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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT  
INTERNATIONAL DEVELOPMENT ASSOCIATION

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APPRAISAL OF  
HIGHWAY IMPROVEMENT AND  
MAINTENANCE PROJECT  
SPAIN

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Department of Technical Operations

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## SPAIN

### APPRAISAL OF HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECT

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## SPAIN

### APPRAISAL OF HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECT

#### SUMMARY

- i. The Government of Spain has requested the Bank to assist in financing a Highway Improvement and Maintenance Project. The total cost of the Project is estimated at about US\$91.5 million equivalent. The proposed loan of US\$33 million equivalent will be the first Bank loan to Spain.
- ii. The Improvement Works cover various important sections totaling 786 km. They comprise works on the roads forming the Madrid-Barcelona-Alicante triangle, construction of a new highway from Oviedo to Figaredo in the north, and construction of the new Palma airport freeway on Mallorca. The cost of the Improvement Works is about US\$82.0 million equivalent, of which the Bank loan will provide US\$26.1 million equivalent.
- iii. The objective of the Maintenance Plan is the establishment of two pilot divisions in the Madrid and Barcelona Regions as a first step in the reorganization of highway maintenance in Spain. The cost of the Maintenance Plan is estimated at about US\$9.5 million equivalent, of which the Bank will provide US\$6.9 million equivalent for the purchase of equipment and spare parts.
- iv. The proposed Improvement Works will be carried out under unit price contracts; contracts for construction of these works, as well as for the purchase of maintenance equipment, will be awarded on the basis of international competitive bidding. Design for the Improvement Works is scheduled to be completed in 1963, and construction in 1967.
- v. Execution of the Project will be the responsibility of the Directorate of Highways of the Ministry of Public Works. The Directorate of Highways is well organized and its staff is efficient. Spanish consulting engineering firms have been retained to prepare final designs for a large portion of the contemplated works; they will also assist in the preparation of contract documents and in bid evaluation.
- vi. Reliable traffic information is being obtained on a regular basis. The various sections of the Project will yield a high economic return on capital investment on the basis of the road users' and maintenance savings alone.
- vii. The Project is considered suitable for a Bank loan of US\$33.0 million to the Government; an appropriate term would be 20 years, including a 5-year period of grace.

## I. INTRODUCTION

1. The Government of Spain has requested the Bank to help finance a high priority Highway Improvement and Maintenance Project. The major portion of the Improvement Works is located in the triangle Madrid-Barcelona-Alicante, but the works also include a highway on Mallorca and one in the industrial region of northern Spain. The Maintenance Plan comprises procurement of equipment and construction of shops in Madrid and in the Northeast. The total cost of the Project is estimated at US\$91.5 million equivalent.

2. An economic survey mission to Spain was organized by the Bank in 1961 at the request of the Government. The report of the mission was published in 1962. With regard to road transportation, it was stated that a general improvement and maintenance program for the existing highway network was of high priority for economic development.

3. In early 1962, the Government published a 16-year development program for the highway network, entitled "Plan General de Carreteras," and toward the end of the same year, a Bank mission visited Spain to investigate the status of the studies being prepared for highway projects. Items of discussion were the contract for the feasibility study and design of the autopista Barcelona-La Junquera, and the urgently needed improvement of several important highways, as well as the unsatisfactory maintenance organization.

4. The Barcelona-La Junquera autopista is still under study and the project will not be ready for some time. It was therefore agreed that the first priority project would be highway improvement and maintenance and in January and February 1963, the Government presented documents giving descriptions and justifications for this Project. The appraisal is based on these documents, and on findings of a Bank mission in March 1963.

## II. BACKGROUND

### General

5. Spain covers an area of 505,000 square kilometers and is the third largest country in Europe after Russia and France. The mainland consists of a plateau, 600 meters above sea level, with high mountains in several parts of the country. Numerous rivers traverse the highlands toward the surrounding seas. They are not navigable due to rapids and uneven distribution of rainfall during the year. Except for the northwestern region which is humid throughout the year, summers are hot and dry. Winters are wet and cold on the plateau with occasional snowfalls in the northern regions. The population is about 31 million and is growing at less than 1 per cent annually. Population centers are mainly located along the coast, at considerable distances from each other, highlighting the importance of the transportation network. Gross national product per capita was about \$410 in 1962. The labor force totals nearly 12 million, of which 41% is engaged in agriculture. All the 54 provinces, including those overseas, are governed directly from Madrid.

## Transport

### Present Situation

6. Transport by rail, road, coastal shipping and air is well developed. As in other countries, however, there has been a considerable shift in favor of road transport; its share in intercity freight transport rose from 24% in 1955 to 38% in 1960 and for intercity passenger transport from 47% to 61% (Tables 1 and 2).

7. Haulage by road is faster and in many cases less costly than by rail and for this and other reasons the railroads have been losing a considerable amount of transport of high value goods. Although rates charged by coastal shipping operators are lower than those in road transport, they also have lost a substantial amount of general cargo traffic to the latter, because of faster haulage and lower overall transportation costs. It can be expected that these trends will continue for some time.

### Road Transport

8. In 1962 the number of motor vehicles was over 1.4 million, nearly 2.5 times the number in 1957 (Table 3). This represents an annual rate of growth of about 20%. Passenger cars accounted for nearly 68% of the total, motorcycles excluded. Motorization is still in an early stage; in 1961 there were 56 inhabitants per vehicle, as compared to 38 in Portugal, 16 in Italy and 6 in France.

9. The trucking fleet consists for the most part of light vehicles, having a load capacity of less than 3 tons. Heavy trucks sometimes are of the 3-axle type, and trailers and semi-trailers are seldom used. Trucks are frequently overloaded in spite of the general limitation of 10 tons per axle load recently enacted in accordance with the European standards, and sometimes even exceed the temporary tolerance of 13 tons per axle. In 1960, 50% of the trucking fleet was over 10 years old despite the fact that the number of trucks had increased by 30% since 1957.

10. Private cars and commercial vehicles are produced in Spain under foreign licenses; the total number of imported vehicles is small, because of high import duties, averaging nearly 100%, and import quotas. On cars manufactured in Spain there is a luxury tax of 16 to 20%.

11. Intercity traffic increased by 13% from 1960 to 1961. Much of it consists of traffic in the vicinity of population centers; 50% of the vehicles cover distances of less than 20 km and only 25% cover more than 50 km. Trucks with load capacity over 3 tons accounted for 32% of traffic.

12. Public transport is subdivided into scheduled services which require special licenses, and non-scheduled services. In general only one license is granted for services on a specific line, but there are exceptions if traffic is such that an increase in service is required. Non-scheduled transportation is permitted without limitation but only in case of full cargoes,

except for perishable goods, and for transport for which a scheduled service does not exist. Freight transport services are mostly provided by small firms and competition is very strong. Of the 22,000 operators providing non-scheduled services, 87% own one truck and only 1.8% own 4 trucks or more.

#### Co-ordination of Transport

13. Road transport is regulated by laws of 1947 and 1949 which subordinate commercial road transport to the railroads. The regulations on road transport have not on the whole been rigorously enforced, but in some cases road haulers may be obligated to pay to the railroads a percentage of revenues for freight carried on highways paralleling railroads, the percentage ranging from 2 to 11%.

14. The Spanish railways (Red Nacional de los Ferrocarriles Espanoles or RENFE) have operated with large deficits for a number of years. Motive power, equipment and track are obsolete and service generally poor, while a substantial portion of investment funds has been devoted to uneconomic construction of new lines. The Government has been increasingly concerned with these problems, and is reorganizing the railway system to give RENFE greater autonomy in operating matters. Consultants have recently completed preparation of a master plan designed to convert RENFE into a viable commercial enterprise.

15. Competition in road transport has brought rates to a level which must be regarded as minimum for profitability on a long-term basis, and the Government is considering various measures to secure the sound development of the trucking industry and create an adequate basis for co-ordination between road and rail.

16. The Spanish Government has agreed with the Bank on the need to establish a permanent organization for the co-ordination of all the means of transportation. Accordingly, it has recently issued a decree establishing a three-member Transport Coordination Commission consisting of the Under-secretaries of Public Works (as chairman), Civil Aviation, and Merchant Marine. The three Ministries concerned together represent all of the principal modes of transportation which will be coordinated through the Commission.

#### Highway System

17. Spain has a very old and extensive network of roads, part of which dates back to Roman times. There are about 132,000 km of highways, of which 81,000 km are administered by the Government and 51,000 km by the Provinces. Most of the present highway system was built in the 1920's. It is in urgent need of improvement since it has not been properly maintained and has not been kept up to modern design standards.

18. The highways administered by the Government are classified into 19,000 km of national highways, 22,500 km of regional highways, 38,000 km of local roads and 1,500 km of roads in urban areas.

19. Most of the highways administered by the Government, about 63,000 km, have a width of 6 meters and less, with shoulders which are generally less than 1.00 meter wide. About 48% have macadam pavement, 47% have a surface treatment, and only 2.5% have asphalt concrete pavement (Tables 4 and 5).

20. Highway expenditures from 1956 to 1962 amounted to less than half of the revenues in the same period from the fuel tax on road transport, as shown in Table 6. In 1962, expenditures for construction and maintenance of highways were about Pts 3.7 billion, or only 0.5% of the gross national product as compared to 1% in Great Britain and 1.5% in France.

