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CONFIDENTIAL

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT PERFORMANCE AUDIT REPORT

on

MEXICO THIRD HIGHWAY PROJECT (Loan 528-ME)

August 8, 1975

Operations Evaluation Department

PROJECT PERFORMANCE AUDIT REPORT
MEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)

PREFACE

This report presents an audit of achievements under the Mexico Third Highway Project, for which Loan 528-ME in the amount of US\$27.5 million was fully disbursed in March 1974.^{1/}

This performance audit is based mainly on correspondence and reports in Bank files (Loan Agreement, Appraisal Report, Progress Reports, Supervision Reports, and correspondence between the Bank and the Borrower), as well as on discussions with staff members of the Mexican Secretariat of Public Works (SOP) and the Bank. A Project Completion Report, prepared by the Latin America and Caribbean Regional Office in February 1975, also was useful in the preparation of this report.

In February 1975, a one-week visit was made to Mexico in connection with this report. The valuable assistance of SOP is gratefully acknowledged.

^{1/} Less than US\$5,000 was cancelled.

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MEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)

PROJECT DATA

Loan Amount	US\$27.5 million
Amount Disbursed	US\$27.5 million ^{1/}
Dates of Negotiations	September 27-October 12 and December 7-13, 1967
Date of Loan Agreement	January 26, 1968
Original Date of Effectiveness	May 1, 1968
Actual Date of Effectiveness	April 25, 1968
Original Closing Date	March 31, 1972
Final Disbursement Date	March 1974
Date of First Supervision Mission	March and April 1968
Date of Last Supervision Mission	May 1973

Exchange Rates (Mexican pesos)

1968-74 ----- US\$1 = Mex\$12.5

^{1/} Less than US\$5,000 was cancelled.

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PROJECT PERFORMANCE AUDIT REPORT

MEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)

SUMMARY

When the Mexican Government presented a preliminary program to the Bank for a Third Highway Project in mid-1965, the Bank decided to introduce certain requirements to reduce the possibility of construction delays and cost overruns, which had been sizeable in the four previous highway projects (Loans 268-ME, 317-ME, 354-ME, 401-ME totalling US\$127.5 million). These requirements included: nearly complete detailed engineering by project appraisal and complete engineering by loan negotiations, broader procedures for inviting bids and awarding construction contracts, and commencement of construction within a year after loan approval.

The Government's preliminary program included construction, reconstruction, or paving of about 3,000 km on 20 roads. Twelve of these roads were deleted from the program before or during appraisal either because the Bank's requirements regarding detailed engineering or commencement of construction were not attainable or because the roads were not economically justified.

The eight remaining roads were economically justified and, therefore, were included in the project. The project comprised: (a) reconstruction, including asphaltic concrete surfacing, of the primary roads Culiacan-Empalme-Nogales, Tulancingo-Tuxpan, and Puebla-Izucar de Matamoros (1,231 km); (b) improvement, including bituminous surfacing, of the tertiary roads Cuatro Caminos-Playa Azul, Ciudad Aleman-Oaxaca, Iguala-Ciudad Altamirano, and Escarcega-Chetumal (885 km); and (c) construction, including asphaltic concrete surfacing, of the primary road San Martin Piramides-Tulancingo (66 km), and provision of the necessary right-of-way.

During negotiations, the main point pursued by the Bank was that the Government should revise bidding procedures to ensure adequate international competition. Consequently, agreement was eventually reached on changes in the following areas: (a) prequalification of contractors; (b) invitations to bid; (c) size of contracts; (d) award of contracts by type of work; (e) signature of contracts in annual tranches; and (f) control of cost overruns and delays.

A US\$27.5 million loan agreement was signed in January 1968. The major reason why two and a half years had passed between the Government's overture to the Bank and signature of the loan agreement was the Bank's requirement that detailed engineering for each road should be nearly complete before appraisal.

During implementation, attention was directed to making bidding procedures attractive to foreign firms, to avoiding delays in completion, and to preventing cost increases. Bidding procedures introduced to encourage international competitive bidding failed to attract foreign firms. Twelve US firms, which had previously shown some interest in bidding for Mexican road projects, have suggested that the main reasons for lack of response were the strong, well organized, competitive nature of the Mexican construction industry and the generally low bids of domestic firms as compared with foreign firms. Other reasons included the small size of the contracts and the presence of the necessary technical capabilities in the country; lack of familiarity with local soils, fill locations, labor relations etc.; and lack of experience with the institutional framework.

The Bank was interested in changing bidding procedures because international competitive bidding was a Bank policy and could lead to improvements in the cost and efficiency of road construction. The Bank seems to have pursued this issue as a matter of principle, and did not achieve any practical results, since Mexican firms seem to be cost efficient in comparison with firms from other countries.

Delays in completion were not avoided but they were shorter than in past projects. By the original closing date, six roads were complete (72% of the total investment) while two roads were 90% complete (28% of the total investment). Mexican authorities have attributed the delay on the two roads to several factors, including: contractor deficiencies in equipment and organization and the need to rebid some sections; problems with project design and specifications and the need to change them; unusually heavy rain and the need to clear big landslides in the mountainous sections; and insufficient Government budgetary allocations during the first years and the need to adjust the amount of work to them.

Cost increases were not prevented, but they were smaller than in past projects. The overall actual cost of the project (US\$82.6 million) was 8% over the appraisal estimate (US\$76.2 million) as a result of considerable variations in actual and estimated costs on six roads (50% of the total investment). Overruns occurred on three roads (34% of the total investment) because of changes in design and quantities as well as adverse weather. In addition, underruns occurred on three roads (16% of total investment) and were caused by overestimation of pavement costs.

Changes in design and quantities were necessary because detailed engineering had not been carefully prepared. Mexican authorities have stated that time and budgetary limitations prohibited anything but their "best effort" to ensure compliance with the Bank's timing requirements

and that they intended any necessary changes to be made during the progress of work. Unfortunately, this procedure increased the possibility of cost overruns and reduced the responsibility of contractors for construction costs.

A control office was established to check that the project was carried out in accordance with approved detailed engineering and cost estimates. The office was not able to carry out its function with regard to detailed engineering because design changes had to be made during the progress of work. In addition, the office was circumvented because Mexican authorities awarded direct contracts for works not adequately covered in the project instead of changing the competitively bid contracts.

At appraisal, an overall economic rate of return of 19% and rates of return on the eight individual roads ranging from 12% to 23% were projected. At audit, the rates of return are higher than at appraisal on five roads (66% of the total investment) and lower on three roads (34% of the total investment). Of these three roads, only one (12% of the total investment) has a rate of return below 10%.

The higher than expected rates of return resulted from the favorable interaction of cost underruns and higher than expected traffic growth. The reasons for the higher than expected traffic growth, in general, were the conservative assumptions used by the Bank at appraisal and the more rapid growth of the vehicle fleet than expected.

