor the limited training addressed key weaknesses in this corporation. Maintenance was not improved by the Project.

Overall, the Project was rated as partly successful. The roadworks can yield substantial benefits as indicated by the reestimated economic internal rate of return (EIRR) of 17.1 percent if maintenance improves and 7 percent if it does not. At appraisal, an EIRR of 22.5 percent was expected, but this was for a larger project scope. The overall rating also takes into consideration the failure of the maintenance component, and the substantial reduction in scope and delays experienced during implementation. There were no major environmental or social issues involving the Project.

Inadequate maintenance remains an issue for roads in Sri Lanka as indicated by the uncertainty about the sustainability of the project roads. The key constraints are insufficient budget allocation and a lack of objective decision making in allocating the road maintenance budget at the national level, capacity constraints within the Government-owned corporation, and insufficient continuity of work to enable the development of private contractors. To improve maintenance, the Government will need to adopt appropriate policy and arrangements in each of these areas, particularly, greater objectivity in decision making. ADB could support such initiatives and help establish systems for data collection and analysis.

Key lessons from the Project include the need to (i) be more realistic when formulating and costing projects, (ii) base capacity-building efforts on actual needs determined from diagnostic studies, (iii) have appropriate Government policies to support project initiatives, and (iv) establish monitoring systems early. For road projects in Sri Lanka, the Project highlights the need to (i) take early action when opening quarries, (ii) improve safety provisions during construction, and (iii) consider hard shouldering of roadways and constructing culverts and other structures to the full width of the carriageway. In view of the uncertainty over maintenance funding, road projects may have to be designed on the assumption that maintenance will be constrained. Some of these lessons, such as about quarries, hard shouldering, and width of culverts, have been incorporated into subsequent projects. Subsequent projects have incorporated arrangements to support the local contracting industry. ADB has also provided technical assistance to address several of the institutional weaknesses, particularly those relating to tendering, and to study institutional needs within the road sector.

In addition to addressing maintenance issues, the Government should study the cost and feasibility of hard shouldering the project roads, and determine why the pavement is cracking.

I. BACKGROUND

A. Rationale

1. When the Project was formulated, Sri Lanka had an extensive and well laid-out road network that had deteriorated due to the rapid increase in road traffic and inadequate maintenance over the late 1970s and early 1980s. The Project formed part of Sri Lanka's Medium-Term Investment Program for the Highway Sector, 1987-1991, which aimed to rehabilitate and improve the main national road network to facilitate future economic development.

B. Formulation

2. The Project was appraised in 1987. Feasibility and engineering studies and contract packaging were conducted prior to appraisal in 1986-1987 under an Asian Development Bank (ADB) funded technical assistance (TA).[1]

C. Objectives and Scope at Appraisal

3. The Project had two basic objectives: (i) to rehabilitate and improve selected roads and bridges so that they would be economically maintainable and provide reliable transport at reduced costs, and (ii) to increase the efficiency and quality of road maintenance operations. To help achieve the latter objective, the Project was to institutionalize road maintenance training as an ongoing activity, provide equipment, and develop the local road maintenance contracting industry comprising mainly small private contractors. Project inputs comprised civil works and consulting services to upgrade 390 kilometers (km) of roads and bridges; maintenance equipment to be hired out to contractors who were expected to undertake maintenance works; and consulting services, training, and training aids for institutional development and training of contractors and government staff in road maintenance. In addition, the Project provided consultants to formulate a possible follow-on project.

D. Financing Arrangements

4. The appraised total cost of the Project was $45.65 million. On 24 November 1987, ADB approved a loan of SDR28.34 million, then equivalent to $36.5 million, from the Special Funds resources to fund all of the foreign exchange requirements and part of the local currency costs of the Project. In addition, a grant of $150,000 was provided to finance part of the consulting cost to prepare a possible follow-on project. The balance of the project cost, equivalent to $9 million, was to be borne by the Government. The Borrower was the Democratic Socialist Republic of Sri Lanka, and the Executing Agency was the Road Development Authority (RDA), a Government corporation under the supervision of the Ministry of Highways.[2] Implementation was through three existing departments and a newly created training cell within RDA. RDA was the Executing Agency for previous ADB and World Bank projects, including the ADB-financed Trunk Roads Improvement

---

[1] TA 792-SRI: *Second Road Improvement*, for $350,000, approved on 27 August 1986.

[2] Now the Ministry of Transport and Highways.

Project,[1] and the World Bank-financed first and second road projects, and is the Executing Agency for four ongoing ADB road projects[2] and the World Bank's third road project. RDA has also benefited from two advisory TAs;[3] one was ongoing at the time of operations evaluation.[4]

E. Completion

5. Implementation was to take 3 years and 4 months, commencing early in 1988. However, the Project was completed in early 1996, with a delay of over 4.5 years. The project completion report (PCR)[5] was circulated to the Board in December 1997.

6. The PCR describes the Project's implementation and the circumstances that led to the increase in costs and subsequent reduction in size of the civil works. The PCR found the road improvements, although smaller in extent than expected, had contributed to the objective of making the country's road network economically maintainable, and the benefits to be substantial. The maintenance component also was deemed successful despite the cancellation of the maintenance training. The PCR did not find any significant negative impacts and assessed the Project as generally successful. The PCR's assessment of the road improvements is based on an analysis of road-user cost savings and savings in future road maintenance costs. The claims made in relation to the success of the maintenance component are not supported by evidence or analysis in the PCR.

F. Operations Evaluation

7. This project performance audit report presents an assessment of the Project's effectiveness in terms of objectives achieved, benefits generated, and sustainability of the operations. It discusses issues of current relevance to the sector, and presents lessons learned from the experience. The results and discussion are based on the findings of an Operations Evaluation Mission (OEM) to Sri Lanka in November 1999; review of the PCR, appraisal report, ADB files, and Government records; and discussions with ADB staff, the Government, contractors, and road users. Copies of the draft audit report were provided to the Borrower, RDA, and ADB staff for review and comments. Comments received were taken into consideration in finalizing the report. Comments were not received from the Government or RDA.

II. IMPLEMENTATION PERFORMANCE

A. Design

8. The Project aimed to restore and improve the service capability of selected roads, and at the same time, to improve road maintenance to ensure that the nation's roads, including the

---

1 Loan 753-SRI(SF): *Trunk Roads Improvement Project*, for SDR20.698 million, approved on 19 November 1985.

2 Loan 1312-SRI(SF): *Third Road Improvement Project,* for SDR38.108 million, approved on 15 September 1994; Loan 1567-SRI(SF): *Southern Provincial Roads Improvement Project,* for SDR22.044 million, approved on 30 October 1997; Loan 1649-SRI(SF): *Road Network Improvement Project,* for SDR56.772 million, approved on 8 December 1998; Loan 1711-SRI(SF): *Southern Transport Development Project,* for SDR64.856 million, approved on 25 November 1999.

3 TA 1110-SRI: *Institutional Strengthening of the Road Development Authority,* for $575,000, approved on 17 January 1989.

4 TA 3110-SRI: *Reengineering of Road Sector Institutions*, for $640,000, approved on 8 December 1998.

5 PCR: SRI 19190: *Second Road Improvement Project*, December 1997.

project-restored roads, would perform and last according to expectations. Road maintenance was to be addressed by supporting the fledgling road maintenance contractor industry with equipment and training. In these broad terms, the project design was sound. However, as it turned out, the components to improve road maintenance did not prosper even though the inputs were procured (para. 28). The Project ended up being simply the improvement of selected roads without any provision for their long-term sustainability or solution of the fundamental national problem of inadequate road maintenance. Failure of the road maintenance improvement components was due mainly to a change in Government policy on implementing road maintenance works—rather than engage private contractors under RDA, all maintenance was placed under the Government-owned, and recently established, Road Construction and Development Corporation (RCDC). However, even if Government policy did not change, it is unlikely that the road maintenance improvement components would have succeeded as their detailed design was flawed. As designed, these components focused on only part of the problem, namely, equipment and skills, whereas adequacy and continuity of work and finance for private contractors, and at the national level, the planning and financing of the road maintenance program, were of equal importance and constitute important constraints for both road maintenance and the road contracting industry (paras. 30-31). However, many of these issues are being addressed under current ADB operations.