### Administration of Highways

#### Organization

21. The Government exercises its responsibility for the administration, design, construction, and maintenance of highways through the Ministry of Public Works (M.O.P.). Responsibilities for regulation and control of traffic are shared by the Ministries of Public Works and of the Interior.

22. The Ministry of Public Works is composed of the Directorates of Highways, Land Transportation, and Hydraulic Works, and of several councils, committees and administrative offices (Chart 1).

23. The Directorate of Highways is composed of a main office in Madrid and of provincial offices (Jefaturas). The main office includes divisions for Studies, Planning and Traffic, Project Formulation and Revisions, Construction, and Maintenance (Chart 2). The Jefaturas report directly to the Director General. Responsibility for the preparation and execution of construction and improvement works is divided between the main office and the Jefaturas.

24. The engineers of the Directorate of Highways are qualified young professionals, devoted to the task of streamlining their departments. The Division of Planning and Traffic, for instance, has been making elaborate traffic studies for the past three years and its office is equipped with up-to-date electronic machinery. There is, however, only limited experience with regard to construction methods and costs in connection with the use of up-to-date construction equipment. This is not restricted to Government agencies, but applies to the Spanish construction industry as well since little heavy construction work had been done in Spain until a few years ago.

25. The staff in Madrid and in the Jefaturas is not sufficient for the amount of planning, design and supervision necessary for carrying out the extensive development program. Much of the planning and engineering is therefore done with the assistance of local and foreign consultants, and this probably will also have to include supervision in the future, if the program is to be finished on schedule.

#### Highway Development Plan

26. In 1962, the Parliament approved the Plan General de Carreteras (General Highway Plan) for the 16-year period 1962-1977. This ambitious program includes a very elaborate plan of improvements, repairs, maintenance, and new construction on the nationally administered highway system and requires a total investment of Pts 178 billion (nearly US\$3 billion equivalent). It is to be carried out in four 4-year terms and gives first priority to a selected



network of main national routes designated Red Azul (Blue Network). Budgetary commitments have been made by law for the first four years of the program. Table 7 shows the investment program during the period 1962-1977.

#### Design Standards and Specifications

27. The Ministry of Public Works has issued complete design standards and specifications to regulate all highway works. The Plan General de Carreteras includes not only standard characteristics for the construction of new highways and relocated or reconditioned highways, but also admissible characteristics for existing highways (Tables 8 and 9). Applicable characteristics for a particular project are chosen from the standards in conformance with the potential volume of traffic and the topographic conditions. Standards and specifications of the Ministry of Public Works are up-to-date and adequate.

#### Execution of Construction

28. All new construction work and a large portion of the maintenance work are undertaken by contract after public bidding. Contract work is on a unit price basis, but is done only on a small scale and at present is handicapped by antiquated laws and regulations. The law normally requires that contracts must be awarded to the lowest bidder. For contracts over Pts 10 million (US\$167,000 equivalent), the Directorate of Highways is now following a different bidding and contracting procedure which, according to the Law for Administration and Accounting (Ley de Administracion y Contabilidad), necessitates approval of the Council of Ministers for each case. In such cases, the contract is not awarded to the lowest bidder but to the one closest to and below the average of all bids which are below or equal to the Government estimate. During the contract period, payments are not made on the basis of contractors' unit prices, but of adjusted Government prices. This system proved to be better than the one which specifies that the contract must be awarded indiscriminately to the lowest bidder, but it also contains disadvantages. It takes much of the incentive out of competitive bidding. Also the payment method presents problems to the contractor; a contractor's planning and therefore his unit prices may be quite different from those of the Government engineers, yet payment is not made on the basis of his own unit prices. The system does have the advantage for the Government of closer control of unit prices.

29. Since prequalification does not exist and performance guarantees are only 4% of the contract amount, many contracts are not finished due to non-performance by the contractor. In some contracts, performance guarantees are increased up to 10%, but this can be done only after special approval by the Council of Ministers. Cancelling of contracts requires a special legal procedure which can take several years. Price increases have not been allowed in the past, in spite of increases in wages and other costs, which has made it difficult for serious construction firms to present bids for larger works and has led to delays in carrying out many important contracts. As a result, road construction in Spain has been slow, in spite of the continued efforts of the Ministry of Public Works and the construction industry to clear away the obstacles to a more efficient operation.

30. It is therefore considered important that, in addition to the requirement for international competitive bidding, the following principles be introduced in the system for bidding and contracting to be followed in the Project:

- (1) Prequalification of interested bidders at an early stage.
- (2) Contractors to present bids with their own unit prices and without being informed of the Government's detailed cost estimates; successful bidder to be selected with preference for the lowest bid, but giving due regard to sound engineering and financial considerations and practices.
- (3) Escalation clause for price increases to be included in the contract documents.
- (4) Increase of performance guarantee.
- (5) Payments to be made on the basis of contractors' unit prices.

These points have been discussed with Government authorities and agreement on the principles to be followed in bidding and contracting procedures for the Project has been reached.

31. There are a number of construction companies in Spain, but not many are capable of undertaking heavy construction projects on a large scale. Even the most important companies do not have much experience in modern highway construction since highway work has not been a large factor in the construction industry. In 1961, for instance, the total yearly production of the construction industry was about Pts 49 billion (US\$820 million equivalent), with only Pts 3.3 billion (US\$55 million equivalent), or about 7%, corresponding to highway works.

32. Spain has relied heavily on manual labor for construction and the amount of construction equipment in the country is very limited. The value of equipment per construction worker in Spain is about US\$170 which is approximately one tenth of the corresponding value in Germany or France. However, contractors can at present rent some equipment from the Government Parque Central (Central Pool). The Government established this pool with equipment used previously for the construction of U.S. bases in Spain as a temporary solution for the equipment shortage.

33. It is therefore necessary to make road contracts large enough to encourage Spanish contractors to buy their own equipment, and also to attract foreign contractors who would bring not only their equipment to Spain, but also their modern construction methods. The minimum contract for this purpose is considered to be about Pts 100 million (US\$1.67 million equivalent), and the Government has agreed that wherever possible sub-projects will be combined into contracts of at least this amount. Since there are less than 20 Spanish contractors who are capable of undertaking such works on their own, joint ventures of foreign and of smaller Spanish companies would contribute much to the construction industry's capacity.

## Highway Maintenance

34. In the early 30's, the Spanish Highway Network was considered one of the best in Europe. Most of the important roads had block paving with a lean concrete base, which was more than adequate for the then prevailing traffic densities and axle loads. Maintenance was done with camineros (road laborers) and was adequate up to the 50's when traffic began to increase rapidly, as did the proportion of trucks and buses and their total weights. Since then, many Spanish roads have deteriorated considerably. This, of course is partly due to the fact that the design for these roads was based on standards not applicable to present density and type of traffic, but it is also obvious that the caminero with his hand tools can no longer take care of maintenance. The Government has realized this and has given much consideration to the mechanization of the maintenance, but reform has barely started, and until now sufficient funds have not been provided. There is very little maintenance equipment available and adequate shops, yards, warehouses, etc., do not exist. The organization and proper equipment of maintenance divisions throughout Spain are therefore of the highest priority.

### III. THE PROPOSED PROJECT

#### Description

35. The proposed Project covers Highway Improvement Works and a Maintenance Plan as follows:

- (1) Improvement of roads on the triangle Madrid-Barcelona-Alicante, construction of a new road from Oviedo to Figaredo in the north, construction of the Palma airport freeway on Mallorca, and construction of a new bridge over the Ebro River at Amposta in the Province of Tarragona (see Map).
- (2) A Maintenance Plan which includes procurement of equipment and construction of adequate shops, office buildings, and warehouses for pilot divisions in the Province of Madrid and in the Northeast region.

#### Highway Improvement Works

36. These works include the improvement of 786 km of highways and are divided into three phases: (Table 10)

Phase I - involves many small projects all located on the triangle Madrid-Barcelona-Alicante. The total length of these projects is about 130 km, and the work will consist mainly of placing an asphalt overlay on existing pavement. The projects have already been designed by the respective provincial offices of the Ministry of Public Works, and construction is to begin this year.

Phase II - represents the most important portion of the Improvement Works. It consists of: i) improvement of 588 km of routes N-II, N-340, C-246, N-332 and N-301 on the triangle, including

the 25 km bypass at Perello and a new bridge over the Ebro River at Amposta; ii) construction of a 5 km bypass of the town of Badalona near Barcelona; iii) construction of a new 22 km road from Oviedo to Figaredo; and iv) construction of 19 km of freeway and access roads between Palma and Son San Juan Airport on Mallorca.

The largest portion of the Improvement Works, covering about 332 km, will consist of the placing of one or more asphalt courses on existing pavement. In sections totaling 109 km it will be necessary to reconstruct the base course and, where needed, to provide a filter course to improve subsurface drainage and prevent the pumping up of silt or clay into the granular base.

Improvement of grade and alignment will be necessary in a few sections, with a total length of about 15 km. The most difficult work of this type is on a portion of route N-332 in Valencia, where unfavorable conditions in rice fields will require special embankments. Route N-332 also presents a special problem in the Province of Alicante where relatively high embankments show great settlements due to lack of compaction; the subgrade in these sections, with a total length of 3.3 km, will have to be reconstructed before the new base course is installed.