The lower than expected rates of return resulted from the cost overruns, with traffic levels close to appraisal projections. Two of the roads had high rates of return at appraisal which were capable of absorbing the cost increases and still producing rates of return over 10%. But on the other road, the negative effect of the cost overrun on the rate of return was reinforced by a lower than expected traffic growth. The reason for the low traffic growth is not known.

In conclusion, the Bank's decision to introduce the requirement that detailed engineering had to be completed before loan negotiations seems to have played an important part in effecting a shorter construction delay and smaller cost overrun in this Third Highway Project than in previous Bank-supported projects in Mexico. Furthermore, the requirement seems to have strengthened the abilities of Mexican firms in planning and in estimating costs.

PROJECT PERFORMANCE AUDIT REPORT

MEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)

I. INTRODUCTION

1.01 The loan for the Mexico Third Highway Project (528-ME) was the Bank's fifth participation in the country's highway sector. The first loan (268-ME for US\$25 million in 1960) and third loan (354-ME for US\$40 million in 1963) had encompassed improvement and expansion of 9,150 km of the Federal Highway System as well as purchases of maintenance and laboratory equipment. The second loan (317-ME for US\$30.5 million in 1962) and fourth loan (401-ME for US\$32 million in 1965) had comprised improvement and expansion of toll facilities, including 844 km of toll roads and 8 bridges, as well as purchase of a ferry.

1.02 All four projects had suffered considerable construction delays and cost overruns. 1/ The Bank considered the primary cause of the delays and overruns to be the lack of detailed engineering and the secondary cause to be the limited competitive bidding, not fully in compliance with procedures normally followed in Bank-supported highway projects. Therefore, the Bank's major objectives in Loan 528-ME were to: reduce delays and overruns by requiring that detailed engineering be nearly complete by project appraisal and complete by loan negotiations; and broaden procedures for inviting bids and awarding construction contracts. The latter objective was to be achieved by removing possible obstacles to foreign bidders and making the procedures comparable to those normally followed in Bank-supported highway projects. Also, in Loan 528-ME, the Bank wanted to ensure that construction would begin within a year after loan approval.

II. THE BANK AND THE LOAN

2.01 In mid-1965, the Mexican Government presented a preliminary program to the Bank for a Third Highway Project. The program included 20 roads totalling about 3,000 km, with construction required on 1,500 km, reconstruction on 1,000 km, and paving on 500 km. The cost was estimated to be about US\$100 million, and a Bank loan of US\$40 million was requested.

2.02 Two years passed between presentation of the preliminary program and appraisal of the project, largely due to the Bank's requirement that detailed engineering for each road should be nearly complete before appraisal. In that period, six of the roads were deleted because it was not likely that detailed engineering could be completed on time and construction could begin within a year after loan approval. The project finally was appraised in February 1967.

1/ The first project had been delayed four years and had a 25% overrun; the second project, two and a half years and a 45% overrun; the third project, four years and a 32% overrun; and the fourth project, half a year and an 18% overrun.

2.03 During appraisal, 6 of the remaining 12 roads were carefully reviewed because they appeared to have inadequate economic justification. The roads would have opened up areas considered by the Bank to have marginal economic potential. The Ministry of Agriculture did not specifically plan to develop the areas, and development would depend on private initiative. But private initiative was not specifically being promoted, so the Bank suggested that regional development programs could parallel the highway program. This suggestion was not pursued, however, because of the Bank's assessment that the development potential of the areas was marginal. The Bank also suggested that time-staging of highway construction could parallel regional development programs, but this suggestion was precluded because of the Government's desire to limit further delays. Finally, the six roads involved were deleted at the Bank's insistence. The roads were subsequently redesigned, and all or part of them have been included in projects financed by the Bank and by the Inter-American Development Bank. Details about these roads are in Annex 1.

2.04 The eight roads remaining in the program were economically justified, and therefore were included in the Third Highway Project. The project comprised:

- (a) reconstruction, including asphaltic concrete surfacing, of the primary roads Culiacan-Empalme-Nogales, Tulancingo-Tuxpan, and Puebla-Izucar de Matamoros, totalling 1,231 km;
- (b) improvement, including bituminous surfacing, of the tertiary roads Cuatro Caminos-Playa Azul, Ciudad Aleman-Oaxaca, Iguala-Ciudad Altamirano, and Escarcega-Chetumal, totalling 885 km; and
- (c) construction, including asphaltic concrete surfacing, of the 66 km primary road San Martin Piramides-Tulancingo, and provision of the necessary right-of-way.

Additional information about the project is provided in Annex 2 and the map. Planning, engineering, supervision, and maintenance of the project roads were the responsibility of the Secretariat of Public Works (SOP) through its Directorates. The Bank considered SOP staff to be qualified and experienced in highway construction and maintenance, and no consulting services were considered necessary.

2.05 Negotiations took place September 27 - October 12 and December 17-13, 1967. During negotiations, the main point pursued by the Bank was that the Government should revise bidding procedures to ensure adequate international competition. After arduous discussion, agreement was reached on the following changes in bidding and contract control procedures:

(a) Prequalification of contractors. In the past, invitations to contractors for prequalification had been issued only at the beginning of a Bank-supported project, although interested firms had been able to request prequalification at any time during project implementation. In addition, no advertisements had been placed in foreign publications, and firms outside of Mexico had difficulties in learning about projects. But any firms which did learn about them had been able to request prequalification. Agreement was reached during negotiations to invite contractors for prequalification, through local and foreign publications, on a regular annual basis during project implementation.

(b) Invitation to bid. Invitations had been sent to one-third foreign and two-thirds domestic contractors in earlier projects. Agreement was reached during negotiations that invitations to bid would be sent to at least 16 prequalified firms, at least half of which would be foreign (assuming that there would be a sufficient number of prequalified foreign firms).

(c) Size of contracts. Previously, the Government and the Bank had agreed to a minimum contract size of US\$2 million for international competitive bidding. The Government would have preferred an even lower amount so that the project works could be shared by the large number of domestic contractors. But the Bank pressed for increasing the minimum to US\$3 million to attract foreign bidders. Agreement was finally reached during negotiations that of the total contract amount international competitive bidding would apply to about 35% in packages exceeding US\$3 million, about 20% in packages between US\$2.5 million and US\$2.9 million, and about 38% in packages between US\$2 million and US\$2.4 million. In addition, local competitive bidding would apply to about 7% of the total contract amount. Annex 3 sets out this size distribution. A total of 22 local competitively bid contracts were planned. Some contracts for bridges and minor or specialized works, not exceeding US\$3.8 million, were to be awarded directly to domestic firms.

(d) Award of contracts by type of work. The procedure of awarding separate contracts for each type of work on a "horizontal" basis (e.g. for earthworks, for subbase and base, for pavements, for bridges, etc.) was changed to awarding contracts for complete road sections on a "vertical" basis, including all works. The procedure of splitting works into small specialized contracts favored the domestic contracting industry, which was specialized along the "horizontal" basis, discouraged foreign participation, and made establishment of responsibilities for failure technically and legally difficult.