9. Several major changes in the Project occurred during implementation. Civil unrest in the area, a related lack of bidders for the works, delays in tendering, and weaknesses in the original detailed roadway designs prepared under the project preparatory TA contributed to higher than expected unit costs for the roadworks (paras. 11 and 20). As a result, the length of roads to be improved was reduced from the targeted 390 km to 147 km to fit the availability of project funds. In addition, several bridges on the completed roads were removed from the Project and funded separately by the Government. Not all of the overseas training was availed of, and the time inputs of the consultants for training and maintenance support were shortened when Government policy for the implementation of road maintenance changed. In exchange for the shortened time inputs of the training and maintenance consultants, the time input of the consultant providing contract management advice to RDA was extended. The increase of this consultant's time input was beneficial as contract issues under various road projects were increasing in importance. The other project inputs were generally procured as planned.

10. The road was designed with flexibility to change standards, such as the road shoulder width, in areas where the normal standards would be difficult to achieve. Such flexibility was particularly useful in limiting cost in the winding sections of hilly areas. However, in some hilly areas, an increase in standards may have proved beneficial, but this aspect of the flexible design approach was not utilized. The road designs contained details that are now not considered good practice, for example, leaving shoulders unsealed and not extending all drainage structures beyond the road shoulders. Subsequent ADB projects have avoided these two design weaknesses.[1]

B. Contracting, Construction, and Commissioning

11. The tendering process for the roadworks suffered from a variety of problems that eventually led to reducing the length of road upgraded. Initially, the roadworks were packaged into three contracts for international competitive bidding. There was a half-year delay in calling tenders for these contracts. Only two companies tendered, one for two of the three contracts and the other for all three contracts. The low interest was reportedly due to the civil unrest in the area at the time. The company that bid for two of the three contracts was the lowest bidder on both contracts

[1] Frequent erosion of the unsealed shoulders occurs, contributing to increased maintenance and potential for damage to the road. The drainage structures that extend just to the width of the paved carriageway rather than the full width of the road constitute a safety problem, particularly at nighttime.

and tendered prices similar to those expected. However, the Government wanted to award one of these contracts to RCDC; ADB objected to this as RCDC had not been prequalified and was a Government-owned corporation. The bid of the only tender for the third contract was far higher than expected. The combination of high bid for one contract and the Government's request to award one contract to RCDC delayed the award of tenders, and eventually the validity period of the bids expired and the company that submitted the lowest bids for two contracts withdrew. This left one company, which bid for each of the three contracts. As these three bids were much higher than the expected amount, the bidding was canceled. A second round of tendering was conducted, but because of the delays already incurred and continued civil unrest, higher than budgeted bid prices were expected. Thus, the roads were first repackaged into several smaller contracts to increase flexibility in matching contracts with available funds. As it turned out, prices were higher than budgeted, and eventually only two contracts totaling 147 km, which was the maximum that could be accommodated by the project funds, were awarded. One contractor was successful in winning both contracts.

12. The road construction supervision consultant found the quality of construction to be satisfactory. At the time of the OEM, the road improvements were from 3-5 years old, and provided a reasonably smooth and quick journey. The roads do have problems, but these are attributed to inherent weaknesses that were not addressed by the Project (para. 23), the design standards adopted (para. 10), and inadequate postconstruction maintenance (para. 27) rather than to improper construction. Nevertheless, the supervision consultant's completion report indicated that the contractor displayed weak general management, such as in the scheduling of works; did not give adequate attention to safety during construction, such as by using barricades and warning lights around excavations; and did not maintain the road sections handed over to it. The contractor's slow deployment of plant and equipment contributed to the construction delay.

13. The consultant for project preparation and design was retained as the supervision consultant. There was no conclusive evidence or opinions from RDA staff to assess the performance of the consultant during supervision, although some back-to-office reports of ADB supervision missions noted slowness in the supervision consultant's preparation of working drawings. This may have contributed to some of the construction delay. There were no problems related to the procurement of equipment or consultants for institutional support, i.e., training, contract management, and maintenance; nor with their performance.

C. Organization and Management

14. The general management arrangements followed a standard format for this type of project and were adequate. However, project implementation was constrained by lengthy tendering and procurement procedures and changes in policy by the Government. The lengthy tendering and procurement procedures caused significant delays (para. 11). This problem is now recognized and has been addressed by several TAs directed at the Government's contract administration and implementation in general,[1] and more recently, at RDA.[2] The change in Government policy, which placed all of road maintenance works under RCDC, significantly affected the Project. This change in policy effectively excluded the private road maintenance contractors that the Project aimed to support and upgrade from direct involvement in the Project, and meant that the maintenance equipment and training components became largely redundant. In addition, the Government's proposal to award one of the original three contracts to RCDC contributed to the failure of the first round of bidding.

---

[1] TA 2433-SRI: *Improvement of Contract Approval and Implementation Procedures*, for $100,000, approved on 26 October 1995 (and a supplementary TA for $20,000, approved on 10 October 1996); and TA 2745-SRI: *Improvement of Project Implementation in Sri Lanka*, for $45,000, approved on 7 January 1997.

[2] TA 1110-SRI: *Institutional Strengthening of RDA,* for $575,000, approved on 17 January 1989; and TA 3110-SRI: *Reengineering of Road Sector Institutions*, for $640,000, approved on 8 December 1998.

15. Within the constraints imposed by the changed Government policies and the tendering and procurement procedures, RDA performance was adequate, although it failed to comply with the loan covenants requiring the collection and analysis of road performance monitoring data (para. 22).

16. ADB's performance was mixed. ADB reevaluated the roads to confirm their viability when the costs were found to be higher than expected, supported the repackaging of contracts, and responded with innovative proposals to involve local construction contractors, and was generally attentive to the needs to complete the roadworks. However, ADB did not maintain a suitably broad view of the Project and neglected the important long-term objective of improving road maintenance. ADB should have been faster in rejecting the Government's request to award one of the original contracts to a company that had not prequalified. ADB's performance in documenting the history of the Project, maintaining complete files, and ensuring compliance with all loan covenants also could have been better. On a broader level, ADB has learned many lessons from this Project, incorporated these lessons in subsequent projects, and provided TA to help address key issues (paras. 10, 14, 40, and 47).

D. Actual Cost and Financing

17. The actual project cost was $56.15 million, about 23 percent higher than expected (Appendix 1). However, this Project was much smaller and differently structured than planned. The most significant reduction in the project scope was in the length of road improved, which was reduced from 390 km to 147 km because of higher than expected unit costs for the roadworks. Even with the reduction in scope, the road improvement component increased to account for 83 percent of the Project, compared with the expected 65 percent. To partly fund the increased costs of the roads, some other components were reduced slightly. Small savings in the road maintenance components also occurred because of lower unit prices for some inputs. The project costs also do not include the cost of four bridges that were removed from the Project and completed by the Government. The cost of these bridges was approximately $350,000. The ADB loan of SDR28.34 million was fully disbursed and was equivalent to $40.59 million at the time of loan closure in 1996. The Government's contribution was 27 percent of the total cost, which was higher than the appraisal estimate of 20 percent.

18. The unit cost for the roadworks, expressed in dollars, increased by about 156 percent between appraisal and award of contract, and by a further 38 percent during construction. Comparison of the appraisal cost estimates for the roadworks with costs for other projects under implementation and preparation at the time suggests that the original appraisal estimates were reasonable. The large increase between appraisal and award of contract was primarily a result of price escalation due to delays and other cost increases, and a premium applied by the contractors, presumably to compensate for the risk of a resurgence of the civil unrest that had previously occurred in the area. During the four years between appraisal and the award of contracts, civil works prices in Sri Lanka in general increased by around 30-40 percent after adjustments for local currency depreciation, implying a risk premium of 80-100 percent. The increase in cost during construction was made up of price escalation (66 percent of the increase), an increase in quantities of materials required to complete the works (24 percent of the increase), and increased taxes (10 percent of the increase). It is noteworthy that the actual price escalation for construction works in Sri Lanka was around 12-15 percent per year, whereas the local cost price contingency allowed at appraisal varied from 1-5 percent per year, reflecting a lack of realism in estimating costs for the Project.[1]

[1] Appraisal missions use standardized price escalation indices prepared for each country.