Several relocated sections, with a total length of about 35 km, will be built, the most important ones being the bypasses at Perello and at Badalona. The bypass at Perello will consist of a 25 km long two-lane highway which will form part of the future four-lane freeway from Barcelona to Valencia. The 5 km long bypass at Badalona will consist of two separate roadways, 3 lanes each, with a total width of 34 meters. It will be linked with the future freeway from Madrid to La Junquera, now under consideration, if the final line of this freeway is located along the coast.

The bridge over the Ebro River at Amposta will have a total width of 21 meters and will consist of three 84 meter and two 48 meter spans.

The freeway from Palma to Son San Juan airport consists of about 10.6 km of freeway and 8.3 km of access roads and intersections. The freeway is divided into two portions, the urban portion with 3 traffic lanes in each direction, and the rural portion with 2 separate two-lane roadways.

The Oviedo-Figaredo highway has a total length of about 23.8 km, of which 2.4 km are already constructed. It will be a two-lane highway which is planned to form part of a future four-lane divided freeway.

Phase III - includes the completion of 2 relocated sections of highway N-II in the Province of Zaragoza which are necessary for the proper flow of traffic over the highway as a whole. The

total length of the two sections is 22 km. Construction of these sections has been stopped, the contractors being in default, and the difficult legal process for cancelling contracts is now under way. Due to the existing regulations, such cancelling procedures may require one year, or even longer. No withdrawals for construction expenditures should be authorized from the Loan for Phase III of the Project until the legal difficulties regarding the defaulted contractors in this part of the Project are well on the way towards a satisfactory solution.

#### Maintenance Plan

37. The Ministry of Public Works is now working out a complete maintenance program for the entire country. Standards and criteria used as the basis for this program are considered adequate. The mainland would be subdivided into 6 maintenance regions, each covering 6 to 9 provinces, with central shops in strategically located towns. All nationally administered highways would be maintained by Government forces and Government-owned equipment and would operate under the overall direction of the main office in Madrid to ensure that the mechanization of maintenance is carried out in accordance with the master plan for the entire country. In a large section of Spain, snow and ice removal equipment will have to be kept in good working order. Very efficient organization will be required for this work to ensure removal immediately after storms.

38. Reorganizing the maintenance operation raises difficult administrative problems which can be resolved only over a period of time. The Directorate of Highways has decided to start the reorganization on the limited basis of the Maintenance Plan included in this Project. The purpose is to establish two pilot divisions, one on a regional basis in the Northeast and the other on a provincial level in Madrid. The Northeast region will include the Provinces of Barcelona, Gerona, Lerida, Tarragona, Zaragoza, and Huesca, with central shops being located at Lerida. The division for the Province of Madrid, with central shops located in Madrid will be organized with a view to enlarging it in the future to cover also the Provinces of Guadalajara, Segovia, Avila, and Toledo.

39. The Maintenance Plan includes procurement of highway maintenance and shop equipment, and also the construction of adequate shops, warehouses, and office buildings in Madrid and in the Northeast region. Contracts for procurement of equipment to be financed out of the proceeds of the loan and amounting to more than US\$50,000 equivalent will be awarded on the basis of international competitive bidding. In the case of maintenance equipment produced in Spain, it has been agreed during negotiations that a preference of no more than 15% will be given to local suppliers in lieu of the customs duties that would otherwise apply to this equipment.

40. Modern maintenance operation, coupled with improvement of pavement, widening of shoulders, better subgrade drainage, and stabilizing, should bring about a considerable decrease of both unit and overall maintenance cost.

#### Status of Engineering

41. Projects forming part of Phases I and III have been designed by engineers of the Ministry of Public Works and the preliminary design appears adequate. For the projects in the triangle Madrid-Barcelona-Alicante, included in Phase II, two competent Spanish engineering firms have been engaged,

assisted by a specialized firm in charge of the soil survey. The work of the two engineering firms includes not only the design of Improvement Works, but also the preparation of bidding documents and analysis of tenders. The detailed design is scheduled to be finished within a few months.

42. The design for the Palma airport freeway was made by the provincial office of the Ministry of Public Works on Mallorca and is finished. The engineering work is considered adequate and the Project should soon be advertised for international bids.

43. The design for the Oviado-Figaredo road was prepared by the provincial office of the Ministry of Public Works in Oviedo. It is completed but it needs revision before final approval by the Spanish authorities.

44. The design of the Badalona bypass was made by the provincial office of the Ministry of Public Works in Barcelona; it is essentially finished and is considered adequate. There are still some difficulties with regard to the acquisition of the remaining parts of the right-of-way.

45. The bridge over the Ebro River at Amposta has been advertised for international bidding on the basis of a preliminary study made by the main office of the Ministry of Public Works; final design is part of the contractor's bid.

#### Cost of the Project

46. The total cost of the Project is estimated at Pts. 5,491.3 million (US\$91.5 million equivalent). This figure includes 25% for contingencies and 15% for price increases (Table 11).

47. The total cost will be distributed as follows:

	<u>Pts million</u>	<u>US\$ equivalent million</u>
Phase I	383.1	6.4
Phase II	4,381.5	73.0
Phase III	157.4	2.6
<hr/>		
Total Improvement Works	4,922.0	82.0
Maintenance Plan	569.3	9.5
<hr/>		
Total Project	5,491.3	91.5
<hr/>		

48. The total cost of the Improvement Works amounts to Pts. 4,922.0 million (US\$82.0 million equivalent) of which Pts. 476.5 million (US\$7.9 million equivalent) is the cost of the rights-of-way. The foreign currency component has been computed for each of the sub-projects of the Improvement Works and the total is estimated at Pts. 1,564.0 million (US\$26.1 million equivalent). The total cost of the Maintenance Plan is estimated at Pts. 569.3 million (US\$9.5 million equivalent) of which Pts. 414.0 million (US\$6.9 million equivalent) is for the procurement of highway maintenance and shop equipment, and miscellaneous items, and Pts. 155.3 million (US\$2.6 million equivalent) for the construction of shops, warehouses, and office buildings.

49. The contingencies of 25% are adequate, taking into account the status of design. The cost estimates are based on realistic unit prices and are considered satisfactory. The contingency of 15% for price increases also seems adequate on the basis of the expected development of wholesale prices.

#### Execution

50. It is planned to finish design and invite bids for **all** projects except Phase III in 1963. Construction will be under unit price contracts awarded on the basis of international competitive bidding. The contracts which will form part of Phase II are considered large enough to interest reputable international construction firms, especially with a view to the future possibilities presented by the 16-year Highway Development Plan of the Spanish Government. Contracts of Phases I and III will be relatively small, due to the type of work involved, and it is unlikely that foreign contractors will be interested in such works.

51. Construction of Phase I projects is to begin this year and to be finished in 1965. Construction of Phase II projects should start during 1964 and be finished in 1967. It cannot be expected that Phase III projects will be started before the latter part of 1964 or finished before 1966.

52. The overall list of proposed road maintenance and shop equipment to be purchased has been discussed and agreed by the Ministry of Public Works and the Bank.

53. The highway administration in Spain is adequately staffed to carry out the Project. Contract documents will be prepared by the Directorate of Highways with the help of consultants as necessary. Construction will be supervised in each province by the Head of the Jefatura (Chief of the Provincial office of the Ministry of Public Works) and his staff, under the control of the central Directorate. The Maintenance Plan will be carried out under the overall direction of the Maintenance Division in Madrid, and two new Chief Engineers will be especially appointed as heads of the two pilot maintenance regions.

#### Financing

54. The Bank will finance US\$26.1 million equivalent of the cost of the Improvement Works, which is the presently estimated foreign exchange component of these works and which is 35.2% of the estimated total cost, excluding costs of rights-of-way. Bank funds will be disbursed as 35.2% of the cost of construction increased by 7% for design and supervision;

expenditures for the rights-of-way will be financed by the Government. As far as the Maintenance Plan is concerned, the Bank will finance US\$6.9 million equivalent which is the estimated total cost of procurement of highway maintenance and shop equipment, including spare parts; the Government will cover the cost of construction of workshops, offices and warehouses. A schedule of expenditures is shown below.

Schedule of Expenditures  
(in million Pesetas)

	<u>Improvement Works</u>			<u>Maintenance Plan</u>			<u>Total Improvement and Maintenance Project</u>		
	<u>Government</u>	<u>Bank</u>	<u>Total</u>	<u>Government</u>	<u>Bank</u>	<u>Total</u>	<u>Government</u>	<u>Bank</u>	<u>Total</u>
1963	493.4	133.4	626.8	7.4	19.9	27.3	500.8	153.3	654.1
1964	609.3	206.5	815.8	118.1	314.6	432.7	727.4	521.1	1248.5
1965	604.0	328.0	932.0	29.8	79.5	109.3	633.8	407.5	1041.3
1966	815.2	443.3	1258.5	- - -	- - -	- - -	815.2	443.3	1258.5
1967	836.0	452.9	1288.9	- - -	- - -	- - -	836.0	452.9	1288.9
Totals	3357.9	1564.1	4922.0	155.3	414.0	569.3	3513.2	1978.1	5491.3
US\$ million equivalent	55.96	26.07	82.03	2.59	6.90	9.49	58.55	32.97	91.52

55. Funds to be provided by the Government would come from the Central Budget. The works which form part of this Project are included in the first four-year term of the Plan General de Carreteras (General Highway Program), for which budgetary plans have been approved by law. The total amount of the Project represents 23% of the amount set aside for the first four-year term. During negotiations firm assurances have been obtained that adequate funds will be provided to carry out the Project on schedule.