(e) Signature of contracts in annual tranches. In previous projects, contracts had been signed piecemeal for the amount appropriated in the annual budget instead of for the full bid amount, and this had discouraged participation of foreign contractors. Agreement was reached during negotiations that the Government would sign contracts for the full bid amount and for a complete road section included in any Bank-financed project.

(f) Control of cost overruns and delays. To ensure that the project would be carried out in accordance with the detailed engineering and cost estimates provided, the Government was to establish a control office staffed with three engineers. A major function of that office would be to obtain approval from SOP, the executing agency, and from the Bank for all changes expected to result in cost increases over 10% for an individual contract.

2.06 Items (a), (d), and (e) preceding are similar to procedures advocated by the Bank in most countries, and their adoption caused Mexican

procedures for competitive bidding to conform to procedures typically used for international competitive bidding in most Bank-supported highway projects. Items (b), (c) and (f) preceding were unique to the Mexico Third Highway Project.

2.07 An agreement for a US\$27.5 million loan, representing the foreign exchange component of the US\$76.2 million project, was signed in January 1968. The Mexican Government agreed to finance the local component through annual appropriations from the Federal Budget.

III. PROJECT IMPLEMENTATION

3.01 Under the Third Highway Project, attention was directed to making bidding procedures attractive to foreign firms, to preventing cost increases, and to avoiding delays in completion. But bidding procedures introduced to encourage international competitive bidding failed to attract foreign firms. An 8% cost overrun occurred, and delays in completion of two of the roads (28% of the total investment) necessitated several postponements of the closing date. The final disbursement for the loan was in March 1974; about two years later than the original closing date of March 31, 1972.

3.02 Information provided by SOP indicates that prequalification procedures agreed by the Government and the Bank were followed satisfactorily. In the first of the annual prequalifications, 8 foreign firms and 38 domestic firms requested prequalification documents. Two foreign firms (Water Resources Development of Israel and Raymond Corporation of the US) and 28 domestic firms were prequalified. The number of domestic firms was unusually low, given the size of the project. Because of the poor response by foreign and domestic firms, in mid-1968 SOP and the Bank agreed to advance prequalification for the second year. This process was completed in late 1968. In the second annual prequalification, 27 foreign firms and 40 domestic firms requested prequalification documents. No foreign firms and only 28 local firms submitted documents, and 18 additional domestic firms were prequalified. The two prequalified foreign firms were invited to bid on all sections of road in which they were interested. But they did not respond, and all contracts were awarded to domestic firms.

3.03 To determine why foreign firms were not responsive, discussions were held with 12 US firms which had previously demonstrated some interest in bidding for Mexican road projects. ^{1/} Those discussions have suggested that the main reason foreign firms lacked interest was the strong, well organized, competitive nature of the Mexican construction industry and the generally low bids of domestic firms compared with those of foreign firms. One of the factors contributing to the low domestic bids was the use of equipment depreciation schedules that were considerably longer than those typically used by US and European firms. Another reason why foreign firms were not responsive was that the contracts were too small and the necessary technical capabilities were available in Mexico. A further reason was that foreign firms lacked familiarity with local soils, fill locations, labor relations, etc., which would help make them competitive with domestic firms. The final reason was that foreign firms lacked experience with the institutional framework.

^{1/} These firms had requested prequalification documents for various Mexican road projects. Only one firm had actually submitted a bid.

3.04 With regard to the size distribution of competitively bid contracts, it seems that the agreement reached at negotiations was not implemented at tendering and that the actual costs of the contracts were considerably higher than the tendered prices (Annex 3). Although the small size of the tenders could have discouraged foreign firms, those firms did not know the size before tendering and, therefore, could not have been affected by the fact that the average size was less than planned. Thus, even if the Mexican Government had complied with the minimum size distribution of contracts, it is doubtful that foreign firms would have participated to a greater extent.

3.05 In subsequent projects, the Bank has required Mexican authorities to combine road contracts into single packages of US\$5 million-US\$7 million to attract foreign firms. Some foreign firms have been prequalified, but they have demonstrated little interest in competing for road construction work in Mexico, and, except in one isolated case, have not bid on any projects. In the project for construction of the Tijuana-Ensenada road, only one foreign firm (from the southwestern United States) submitted a bid, and the bid was nearly double the average bid of domestic firms.

3.06 Mexican authorities have attributed the low response of domestic firms to the Third Highway Project to the increased size of the contracts and to the award of contracts on a vertical basis rather than a horizontal basis. The award of contracts on a vertical basis, including all types of work, encouraged Mexican road construction firms to develop expertise in new areas. The industry responded well to the new arrangement, and individual firms expanded their areas of qualification and increased their volumes of work.

Delays

3.07 A serious attempt was made to complete the project roads on schedule (October 1971). On the original closing date in March 1972, reconstruction of the Culiacan-Empalme-Nogales and Puebla-Izucar de Matamoros roads, improvement of the Cuatro Caminos-Playa Azul, Iguala-Ciudad Altamirano, and Escarcega-Chetumal roads, and construction of the San Martin Piramides-Tulancingo road (72% of the total investment) had been completed or essentially completed. In addition, about 90% of the reconstruction of the Tulancingo-Tuxpan road and of the improvement of the Ciudad Aleman-Oaxaca road (28% of the total investment) had been completed. The remaining 10% was finished within about two years.

3.08 SOP has attributed the delays to several factors, including: contractor deficiencies in equipment and organization and the need to rebid some sections; problems with project design and specifications and the need to change them; unusually heavy rain and the need to clear big landslides in the mountainous sections; and insufficient Government budgetary allocations during the first years and the need to adjust the amount of work to them. The last factor delayed construction for nearly a year because only about 8% of the requested funds were allocated in 1968, the first year of project implementation, as shown in Annex 4. If the Bank had investigated the restrictions on budgetary allocations, it might have succeeded in causing them to be reduced or construction to be rescheduled more realistically.

Costs

3.09 The overall actual cost of the project was US\$82.6 million compared with the appraisal estimate of US\$76.2 million. Although the overrun on the overall project cost was only 8%, considerable variations occurred in the actual versus estimated costs of six of the eight project roads, as shown in Annex 5.

3.10 In the case of the Tulancingo-Tuxpan, Ciudad Aleman-Oaxaca, and Iguala-Ciudad Altamirano roads (34% of the total investment), overruns were 36%, 34%, and 30%, respectively. And in the case of the Cuatro Caminos-Playa Azul, Escarcega-Chetumal, and San Martin Piramides-Tulancingo roads (16% of the total investment), underruns were 25%, 16%, and 8%, respectively. The Culiacan-Empalme-Nogales and Puebla-Izucar de Matamoros roads (50% of the total investment) had actual costs that were close to the estimates. The overruns were primarily due to changes in design and quantities, particularly earthworks on the three roads and pavement on the Tulancingo-Tuxpan road. SOP has also attributed the overruns to adverse weather. The underruns were due to overestimation of pavement cost.

