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**INTERNATIONAL DEVELOPMENT ASSOCIATION**

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**APPRAISAL OF A HIGHWAY PROJECT**

**SWAZILAND**

**March 5, 1962**

**Department of Technical Operations**

CURRENCY EQUIVALENTS

£ 1 million = US \$2.8 million  
£1 = US \$2.80  
US \$1 million = £ 357,143

APPRAISAL OF A HIGHWAY PROJECT

SWAZILAND

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## SWAZILAND

### APPRAISAL OF A HIGHWAY PROJECT

#### SUMMARY

- i. The Protectorate of Swaziland has asked the Association to assist in financing the completion of a trans-territorial highway 112 miles long, extending from the South African border on the west to the Mozambique border on the east, and 9 miles of connecting roads.
- ii. The total cost of the project is estimated at US\$4.2 million equivalent. The cost estimates are based on costs of similar work in Swaziland and include a reasonable allowance for contingencies.
- iii. Present traffic counts and the traffic expected from the economic development of Swaziland justify the completion of the highway to the primary standards selected.
- iv. Swaziland has undertaken to employ consultants to assist in the design and supervision of base and paving works. The Public Works Department is adequately staffed to supervise the over-all program.
- v. With the exception of a small amount of grading, work will be carried out by contractors selected on the basis of international competitive bidding.
- vi. Swaziland has given assurance that the highway will be properly maintained and has agreed to establish and enforce vehicle weight regulations.
- vii. The project provides a suitable basis for a development credit of US\$2.8 million equivalent to be made available by the Association.

## I. INTRODUCTION

1. The United Kingdom High Commission Territory of Swaziland has requested a credit of US\$2.8 million equivalent from the International Development Association (IDA) to assist in financing the construction of the main highway across the territory. The proposed highway extends from the South African border on the west to the Mozambique border on the east.
2. An IDA mission visited Swaziland in April 1961 to evaluate a loan request originally submitted late in 1960. The mission was presented with a considerably revised program on its arrival which included the construction and reconstruction to gravel and paved surface of seven roads totaling 200 miles in length. Field trips indicated both to the Government and the mission that parts of the program could not be justified and that further study was needed.
3. In July 1961 Swaziland submitted a new proposal prepared by its Public Works Department. This report is based on this proposal together with the information obtained during the visit of the IDA mission and during the negotiations in August 1961. It has been revised to reflect the findings of a second visit to Swaziland in January 1962.

## II. BACKGROUND

### A. General

4. Swaziland is bounded on the north, west and south by the Republic of South Africa and to the east by the Portuguese overseas province of Mozambique. It has an area of 6,704 square miles and a population estimated in 1960 at 243,000 Africans, 7,000 Europeans and 2,000 Eurafricans or people of mixed origin.
5. The territory is controlled by the Commonwealth Relations Office through the High Commissioner for Basutoland, Bechuanaland Protectorate and Swaziland and administered by a Resident Commissioner. The capital and headquarters of the Government are at Mbabane. The territory is divided into four districts each under a District Commissioner.
6. Though only a small country, Swaziland has wide variations in topography and climate. The terrain slopes from a mountainous area in the west where the veld reaches an elevation of 6,000 feet, to an average of 1,000 feet in the low veld in the east. The climate varies from temperate in the west to semi-tropical in the east. The rainfall is one of the highest in Southern Africa.
7. Swaziland is basically an agricultural country. Maize is the most important subsistence crop while cotton, tobacco and pineapples are the principal cash crops. Irrigation agriculture is playing an increasing role in the economy of the territory, with rice, vegetables, citrus and other fruits, and sugar being the main crops. The production of livestock is also an important part of agriculture.

8. Mining and industry are becoming increasingly significant sectors of the economy. Asbestos is the territory's most valuable export commodity; the exploitation of iron ore deposits has now been assured by a 10-year contract signed with Japan. A large scale forestry industry including the production of pulp has developed in recent years. Two sugar mills have been built since 1958 and a canning factory has been established.