IV. ECONOMIC JUSTIFICATION

General

56. Road transport in Spain has grown rapidly since 1955. The reasons for this are numerous, but two special ones are the inadequacy of railroad services and the large growth of foreign tourism.

57. The scale of interregional trade cannot continue to grow without a more efficient transportation system. The rapidly growing traffic is causing serious deterioration of the main highways, and unless roads are improved and kept at satisfactory standards, road transportation will be possible only at high costs. In addition, tourism has become an important contributor to national income and foreign exchange, and most of it is based on road transportation. In 1962 gross receipts from tourism were 4% of GNP; they amounted to 65% of exports and to 31% of all receipts of foreign exchange from goods and services.

58. The highways included in the Project cover some of the most important areas of Spain. Madrid and Barcelona are two of the three principal industrial



areas in the country. Barcelona is also the main port for general cargo (three million tons per year). In most provinces between Madrid and Barcelona, agriculture is well developed and Zaragoza and Lerida are important industrial centers. The Mediterranean coast is of growing importance for foreign tourism and also has a significant agricultural output, a substantial part of which is exported. Valencia is well known as a center of orange growing; other products include vegetables and rice. Most of the products for domestic consumption are moved by road, partly along the Alicante-Madrid road.

59. Another specific road included in the Project, Oviedo-Figaredo, is located in one of the most industrialized regions of Spain. The existence of coal and iron ore has made this region the center of iron and steel industry. The favorable climate and fertile soil have led to intensive agriculture and cattle raising, and the region provides an important part of the country's supply of fruits and dairy products.

60. The other region served by the Project is the island of Mallorca. More than 600,000 tourists visited it last year and it is likely that this number will grow further during the next decade.

### Benefits

61. The proposed investments will yield benefits of various kinds. The ones that can be measured in monetary terms include reduced operating expenses for road users, lower cost of highway maintenance, and reduced accidents. The returns on investment from these benefits are indicated in paragraph 67, and are discussed in greater detail in the appendix.

62. Other benefits are also important, but cannot be measured in money. The improvements will allow higher speeds and consequently reduce traveling time both for passengers and freight. Passengers will travel in greater comfort, and damage to goods will be reduced. The improved safety, comfort and traveling time will attract more foreign tourists. All these factors will, in turn, induce increased transport of both passengers and freight.

63. With respect to the Maintenance Plan, it is necessary to transform the present inadequate system into one which will enable maintenance operations on an appropriate scale to avoid deterioration of the highway system which, if continued, would lead to excessive costs for reconstruction. In view of the magnitude of the tasks of reorganizing the maintenance services, providing up-to-date equipment and introducing new methods, it is desirable to establish pilot divisions before proceeding on a broader scale.

### Road User Benefits

64. The computation of road user benefits is based on the following major assumptions which are regarded as reasonably conservative:

#### Traffic

- i) The present daily average traffic over the project roads ranges from 1,450 to 15,000 and consists of approximately 40% trucks and buses, 45% passenger cars and 15% motorcycles. Regular and reliable traffic counts were initiated only in 1959. However, over the previous decade the road traffic in Spain, as estimated from fuel consumption and number of vehicles, has been regularly

increasing by 17% a year. On each section of the Project the annual growth of traffic is estimated to continue at the present rate until 1965; this ranges from 11% to 17% except on the Mallorca airport road, where it reaches 26%. From 1965 to 1977 the rates of traffic growth are assumed to decrease gradually to 7% which is the expected average for the country at the end of this period, and to remain at 4% thereafter. These figures are based on an expected growth in gross national product of 5% per year over the 16-year period, on the relationship between national income per capita and number of vehicles in other European countries and on the fact that the regions served by these roads are the most rapidly growing regions in the country.

ii) Economic Life of the Project Roads

The proposed improvements have an estimated economic life of approximately 12 years. The economic life of new construction work is estimated at 30 years. However, according to the expected growth, traffic on some of the improved two-lane roads will reach a daily average of 5,000 vehicles before the end of their economic life. Since this number is considered their maximum capacity without congestion, savings in vehicle operating expenses are not estimated to increase thereafter.

iii) Highway Conditions and Savings

Because the road conditions on different sections of the Project, and with them the vehicle operating costs, vary widely, the road sections were classified according to their condition, and savings computed separately for each class. The savings are based on Spanish data, supplemented when necessary by information on the results of analogous road improvements in other countries. A sampled comparison between the estimated vehicle operating expenses before and after the improvements is given in Table 12.

Benefits from Reduced Maintenance Cost

65. The Improvement Works will reduce the cost of maintaining the project roads. While the cost of maintaining the existing roads, together with the estimated additional periodic maintenance cost, ranges from US\$1,000 to US\$1,500 per km annually, the cost of routine and additional periodic maintenance on the new roads would average only US\$700 per km.

Benefits from Reduced Accidents

66. These benefits are not generally included except for two short sections of the Alicante-Madrid road, where the purpose of the improvement is to reduce the high number of accidents; the estimate assumes a reduction from 30 to 5 accidents per year.

Return on Investment

67. The following table presents the costs of the Improvement Works, the measurable benefits in the first year of full utilization and the discounted rate of return during the useful life of the investments. It clearly indicates that the investments are economically well justified. A description of each section of the Improvement Works is given in the Appendix.

<u>Section</u>	<u>Cost<sup>1/</sup></u> .....Million Pesetas.....	<u>Road-User Savings in First Year of Utilization</u>	<u>Annual Maintenance Cost Savings</u>	<u>Discounted Rate of Return Over the Life of the Investment</u> %
Madrid-Barcelona	1,064.9	487	8.7	70
Barcelona-Alicante	769.8	466	17.7	73
Alicante-Madrid	176.6	19	1.4	12
Badalona	301.2	136	0.3	29
Perelló	467.5	110	-	20
Amposta Bridge	369.4	361	-	75
Oviedo	561.2	81	0.5	12
Palma	569.4	137	0.9	21

<sup>1/</sup> Including 25% contingencies, and excluding the 15% price contingency on the assumption that savings would increase proportionately.

V. CONCLUSIONS AND RECOMMENDATIONS

68. The Project will greatly improve conditions for transportation on the roads forming the triangle Madrid-Barcelona-Alicante, and replace two obsolete sections in the north and on Mallorca; it will also initiate the reorganization of highway maintenance in Spain by establishing two pilot divisions in Madrid and in the Northeast region.

69. Design and specifications are satisfactory and the execution of the Project will be controlled and supervised by the Directorate of Highways, under the Ministry of Public Works; the Directorate is well organized and efficient, and will be assisted by competent consulting engineers for design work.

70. The Project will yield a high economic return on investment from road users' and maintenance savings alone.

71. During loan negotiations, firm assurances have been obtained from the Government of Spain that it would:

- i) provide adequate local funds to carry out the Project according to the agreed schedule (see paragraph 54);
- ii) take the necessary steps to modify bidding and contracting procedures as outlined in paragraph 30.

72. The Project provides a suitable basis for a Bank loan of US \$33.0 million equivalent to the Spanish Government; a suitable term would be 20 years, including a five-year period of grace.

ECONOMIC JUSTIFICATION FOR SPECIFIC SECTIONS OF THE PROJECT

Madrid-Barcelona Highway

1. This highway not only connects the two largest cities in Spain, Madrid and Barcelona (with a population of 2.3 million and 1.6 million respectively), but also carries traffic to Barcelona from the Cadiz-Sevilla area and from the industrial northern region. In 1962 the average daily traffic density between Madrid and Barcelona was about 2,000 vehicles; between Zaragoza and Barcelona it was 2,500 to 4,000 vehicles due to suburban traffic in the industrial areas of Zaragoza and Lérida and additional traffic to and from Bilbao. Trucks and buses made up 41% of the traffic, private cars 46%, and motorcycles 13%. From 1960 to 1962 traffic on this highway increased by 15% annually.

2. Savings in vehicle operating costs are expected to average 30%. The greatest savings in operating costs will be obtained in the section Zaragoza-Barcelona where the traffic is heavy, the percentage of trucks and buses relatively high (45-55%), and the highway in bad condition.

3. Present maintenance costs, including periodic maintenance, are estimated at Pts 69,000 (US\$1,150 equiv.) per kilometer annually if further deterioration is to be avoided. Maintenance costs after the carrying out of the proposed improvements are estimated to decline to Pts 42,000 (US\$700 equiv.), a saving of Pts 27,000 (US\$450 equiv.) per kilometer per year.

4. The above benefits result in a rate of return on investment of 70% over the useful life of 12 years.

Barcelona-Alicante Highway

5. The highway from the French frontier to Murcia, which runs along the Mediterranean coast for most of the way is one of the country's most important roads in terms of traffic density. This is not only a result of the great number of tourists, but also of the extensive trade between the industrial area of Barcelona and the agricultural region near Valencia.