3.11 The changes in design and quantities were necessitated because detailed engineering had not been carefully prepared and, hence, adjustments had to be made as work progressed. This situation occurred because time and budgetary limitations had compelled SOP to produce engineering representing only its "best effort" although a competent job was within its capability. SOP had been anxious to meet the Bank's requirement for complete detailed engineering of all project roads by loan negotiations. Therefore, it had done only what was essential to ensure that work could be initiated and had intended that any necessary adjustments would be made subsequently. This procedure not only increased SOP's workload and the possibility of cost overruns but also reduced the responsibility of contractors for construction costs.

3.12 During appraisal, Bank staff had reviewed the detailed engineering and found that it appeared to be complete in scope and design. But some of the field information proved to be inaccurate, and changes had to be made in design and quantities during execution. The need for these changes could not have been detected by a desk review of plans, profiles, and cost estimates, and the Bank has informed SOP on many occasions that detailed engineering must be carefully prepared. 1/

3.13 As a result of the problems in the engineering work, the quantity contingency of 10% was clearly inadequate. However, the price contingency of 10% was adequate as prices of most construction items rose only 3%-5% per year during 1969-71, the period of major execution, although they rose 20%-25% per year thereafter.

1/ This raises the issue of whether the Bank appraisal staff should have engaged physically in some field testing or directing of the consultants' survey and design works. Full consideration of this issue requires comparison of the extra costs in terms of Bank staff time and the likely delays in loan processing with the benefits expected in the form of avoidable cost overruns. Such comparison was not possible in this audit, but the issue may be of interest for future work.

3.14 One of the consequences of the design and quantity changes was the 26% increase between the total tendered prices and actual costs of competitively bid contracts, as shown in Annex 6, or 6 percentage points above the 20% contingencies, which resulted in a cost increase of US\$3.1 million. However, this 26% increase actually represented an underestimation of the actual overrun on these contracts because some of the extra work was awarded through direct contracts without adjusting the competitively bid contracts. As a consequence, the cost of direct contracts was US\$9.5 million, or over double the appraisal estimate of US\$3.8 million. This procedure meant that the function of the control office in monitoring and limiting contract changes was circumvented. SOP has stated that direct contracts were awarded because the work was not included in the original design or the original contract, was not included in the Loan Agreement with the Bank, or was financed entirely with local funds.

3.15 Changes resulting in cost increases for direct contracts were not submitted to the Bank for approval. But changes resulting in cost increases exceeding 10% for competitively bid contracts which the Mexican authorities identified as part of the Bank-supported project were submitted to the Bank for approval, as required in the Loan Agreement. Quantitative justifications of cost increases were not routinely submitted to the Bank. In only one case, was a quantitative justification submitted. Subsequent Bank-supported projects in Mexico have included covenants requiring approval of contract cost increases, and SOP has stated that it has provided detailed quantification of these cost increases.

3.16 A problem occurred regarding SOP's cost reporting procedures for the project. It seems that most of the cost increase of the Tulancingo-Tuxpan road took place after it was 90% complete, while almost all of the cost increase of the Iguala-Ciudad Altamirano road took place after it was reported as complete. In addition, all project works reported as complete by August 1973 were in fact not completed until February 1974. These discrepancies occurred because SOP reported on cost estimates and construction periods for works supported by the Bank but did not report on minor portions (about 7%) financed entirely by the Government.

3.17 The Bank became aware of cost reporting problems only when it requested information on total construction costs, including Government and Bank-financed portions, after project completion. In the future, the Bank should review cost reporting procedures to avoid a similar situation.

Quality of Work

3.18 SOP has stated that deficiencies occurred in contract performance. These deficiencies included cancellation of contracts because contractors lacked the capacity to complete the work in the required time and the need to award new contracts, delays in transportation of materials, and difficulties in recruitment of labor. On the whole, however, the contractors performed adequately and constructed satisfactory roads.

3.19 SOP's preparation of final engineering could have been more thorough, but its construction supervision was adequate.

IV. ECONOMIC JUSTIFICATION

4.01 The Mexico Third Highway Project projected an overall economic rate of return of 19% and rates of return on the eight individual roads ranging from 12% to 23% at appraisal. The rates of return are higher at audit than at appraisal on five roads (66% of the total investment), while they are lower on three roads (34% of the total investment). But of these three roads, only one (12% of the total investment) has a rate of return below 10%.

4.02 The proportion of the total investment devoted to the individual roads and a comparison of the economic rates of return as estimated at appraisal and at audit are:

<u>Road</u>	<u>Proportion of Total Investment</u>	<u>Appraisal Estimate of Economic Rate of Return %</u>	<u>Audit Estimate of Economic Rate of Return /a</u>
Culiacan-Empalme-Nogales	45	20	Over 20
Tulancingo-Tuxpan	16	21	10-14
Puebla-Izucar de Matamoros	5	21	Over 21
Cuatro Caminos-Playa Azul	6	13	Over 13
Ciudad Aleman-Oaxaca	12	12	5-6
Iguala-Ciudad Altamirano	6	20	Over 10
Escarcega-Chetumal	5	18	Over 18
San Martin Piramides-Tulancingo	5	23	Over 23
Total	<u>100</u>		

/a If new oil prices are taken into account, the rates of return would rise one percentage point.

Details about the economic justification are given in Annex 7.

4.03 The main reasons for the lower than expected rates of return were cost overruns, with traffic levels close to appraisal projections; traffic is shown in Annex 8. This situation occurred on the Tulancingo-Tuxpan, Ciudad Aleman-Oaxaca, and Iguala-Ciudad Altamirano roads, whose cost overruns averaging 33% were the highest in the project (Annex 5). The Tulancingo-Tuxpan and Iguala-Ciudad Altamirano roads had high rates of return at appraisal which were capable of absorbing the cost increases and still producing rates of return over 10%. But the negative effect of the 34% cost overrun on the rate of return of the Ciudad Aleman-Oaxaca road was reinforced by a lower than expected traffic growth. Actual traffic on that road was 21% less than expected traffic in 1974, and this factor as well as the cost overrun explains the audit rate of return of about 5%-6% as compared with the appraisal rate of return of 12%. Unfortunately, traffic figures are available for only 1974, and the reasons for the short-fall are not clear.

4.04 In the case of the five remaining roads, the rate of return is higher than expected because of the favorable interaction of cost under-runs (Annex 5) and higher than expected traffic growth (Annex 8). The general reasons for the higher than expected traffic growth were the conservative assumptions used by the Bank at appraisal and the more rapid growth of the vehicle fleet than expected, from 8% per year in 1958-68 to 10% per year thereafter, as shown in Annex 9.