E. Implementation Schedule

19. The Project was substantially delayed by over 4.5 years, being completed in early 1996 compared with the expected completion date of June 1991. Although some delays occurred in the procurement of the maintenance equipment, the major delays occurred in the tendering and implementation of the roadworks. The award of contracts took about three years longer than expected and was not completed until August 1991 (para. 11).[1] The roadworks required an extra 16 months to complete.[2] The construction delay appears to be due to several reasons including weak management and slow equipment deployment by the contractor, difficulties in opening up a quarry, increases in quantities of materials, initial delays in getting working drawings from the supervision consultant, and abnormally high rainfall. The delays contributed to higher costs, and apart from the higher rainfall and the opening of the quarry, were avoidable. The contractor also had the contract for the ADB Trunk Roads Project (footnote 3) and rather than mobilize more plant for the project contracts, the contractor used his existing plant in a sequential manner to first finish the Trunk Roads Project, then one of the Project's contracts, and finally the second project contract. In the latter stage of construction, the contractor did mobilize more equipment, but this was old plant and was too late to overcome the already incurred construction delay. Opening a quarry is particularly difficult in Sri Lanka due to the procedures involved in obtaining environmental clearances and the possibility, as occurred under the Project, of the potential quarry attracting strong community objections (para. 38).

F. Technical Assistance

20. The adequacy of the project preparatory TA for the Project and the performance of the consultants could not be fully assessed due to lack of records and institutional memory. However, it is noted that the TA developed detailed designs for the roadworks, and two significant problems related to these detailed designs occurred and contributed to the delays and cost overruns. The first is that not all of the TA road survey marks could be relocated at the start of construction; this meant that the TA road design, based on the survey, could not be fully used. Secondly, the redesign based on a new survey resulted in much larger quantities of materials being required. In the case of the first point, there are many possible reasons other than poor performance on the part of the consultant for why the survey marks could not be found. However, in the case of the second point, the redesign was technically similar to the initial design, which suggests that the TA design lacked precision. This could be due to the limited time allocated for detailed design under the TA contract.

21. The attached TA to prepare a follow-on project did result in a project, the Third Road Improvement Project,[3] being prepared and approved. This TA was of a similar design as the TA to prepare the Project in that the feasibility study, detailed engineering, and preparation of tender documents were included under one contract. Preparation of the feasibility study was disrupted when the consultants left the country because of the civil unrest. Eventually, they returned and finished the work, although RDA and ADB found the initial drafts to be deficient and needing correction. Subsequently, another consultant was hired to repackage the roadworks into contracts suitable for local contractors and local competitive bidding. This consultant also was engaged for project supervision and reported the designs made by the TA consultant to contain substantial errors in terms of technical details and the quantities of materials required.

---

[1] Compared with the expected date of September 1988.

[2] The Homagama-Ratnapura road took 2 months longer than expected, and the Avissawella-Hatton road an extra 16 months.

[3] Loan 1312-SRI(SF): *Third Road Improvement Project,* for SDR38.108 million, approved on 15 September 1994.

G. Compliance with Loan Covenants

22. All covenants were complied with except one concerning the collection and analysis of appropriate indicators to monitor and evaluate the impact of the roads on traffic and RDA's cost performance for maintenance. The data collection and analysis was supposed to continue for two years after project completion. Although the PCR claims that the covenant was complied with, the only data available comprises some raw unprocessed traffic counts and road roughness indices. There is no information on maintenance cost performance and no analysis. The available information is insufficient to provide anything other than a weak indication of the performance of the roads. RDA has staff and basic equipment to collect appropriate data. Failure to adequately address the loan covenant reflects a general lack of attention by both the Ministry of Transport and Highways and RDA to systematically evaluate and plan roadworks, and generate data for such evaluation and planning (para. 40).

III. PROJECT RESULTS

A. Operational Performance

1. Road Rehabilitation

23. Two roads were rehabilitated: the 75-km Homagama-Ratnapura road, and the 72-km Avissawella-Hatton road. The former has two distinct sections, 37 km from Homagama to Avissawella, and 38 km from Avissawella to Ratnapura. The roads link the inland towns of Ratnapura and Hatton with Colombo via Avissawella. The rehabilitation works mainly comprised the laying of new asphaltic concrete pavement[1] on the existing roads, repair of drainage structures, and reconstruction of some bridges. There were some short sections of widening to maintain a minimum lane width and local curve widening, but in general, the works did not include any major improvement to the road geometry. The road base was reconstructed only in places where the entire pavement had failed, and this occurred only for limited lengths of the road. The road shoulders were restored but not sealed.

24. At the time of the OEM, the various road sections had been in service for 3-5 years. During this time, road users found travel on the roads to be smoother, faster, and subject to fewer stoppages because of vehicle breakdown. Bus services had expanded and were more reliable with bus companies able to keep to scheduled times. These perceptions are supported by roughness data, and time and maintenance cost estimates by bus companies plying the routes from Ratnapura and Hatton to Colombo. The international roughness index (IRI),[2] which typically ranges from 1-12, is a commonly used quantitative measure of road roughness; the lower the IRI number the smoother the surface. Before rehabilitation, the Homagama-Ratnapura road had an average IRI of 6, which was reduced to an average of 2 after rehabilitation. The IRI of the Avissawella-Hatton road was reduced from an average of about 9 before the Project to an average of just over 4 after rehabilitation. The average IRI values of 2-4 are consistent with appraisal expectations and are considered satisfactory for the traffic volumes on the project roads. The OEM estimated the roughness of the road to be no more than one unit higher than the immediate postrehabilitation levels, which is still considered a satisfactory level of roughness. Travel times from both Ratnapura and Hatton to Colombo via Avissawella were reported by the bus companies to be about 20 percent shorter than before the Project. The reductions were from about 3 hours to about 2.5 hours per one-way trip from Ratnapura, and from about 4.5 hours to 3.5 hours per one-way trip from Hatton. The bus companies also indicated that their repair and maintenance costs had decreased by 20-25 percent. The bus companies considered that the repair and maintenance savings were associated with fewer breakdowns and mechanical damage, despite increases in tire wear and, for the Homagama-Ratnapura road, increased accident damage.

25. Although the available traffic data for the project roads contains weakness that reduces its accuracy,[3] it does provide some broad indication of traffic volumes and growth trends (Table). The data indicates that traffic has been in line with or exceeded appraisal expectations, and therefore, the benefits in terms of transport reliability and operating cost savings so far have been in line with expectations.

Indicative Traffic on Project Roads

1 Comprising both wearing and regulating courses.

2 The IRI is measured in meter/km.

3 The data gives daily traffic unadjusted for day of the week or season.

Item	Average Daily Traffic 1998 (vehicles)	Growth Rate (%) Early 1990s-1998
Homagama-Avissawella	9,000	8-9
Avissawella-Ratnapura	6,500	6
Avissawella-Hatton		
- near to Avissawella	3,400	4-7
- near to Hatton	1,200	3-4

Source: Mission estimates based on data from the Road Development Authority, Sri Lanka.

26. Altogether, the evidence indicates that up to the time of the OEM, the roads have provided reliable transport at reduced vehicle operating costs (VOCs). Traffic volumes for which these benefits apply meet or exceed expectations. However, there is insufficient data to assess the effect of these transport improvements on the general public and on economic activity in the vicinity of the roads. The achievements also relate to only part of the expected life of the roads and must be further assessed on the basis of their sustainability. At the time of the OEM, the roads were in a precarious state with defects starting to appear. Although correctable, if not soon attended to, the defects could lead to rapid deterioration and loss of potential future benefits. Assuming that the defects are corrected and that future maintenance is sufficient to maintain pavement integrity, the full working life of the roads should be achieved even though this could be a few years shorter than expected because of the higher than expected traffic volume.

27. Inspections of the roads during the OEM, while limited in extent, revealed significant amounts of longitudinal and block cracks, particularly in the wheel tracks, and erosion of the unsealed shoulders. Rippling and other defects in the pavement also were noted. Most cracks were very narrow, and individual areas of cracking were not extensive. An investigation program would be required to determine the causes of the cracks. The shoulder erosion prevents runoff water reaching the side drains; instead the water can run along the edge of the pavement and seep under the pavement and weaken the road base. The Avissawella-Hatton road is also affected by several active earth slips. The scale of these slips suggests that engineered stabilization measures would be extensive and too expensive to be economically viable. Stabilization of the slips would come about with time.

2. Road Maintenance

28. The Project aimed to improve maintenance quality and efficiency by expanding the role of small contractors in such works, and providing them with appropriate equipment and training. Change in Government policy at the start of the Project effectively meant that all road maintenance works were contracted to RCDC.[1] RCDC undertakes most work itself but does subcontract some minor works, such as the repair of culverts, sand-sealing of pavement cracks, and roadside cleaning. The project-procured equipment was placed in RDA workshops and has been used almost exclusively by RCDC. There is no evidence of increased use by small contractors. The training component was abandoned in 1990 soon after it was established. Only a few courses were conducted, and the training booklets and other outputs had very limited impact, if any, on the small contractors. Effectively, the small contractors were not developed as expected, and because RCDC is the main contractor for road maintenance and does most of the work itself, the small

[1] Although this arrangement continued up to the time of the OEM, capacity limitations within RCDC have resulted in RDA engaging in force-account operations for routine maintenance such as roadside cleaning and limited contracting of small contractors for sand-sealing.

contractors are unlikely to have contributed to any improvement in road maintenance quality and efficiency.