6. In 1962 the average daily traffic between Barcelona and Alicante was about 3,400 vehicles; south of Barcelona and near Valencia it was as high as 4,500 to 6,000 vehicles per day. Trucks and buses made up 38% of total traffic, private cars 44% and motorcycles 18%. Traffic increased 17% per year between 1960 and 1962. The many trucks and carts near Valencia reduce the average speed considerably and high seasonal peaks of traffic cause congestion in mountainous sections and in villages.

7. Planning for a high standard Mediterranean coast freeway is quite advanced. Near Valencia, a short section is already under construction and will soon give relief to sections where traffic density exceeds capacity. The freeway will be built in stages and since the entire freeway will not be open for traffic for a considerable number of years, the existing road must be rehabilitated to meet the requirements of present traffic.

8. It is expected that vehicle operating costs will be reduced by an average of 20%.

9. Maintenance costs between Barcelona and Alicante are high, due to heavy traffic and the bad condition of the highway in several sections. It should be at present Pts 92,000 (US \$1,540 equivalent) per kilometer per year, if further deterioration is to be avoided. Estimating future maintenance costs at Pts 42,000 (US \$700 equivalent), an annual saving in maintenance cost of Pts 50,000 (US \$840 equivalent) per kilometer can be expected.

10. Road user and maintenance savings result in a rate of return of 73%. This does not include the planned bypass near Perelló, for which the benefits have been computed separately.

#### Alicante-Madrid Highway

11. There is less traffic on this highway than on the two other sides of the triangle; there are also fewer towns with important suburban traffic. In general, it is a poor part of the country, the highway crossing dry areas where agriculture is not much developed. There is little industry, most of it at Elda and Albacete.

12. The average daily traffic in 1962 between Alicante and Madrid was about 1,500 vehicles, of which 48% were trucks and buses, 46% private cars, and 6% motorcycles. Between 1960 and 1962 traffic increased 11% annually.

13. Considering present conditions in several sections of the road, it is expected that vehicle operating expenses will be reduced by an average of 7%.

14. Included in this part of the Project is the improvement of grade and alignment of two sections where poor visibility has caused an accident rate 20% higher than the average for the country. A reduction in the number of accidents has therefore been taken into account.

15. The present maintenance cost is estimated at Pts 62,000 (US \$1,040 equivalent) per kilometer per year, including additional periodic maintenance and the annual saving in maintenance cost is about Pts 20,000 (US \$340 equivalent) per kilometer.

16. The above benefits result in an overall rate of return of 12%, computed over the 12-year useful life of the improvements.

#### Bypass at Badalona

17. Badalona is an industrial suburb north of Barcelona. Its main street, which is less than 5 meters wide at some places, is at present part of the road from Barcelona to the Costa Brava and the French border. Local traffic is considerable and crosses the main highway in several places. There is serious congestion in seasonal months and cars are lined up for several

hours during the evening. The planned bypass will have grade separation and will relieve the congested traffic in transit through Badalona. Speed will be increased considerably with corresponding savings in time. These and other savings will reduce the operating costs by an average of 54%. The estimate of total benefits is based on an average daily traffic in transit through Badalona of 15,000 vehicles in 1962. There is a possibility that the new freeway from Barcelona to La Junquera will be built via the interior, which would reduce transit traffic through Badalona. This possibility has been taken into account in estimating future traffic.

18. The present maintenance cost is estimated at Pts 64,000 (US \$1,067 equivalent) per kilometer annually and the resulting savings in maintenance would be about Pts 22,000 (US \$367 equivalent) per kilometer per year.

19. The road user and maintenance savings would result in a return on investment of 29% over its 30-year life.

#### Bypass at Perelló

20. The highway along the Mediterranean coast follows mainly the plain between the sea and the mountains. A 30 kilometer long section south of Tarragona, however, traverses mountainous country. It has poor alignment and grades up to 12%. Average speed is reduced considerably, as slow moving trucks make passing impossible on steep grades where sight distances are insufficient. The new road will bypass the town of Perelló and will be 5 km shorter. Total savings on vehicle operating expenses are expected to average 41%, which gives a rate of return of 20%.

#### Amposta Bridge

21. The bridge over the Ebro River at Amposta is part of the highway from Barcelona to Alicante. It is in very bad condition and trucks over 7 tons are not allowed to cross it and are forced to take a detour of 25 km. Traffic lights are used to regulate the traffic across the single lane bridge, which causes considerable congestion and reduces average speed accordingly. The condition of the bridge becomes worse each week, and only emergency repairs help to permit traffic until a new bridge is built. In fact normal security conditions would require that the bridge be closed to all traffic very soon, and all traffic be diverted to another bridge upstream, making a detour of 25 km.

22. The average daily traffic in 1962 was about 2,700 vehicles; this number includes heavy trucks which at present are forced to detour the bridge. In spite of the considerable tourist traffic in this section, trucks and buses account for 41% of the total number of vehicles.

23. The new bridge will enable all traffic to flow continuously, thus increasing speed and avoiding congestion during peak periods. The present detour for trucks will, of course, be eliminated.

24. A new approach from Amposta to the bridge will be constructed, bypassing the center of the little town and thus creating additional savings on vehicle operating expenses.

25. Total savings on vehicle operating expenses would result in a rate of return on investment of 75% over the useful life of the bridge of 30 years.

#### Oviedo-Figaredo Highway

26. The road from Oviedo to Figaredo is not only part of the inter-provincial highway running south but is also of great importance for the traffic between Oviedo and Mieres. Mieres is a center of coal mining and has a steel plant that employs 8,000 workers. Iron ore is hauled mostly via Oviedo and accounts for a considerable portion of total traffic. Transportation of cattle, dairy and agricultural products by this road is also significant.

27. In 1961, the average daily traffic was about 2,700 vehicles, 34% of which was made up by trucks and buses, 49% by private cars and 17% by motorcycles. Traffic increased 19% annually from 1960 to 1962.

28. The present road leads through a mountainous region and has very poor alignment, very short sight distances and grades up to 14%. Traffic lanes are narrow and in many curves too narrow for two-way traffic. The capacity of the road, therefore, does not permit reasonable speeds which are even further reduced by slow moving trucks on steep grades where sight distances are such that passing is not possible. The new highway, designed to high standards, will follow the river and bypass the town of Mieres. Total savings have been estimated to average 38%.

29. The present maintenance cost is estimated at Pts 64,000 (US \$1,067 equivalent) per kilometer per year, and annual savings in maintenance costs would be about Pts 22,000 (US \$367 equivalent) per kilometer.

30. On the basis of the above, a rate of return of 12% can be expected over its useful life of 30 years.

#### Palma Airport Freeway

31. In 1952 the road carrying the traffic between Palma and the airport was split by a prolongation of the airport's runway. As a result traffic was forced to pass through some small villages. To relieve this traffic a provisional road connecting the airport with the road from Palma to the north-east was built in 1961. Both roads are insufficient to carry all traffic during the tourist season without serious congestion.

32. The proposed freeway with its four to six lanes will give a better access to the center of Palma and will decrease traveling time considerably. It will also shorten the distance for trucks and buses, now forced to take the detour, by 25%. Finally, it will give better access from Palma to the beaches.

33. In 1961 the average daily traffic for the section of the direct road between Palma and the airport was about 9,000 vehicles. Motorcycles made up 37% of the traffic, cars 48% and trucks 15%. The average daily traffic on the detour was about 2,500 vehicles. From 1960 to 1962 traffic increased at an annual rate of 26%, and this trend is expected to continue until 1965.

34. Reduction of vehicle operating expenses, mainly due to savings on time and fuel consumption, are expected to average 35%, and savings on maintenance costs are estimated to be Pts 22,000 (US \$367 per kilometer equivalent) per year. The overall rate of return on the investment would be 21% over its useful life of 30 years.

October 7, 1963



Table 1SPAINHighway Improvement and Maintenance ProjectEstimates of Freight Transportation  
(In billion ton-kilometers)

Year	Railway (Renfe only)	Highway (Intercity only)	Coastal shipping	Camsa tankers	Total Intercity <sup>1/</sup> Traffic
1955	7.0	5.1	7.5	2.0	21.6
1956	7.6	6.4	7.6	2.1	23.7
1957	7.9	6.9	8.2	3.4	26.4
1958	7.9	7.5	8.5	3.5	27.4
1959	6.6	8.5	8.5	3.5	27.1
1960	5.1	10.0	7.7	3.8	26.6
1961	5.1	11.2	-	-	-

<sup>1/</sup> Airlines excluded

Source: The Economic Development of Spain,  
Report Mission IBRD 1962

Plan de Desarrollo 1963,  
Ministry of Public Works

SPAINHighway Improvement and Maintenance ProjectEstimates of Intercity Passenger Transportation  
(In billion passenger-kilometers)

Year	Railway (Renfe only)	H i g h w a y			Airlines	Total Intercity Traffic <sup>2/</sup>
		Total	Buses	Private Vehicles <sup>1/</sup>		
1955	8.0	7.3	2.5	4.8	.2	15.5
1956	8.6	8.6	2.8	5.8	.3	17.5
1957	8.6	10.0	3.1	6.9	.3	18.9
1958	8.7	11.0	3.3	7.7	.3	20.0
1959	8.5	11.6	3.4	8.2	.3	20.4
1960	7.3	12.2	3.5	8.7	.4	20.0
1961	7.8	22.8	5.0	17.8	-	-

<sup>1/</sup> 1955-1960 figures are based on estimates.