4.05 Traffic exceeded estimates to the highest extent on the San Martin Piramides-Tulancingo road, where actual traffic was 141% more than projected traffic in 1973. This large increase is attributed to the use of the road for traffic between Mexico City and the Port of Tampico, most of which had been expected to be diverted to a new, direct toll road.

4.06 In 1973, actual traffic was 71% more than projected traffic on the Puebla-Izucar de Matamoros road. Some of the increase can be accounted for by the larger than expected expansion of the city of Puebla along the route to the city of Izucar de Matamoros.

4.07 Actual traffic on the Cuatro Caminos -Playa Azul road was 66% more than projected traffic in 1974. This increase is attributed to the construction of a steel mill at Playa Azul that was not foreseen at the time of appraisal.

4.08 In 1973, actual traffic was 33% more than projected traffic on the Escarcega-Chetumal road, and was due to the generation of traffic after surfacing of the road.

4.09 On the Culiacan-Empalme-Nogales road actual traffic was 23% more than projected traffic in 1973 because of development in the surrounding area. Some of that development had been spurred by increased Government investment over the previous five years. During appraisal, only a minimal amount of traffic had been expected to be diverted to the improved road from the railroad parallel to the road. Goods traffic on the railroad has increased considerably, particularly the north-south flow of local bulk products, such as grains, for which the railway is currently operating at full capacity. The only goods diverted to the improved road, according to the railroad traffic manager, are fresh fruits and vegetables being shipped to the US. Before road improvement, all rail shipments north were by refrigerated piggy-back trailers. Now, these vehicles flow about equally on road and rail.

4.10 While traffic was considerably higher than expected on these five roads in percentage terms, it was sufficiently large in absolute terms on only the Cuatro Caminos-Playa Azul road to question the design capacity. That road was built to a geometric standard appropriate for low volume penetration or tertiary roads, a standard clearly inappropriate for the traffic now occurring. To resolve this problem, some difficult road sections have been improved to facilitate traffic generated by construction of the Las Truchas Steel Mill pending completion of a railway, now being constructed, that will transport mill products to other parts of the country.

4.11 The other four roads (Culiacan-Empalme-Nogales, Tulancingo-Tuxpan, Puebla-Izucar de Matamoros, and San Martin Piramides-Tulancingo) were built to "Special" and "A" geometric standards, which were appropriate. Typically, in roads of these standards, parallel lanes are added when capacity (approximately average daily traffic of 6,500 vehicles) is reached. If future traffic on these roads were to increase as projected, the additional lanes would have to be constructed somewhat earlier than anticipated.

V. CONCLUSIONS

5.01 In the Mexico Third Highway Project, the Bank had endeavored to reduce construction delays and cost overruns by requiring that detailed engineering be nearly complete by appraisal and complete by loan negotiations, by causing a control office to be established to maintain project implementation in accordance with detailed engineering and cost estimates, and by changing bidding procedures to facilitate international competitive bidding.

5.02 Detailed engineering was required as a means of improving design and cost estimation. This requirement was appropriate as delays and overruns in past projects had been related to design and cost estimation based on preliminary engineering; and it has resulted in a lower cost overrun than in previous projects despite the fact that detailed engineering was not carefully prepared because of SOP's time and budgetary limitations.

5.03 In the case of the control office, its function of ensuring that project implementation was in accordance with detailed engineering and cost estimates approved by SOP could not be fulfilled with regard to detailed engineering because of SOP's intention that design changes should be made during the progress of work. In addition, the office was circumvented when Mexican authorities awarded direct contracts for works not adequately covered in the project instead of changing the competitively bid contracts.

5.04 In regard to bidding procedures, the Bank wanted to effect changes to facilitate international competitive bidding not only because international competitive bidding was a Bank policy but also because it could possibly lead to improvements in the cost and efficiency of road construction. Mexican authorities did not believe that these improvements would be achieved, and not only viewed their own construction industry as competitive on an international basis but also felt that local firms were able to carry out satisfactorily any type of highway works.

5.05 The Bank seemed to pursue the issue of international competitive bidding as a matter of principle. Although competition did not materialize,

the project does not seem to have been negatively affected because Mexican firms seem to be cost efficient in comparison with firms from other countries. Certainly, the current success of Mexican firms in competing for contracts in other Latin American and Caribbean countries seems to support this argument.

5.06 Taking advantage of hindsight, the original delay in making the loan awaiting completion of detailed engineering for many roads and the deletion of several roads from the original project proposal because detailed engineering could not be completed by appraisal suggest that perhaps other approaches might have contributed to the successful completion of the project. One might have been that of the ongoing Seventh Highway Project (Loan 968-ME for US\$90 million in 1974). In the Seventh Project, the Bank and the Government agreed that disbursement for roads on which detailed engineering could not be completed by Board presentation would be conditional upon confirmation of the economic justification of the roads, based on cost estimates resulting from completed detailed engineering. If this confirmation could not be obtained, the Government would be permitted to propose for inclusion in the project other roads which would be subject to the same evaluative criteria.

5.07 These conditions for the Seventh Project can be regarded as a step toward highway sector lending as defined in a recent Bank paper.^{1/} While full consideration of sector lending is outside the scope of this audit, it seems that the more flexible approach of sector lending could have helped the successful completion of the project. Work on some of the roads included in the project could have started earlier and financing of some of the roads deleted from the project would not have had to wait until a new "package" could be formed for Bank financing. As it turned out, some of the deleted roads were subsequently financed by the IDB in 1970 and by the Bank in 1974.

5.08 In conclusion, the eight roads included in the Mexico Third Highway Project were constructed satisfactorily. Five roads have produced rates of return at audit higher than those at appraisal and only one road has produced an uneconomical rate of return at audit indicating that construction possibly should have been postponed.

5.09 The closing date of the project was delayed for about two years, but six of the eight roads had been entirely completed and 90% of the work on the other two roads had been completed by the original closing date. In addition, an 8% cost overrun occurred. The delay was considerably shorter and the overrun smaller than in previous Bank-supported projects in Mexico. Therefore, the Bank's requirement that detailed engineering had to be completed before loan negotiations seems to have played an important part in these improvements. In addition, this requirement seems to have strengthened the abilities of Mexican firms in planning and in estimating costs.

^{1/} "Highway Sector Lending", SecM75-487, June 27, 1975.

PROJECT PERFORMANCE AUDIT REPORT
MEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)

Roads Deleted From the Project During Appraisal and Subsequently
 Financed by IBRD or IDB

<u>Road</u>	<u>Length</u> (km)	1967 <u>Cost Estimate</u> (US\$ million)	<u>Revised Cost</u> <u>Estimate</u> (US\$ million)	<u>Related</u> <u>Loan No.</u>	<u>Year</u>
Atoyac-Playa Azul	275	12.6	7.8 ¹) 192/OC-ME) (IDB)	1970
Escopetazo-Pichucalco	124	3.1	8.7		
Sayula-Cintalapa	200	1.1	9.3	968-ME	1974
Pto Escondido-Salina Cruz	243	16.2	17.0	(IBRD)	
Agua Prieta-Janos y Ramal a Naco	173	7.7	10.4	403/SF-ME (IDB)	1975
Nuevo Laredo-Ciudad Guerrero	123	3.9	7.1	968-ME (IBRD)	1974

¹ This corresponds to the section between Zihuatanejo and Playa Azul (116 km).