29. Despite the failure to develop the small contractors, RCDC used the equipment in its general operations, including road maintenance. However, the quantity of equipment supplied is small compared with the amount of equipment under the control of RCDC, and its impact on the maintenance quality and efficiency would be commensurately small. Some of the equipment had special characteristics, such as the road graders, which were small, and the stone crushers, which were portable. However, RDA and RCDC could not identify specific areas where the equipment created special capabilities that were either not available or of limited availability before the Project. The training component did not function for long, and RDA and RCDC did not benefit from road maintenance training. RDA availed of some overseas training but could not identify the impact of the training on its operations.

30. At the broader sector level, a review of the planning and decision-making process for road maintenance reveals a lack of systematic planning and implementation of road maintenance works. There is no operational road management system, and suitable information for planning and evaluating roadworks, while collected, is not adequately processed or used. Each year, suggested roadworks, selected on the basis of the experience of field engineers, or requested by politicians, mayors, and other people of influence, are collated and ranked subjectively. The amount of work done is based on the budget released by the Government. Such a system has little probability of being efficient. The project roads provide an example of this inefficiency. Maintenance funding has continued at a level similar to that prevailing before the Project, but has been allocated to the repair of shoulders and cleaning of roadsides. Despite the presence of cracks and other defects, the pavement has not yet received any maintenance and if action is not taken soon, special effort will be required to overcome damage caused as a result of neglected maintenance.

31. Overall, road maintenance is constrained by broad issues pertaining to planning and decision making, which renders the current program inefficient. Maintenance works were taken over by RCDC; however, it is unable to cope with the volume of work involved in both maintenance and construction. Although RDA now uses force account arrangements and small contractors for some of the maintenance works, the small contractors, which were to be supported under the Project, were effectively excluded and have limited capabilities. In any case, the major problems comprise continuity of work and financing, aspects that were not specifically addressed under the Project. While the Project did contribute equipment, the quantity was small and it has not had a notable impact. The training conducted was insignificant and maintenance training was not institutionalized. As a result, road maintenance, which was correctly viewed as important to sustain the project investment in roadworks as well as other similar investments, remains a problem area. The sustainability of the two project roads is not ensured.

B. Institutional Development

32. The Project did not have any appreciable effect on institutional development. The planned strengthening of the small road maintenance contracting sector and transfer of some road maintenance works to this sector did not occur because of a change in Government policy. Recently, RDA has begun to directly contract small contractors for sand-sealing and other minor works because RCDC has reached its capacity. RDA must contend with small road- maintenance contractors that are largely poorly equipped and skilled. This could have been better if the Project had been implemented as planned. Maintenance training was not institutionalized as expected because the training unit was closed and the function abandoned within three years of its initiation. The training of RDA and RCDC staff did not create any identifiable change in operations.

C. Economic Reevaluation

33. The economic viability of the road rehabilitation component was reassessed by comparing the savings in VOCs and road maintenance costs with the project investment cost (Appendix 2). The same methodology was used at appraisal and project completion; however, the roads evaluated at appraisal differed from those evaluated at project completion and by the OEM because of the repackaging of road sections in response to the higher than expected construction costs. Operations evaluation assessed two basic scenarios. The first scenario assumed that the roads would be adequately maintained—a change from the existing practice. Under this scenario, the road component yielded an economic internal rate of return (EIRR) of 17 percent, which is satisfactory although less than the appraisal and project completion EIRRs of 22 and 20 percent.[1] The second scenario assumed that maintenance will not improve, leaving the roads to deteriorate rapidly. Under this scenario, the riding quality of the roads would become equivalent to that of the without-project case implying a 5-6 year reduction in road life and reduced savings in VOCs. This second scenario yielded an EIRR of 7 percent. The three road sections were also evaluated separately and gave results of 12.9-17.6 percent under the adequate maintenance scenario and 4.1-8.7 percent if maintenance does not improve. The Avissawella-Hatton road section gave the lowest result because of relatively low traffic volumes and high unit construction costs associated with the hilly terrain. It is important to note that the basic data used in all the estimates is considered weak, and the EIRR estimates are, at best, a rough guide to the economic viability of the Project. Nevertheless, the analysis does highlight the importance of adequately maintaining the roads to capture all the economic benefits.

D. Socioeconomic and Sociocultural Results

34. The improved road conditions have benefited users of the project roads with faster travel and more reliable transport, and for vehicle owners, lower VOCs. The faster travel times and less frequent breakdowns have also enabled bus companies to use their existing bus fleets to increase services to nearby townships not along the project roads. Cost savings for bus companies have not been passed on to the riding public because the Government fixes bus fares at standard rates throughout the country. Lack of comparative data prevents an assessment of the impact of the road improvements on freight rates and on other socioeconomic aspects.

E. Gender and Development

35. The Project did not have any specific component or feature to promote women's development. There were no notable impacts specific to women; women benefit as part of the general road user population.

F. Environmental Impacts and Control

36. The Project predominantly utilized the existing road; land acquisition was of a minor nature for localized widening and did not require resettlement or major change to existing settlements. There were local improvements in drainage and dust pollution commensurate with this type of road rehabilitation. Several significant landslips occurred along the Avissawella-Hatton road, however. The area has a history of landslips and those related to the Project were not unusual. There is a

[1] In making this comparison, it must be recognized that the appraisal EIRR is for a different package of roads.

trade-off between eliminating the risk of slips and the cost involved. It is not possible to tell if the road design in the affected areas was an appropriate compromise at the time. However, it is known that project implementation focused on minimizing road construction costs in view of the cost escalation already incurred, and this may have compromised the choice of road design.

37. The project roads enable greater speed, thus increasing the risk of traffic accidents. Although comparative statistics on accidents for the project roads were not available, bus companies indicated that accident rates had increased on the Ratnapura-Homagama road compared with before the Project, but had not done so on the Avissawella-Hatton road. The increased speeds, corroborated by statements made by the local police officers in Hatton, are thought to have been compensated for by the curve widening and general improvement of the surface of the Avissawella-Hatton road. Nationally, traffic accident rates have increased substantially over the past decade and the Government has initiated efforts to improve the situation. In this respect, the Project missed one opportunity to improve safety. Many culverts and drainage structures repaired under the Project extend only to the edge of the pavement causing the road shoulder to end abruptly, which creates a potentially dangerous situation, particularly at night given the lack of street lighting. A better arrangement would have been to extend the width of these structures so that they accommodate the full road including the road shoulders. The OEM noted that subsequent ADB projects have incorporated this lesson.

38. The contractor's quarry was subject to several environmental complaints raised by nongovernment organizations on behalf of local residents. The complaints mainly concerned cracks in houses caused by blasting operations. The contractor contends that the complaints were largely exaggerated in order to extract compensation. A similar experience occurred with the Trunk Roads Project. Given the passage of time, the truth could not be determined; however, the experience highlights the sensitive nature of quarries in the country and underscores the need for early identification of environmentally acceptable quarries for future projects. The Government now attempts to identify and get approval for possible quarry sites prior to inviting tenders.

G. Gestation and Sustainability

39. Some road users would have benefited as early as 1993 when the first sections of the roads were completed. However, because the contractor did not adequately maintain road sections under its control, the conditions of other sections of roads deteriorated. Nevertheless, the roads were completed in 1996 when full benefits were being generated. At the time of project completion, these benefits were expected to gradually decrease as the road surface ages and roughness increases. In the 12th year, new pavement was expected to be required to restore the surface smoothness and most of the benefit flow from VOC and road maintenance savings.[1] After the resurfacing in the 12th year, the roads are expected to slowly deteriorate again until their 20th year, when they will require major rehabilitation. Assuming maintenance of the roads improves, these expectations remain valid except that the increase in traffic levels over those predicted at appraisal and upon which the road was designed, should reduce the expected life of the roads slightly to around 18-19 years. The key to sustainability is improved maintenance, and given the

[1] This is a major resurfacing designed to restore road-riding quality. Surface treatments such as sand sealing and double bituminous surface treatment will be provided over short sections in intervening years to seal cracks and repair other defects.

cracking and other pavement defects apparent at the time of the OEM, immediate improvement is required (para. 26).