<sup>2/</sup> Coastal shipping excluded.

Source: The Economic Development of Spain,  
Report Mission IBRD 1962

Plan de Desarrollo 1963, Ministry of  
Public Works

Table 3

## SPAIN - HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECT

NUMBER OF VEHICLES - 1951-1962  
(in Thousands)

<u>Year</u>	<u>Cars</u>	<u>Trucks</u>	<u>Buses</u>	<u>Sub- Total</u>	<u>Motorcycles</u>	<u>Total</u>
1951	98.1	87.8	8.5	194.5	24.4	219.0
1952	101.7	84.7	8.5	195.0	34.1	229.1
1953	108.0	88.7	8.9	205.7	50.5	256.3
1954	115.7	90.6	9.0	215.3	77.3	292.7
1955	127.8	94.9	9.4	232.2	125.5	357.7
1956	151.9	106.1	9.5	267.5	177.7	445.3
1957	172.1	113.5	10.0	295.6	281.9	577.6
1958	192.2	121.7	10.4	324.4	375.6	700.0
1959	240.4	131.8	10.9	383.2	476.3	859.5
1960	290.6	147.3	11.9	449.9	555.0	1,004.9
1961	358.9	174.3	13.0	546.2	677.2	1,222.5
1962	442.1	195.9	14.6	652.6	805.3	1,457.9

Source: Ministry of Public Works

Table 4

SPAIN - HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECT

CLASSIFICATION OF NATIONALLY ADMINISTERED HIGHWAYS

ACCORDING TO WIDTH AND CATEGORY, 1962

Width of Surfacing	C a t e g o r y			Total km
	National	Regional	Local	
Less than 6 meters	7,977.7	18,682.8	36,545.4	63,205.9
From 6 to 7 meters	4,371.1	3,329.2	973.6	8,673.9
From 7 to 9 meters	6,063.4	409.1	134.8	6,607.3
From 9 to 10.50 meters	220.7	35.4	37.6	293.7
From 10.50 to 12 meters	211.2	1.2	3.5	215.9
More than 12 meters	144.9	20.0	4.7	169.6
Totals	18,989.0	22,477.7	37,699.6	79,166.3
Roads in urban sections, varying widths from 6 to more than 22 meters, varying categories				<u>1,443.1</u>
Total				80,609.4

Note: These figures include 3,726 kilometers of national, regional and local highways in the provinces of Alava and Navarra, which, due to tradition, are usually considered a separate system.

Source: Ministry of Public Works

Table 5

SPAIN - HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECT

CLASSIFICATION OF NATIONALLY ADMINISTERED HIGHWAYS

ACCORDING TO WIDTH AND TYPE OF PAVEMENT

1 9 6 2

Width of Surfacing	Type of Pavement						Total km
	Surface Treatment	Asphalt Concrete	Concrete	Block Pavement	Macadam	Stabil- ized Soil	
Less than 6 meters	25,517.9	275.0	126.8	290.8	36,307.4	688.0	63,205.9
From 6 to 7 meters	6,764.1	324.7	72.7	222.6	1,289.8	-	8,673.9
From 7 to 9 meters	4,749.9	1,207.9	93.9	419.2	136.4	-	6,607.3
From 9 to 10.50 meters	146.1	67.3	4.4	64.1	11.8	-	293.7
From 10.50 to 12 meters	149.0	42.0	4.8	20.1	-	-	215.9
More than 12 meters	46.3	96.6	1.9	22.1	2.2	0.5	169.6
T o t a l s	37,373.3	2,013.5	304.5	1,038.9	37,747.6	688.5	79,166.3
Roads in urban sections, varying widths from 6 to more than 22 meters, varying type of pavement							<u>1,443.1</u>
T o t a l							80,609.4

Source: Ministry of Public Works

SPAIN - HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECTHighway Expenditures and Fuel Tax Revenues, 1956 - 1962  
(Million Pesetas)

<u>Year</u>	<u>Highway Expenditures</u>			<u>Revenues From Fuel Tax</u>
	<u>by</u> <u>Government</u>	<u>by</u> <u>Provinces</u>	<u>*</u> <u>Total</u>	
1956	1,584	234	1,818	3,520
1957	1,584	329	1,913	3,840
1958	1,816	478	2,294	4,070
1959	1,856	517	2,373	4,780
1960	2,007	433	2,440	6,340
1961	2,376	504	2,880	7,190
1962	3,150	500	3,650	8,030

\* These expenditures are financed out of Provincial Budgets.

Source: Ministry of Public Works.

Table 7

SPAIN - HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECTHIGHWAY DEVELOPMENT PROGRAM 1962-1977

<u>Type of Expenditures</u>	<u>Million Pts</u>
Freeways	31,192
Relocations	13,282
Improvement of Base and Pavement	33,950
Improvement of Curvatures, Grades, etc.	3,866
Structures	6,021
Intersections	403
Elimination of Grade Crossings	1,824
Improvement in Urban Zones	36,410
New Highways	9,439
Right of Way	4,229
Maintenance	31,388
Signs, Investigations, Work under Construction	<u>5,636</u>
TOTAL	177,640

Expenditures by Period

1962 - 1965	24,000
1966 - 1969	42,560
1970 - 1973	55,320
<u>1974 - 1977</u>	<u>55,760</u>
1962 - 1977	<u>177,640</u>

Source: Ministry of Public Works

SPAIN - HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECT  
DESIGN STANDARDS FOR NEW, FOR RELOCATED, AND FOR RECONDITIONED HIGHWAYS

	veh/day	Light Traffic								Medium Traffic								Heavy Traffic					
		-250				250-500				500-1000				1000-2000				2000-5000			+5000		
Type of Terrain		F	R	M	VM	F	R	M	VM	F	R	M	VM	F	R	M	VM	F	R	M-VM	F	R	M-VM
Design Speed	km/hr	70	60	50	30	70	60	50	30	100	80	60	40	100	80	60	40	(120 100)	100 80	80 60	(120 100)	100 80	80 60
Type of Pavement		ADT-100 No Surface Treatment		ADT+100 Single Sur- face Treat- ment		Single Surface Treat- ment				Double Surface Treat- ment				Asphalt Concrete				Asphalt Concrete			Asphalt Concrete		
Width of Pavement	m	6.00				6.00				7.00				7.00				7.00			2x7.00 (if velocity -100) 2x7.50 (if velocity +100)		
Shoulders (Right Left)	m m	1.50 "	1.00 "	1.00 "	0.50 "	1.50 "	1.00 "	1.00 "	1.00 "	2.50 "	2.00 "	1.00 "	1.00 "	2.50 "	2.50 "	1.50 "	1.00 "	3.00 "	3.00 "	2.50 "	3.00 1.50	3.00 1.50	2.50 1.00
Roadway, Shoulder to Shoulder Width	m	9	8	8	7	9	8	8	8	12	11	9	9	12	12	10	9	13	13	12	11.50	11.50	10.50
Median Strip, Width	m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+5.00	+5.00	+2.00
Right of Way, Width	m	+25				+25				+36				+36				+80			+80		
Maximum Grade	%	5 (+ 1% if length -250)	6	7	8	4 (+ 1% if length -250)	5	6	7	3 (+ 1% if length -250)	4	5	6	3	4	5	6	3	4	5	(Study necessity of slow lanes)		
Minimum Radius	m	180	120	75	25	180	120	75	25	450	240	120	40	450	240	120	40	(800 450)	450 240	240 120	(800 450)	450 240	240 120
Sight Distance for Stopping	m	80	60	40	30	80	60	40	30	150	100	60	30	150	100	60	30	(200 150)	150 100	100 60	(200 150)	150 100	100 60
Sight Distance for Passing	m	450	350	250	150	450	350	250	150	600	500	350	200	600	500	350	200	(600 600)	600 500	500 350	-	-	-
S T R U C T U R E S	Loading	Under Study																					
	Roadway Width	Same as Shoulder to Shoulder Width Shown Above																					
	Height	Five Meters																					
	Railroad Crossings	Grade Separation																					