PROJECT PERFORMANCE AUDIT REPORT

MEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)

Detailed Project Description

A. Roads to be Reconstructed

Culiacan-Empalme-Nogales (956 km)

Reconstruction of this road was to be the major component of the project, and was to account for about half the total cost. The road was to be part of the 2,300 km trunk route along the western seaboard from Nogales, on the Mexican/United States border, to Mexico City, passing through Guadalajara, the country's second largest city, and many other important towns. The Bank had financed improvement of substantial sections of the road between Guadalajara and Mexico City under previous projects.

The road ran parallel to the Pacifico Railway, passing through flat or rolling country and crossing numerous rivers. It had two lanes and had been constructed between 1950 and 1955 when the area was still undeveloped. The structure and design standards were suited to the traffic conditions prevailing at that time. As a result of increasing traffic volumes and vehicle weights, the road had deteriorated and needed to be reconstructed and improved. The works to be carried out were to provide for reconstruction of the base over part of the road and for asphaltic concrete surfacing over the whole road. For about 120 km, where the traffic volume ranged between 1,200 vpd and 2,400 vpd, earthworks and drainage structures were to be widened from 9 m to 13 m. For about 80 km, where the traffic volume was particularly high (3,100 vpd-4,000 vpd) the road was proposed to be widened from two to four lanes. The works also were to include construction of four overpasses and a bypass of Guamuchil.

Tulancingo-Tuxpan (206 km)

From Tulancingo, the first section of this two-lane road crossed the eastern mountain range and reached altitudes of 2,700 m before descending toward Tuxpan on the Gulf of Mexico. The last 60 km were located on flat terrain. The road had been built between 1940 and 1945, and traffic requirements made its improvement necessary. Widening of earthworks, culverts, and bridges; reconstruction of the base; provision of asphaltic concrete surfacing 7.2 m wide as well as bypasses of three cities; and realignment of certain sections were proposed.

Puebla-Izucar de Matamoros (69 km)

This two-lane road had been built between 1940 and 1942, and was deteriorating rapidly due to heavy traffic demands. The road crossed flat and rolling terrain, serving important industrial and agricultural areas, and the cities of Puebla, Atlixco and Izucar de Matamoros, with a total population of about 430,000. The proposed works included realignment of four sections totalling about 5 km to eliminate sharp curves: widening of earthworks, culverts, and bridges; reconstruction of the base; and provision of asphaltic concrete surfacing 7.2 m wide. Three bridges, with a total length of about 120 m, also were to be constructed.

B. Roads to be Improved

Cuatro Caminos-Playa Azul (202 km) and Ciudad Aleman-Oaxaca (239 km)

These two roads had been under construction since about 1956, but progress had been delayed by failure to make available adequate funds and resources for their completion. Earthworks and some drainage structures had been completed, but the base and surfacing had not been constructed. Widening of earthworks, culverts, and bridges; construction of certain minor bridges; and provision of the base and single bituminous surface treatment 7 m wide were proposed.

Iguala-Ciudad Altamirano (189 km) and Escarcega-Chetumal (255 km)

These two roads were designed with a light gravel surface suitable for low traffic volumes, but rapid development in the localities caused traffic to grow faster than expected and justified provision of a light pavement. Earthworks, drainage, and construction of the subbase had been included in Loan 354-ME; this work, which was scheduled for completion by late 1968, was to be advanced early in 1968 to a stage where the proposed project works could commence. The proposed project provided for additional drainage works, construction of the base, and provision of a single bituminous surface treatment 7 m wide.

C. Road to be Constructed

San Martin Piramides-Tulancingo (66 km)

This road represented an extension of the Mexico City-San Martin Piramides (Teotihuacan) road supported by the Bank under Loan 317-ME. It was also linked with the Tulancingo-Tuxpan road, to be reconstructed under the proposed project, and was to provide a short cut for through traffic moving to and from an area northeast of Mexico City, and was to reduce the journey distance by about 25 km. The proposed works comprised construction of earthworks, 11 bridges with a total length of about 220 m, drainage structures, and 4 overpasses as well as provision of the base and asphaltic concrete surfacing 7.2 m wide.

PROJECT PERFORMANCE AUDIT REPORT

MEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)

Size Distribution of Contracts as Agreed at Negotiations, as Tendered,
and as Actually Realized

<u>Size Distribution of Contracts</u>	<u>Agreement at Negotiations</u>	<u>Tendered Contract Price</u> (%)	<u>Actual Contract Cost</u>
International Competitive Bidding			
Below US\$2 million	0	16	7
US\$2 million- US\$2.4 million	38	48	18
US\$2.5 million-US\$2.9 million	20	9	21
Over US\$3 million	35	12	41
Local Competitive Bidding	<u>7</u>	<u>15</u>	<u>13</u>
Total	<u>100</u>	<u>100</u>	<u>100</u>

PROJECT PERFORMANCE AUDIT REPORT

MEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)

Funds Requested and Appropriated by the Secretariat of Public Works, 1968-71

<u>Road</u>	<u>1968</u>			<u>1969</u>			<u>1970</u>			<u>1971</u>		
	<u>Requested</u> <u>----(Mex\$ million)-----</u>	<u>Appropriated</u> <u>----(Mex\$ million)-----</u>	<u>Appropriated</u> <u>as % of</u> <u>Requested</u>	<u>Requested</u> <u>----(Mex\$ million)-----</u>	<u>Appropriated</u> <u>----(Mex\$ million)-----</u>	<u>Appropriated</u> <u>as % of</u> <u>Requested</u>	<u>Requested</u> <u>----(Mex\$ million)-----</u>	<u>Appropriated</u> <u>----(Mex\$ million)-----</u>	<u>Appropriated</u> <u>as % of</u> <u>Requested</u>	<u>Requested</u> <u>----(Mex\$ million)-----</u>	<u>Appropriated</u> <u>----(Mex\$ million)-----</u>	<u>Appropriated</u> <u>as % of</u> <u>Requested</u>
Culaican-Empalme-Nogales	105.1	12.5	11.9	145.0	119.0	82.1	110.0	146.9	133.5	135.3	135.3	100
Tulancingo-Tuxpan	40.1	1.6	4.0	51.8	29.6	57.1	37.3	37.3	100.0	44.6	44.6	100
Puebla-Izucar de Matamoros	15.8	0	0	18.7	9.5	50.8	16.5	23.5	142.4	9.6	9.6	100
Cuatro Caminos-Playa Azul	14.1	0.4	2.8	30.0	29.7	99.0	29.1	24.1	82.8	0	0	0
Ciudad Aleman-Oaxaca	19.6	0	0	25.0	21.0	84.0	30.0	37.0	123.3	48.3	48.3	100
Iguala-Ciudad Altamirano	7.5	0	0	13.1	13.1	100.0	19.6	19.6	100.0	9.5	9.5	100
Escarcega-Chetumal	10.8	3.5	32.4	24.0	18.9	78.8	18.6	24.8	133.3	0	0	0
San Martín Piramides-Tulancingo	<u>20.2</u>	<u>0</u>	<u>0</u>	<u>17.7</u>	<u>17.5</u>	<u>98.9</u>	<u>26.7</u>	<u>22.7</u>	<u>85.0</u>	<u>8.4</u>	<u>8.4</u>	<u>100</u>
Total	<u>233.2</u>	<u>18.0</u>	<u>7.7</u>	<u>325.3</u>	<u>258.3</u>	<u>79.4</u>	<u>287.8</u>	<u>335.9</u>	<u>116.7</u>	<u>255.7</u>	<u>255.7</u>	<u>100</u>