IV. KEY ISSUES FOR THE FUTURE

A. Road Maintenance Planning

40. Weaknesses within the arrangements for planning road maintenance works have been highlighted (para. 30). The lack of systematic measurement of road quality and traffic parameters, and of objective decision making renders the road maintenance program inefficient. Lack of data is often cited as the major constraint. Yet, RDA has a planning division and does collect traffic counts and road roughness data, basic information that could be used in a rudimentary maintenance-planning program. However, the current thinking within Government is that the equipment for data collection has first to be improved before a proper planning system can be implemented. While such upgrading of equipment would be beneficial, much can be done with the currently available equipment and data that is generated. The data needs to be more systematically collected and properly processed into usable forms by, for example, adjusting traffic counts for seasonality, time of day, and time of week into annualized average daily traffic counts so that the data may be readily used in comparative analyses. Other information on road conditions could be generated through the regular inspection program of the district engineers. These aspects may be addressed under the TA to reengineer the road sector institutions (footnote 6). Of greater significance, however, is the lack of importance the central Government agencies place on systematic planning and objective decision making. As a consequence, there is no strong need for information and no drive to collect data. A change in the decision-making approach, and establishment and use of systems to support objective measurement and decision making is, therefore, an important prerequisite for improving road maintenance planning.

41. The University of Moratuwa in Colombo has an active interest in developing road-planning tools. It has developed a model for traffic forecasting and could participate in developing other tools, for example, in adapting the World Bank's Highway Design and Maintenance Standards Model for use in Sri Lanka for planning road maintenance and construction. Should the Government become committed to more systematic planning and decision making, a working partnership between the University of Moratuwa and RDA would be useful for developing an operational system.

B. Road Maintenance Funding

42. In 1999, total expenditure on the maintenance of class A and B roads, the main national roads, was about SLRs2.4 billion ($32 million). Because this is less than what is required to adequately maintain these roads, some maintenance is deferred, the sustainability of the national road network is threatened, and economic benefits are lost (para. 33). Although the revenue from transport-related taxes exceeds the expenditure on roads, national priorities limit the allocation of such funds for road maintenance. Unless national priorities change, the funding of road maintenance remains an issue to be resolved if the road network is to be maintained without continuing large foreign loans. In the meantime, alternative arrangements must be sought to maximize sustainability. One such arrangement is to design roads based on the premise that maintenance expenditure will be constrained. However, this does not address the real issue and is likely to be economically less efficient than a road that is designed without a maintenance constraint—provided the maintenance is properly provided. Another arrangement that is being explored under the TA to strengthen RDA (footnote 6) is the establishment of a road fund.

C. Road Maintenance Contractors

43. Private contractors could play a useful role in road maintenance, but the Government has not accorded their involvement any importance. In 1989, private contractors were excluded from road maintenance with the change in Government policy that placed all road maintenance works under RCDC. Recently, RCDC reached its capacity limit and RDA began to use force account works and is hiring small private contractors for simple maintenance works, leaving RCDC to do all the larger works. RDA prefers to use force account arrangements, rather than hire private contractors. The arguments for use of both RCDC and force account are that they cost less and/or improve efficiency. However, neither argument has been proven. RCDC enjoys a profit margin of 35 percent over costs, so the arrangement does not necessarily lead to the lowest cost. RDA claims the force account arrangements are 20 percent lower in cost than using RCDC. However, not all RDA overhead costs are included and actual savings may be less than 20 percent. Arguments based on such cost savings analyses also do not consider the long-term benefits that can come from competitive efforts to improve efficiency and drive down costs. It is possible that an industry with many competitive contractors operating in parallel to, and on equal footing with, RCDC and RDA force account arrangements could provide more efficient and lower cost maintenance. In addition, road maintenance would be freed from the constraints imposed by RCDC's capacity or RDA's direct supervision capacity. While there do appear to be valid reasons for greater involvement of private contractors in road maintenance, the current environment is not conducive to this. The greatest constraint is the reluctance of the Government to involve private contractors, which results in a lack of continuity of work. Without continuity, contractors cannot keep trained staff and cannot afford to invest in equipment and training, all of which are necessary for contractors to be effective.

V. CONCLUSIONS

A. Overall Assessment

44. The Project did succeed in restoring the riding quality of two important roads. As a result, travel on these roads is faster and more reliable, and bus companies have been able to use their fleets more effectively to increase services along both project and nonproject roads. Although lack of data does not allow the socioeconomic and broader economic impacts to be determined, the immediate economic effects have been savings in VOCs and road maintenance expenditure. Economic analyses suggest that for the road component, these immediate benefits yield an EIRR of 7 percent if maintenance does not improve and 17 percent if maintenance improves. The results reflect the higher than expected costs of the roadworks (by about three times) and delays that are partly offset by higher than expected increases in traffic. The roadworks were not associated with any major negative impact.

45. The success for the roadworks was not repeated with the important components for improving road maintenance. Changed Government policy for road maintenance works meant that the project inputs were not used as planned, the small maintenance contractors were excluded, and maintenance training was not institutionalized. Overall, the project inputs had little effect on road maintenance and the probability of long-term sustainability for the road network in Sri Lanka, including the project roads, has not been improved. In any case, these inputs addressed aspects that now can be seen to be of lesser importance than national level maintenance planning and decision making, and continuity of work and financing for contractors.

46. Overall, the successful improvement of the project roads must be tempered by the lack of achievement in improving road maintenance, the implementation problems that contributed to reduction in scope, and the real risk that the roads may not be sustained because of inadequate maintenance. On balance, the Project is rated partly successful.

B. Lessons Learned

47. The Project suffered from a lack of realism in its formulation. Institutional capacities, the time needed for tendering and contract award, and postproject maintenance were substantially overestimated, whereas local currency price contingencies were grossly underestimated. While efforts have been made to improve the contract tendering and award process, such as through ADB-financed TA,[1] projects in Sri Lanka will still need to consider the institutional constraints and high probability of inadequate postproject maintenance. The latter is of particular importance, and until maintenance planning, decision making, and funding are improved, both the design of roads and their evaluation should be done on the basis that maintenance will be inadequate. Local currency cost increases have historically exceeded those used in project appraisal, and more realistic estimates of price contingencies are also warranted.

48. The lack of success in the Project's capacity-building efforts highlights two lessons. The first is that the design of capacity-building interventions should be based on real needs as defined by diagnostic studies. Such a review of the needs of the private road maintenance contracting industry would reveal the importance of continuity of work and access to working finance.

---

[1] These include TAs 2433 and 2745 (footnote 9) and TA 2950-SRI: *Establishing the Sri Lanka Tender Support Bureau,* for $1 million, approved on 12 December 1997.

Secondly, appropriate policies are required to support project capacity-building initiatives. When the Government changed its policy concerning the implementation of road maintenance works, an important part of the Project could no longer be achieved.

49. The Government recently acknowledged that it is inappropriate to rely upon RCDC to undertake all road maintenance works. Such an arrangement constrains road maintenance to the capacity of RCDC, which has recently reached its limit. Alternative arrangements that include force account operations by RDA and use of private contractors are now being used. The latter conforms to the original intent of the Project.

50. ADB should respond quickly to resolve tendering problems so as to avoid situations such as the expiry of validity periods, which happened under the Project. Where the tender rules directly and clearly address the problem, there should not be any delay on the part of ADB.

51. Both the Government and ADB should ensure that monitoring systems are established and data collected as expected at appraisal.

52. When preparing detailed designs for roads, greater consideration should be given to (i) hard surfacing road shoulders to save future maintenance expenditure rather than just graveling shoulders as done under the Project; (ii) constructing bridges and culverts to the full width of the roadway, including shoulders; and (iii) providing road safety during construction. This lesson has been incorporated in subsequent ADB-funded road projects.

53. The experience of both the Project and ADB's previous Trunk Roads Project highlights the difficulties in establishing quarries. Such difficulties may unnecessarily delay projects or cause contractors to submit higher tender prices because of the uncertainty raised. The problem of quarry establishment has been recognized, however, and the Government now attempts to identify appropriate quarry sites and seek clearances prior to the opening of tenders.

C. Follow-Up Actions

54. The Government, using in-house staff, should prepare a study of the cost and feasibility of hard shouldering the project roads, and investigate means for financing such work. The Government also should study the cracks in the project roads to identify their cause and an appropriate long-term solution to correct the problem.

55. Maintenance has not been provided according to design requirements. While the roads have largely survived up to the time of operations evaluation, they are in a precarious position and will need maintenance in future years. At issue is if such maintenance will be provided. ADB has funded three subsequent road projects in Sri Lanka, all of which may suffer if maintenance is inadequate. The Government's maintenance program should be monitored to avoid loss of benefits from all projects. Reevaluation of the Project in five years time could help to address this requirement.