F-Flat; R-Rolling; M-Mountainous; VM-Very Mountainous



SPAIN

HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECT

Admissible Characteristics for Existing Highways

Average Daily Traffic	veh/day	Light Traffic								Medium Traffic								Heavy Traffic															
		-250				250-500				500-1000				1000-2000				2000-5000				+5000											
Type of Terrain		F	R	M	VM	F	R	M	VM	F	R	M	VM	F	R	M	VM	F	R	M	VM	F	R	M	VM								
Speed	km/hr	-	-	-	-	-	-	-	-	60	50	40	30	70	60	50	40	70	60	50	40	80	70	60	50								
Type of Pavement		ADT-100 Unpaved or Macadam		ADT + 100 Single Sur- face Treatment		Single Surface Treat- ment				Double Surface Treat- ment				Double Surface Treat- ment				Asphalt Concrete				Asphalt Concrete											
Width of Pavement	m	5.00				5.00 5.00 5.00 5.00				6.00 6.00 5.00 5.00				7.00 7.00 6.00 6.00				7.00 7.00 7.00 7.00				14 m											
Shoulders, Width	m	0.25				0.50 0.50 0.50 0.25				0.50 0.50 0.50 0.50				1.50 1.50 1.00 1.00				1.50 1.50 1.00 1.00				2.00											
Roadway, Shoulder to Shoulder Width	m	5.50				6.00 6.00 6.00 5.50				7.00 7.00 6.00 6.00				10.00 10.00 8.00 8.00				10.00 10.00 9.00 9.00				18											
Maximum Grade	%	-	-	-	-	6	8	10	-	6	8	10	12	6	8	10	12	5	6	8	10	5	6	8	10								
Minimum Radius	m	-	-	-	-	-	-	-	-	120	75	40	25	180	120	75	40	180	120	75	40	240	180	120	75								
Sight Distance for Stopping	m	-	-	-	-	-	-	-	-	60	40	30	20	80	60	40	30	80	60	40	30	100	80	60	40								
Sight Distance for Passing	m	-	-	-	-	-	-	-	-	350	250	200	150	450	350	250	200	450	350	250	200	500	450	350	250								
STRUCTURES	Load limit	8				3				15				Not less than maximum weight authorized in accordance with code for perma- nent permits																			
	Width	4				6				7				7				8				14											
	Height	4				4				4				4.50				4.50				4.50											
Railroad Crossings		Signs								Signs and Barriers								Signs and Barriers								Grade Separations							

F-Flat; R-Rolling; M-Mountainous; VM-Very Mountainous

SPAIN - HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECT

HIGHWAY IMPROVEMENT WORKS

Total Lengths of Highways included in Project as Compared to Lengths of Various Types of Proposed Improvements

Project	Location	Total Length of Highway km	Improvement						Total Length of Improvement		
			New Construction km	Relocation km	Improvement of Grade and Alignment km	Reconstruction of Subgrade and Base km	Reconstruction of Base km	Increase of Base km	Asphalt Overlay km	Partial km	Phase km
PHASE I	Triangle Madrid-Barcelona- Alicante	Included in Sub- Total Triangle			7.00				122.86		129.86
PHASE II											
A	Soria	Madrid- Barcelona						15.00	26.00		41.00
B+C	Zaragoza			1.00				6.00	37.70	57.97	102.67
	Huesca		629.60							41.69	41.69
D	Lerida							67.70			67.70
E+F	Barcelona	Barcelona-Alicante			2.00			6.50	67.80		76.30
O	Perello			25.00							25.00
G	Castellon					3.00				75.34	78.34
H	Valencia	594.40						4.00	1.70		5.70
I	Valencia				5.05			3.05	62.30		70.40
J+N	Alicante	Alicante-Barcelona		3.94		3.30		6.40			13.64
M	Albacete								20.00		20.00
K	Cuenca-Toledo		411.20			4.60			41.30		45.90
Sub-Total Triangle Madrid-Barcelona-Alicante		1,635.20		29.94	14.65	3.30	108.65	100.00	331.80		588.34
P	Asposta Bridge	Included in Sub- Total Triangle	0.35								0.35
Q	Badalona Bypass	5.07		5.07							5.07
R	Oviedo-Figaredo Highway	23.83	21.42								21.42
S	Palma Airport Freeway	18.87	18.87								18.87
Sub-Total Phase II		1,682.97	40.64	35.01	14.65	3.30	108.65	100.00	331.80		634.05
PHASE III	Zaragoza	Included in Sub- Total Triangle		21.93							21.93
T O T A L		1,682.97	40.64	56.94	21.65	3.30	108.65	100.00	454.66		785.84

SPAIN - HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECT

Cost Estimate

Costs - Million Pts

	Direct Cost + General & Administra- tive Cost	Contract Amount	Right of Way	Design	Supervision	Totals
<b>I. IMPROVEMENT WORKS</b>						
PHASE I	210.5	242.0	10.0	2.5	12.0	266.5
<b>PHASE II</b>						
Madrid-Barcelona	486.2	558.5	18.0	0.0	28.5	611.0
Barcelona-Alicante	375.5	432.0	33.0	6.0	21.0	492.0
Alicante-Madrid	100.5	115.5	7.0	1.5	6.0	190.0
Perello Bypass	297.0	341.5	7.0	8.5	17.0	374.0
Amposta Bridge	232.0	267.0	5.5	10.0	13.0	295.5
Badalona Bypass	167.5	192.5	34.0	5.0	9.5	241.0
Oviedo-Figaredo Highway	341.5	392.5	27.0	10.0	19.5	449.0
Palma Airport Freeway	215.0	247.5	90.0	0.0	12.0	455.5
PHASE III	90.0	103.5	-	1.0	5.0	109.5
Sub-Totals	2,515.7	2,292.5	231.5	56.5	143.5	3,424.0
Contingencies 25%						856.0
<b>Sub-Total</b>						<b>4,280.0</b>
Escalation 15%						642.0
<b>Total Cost Improvement Works</b>						<b>4,922.0</b>
<b>II. MAINTENANCE PLAN</b>						
Equipment						349.5
Shops, Warehouses, Buildings						116.5
Sub-Totals						466.0
Contingencies						29.0
Sub-Totals						495.0
Escalation 15%						74.3
<b>Total Cost Maintenance Plan</b>						<b>569.3</b>
<b>GRAND TOTAL</b>						<b>5,491.3</b>

SPAINAPPRAISAL OF HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECT

Operating Costs per km for a 7-ton Truck  
Under Different Road Conditions

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	Before Improvements			After Improvements
	Very bad road 1/	Average road 2/	Fair road 3/	
	Pts	Pts	Pts	Pts
Depreciation	.93	.77	.69	.61
Repairs	2.23	1.85	1.66	1.47
Fuel	1.53	1.70	1.61	1.53
Lubricants	.14	.15	.14	.14
Tires	.62	.47	.38	.33
Wages	3.13	2.33	1.56	1.56
Interest and Insurance	1.52	1.13	.76	.76
	10.10	8.40	6.80	6.40

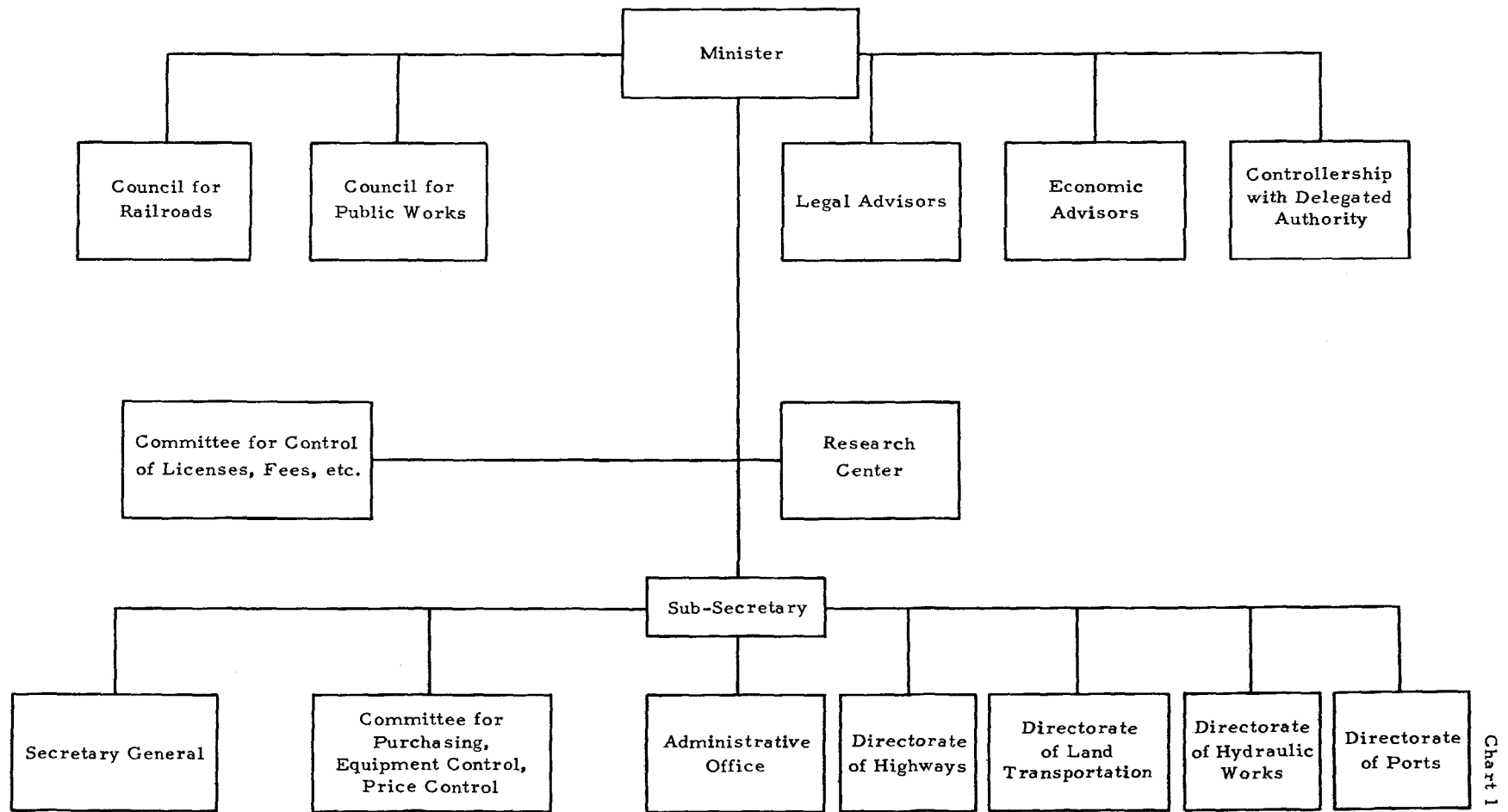
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1/ Very bad alignment and grades, narrow and cracked surface with chuck holes, broken edges, no shoulders.