PROJECT PERFORMANCE AUDIT REPORT
MEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)

Estimated and Actual Costs

<u>Type of Work and Road</u>	<u>Length (km)</u>	<u>Appraisal Cost Estimate</u> ¹	<u>Actual Cost</u>		<u>Total</u>	<u>Actual Cost as % of Estimated Cost</u>
			<u>Competitively Bid Contracts</u>	<u>Direct Contract</u>		
			(Mex\$ million)			
<u>Reconstruction</u>						
Culiacan-Empalme-Nogales	956	420.5	380.9	45.5	426.4	101
Tulancingo-Tuxpan	206	112.4	110.4	42.3	152.7	136
Puebla-Izucar de Matamoros	<u>69</u>	<u>42.3</u>	<u>37.9</u>	<u>5.8</u>	<u>43.7</u>	103
	1,231	575.2	529.2	93.6	622.8	
<u>Improvement</u>						
Cuatro Caminos-Playa Azul	202	72.2	53.9	0.3	54.2	75
Ciudad Aleman-Oaxaca	239	85.1	106.2	8.1	114.3	134
Iguala-Ciudad Altamirano	189	39.7	42.0	9.8	51.8	130
Escarcega-Chetumal	<u>255</u>	<u>56.0</u>	<u>47.2</u>	<u>0</u>	<u>47.2</u>	84
	885	253.0	249.3	18.2	267.5	
<u>Construction</u>						
San Martin Piramides- Tulancingo	<u>66</u>	<u>52.9</u>	<u>41.5</u>	<u>7.0</u>	<u>48.5</u>	<u>92</u>
Subtotal	2,182	881.1	820.0	118.8	938.8	107
Engineering and Supervision	<u>-</u>	<u>72.3</u>	<u>82.0</u>	<u>11.9</u>	<u>93.9</u>	<u>-</u>
Total	<u>2,182</u>	<u>953.4</u>	<u>902.0</u>	<u>130.7</u>	<u>1,032.7</u>	108

¹ Including contingencies.

PROJECT PERFORMANCE AUDIT REPORT
MEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)

Tendered Price and Actual Cost of Competitively Bid Contracts

<u>Road and Number of Contracts</u>	<u>Tendered Price</u> ----- (US\$ million) -----	<u>Actual Cost</u> -----	<u>Actual Cost</u> as % of <u>Tendered Price</u>
Culiacan-Empalme-Nogales -- 11 contracts	1.8	2.1	119
	2.5	4.5	179
	2.6	3.6	140
	2.3	3.8	164
	1.7	2.1	123
	2.2	2.5	116
	2.1	2.3	109
	2.0	2.9	147
	2.3	2.5	108
	1.8	1.9	106
	2.2	2.2	100
Tulancingo-Tuxpan -- 4 contracts	2.4	2.5	107
	2.2	2.1	92
	1.1	1.4	132
	2.4	2.7	112
Puebla-Izucar de Matamoros -- 1 contract	2.1	3.0	141
Cuatro Caminos-Playa Azul -- 2 contracts	1.8	1.9	107
	2.1	2.4	113
Ciudad Aleman-Oaxaca -- 2 contracts	3.5	5.5	157
	2.4	3.0	125
Iguala-Ciudad Altamirano -- 1 contract	2.9	3.4	117
Escarcega-Chetumal -- 1 contract	3.5	3.8	108
San Martin Piramides-Tulancingo -- 1 contract	<u>2.3</u>	<u>3.3</u>	<u>145</u>
Total	<u>52.2</u>	<u>65.5</u>	<u>126</u>

Source: SOP.

PROJECT PERFORMANCE AUDIT REPORT
MEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)

Economic Justification

<u>Road</u>	<u>Proportion of Total Investment</u>	<u>Appraisal Estimate of Economic Rate of Return</u>	<u>Audit Estimate of Economic Rate of Return</u>	<u>Actual Cost as Proportion of Estimated Cost</u>	<u>Actual Traffic as Proportion of Estimated Traffic</u>	
					<u>1973</u>	<u>1974</u>
			(%)			
Culiacan-Empalme-Nogales	45	20	Over 20	101	123	-
Tulancingo-Tuxpan	16	21	10-14	136	97	-
Puebla-Izucar de Matamoros	5	21	Over 21	103	171	-
Cuatro Caminos-Playa Azul	6	13	Over 13	75	-	166
Ciudad Aleman-Oaxaca	12	12	5-6	134	-	79
Iguala-Ciudad Altamirano	6	20	Over 10	130	107	-
Escarcega-Chetumal	5	18	Over 18	84	133	-
San Martin Piramides-Tulancingo	5	23	Over 23	92	241	-

PROJECT PERFORMANCE AUDIT REPORTMEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)Projected and Actual Average Daily Traffic on Project Roads, 1973 and 1974