#### B. The Highway System

9. Swaziland is completely dependent on its highway system for transport as there are at present no railway or scheduled air services. Tenders have been called for the extension of the Portugese railway from its present terminal at Goba across Swaziland to tap the iron ore deposits in the west. The railway will presumably have the right to handle general traffic, however, light freight and passenger traffic would probably still travel by road because of the short distances involved. A new airport was recently completed near Mbabane primarily for the movement of external traffic. Thus, highways are and will continue to be the main means of transport within the territory.

10. At present there are 1,155 miles of roads in Swaziland which are classified as primary (255 miles), secondary (390 miles) and tertiary (510 miles). There is only one paved road in the country and the graveled surfaces of the remaining roads do not stand up to heavy traffic and to the frequent heavy rains. A large road construction program has been under way since 1958 in which the main objective has been to improve the standards and surfacing of the most important trunk roads. This work has been financed by Colonial Development and Welfare funds, local bank loans and exchequer loans from the United Kingdom to the amount of £ 2.6 million over the past five years.

11. Construction and maintenance of the highway system is the responsibility of the Public Works Department (PWD) which is staffed with competent and able engineers. The PWD does some of its own engineering work but also uses consultants to design and supervise larger projects. Construction contracts are awarded on a competitive basis and the territory obtains bids from well-equipped and experienced road building contractors throughout Southern Africa. Modern design and road building practices are followed.

12. The existing road system is well maintained by a competent maintenance organization. Shops and equipment are adequate at the present time although some additional equipment for maintenance of asphalt roads will be needed as the paved roads presently under construction are completed. In recent years the budget for maintenance has been increased annually to meet expanding needs, as can be seen from the following figures:

1958/59	£ 48,500
1959/60	£ 49,300
1960/61	£ 64,000
1961/62	£105,000

13. The IDA mission found that insufficient attention was being given to feeder roads in Swaziland and that the territory should include such roads in the planning of its highway system. The Government has recently started

to prepare a feeder road program, but considerably more field work will be required. However, as feeder roads supplement the main road system, the construction of a trans-territorial highway has the higher priority.

### III. THE PROJECT

#### A. Description

14. The project consists of the design and construction of a 112 miles long two-lane all-weather highway across Swaziland. It would stretch from Oshoek on the border of the Republic of South Africa, through the capital city of Mbabane, the commercial center of Manzini and on to Namaacha on the Mozambique border (see map). As both Oshoek and Namaacha are served by the existing highway systems of South Africa and Mozambique respectively, the highway would act as a main east-west link across Southeastern Africa.

15. The highway runs in a generally east-west direction across the widely variable types of terrain found in Swaziland. From Oshoek the alignment is located in rolling terrain across the high veld, descends a cliff below Mbabane and continues to fall to the low veld at Point X. From here to Nokwane Intersection it lies in flat country after which the alignment ascends a hilly region to Namaacha.

16. The Public Works Department started in 1958 to construct the western sections of the highway where the traffic was heaviest; the present status of the highway, and the work required to complete it is as follows (see Table 1). Grading on Section 1 (Oshoek-Mbabane) has been completed and plans are now under preparation for base and pavement. Planning on Section 2 (Mbabane bypass) has been started. Section 3 (Mbabane-Mahlanya) has been graded and a contract for base and pavement has been awarded. Three contractors are now working on Section 4 (Mahlanya-Point X). The grading is virtually completed while base and paving operations are in various stages of completion. Surveys are almost completed on the two remaining sections from Point X to Namaacha.

17. The project also includes 9 miles of connecting roads, one to a proposed railway terminal at Point A and a second to Nokwane where it joins the Nokwane-Mhlume mill road. A high-level bridge is to be built across the Black Umbuluzi River near Nokwane replacing an existing causeway which is dangerous and impassable to traffic for lengthy periods during the wet season.

18. The highway is being built to primary road type design standards with an all-weather surface throughout its length (see Table 2). The heavily trafficked part to Point X will be paved while the remaining part, including the connecting roads where the traffic would be much lighter, will be gravel surfaced. Road building materials are readily available along the alignment over most of its length.