56. Both the Government and ADB should give greater attention to increasing the objectivity of decision making in allocating the road maintenance budget. While it is necessary for the Government to take the first step in embracing objectivity as the basis for its decision making, ADB could consider support for such efforts through TA to help establish systems for the analysis of data and data collection.

APPENDIXES

Appendix 1

Appendix 2
app 2.6

Appendix 1

PROJECT COSTS
Cost Breakdown by Project Component
($ million)

Component	Appraisal Estimate			Actual Estimate		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
A. Civil Works	19.00	10.95	29.95	29.28	16.93	46.21
B. Right-of-Way[a]	0.00	0.73	0.73	0.00	1.61	1.61
C. Consulting Services	1.03	0.73	1.76	1.37	1.36	2.73
D. Institutional Support	4.83	0.97	5.80	3.04	0.71	3.75
E. TA Components	0.85	0.28	1.13	0.56	0.32	0.88
F. Service Charge During Construction	0.70	0.00	0.70	0.79	0.00	0.79
G. Unallocated	3.64	1.94	5.58	0.00	0.00	0.00
Total	**30.05**	**15.60**	**45.65**	**35.04** [b]	**20.93**	**55.97**

TA = technical assistance.

[a] The costs shown here are the Road Development Authority's costs for actual land and property acquisition costs, surveys, shifting of electric and telephone poles, and damage caused by construction operations.

[b] This excludes the portion ($0.18 million) of the prior TA chargeable to the loan.

Source: PCR: SRI 19190: *Second Road Improvement Project*, December 1997.

(Reference in text: page 5, para. 17)

ECONOMIC REEVALUATION

A. Methodology and Assumptions

1. The economic viability of the Project was reassessed applying the same methodology used in the appraisal report and project completion report (PCR). The basic methodology for the economic analysis follows the approach given in the Asian Development Bank's *Guidelines for the Economic Analysis of Projects*. The rehabilitation of the roads under the Project was expected to lead to reduced vehicle operating costs (VOCs) and decreased expenditure on routine and periodic maintenance costs over the life of the roads. Economic internal rates of returns (EIRRs) were recalculated for each of the three road sections of Homagama-Avissawella, Avissawella-Ratnapura, Avissawella-Hatton, and the combination of all three sections. The PCR did not estimate separate EIRRs for each of the three road sections, and the road sections evaluated at appraisal differed from the three evaluated here.

2. The EIRR calculations are based on four major assumptions:

(i) The economic life of the project roads is assumed to be 20 years. The bridges constructed under the Project are assumed to have a life of 60 years. Salvage values for the remaining life of the bridges are added at the end of the 20-year analysis period.

(ii) Project construction costs comprise actual financial costs for civil works, design and supervision, and right-of-way costs. Expenditures for bridges strengthened by the Road Development Authority (RDA) are included in the project costs.

(iii) All taxes and other transfer payments are removed from the financial costs and benefits streams. The financial costs and benefits are converted to economic costs and benefits using a standard conversion factor of 0.80 for the nontraded costs.

(iv) All current costs and benefits are brought to 1999 prices by applying the World Bank's manufacturer's unit value index for the traded components and gross domestic product deflator for all local costs.

3. The quantifiable benefits were estimated as the difference between the VOCs and road maintenance with and without the Project. VOCs were estimated using the VOC submodel of the World Bank's Highway Design and Maintenance Standards Model (HDM)[1] version III and calibrated for Sri Lanka conditions. The unit VOCs and unit costs for maintenance were adopted from estimates prepared under the feasibility report prepared for the Road Network Improvement Project in 1996.[2] Most of the basic input data used to calculate the VOCs in this feasibility report were developed under the Sri Lanka: Road User Charges Study (1993).

[1] The HDM model simulates total lifecycle conditions and costs, and provides economic decision-making criteria for multiple road design and maintenance alternatives for one road link, a group of roads with similar characteristics, or an entire network.

[2] TCR 2151-SRI: *Technical Assistance for the Preparation of the Road Network Improvement Project*, December 1996.

(Reference in text: page 10, para. 33)

B. Estimation of Economic Costs and Benefits

1. Traffic and Traffic Growth

4. RDA carries out periodic traffic surveys to assess growth and vehicle composition on selected locations throughout the country. Table A2.1 provides information on average daily traffic and derived traffic growth rates at four locations for the project roads. The overall growth on the roads varied between 6 and 19 percent per annum. Some of these data are only raw daily traffic counts and to that extent of somewhat limited value; however, these are the best available estimates. The appraisal report assumed an annual 4 percent increase in overall traffic and approximately 3,400 vehicles were expected to use the road upon completion of the Project for the Homagama-Avissawella section and 1,380 vehicles on the Avissawella-Hatton section. At project completion, the actual average daily traffic volumes were much higher at about 6,136 vehicles for the Homagama-Avissawella section and 3,746 vehicles for the Avissawella-Hatton section. Because of the higher traffic volumes, the PCR assumed a higher growth rate of 6.5 percent to forecast future traffic on these roads. However, growth is not uniform over all the roads and different rates for each of the three roads would have been more appropriate. The PCR also assumed a base traffic count of 3,746 for the entire Homagama-Hatton road, whereas the actual counts indicate that traffic density falls significantly after about 40 kilometers (kms) out from Avissawella. Table A2.1 indicates that traffic volumes after the 40-km point fall to almost one fourth of the initial traffic on the road.

5. The economic analysis is based on actual traffic volumes at four points until 1997. For years beyond 1997, traffic growth of 6 percent per year is assumed until 2005. Given the road alignment and narrow width of many bridges, it does not seem feasible to accommodate large continuous growth without imposing serious congestion costs. It is, therefore, assumed that traffic growth will slow to 4 percent per annum beginning in 2006. Sensitivity analysis is used to assess the impact of this assumption on the overall viability (para. 14).

Table A2.1: Traffic Growth

Item	Homagama-Avissawella	Avissawella-Ratnapura	Avissawella-Hatton (0 to 41 kms)	Avissawella-Hatton (42 to 72 kms)
Average Daily Traffic Volumes				
1989	4,450	4,010	2,260	No Survey
1990	No Survey	No Survey	No Survey	420
1993	5,560	4,230	2,850	670
1996	7,595	5,870	3,070	1,141
Growth Rates (in percent per year)				
Before the Project (1987-1994)	9.3	6.3	3.2	16.8
After the Project (1995-1998)	12.0	11.1	11.6	19.4
Average Growth (1987-1997)	9.9	6.0	6.5	18.1

Source: Road Development Authority.

2. Road Conditions

6. Scenarios of the likely road maintenance regimes and resultant conditions with the Project and without the Project were developed based on (i) the analysis of the initial road conditions, (ii) actual conditions of nearby roads not covered by the Project, and (iii) a review of maintenance practices in the districts where the project roads are located. Information on maintenance was also taken from the project preparatory technical assistance[3] for the Road Network Improvement Project Report, which developed a series of maintenance programs designed to maintain a road at various roughness levels. Table A2.2 lists the maintenance regimes and the resultant international roughness indexes (IRIs) indicating road condition and used for estimating VOC savings given in Figure A2. It is to be noted that the without the project maintenance regime is intended to maintain the roads in usable condition, but that the increasing traffic levels will cause a gradual increase in roughness. Gradual deterioration and increase in roughness is also assumed in the with the project scenario; this is corrected at about year 12-15 by a major asphalt resurfacing.