2/ Poor alignment, ravelled surface, broken edges, insufficient width in some sections, bad shoulders.

3/ Ravelled surface, slippery in some sections.

SPAIN  
**HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECT**  
 ORGANIZATION OF MINISTRY OF PUBLIC WORKS



SPAIN  
HIGHWAY IMPROVEMENT AND MAINTENANCE PROJECT  
ORGANIZATION OF DIRECTORATE OF HIGHWAYS

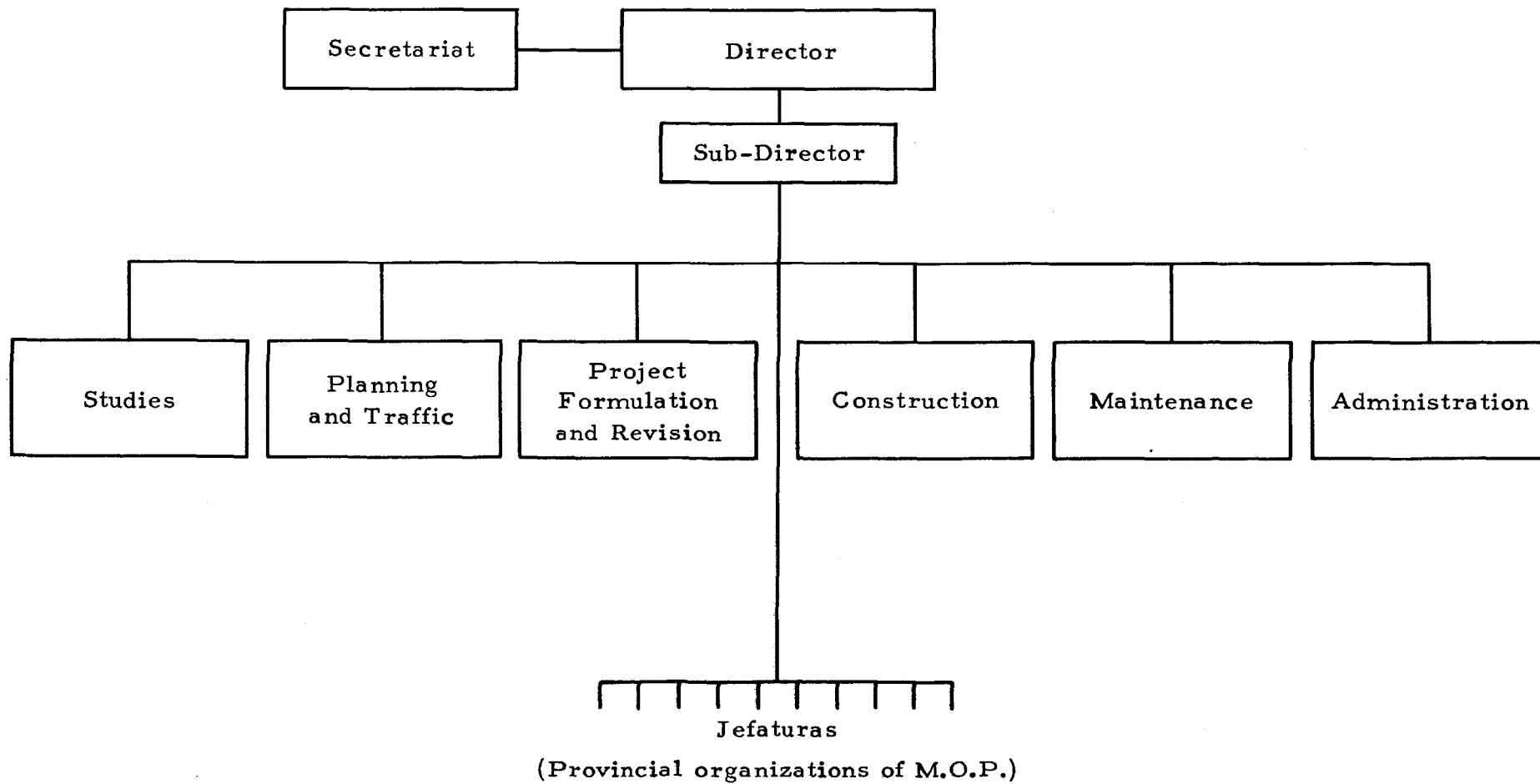
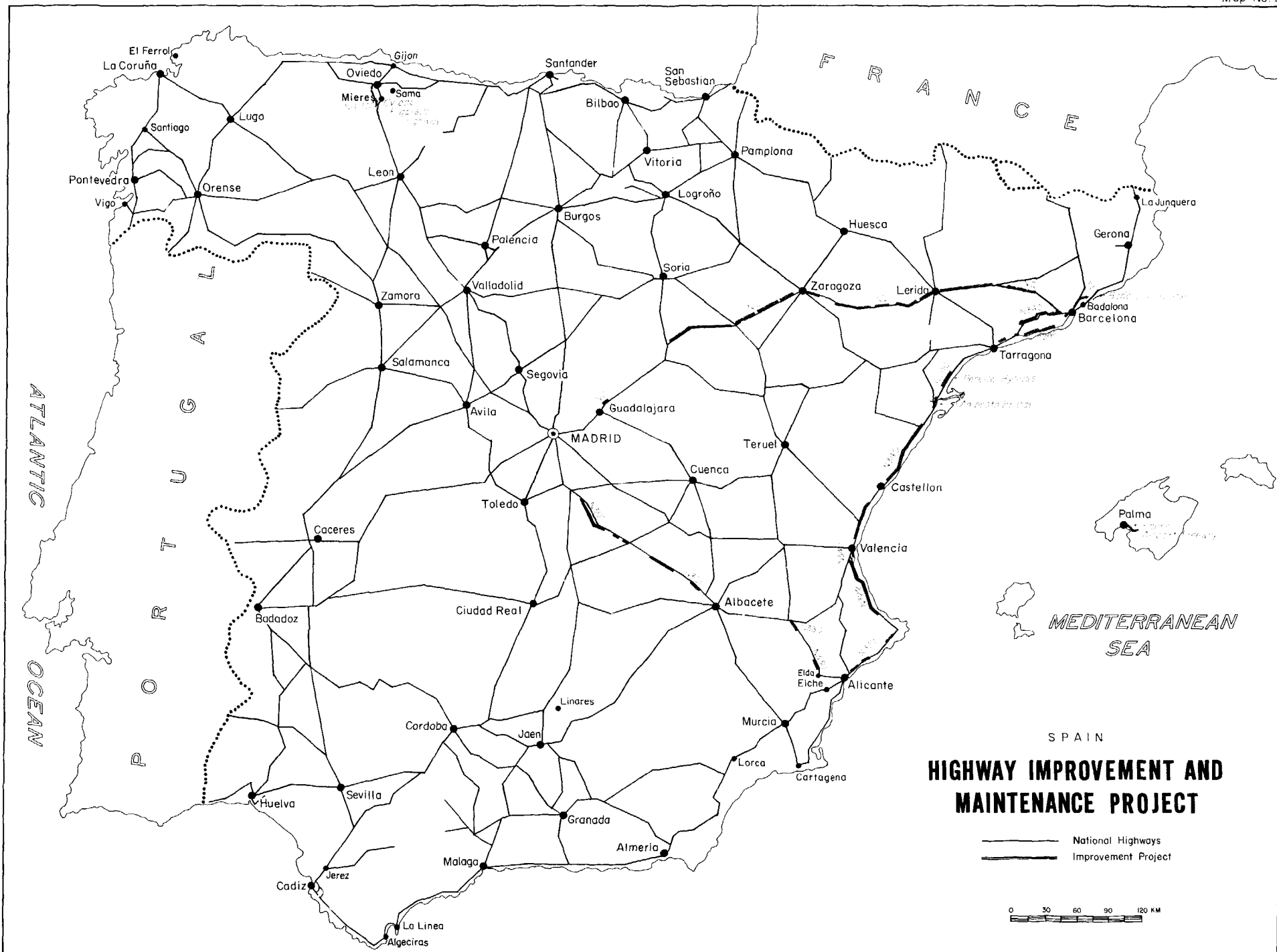


Chart 2



SPAIN  
**HIGHWAY IMPROVEMENT AND  
 MAINTENANCE PROJECT**

— National Highways  
 — Improvement Project

0 30 60 90 120 KM