19. Swaziland has a regulation on the maximum weight of motor vehicles but it is not enforced because the maximum permitted is too low for the type of roads now under construction. It has been agreed to raise the allowable maximum consistent with present design loadings and to enforce the revised regulation. Swaziland has given assurance that the project will be properly maintained. As noted in paragraph 12, the maintenance budget has been increased annually in recent years to meet expanding needs.

## B. Cost Estimates

20. The total cost to complete the project as of August 1 is estimated by IDA at US\$4.2 million equivalent as shown in detail in Table 3. The estimates for Sections Nos. 1 to 4 are based on the costs of work presently under contract, while those for the remaining sections are based on costs per mile. While on the latter sections costs based on quantities obtained from engineering surveys would have been preferable, the figures were selected on the basis of costs of comparable work recently carried out in Swaziland. In its financial plan the Government has allocated 10% of the estimated cost of construction as a contingency item from which increases in cost would be met. The allocation is based on 7½% of the estimated cost of Sections 1 through 4 on which an advanced stage of planning has been reached and 15% for those sections (5 and 6) on which the surveys are almost complete, which, in terms of estimated cost and mileage, are about one-third of the project. The contingency allowance may be considered as a trifle low but in the conditions indicated it is not unreasonable, and it has therefore been accepted by the Association. The item for engineering services provides for the payment of consultants.

21. X The foreign currency cost of the project is estimated at approximately 75% or US\$3.1 million equivalent, well over the amount of the proposed IDA credit. The Government has already set aside the balance of funds needed to carry out the project. X

## C. Administration and Execution

22. As noted in paragraph 17, the grading has been completed on Sections 1 and 3, and work is under way on Section 4. The grading of Section 2 will be carried out by departmental forces as it is only two miles in length, while the remaining work will be carried out by unit-price contracts, let on the basis of international competitive bidding. Final plans have already been completed on Section 3 and a contract for this work has been awarded. Execution of the project is expected to take about two and a half years.

23. Engineering consultants will be employed to design and supervise the placing of all base and paving work and to assist in the design and supervision of the Black Umbuluzi River Bridge. The staff of the Public Works Department will locate, design and supervise the grading works. As the Department has had considerable experience in the use of consultants and contractors, and in performing work departmentally, the execution of the project is not expected to raise any unusual administrative problems.

## D. Economic Justification

24. Swaziland has some good agricultural lands, large timber resources now being exploited and coal deposits near Point X which will be mined when the proposed railway reaches them. While good progress has been made over the past five years in expanding the territorial economy, reliable all-weather connections to the most important centers are still lacking; even the main roads are frequently closed by heavy rainfall. If Swaziland is to continue developing its natural resources, especially agricultural, forest and mineral resources, a network of reliable all-weather roads will have to be built. The trans-territorial highway proposed in the project would be the most important route.

25. The project is soundly conceived. It aims to provide a means of all-weather transportation across the territory and to link the internal road system with the roads of South Africa and Mozambique. The planned highway will join the largest towns, where industrial trade and governmental services are concentrated, with the most productive agricultural, forest and mineral resources of Swaziland. The highway will also serve large areas, particularly in the eastern part of the territory, which have not yet been developed. The completion of this highway will permit the later development of a feeder road program to reach areas of high agricultural potential.

26. Over a large part of its length, the highway will parallel a railway line. This railway is to be built primarily to haul iron ore from a mine now being developed to the port of Lourenco Marques, in Mozambique, and to haul back supplies, materials and equipment. Freight traffic between South Africa and Swaziland, which is a substantial part of the truck traffic now on the project road, will continue to move, as at present, by road transport because of the high cost of trans-shipment. Furthermore, it is unlikely that the railway would divert much of the light and perishable freight which now moves over the road because of the short distances involved and the special handling required. Passenger traffic will continue to move by road as the railway will not be in a position to provide passenger handling facilities without substantial additional investment.

27. Present road traffic on the western sections of the Trans-Swaziland highway is heavy, ranging up to 700 vehicles per day, about 20% of which are trucks and buses. Most of this traffic is from and to South Africa. The traffic to Mozambique is also substantial. Traffic counts at Mhlumeni, which will be replaced by Namaacha as the main border crossing point into Mozambique, now indicate a traffic level on the eastern border sections ranging from 50 to 100 vehicles per day. Traffic densities have been increasing at an annual rate of 15% over the past few years and it is estimated by the Government that in five years traffic will double on both the eastern and western sections of the project road. This appears reasonable considering the traffic expected from the development of the mining and related industries (see para. 8).