Table A2.2: Maintenance Regime With and Without the Project

Year	Maintenance Activity With-Project	Maintenance Activity Without-Project
1	Rehabilitation construction work	Routine maintenance, 5 percent patching, 20 percent DBST, 80 percent sand seal, and improve drainage
2	Rehabilitation construction work	2 percent patching and routine maintenance
3	Rehabilitation construction work	3 percent patching and routine maintenance
4	Routine maintenance	Routine maintenance, 5 percent patching, 20 percent DBST, and 80 percent sand seal
5	Routine maintenance	2 percent patching and routine maintenance
6	Routine maintenance	3 percent patching and routine maintenance
7	Routine maintenance	Routine maintenance, 5 percent patching, 20 percent DBST, and 80 percent sand seal
8	Routine maintenance	2 percent patching and routine maintenance
9	Routine maintenance	3 percent patching and routine maintenance
10	Routine and 1 percent surface maintenance and sand seal	Routine maintenance, 5 percent patching, 20 percent DBST, and 80 percent sand seal
11	Routine and 1 percent surface maintenance	2 percent patching and routine maintenance
12	Routine and 2 percent surface maintenance and sand seal	3 percent patching and routine maintenance
13	Routine and 3 percent surface maintenance	Routine maintenance, 5 percent patching, 20 percent DBST, and 80 percent sand seal
14	Routine maintenance and asphalt resurfacing (50 mm)	2 percent patching and routine maintenance
15	Routine maintenance	Routine maintenance, 5 percent patching, 20 percent DBST, and 80 percent sand seal
16	Routine maintenance	2 percent patching and routine maintenance
17	Routine and 1 percent surface maintenance and sand seal	Routine maintenance, 5 percent patching, 20 percent DBST, and 80 percent sand seal
18	Routine maintenance	2 percent patching and routine maintenance
19	Routine and 1 percent surface maintenance and sand seal	Routine maintenance, 5 percent patching, 20 percent DBST, and 80 percent sand seal

DBST = double bituminous surface treatment.

[3] TA 2151-SRI: *Road Network Improvement Project*, for $700,000, approved on 15 September 1994.

Year	Maintenance Activity With-Project	Maintenance Activity Without-Project
20	Routine and 2 percent surface maintenance	2 percent patching and routine maintenance
21	Routine and 3 percent surface maintenance	Routine maintenance, 5 percent patching, 20 percent DBST, and 80 percent sand seal
22	Routine maintenance	2 percent patching and routine maintenance
23	Routine maintenance	Routine maintenance, 5 percent patching, 20 percent DBST, and 80 percent sand seal

Note: The with the project scenario reflects the actual maintenance regime up to year 7.
Source: Staff estimates.

3. Vehicle Operating Cost Savings

7. VOCs were estimated for seven types of vehicles. These estimates were found to be similar to estimates used in recent project feasibility reports in Sri Lanka and to estimates used for a 1999 report under preparation by the Department of National Planning for assessing public investment in the transport sector. Table A2.3 provides estimates of VOCs for different road conditions for the seven types of vehicles. VOCs for motorcycles are not calculated by the HDM and were assumed to be 25 percent of those for passenger cars. Overall VOC savings are derived for each road according to the differences in the IRIs between the with and without the project scenarios in each year as given in Figure A2, the traffic volumes, and the 1997 vehicle composition for each of the project roads.

Table A2.3: Economic Vehicle Operating Costs for Different Roughness
(SLRs per km)

Types of Vehicles	IRI=2	3	4	5	6	7	8	9	10	11	12
Car	7.4	7.6	7.7	7.9	8.1	8.3	8.6	8.8	9.1	8.4	9.7
Light Truck	6.5	6.7	6.9	7.1	7.3	7.5	7.8	8.0	8.3	8.6	8.9
Medium Truck	8.9	9.2	9.5	9.7	10.0	10.3	10.6	11.0	11.4	11.8	12.2
Heavy Truck	13.9	14.5	15.0	15.6	16.1	16.7	17.3	17.9	18.6	19.3	20.0
Mini Bus	10.2	10.5	10.8	11.0	11.4	11.7	12.2	12.6	13.1	13.7	14.3
Bus	13.7	13.9	14.3	14.6	15.0	15.4	16.0	16.6	17.2	18.0	18.7
Motorcycle	1.5	1.5	1.5	1.6	1.6	1.7	1.7	1.8	1.8	1.9	1.9

IRI = international roughness index.
Source: TCR 2151-SRI: *Road Network Improvement*, December 1996.

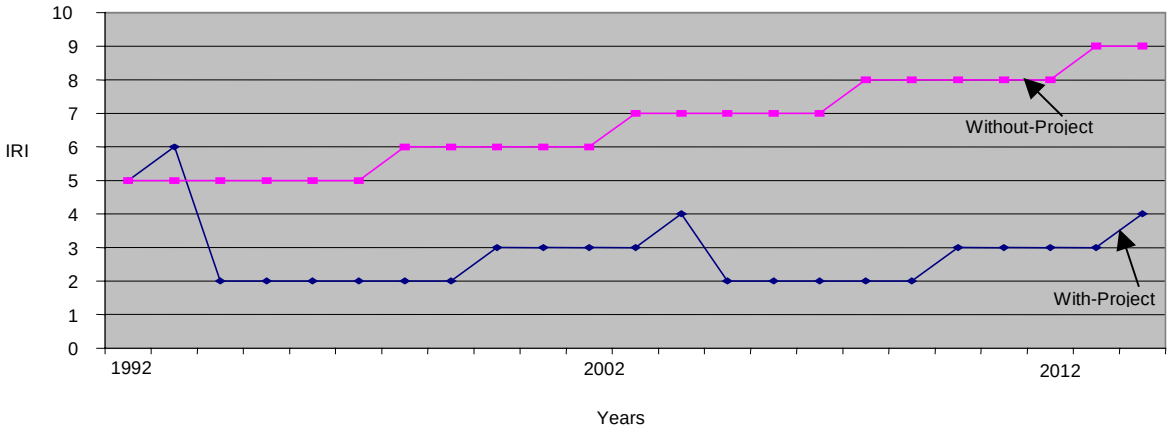
4. Savings in Maintenance Costs

8. The maintenance cost savings were derived as the difference between the costs of the with and without the project maintenance regimes in Table A2.2. The cost of each maintenance activity was based on the Highway Standard Rates used in Sri Lanka.

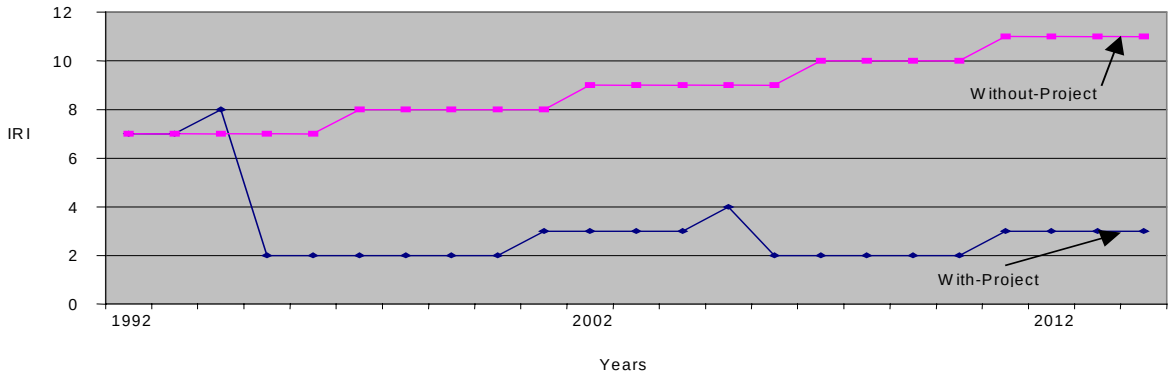
5. Project Costs

9. The project investment costs are derived from the actual construction costs and payments made to the contractors for actual work, right-of-way costs, and costs for the supervision. The investment cost includes $350,000 for bridges constructed by the Government outside of the Project.

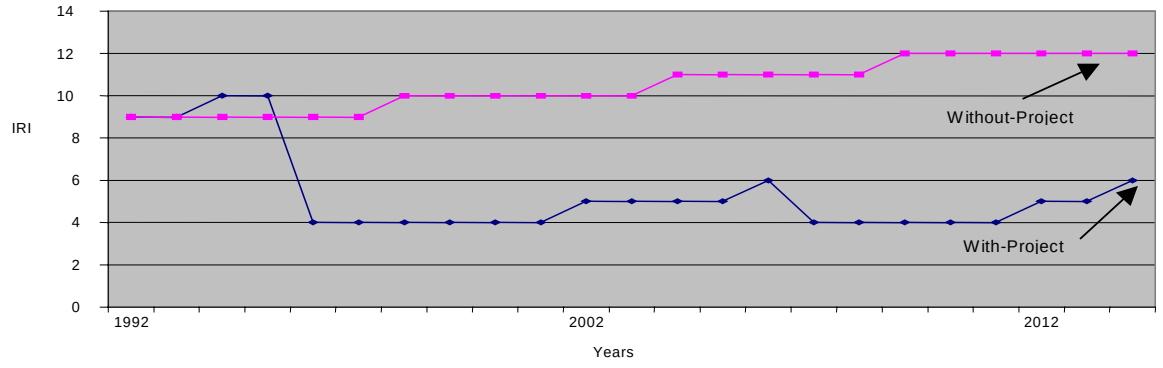
Figure A2: Changes in International Roughness Index (IRI) over Project Life
Homagama-Avissawella Road Sector



Avissawella-Ratnapura Road Sector



Avissawella-Hatton Road Sector



Source: Staff estimates.