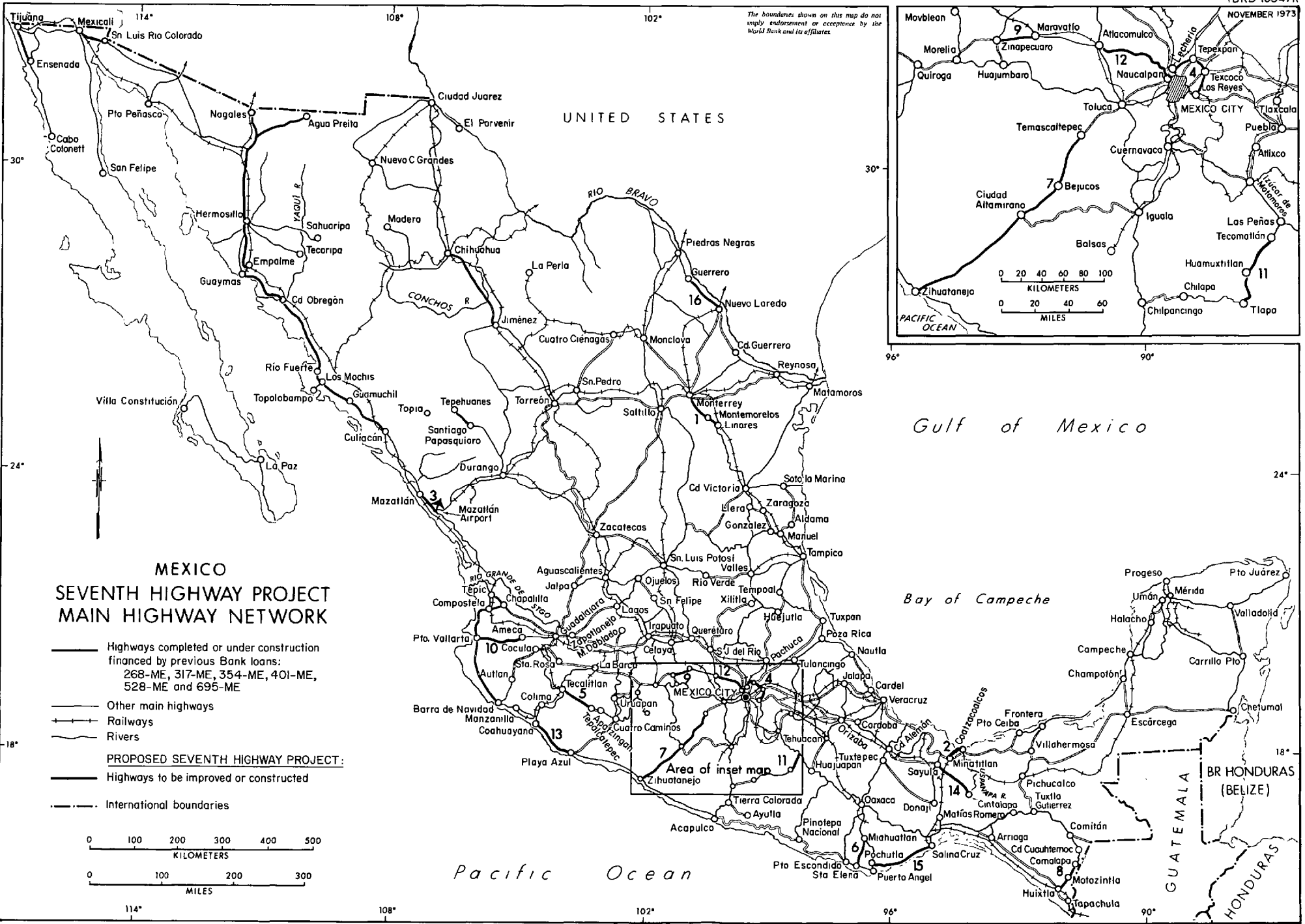
<u>Road</u>	<u>Traffic</u>				<u>Actual Traffic</u>	
	<u>1973</u>		<u>1974</u>		<u>as % of Pro-</u>	
	<u>Projected</u>	<u>Actual</u>	<u>Projected</u>	<u>Actual</u>	<u>jected Traffic</u>	
	<u>(Appraisal)</u>	<u>(SOP)</u>	<u>(Appraisal)</u>	<u>(SOP)</u>	<u>1973</u>	<u>1974</u>
Culiacan-Empalme-Nogales	2,747	3,376	-	-	123	-
Tulancingo-Tuxpan	2,232	2,167	-	-	97	-
Puebla-Izucar de Matamores	2,626	4,496	-	-	171	-
Cuatro Caminos-Playa Azul	-	-	444	737	-	166
Ciudad Aleman-Oaxaca	-	-	400	315	-	79
Iguala-Ciudad Altamirano	362	388	-	-	107	-
Escarcega-Chetumal	429	571	-	-	133	-
San Martin Piramides-Tulancingo	1,328	3,198	-	-	241	-

PROJECT PERFORMANCE AUDIT REPORT
MEXICO THIRD HIGHWAY PROJECT (LOAN 528-ME)

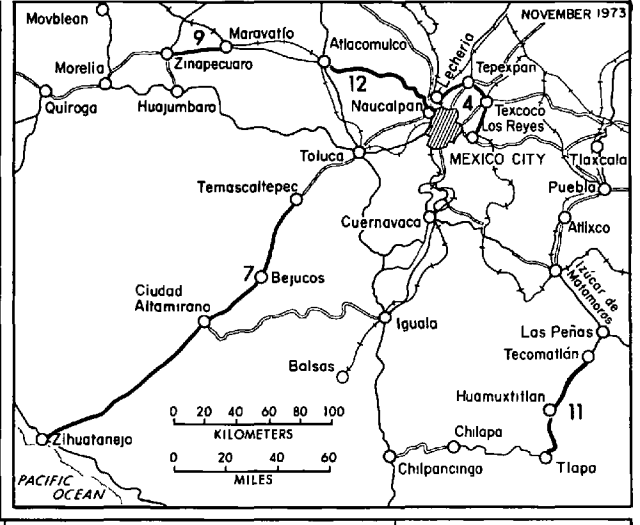
Registered Motor Vehicles, 1968-71

<u>Year</u>	<u>Automobiles</u>	<u>Buses</u>	<u>Trucks</u>	<u>Total</u>
	-----(thousands)-----			
1958	379	23	274	675
1959	438	26	301	765
1960	483	26	293	803
1961	521	33	300	854
1962	548	26	328	902
1963	618	28	353	998
1964	688	30	364	1,081
1965	771	31	388	1,190
1966	812	28	409	1,248
1967	917	28	440	1,385
1968	1,000	29	466	1,495
1969	1,133	32	505	1,670
1970	1,234	33	525	1,792
1971	1,338	35	555	1,927
1972	1,520	36	593	2,149
1973	1,767	37	645	2,449

Source: Anuario Estadístico de Los Estados Unidos Mexicanos and SOP.

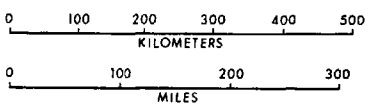


The boundaries shown on this map do not imply endorsement or acceptance by the World Bank and its affiliates.



**MEXICO
SEVENTH HIGHWAY PROJECT
MAIN HIGHWAY NETWORK**

- Highways completed or under construction financed by previous Bank loans: 268-ME, 317-ME, 354-ME, 401-ME, 528-ME and 695-ME
- Other main highways
- Railways
- Rivers
- PROPOSED SEVENTH HIGHWAY PROJECT:**
- Highways to be improved or constructed
- - - International boundaries



Gulf of Mexico

Bay of Campeche

Pacific Ocean

GUATEMALA
BR HONDURAS (BELIZE)
HONDURAS