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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

SPANISH RAILWAYS' 1964-73 MODERNIZATION PROGRAM (LOANS 387-SP, 507-SP, 772-SP)

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Operations Evaluation Department

PREFACE

Loan 507-SP of August 1967 to the Spanish Railways, RENFE, was closed on July 31, 1972. According to current guidelines, the Operations Evaluation Department included the preparation of a Performance Audit on the project supported by that loan in its FY 1974 work program. However, Loan 507-SP was the second of three loans made to RENFE to help finance its 1964-73 Modernization Program. The Bank played a central role in the preparation of that Program and has maintained a continuous dialogue with RENFE since 1963. Thus, the nature and scope of the Bank's objectives in this case made it appropriate to study the loan in the context of the whole Modernization Program, and to review in the audit all Bank assistance to that Program. The audit deals not only with the economic effects of the Investment Plan but also with the institutional and operational improvements included in the Program, which attempted to modernize all aspects of RENFE's operations.

The study took about six months, including two missions to Spain totalling seven weeks. The audit has been based on a review of all Bank files and consultant reports, particularly those of SOFRERAIL of France, the principal consultant in the design and implementation of the Modernization Program. The audit team also analyzed in some detail some aspects of RENFE's technical operations through special visits to existing facilities, and made a new estimate of the economic return of the Investment Plan.

The excellent collaboration received from RENFE's authorities and from the Ministry of Public Works is gratefully acknowledged.

Exchange Rates

1964-1966:	Ptas. 60 = US$ 1.00
1967-1970:	Ptas. 70 = US$ 1.00
1971:	Ptas. 66 = US$ 1.00
1972:	Ptas. 64 = US$ 1.00
1973:	Ptas. 57 = US$ 1.00

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SUMMARY

Since 1961, the Bank has extended 10 loans to Spain totalling US$ 428 million equivalent, half of which has been for railways: US$ 65 million in 1964, US$ 50 million in 1967, and US$ 90 million in 1971. These three loans were made to the National Railway of Spain (RENFE) to help finance its 1964-73 Modernization Program. The general objective of the Program was to "transform RENFE from an antiquated enterprise operating at a large deficit and providing inadequate service into an efficient and modern railway system earning a reasonable return on its investment." The Modernization Program, prepared by a firm of consultants with active Bank supervision, has been modified several times since 1964 but its general lines have remained largely unchanged. It had two major components, the Investment Plan, comprising modernization of motive power and rolling stock and renovation of track and other fixed installations, and the Plan of Action, a set of measures dealing with transport coordination, railway operations, rates and fares, and finances.

The particular characteristic, and the innovation, of the Bank's relations with RENFE is that throughout the 1964-73 period the Investment Plan, which the loans helped finance, and the Plan of Action were given the same priority. Both elements of the Modernization Program were officially incorporated in the Loan Agreements and targets related to them were included as loan covenants. Bank supervision also kept a generally adequate balance between objectives related to the Plan of Action and to the Investment Plan.

The Investment Plan was implemented without serious difficulties. At various times modifications were made, the most important being the acceleration of the program to eliminate steam traction and replace it with deisel and electric locomotives. The total cost of the Plan, originally estimated at slightly over US$ 1 billion, had a 37% overrun, largely due to inflation and to higher standards of track renewal. The latter program experienced the longest delays and largest overruns. Overall, more resources were invested in fixed installations, mainly track renewal (64% of total funds), than in motive power and rolling stock (36%), instead of the original almost equal allocation between these two categories.

The economic justification of the investment given in the 1964 appraisal report, and maintained with only minor variations in the other two projects, was that "a significant part of the nation's traffic can be carried most economically by railway, that this traffic is likely to increase in the next 10 years and, most important, that the Investment Plan will make it possible to carry the traffic at substantially lower costs and improve the quality of service." Two-thirds of the investments were expected to increase efficiency and the remainder to increase capacity. The overall rate of return for the Plan was estimated at 15%, the same