C. Economic Internal Rates of Return

10. The economic analysis was carried out for each of the three project roads and also for all roads combined (Table A2.4). EIRRs are lower than those estimated at appraisal and in the PCR in particular, the EIRR for the Avissawella-Hatton which is only 12.9 percent, despite actual higher growth in traffic volume.

11. The difference in the overall viability compared with the analysis in the PCR is explained by differences in the estimates of investment cost, VOC savings, and maintenance cost savings. The PCR does not provide details about the investment costs used in its analysis so it is not possible to quantify the reasons for the differences in investment costs. The differences in VOC savings can be largely accounted for by differences in the assumptions about road roughness over the life of the project roads. The PCR assumption of a constant roughness throughout the life of the Project was not borne out by the actual conditions. In addition, the roughness increased during the construction phase which increased VOCs during this period; thus the Project gave negative benefits in the initial period. Traffic volumes beyond 40 kms from Avissawella on the Avissawella-Hatton roads were much lower, only about a third compared with the first 40 kms, than those assumed in the PCR. The PCR assumed the same levels of traffic volumes for the entire length of the road whereas the current analysis uses different traffic densities for these two road subsections.

Table A2.4: Economic Internal Rate of Return for the Project Roads

Road Sections	Appraisal Report or Feasibility Study (%)	Project Completion Report (%)	Operations Evaluation (%)
Project	22.5	20.3	17.1
Road A:			
Appraised road	26.6		
Homagama-Avissawella section		not calculated	17.6
Road B:			
Appraised road	27.3		
Avissawella-Ratnapura section		not calculated	16.2
Road C:			
Appraised road	11.2-26.3		
Avissawella-Hatton section		not calculated	12.9

Source: Appraisal report, project completion report, and staff estimates.

12. The EIRR estimates at appraisal are not directly comparable to those of the PCR and operations evaluation because it was not possible to complete the roads as planned. The appraisal EIRR for the Homagama-Avissawella-Ratnapura-Belangoda road, for example, was 27.3 percent; however, this included benefits and costs related to road lengths of over 80 kms beyond the sections completed under the Project. Similarly, actual Avissawella-Hatton road alignment was somewhat different than the one presented in the feasibility report.

D. Sensitivity Analysis

13. Given the quality of data, it was considered important to analyze the sustainability of the Project under different assumptions. Sensitivity analyses were, therefore, carried out for lower traffic growth rates, lower VOC savings, higher and lower maintenance cost savings, and a

scenario of inadequate maintenance (Table A2.5). The possibility that road maintenance remains seriously constrained due to paucity of funds is a significant project risk. In such a case, the roads will deteriorate rapidly leading to loss of VOC savings due to higher roughness, reduced traffic growth as traffic diverts to other roads, and shortened road life (by 5-6 years).[4]

Table A2.5: Sensitivity Analysis-EIRR

Project Roads	Base Case	Lower Traffic Growth	Maintenance Cost Savings		10% Lower VOC Savings	Inadequate Maintenance and Reduced Life of Road
			10% higher	10% lower		
All Road Sections	17.1	16.1	17.2	17.0	15.6	7.3
Homagama-Avissawella	17.6	16.7	17.7	17.5	16.3	8.7
Avissawella-Ratnapura	16.2	15.1	16.3	16.1	14.8	8.5
Avissawellla-Hatton	12.9	11.9	13.0	12.8	11.8	4.1

EIRR = economic internal rate of return, VOC = vehicle operating cost.

[4] A number of projects funded through external aid seem to confirm this practice. The annual road maintenance expenditure is kept at the minimum on such new roads. As a result, the road conditions deteriorate thus limiting the life of the road to no more than 12 years. RDA then rehabilitates such roads almost completely.

Table A2.6: Economic Internal Rate of Return

(SLRs million)

Overall Project					Homagama-Avissawella Road Sector				
Years	Project Costs	VOC Savings	Maintenance Cost Savings	Net Benefits	Years	Project Costs	VOC Savings	Maintenance Cost Savings	Net Benefits
1992	400.6	0.0	0.0	(400.6)	1992	143.3	0.0	10.8	(132.5)
1993	543.4	(20.5)	45.2	(518.7)	1993	294.9	(20.5)	5.6	(309.8)
1994	869.3	21.5	18.7	(829.0)	1994	264.7	64.7	6.7	(193.4)
1995	573.2	132.7	26.5	(414.0)	1995		67.8	9.0	76.7
1996	280.0	274.0	36.2	30.2	1996		76.0	5.7	81.7
1997		326.2	23.2	349.3	1997		80.6	6.7	87.3
1998		409.6	25.5	435.1	1998		117.5	7.9	125.4
1999		434.2	35.6	469.8	1999		124.5	3.3	127.9
2000		429.0	18.2	447.2	2000		100.8	2.1	102.9
2001		429.9	7.7	437.6	2001		106.8	5.0	111.8
2002		471.9	23.8	495.7	2002		113.2	0.0	113.2
2003		546.5	3.2	549.7	2003		166.2	(1.0)	165.3
2004		585.6	8.2	593.8	2004		135.9	6.5	142.4
2005		673.0	19.5	692.6	2005		228.6	2.4	231.0
2006		737.0	2.5	739.5	2006		238.9	5.0	244.5
2007		893.7	18.1	911.9	2007		249.6	1.0	250.7
2008		999.2	1.5	1,000.6	2008		326.1	4.6	330.7
2009		1,106.7	21.7	1,128.4	2009		340.8	2.6	343.4
2010		1,104.4	10.7	1,115.1	2010		304.0	3.3	307.3
2011		1,187.0	19.8	1,206.7	2011		317.7	(1.1)	316.6
2012		1,200.8	4.8	1,205.7	2012		332.0	9.6	341.6
2013		1,344.2	23.0	1,367.2	2013		436.2	2.6	438.9
2014	(7.1)	1,294.6	4.8	1,306.4	2014	(1.7)	392.4	24.0	418.1
			EIRR	**17.05%**				**EIRR**	**17.57%**

Avissawella-Ratnapura Road Sector					Avissawella-Hatton Road Sector				
Years	Project Costs	VOC Savings	Maintenance Cost Savings	Net Benefits	Years	Project Costs	VOC Savings	Maintenance Cost Savings	Net Benefits
1992	89.3	0.0	11.2	(78.1)	1992	169.3	0.0	23.2	(146.1)
1993	104.3	0.0	5.6	(98.8)	1993	146.9	0.0	7.5	(139.4)
1994	288.5	(23.1)	7.3	(304.4)	1994	318.5	(20.0)	12.6	(325.9)
1995	172.5	87.9	9.8	(74.8)	1995	400.7	(23.0)	17.5	(406.2)
1996	552.5	105.8	6.5	(440.2)	1996	280.0	92.2	11.0	(176.8)
1997		136.1	7.6	143.7	1997		109.5	11.2	120.7
1998		144.9	10.0	155.0	1998		147.2	17.6	164.8
1999		153.6	2.5	156.2	1999		156.0	12.4	168.4
2000		162.8	2.2	165.1	2000		165.4	3.4	168.8
2001		147.8	6.9	154.7	2001		175.3	11.9	187.2
2002		197.3	1.1	198.4	2002		161.4	2.1	163.5
2003		209.2	2.3	211.4	2003		171.1	6.9	178.0
2004		221.7	3.5	225.2	2004		228.0	9.6	237.5
2005		202.8	(1.1)	201.7	2005		241.7	1.3	242.9
2006		278.3	5.9	284.3	2006		219.7	6.6	226.3
2007		348.4	2.5	351.0	2007		295.7	(2.1)	293.5
2008		364.1	6.0	370.2	2008		309.0	11.1	320.0
2009		380.5	1.9	382.4	2009		385.4	6.2	391.6
2010		397.6	6.0	403.7	2010		402.8	10.4	413.2
2011		448.4	1.1	449.5	2011		420.9	4.8	425.7
2012		468.6	4.6	473.2	2012		400.3	8.7	409.0
2013		489.7	0.0	489.7	2013		418.3	2.1	420.4
2014	(1.7)	511.7	16.5	529.9	2014	(3.6)	390.5	27.4	421.5
			EIRR	**16.20%**				**EIRR**	**12.91%**

EIRR = economic internal rate of return, VOC = vehicle operating cost.

Source: Staff estimates.