28. Present traffic justifies the construction of the highway to primary design standards over its full length. The report of an economic survey mission from the United Kingdom submitted in 1960, estimated a savings in Swaziland of 3 pence per mile in vehicle operation on a paved as against a gravel surface. Accepting this figure, for the purpose of an illustrative calculation of economic benefits, it is estimated that on the basis of present traffic the cost of paving the western sections will be more than met by savings in road-user and highway maintenance costs. The latter costs on these sections should be greatly reduced as the present volume of traffic necessitates frequent regravelling. Assuming that traffic increases in five years as estimated in the preceding paragraph, a benefit cost ratio of 2 is obtained by paving the western sections. On the eastern sections, a gravel surface is adequate at the present time and is justified by the volume of traffic.

#### IV. CONCLUSIONS AND RECOMMENDATIONS

29. The project is technically sound and economically justified on the basis of present day traffic. The cost estimates are based on costs of similar work and include a reasonable allowance for contingencies.

30. Swaziland has undertaken to employ consultants to assist in the design and supervision of base and paving works. The Public Works Department is adequately staffed to supervise the project.

31. With the exception of a small amount of grading, work will be carried out by contractors selected on the basis of international competitive bidding.

32. Swaziland has given assurance that the highway will be properly maintained and has agreed to establish and enforce vehicle weight regulations.

33. The project provides a suitable basis for a development credit of US\$2.8 million equivalent to be made available by the Association.

SWAZILAND  
TRANS-TERRITORIAL HIGHWAY

LIST OF WORKS

Main Highway

<u>Section</u>		<u>Approximate length (miles)</u>
1. Oshoek - Mbabane	base and paving	14
2. Mbabane bypass	grading, base and paving	2
3. Mbabane - Mahalanya	base and paving	16
4. Mahlanya - Point X (Mpaka)	complete grading, base and paving	39
5. Point X (Mpaka) - Nokwane Intersection	grading to gravel surface	24
6. Nokwane Intersection - Namaacha	grading to gravel surface	17
7. Black Umbuluzi River Bridge	construction	-
		<hr/> 112

Connections from Main Highway

To Point A	grading to gravel surface	4
To Mokwane	grading to gravel surface	5
		<hr/> 9

SWAZILANDTRANS-TERRITORIAL HIGHWAYDESIGN STANDARDS

	<u>Level and Rolling Section</u>	<u>Mountainous Section</u>
Design speed (mph)	60	40
Maximum gradient (percent)	6.5%	8%
Minimum radius (feet)	1,200	350
Minimum sight distance (non-passing feet)	750	500
Minimum sight distance	2,500	900
Pavement width (feet)	22	22
Shoulder width (feet)	8	6
Maximum super-elevation (percent)	10	10
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Slope of cut banks	$1\frac{1}{2} : 1$	
Slope of fills	$1\frac{1}{2} : 1$	
Structure width (curb to curb-feet)	26	
Design loading for bridges	U.K. Ministry of Transport standard loading.	
Design loading for pavement*	9,000 lbs. wheel load	
Minimum thickness of gravel surfaces (inches)	6	

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\* Pavement to consist of 1" three-course surface treatment except for a 4-mile section on the Mbabane escarpment which will be surfaced with a 1" dense graded premix.

SWAZILAND  
TRANS-TERRITORIAL HIGHWAY

COST ESTIMATE

Construction

Sections Nos. 1 - 3*	£ 400,000
Section No. 4*	450,000
Section No. 5	150,000
Section No. 6	170,000
Connecting Roads to A and to Nokwane	70,000
Bridge over Black Umbuluzi River	<u>60,000</u>
	£ 1,300,000

Contingencies 130,000

Engineering Services

Consulting Engineers 70,000

TOTAL £ 1,500,000

or US\$4,200,000

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\* Cost to complete as of August 1, 1961