rate implicitly used in the second appraisal, and explicitly in the third. The new estimate made in this audit produced a rate of 12%, which is remarkably close to the appraisal figure, especially if one takes into account that both calculations include among benefits, in an unknown amount, the effects of operational improvements which might or might not be independent from the Investment Plan. Among the investment components which were analyzed in detail in the new estimate, the most successful was the dieselization program, which had a return of about 24%, less than the 30% estimated at appraisal, but still a successful program. The fast absorption of a relatively complex technology such as diesel traction, with its problems of retraining personnel for operations and maintenance, has been one of RENFE's main accomplishments during the Modernization Program. The new estimate of the return of the electrification program is 12%, similar to the figure quoted in the appraisal for the third project. Finally, the track renewal program had a low return, about 6%, on account of the high investment costs (partly due to higher than projected standards) and the relatively low increase in the average running speed of trains.

Of the three areas included in the Plan of Action, operations, finances and transport coordination, progress has been fast in the technical aspects of operations, relatively slow in the financial field, and quite unsatisfactory in transport coordination. Overall, RENFE's operational efficiency improved considerably during the period, and most of the targets of the Plan of Action have been achieved. In many aspects of operation RENFE is now equal to or better than most European railways. Major improvements have been achieved in the rationalization of less-than-carload traffic, thus eliminating one of the major causes of financial loss; in the system of allocating wagons, resulting in a large reduction in the number of wagons required; in the establishment of a system of unit trains, and particularly in the organization of commercial operations, which are now modern and effective. The end result of these and other measures, including the Investment Plan, has been important reductions in personnel, from 120,000 in 1963 to 77,000 in 1972. However, progress has been slow in areas which required a better organization of operations; for example, in the organization of train services, in order to have bigger trainloads, in the utilization and availability of motive power, and in commercial speeds. Similarly, line closures have not proceeded at the speed indicated by economic considerations.

The original version of the Plan of Action contained a program for achieving financial independence and a positive return on net fixed assets by 1973 based on a series of measures, largely promoted by the Bank, such as revision of the level and structure of rates and fares, application of normal commercial rates to Government traffic, a clarification of the financial relations of RENFE with the Government, and revaluation of assets.

However, although most of the measures included in the Plan have finally been taken, progress in this area has been slower than expected. RENFE's financial situation remained relatively stable between 1964 and 196 , it deteriorated considerably in 1967 and 1968, but since 1969 it has shown a slow but steady progress. The original targets have since been revised twice, in 1966 and 1970, and the enterprise is now expected to cover operating expenses, including interest and depreciation, in 1977 instead of 1971. Although the net deficit has declined in real terms, the operating ratio has remained above 100 and cash operating expenses, including interest, were covered only in 1973. These accumulated deficits continued to have a negative impact on the overall financial position of RENFE, particularly on its cash situation. Government delays in making the necessary payments to cover the deficits further deteriorated the cash position.

The increasing impact of road competition appears as the central cause of RENFE's financial difficulties. It has had a negative effect on traffic: freight movement has been less than expected (9.7 billion ton-kms against 11.2 billion expected in 1972) and only passengers have shown some dynamism (14.4 billion passenger-km against 12.0 billion planned in 1972). More importantly, competition has not allowed RENFE to raise its rates and fares to cover the increase in costs, and average revenues per unit of traffic have declined in real terms between 15% and 30%. Another reason for the poor financial performance has been the higher than expected growth of labor costs, in spite of massive personnel reductions, because of important increases in real wages. One consequence of RENFE's financial difficulties has been its inability to contribute to the financing of the Investment Plan and, aside from foreign loans, the Plan has been largely financed by the Government.

Finally, an important set of measures included in the Plan of Action dealt with transport coordination. The main objective of these measures was to ensure Government "neutrality" in the sector in order to achieve an efficient allocation of traffic between road and rail through market forces. Progress in this area has been slow and in some respects non-existent, largely because of the Government's lack of interest in the subject and, at times, the impression that the country's economic growth required vast amounts of transport services and little coordination. However, several achievements can be reported. Various measures have been enacted and implemented to regulate the technical aspects of road transport. Many studies were undertaken about the operation of transport services, which have concluded that there has been no major distortion in the sector deriving from Government actions. The findings and conclusions of these studies and a few institutional arrangements already implemented -- particularly the planning capability -- have provided the basis for an efficient transport policy.

On the whole, the Modernization Program, that is, the combination of the Investment Plan and the Plan of Action, has succeeded in transforming RENFE from an antiquated enterprise into a modern company. The positive effects are reflected not only in RENFE's operational efficiency, but also in the attitude of its management and a large proportion of its staff, who consider RENFE an undertaking operating in a competitive environment, that must show a profit, and be efficient. The Railway is by now capable of pursuing and improving other modernization programs on its own. Its commercial department is truly a sales department, actively promoting traffic and having an influence in the organization of the services.

Several factors explain the success of the Modernization Program. Among the most important are the very structure of the Program itself; RENFE's internal efficiency, especially in management and operations; the adequate use of efficient consultants, and the rapid growth of the Spanish economy, which made possible the program of personnel reduction, without which the potential benefits of the Program could not have materialized. The dynamic economy also allowed RENFE to roughly maintain its traffic level in absolute terms in spite of a steadily declining share of total movements. In fact, the main negative factor (negative for RENFE, but not necessarily for the Spanish economy) faced by the company has been the growing competition from road transport.

Another central element that explains the success of the Program was the Bank's participation. The Bank deserves most of the credit for promoting the basic approach of the Modernization Program, of having an investment plan and a plan of action which in principle were given the same priority, and for suggesting the use of consultants in key areas of operations. In addition, the Bank's attention to RENFE in the last 10 years has been by and large sustained and timely, although in retrospect it probably paid too much attention to the railways' financial problems and to transport coordination. It is likely that earlier attention to operational efficiency might have had a positive effect on RENFE's development.

Several lessons can be derived from RENFE's experience in the last ten years, particularly about the way in which the design and implementation of the Modernization Program could have been improved. First, the Program should have put relatively more emphasis on the technical aspects of railway operations (e.g., train composition, wagon turnaround, yard operations) and probably less emphasis on RENFE's financial goals. Second, the track renewal program, the most important component of the Investment Plan, should have been reappraised in more detail in one of the revisions of the Program, in light of the overrun and upgrading of standards.

Third, personnel reductions were a key factor in achieving the objectives of the Program. These reductions were facilitated by the dynamic growth of the Spanish economy, because labor could be absorbed by other activities, but planning the reductions was essential in achieving the results. Fourth, the impact of road competition on RENFE's finances was not fully taken into account. The assumption that all cost increases could be compensated through higher rates and fares, proved to be unrealistic. Finally, the improvement of RENFE's commercial capability should have been given a higher priority in the Program and achieved several years earlier. After all, RENFE's degree of competitiveness will be essential in determining its future role in the Spanish economy.

I. INTRODUCTION. TRANSPORT IN SPAIN AND BANK LENDING TO RENFE

A. The Bank's Role in Spain

Since the 1961 economic survey mission, the Bank has extended 10 loans to Spain, totalling US$ 427.7 million equivalent of which 77% has been for transportation and nearly 50% for railways, as follows:

Sector and Loan No.	Date of Loan Agreement	Amount of Loan (US$ million)
Transport		
Railways 387	July 31, 1964	65.0
507	August 4, 1967	50.0
772	June 30, 1971	90.0
Roads 360	October 25, 1963	33.0
Ports 429	September 29, 1965	40.0
884	March 27, 1973	50.0
Other Sectors		
Agriculture 633	July 17, 1969	25.0
768	June 28, 1971	12.7
Education 699	June 30, 1970	12.0
832	June 21, 1971	50.0
		427.7

In the 1963-65 period the Bank became very active in the transport sector. Loans were made for railways, highways and ports, and transport coordination was a major subject of discussion with the Spanish authorities. However, the Bank did not continue its lending to the highway sector and assistance to ports was renewed only in 1973, after a seven-year gap. Thus, the main and most continuous effort has been in railways and, through them, in transport coordination.

B. Transport in Spain 1960-73

Spain's mountainous terrain and the concentration of population in the north, northeast and center in areas that are far from each other (see map), has required costly investments in land transport. The extensive network radiates from Madrid to other large cities which, in turn, are connected laterally with local and branch systems. There are about 300 ports,

but only a dozen are of importance. The network of airports is very extensive and has grown rapidly as a result of growth in tourism. Spain invested the equivalent of US$ 8.1 billion in transport (including vehicles) in 1964-70.

Freight traffic (in ton-kms) grew between 1960 and 1972 at about 7% per year. Rail and coastal shipping, although increasing their traffic, declined in their shares of the total freight market from 18% and 37% to 10% and 29%, respectively. Road transport, favored by the pattern of development and by the absence of restrictive regulations,increased its market share from 45% to 60%. The trucking industry, largely formed by owner operators provides fast and flexible service; competition within the industry, as well as with other modes, is intense. Due to its higher speed and reliability, road transport has also been able to capture from the railway some long hauls of high value commodities.

The railway carries mainly bulk commodities over long hauls, although it is also the major carrier of citrus exports to the rest of Western Europe. It is now attempting to increase its share of the freight market by further improving the quality of service, upgrading its marketing organization and developing container services. Recent investments in infrastructure and equipment and improved efficiency are enabling the railway to capture more traffic of high-value commodities such as steel products and automobiles.

Total passenger traffic in Spain has been more dynamic than freight, increasing by almost 400% between 1960 and 1972. With rising personal income, increased mobility and tourism, the private car has played a key role; its share of the total traffic increased from 38% to 64% between 1961 and 1972. The road transport vehicle fleet has grown at 21% per year between 1960 and 1972. During severe winter weather, however, the railway provides the only reliable transportation for various regions.

Following Bank recommendations, the Government established in 1964 the Superior Council of Land Transport (CSTT) within the Ministry of Public Works as an advisory body, with the purpose of studying all aspects of land transport coordination, as well as ports. After a good start and a satisfactory performance in carrying out basic studies, the CSTT lost its momentum in the late 1960s due to lack of political support. In 1971, at the Bank's insistence, the Government agreed to broaden the structure and functions of the CSTT and to strengthen its organization. The effect of these measures will be apparent during the next few years. However, the studies that have been made about transport services have concluded that there has been no major distortion in the sector deriving from Government actions.

C. RENFE: The Modernization Program and the Bank's Three Loans

The Bank first became involved with RENFE during the survey mission of 1961-62. The Government had requested that transportation, and RENFE especially, be studied in some detail. RENFE had been established as the National Railway of Spain in 1941 when all broad gauge railways, consisting of more than 20 privately owned companies, were brought under Government ownership. The Ministry of Public Works was made directly responsible for RENFE's operations. Since its establishment, RENFE faced severe problems, most importantly large deficits, declining performance and loss of traffic to highways. In 1962, it operated 13,000 km of broad gauge track. Motive power was primarily steam, and rolling stock was largely obsolete and under-utilized. While freight traffic remained relatively constant between 1951 and 1958 (7-8 billion ton-km per year) it began to decline in 1959 largely due to an untimely rate increase, economic recession and increased trucking competition. However, perhaps the most important of RENFE's problems were its inadequate internal structure, weak management and lack of commercial motivation.

The Government saw the importance of transforming RENFE from an antiquated and inefficient system into a viable modern railway and began to take remedial steps in 1959 when SOFRERAIL of France was hired to carry out a comprehensive study of operations. However, by 1963 few improvements had taken place.

The Bank indicated a willingness to assist RENFE on the basis of the conclusions of the survey mission, which recommended a modernization program very similar, in its general lines, to the one finally adopted. At the Bank's suggestion, RENFE retained SOFRERAIL to prepare a master plan along the lines proposed by the survey mission. SOFRERAIL's report, "Modernization Plan of RENFE", was published in July 1963. This document, modified following RENFE and Bank suggestions, is the basis of RENFE's 1964-73 Modernization Program for which the Bank has made the three loans indicated above.

The Modernization Program has been modified on several occasions since 1964, but its general lines have remained unchanged. It had two major components, the Investment Plan, equally divided between modernization of motive power and rolling stock, and renovation of track and other fixed installations, and the Plan of Action, dealing with transport coordination, railway operations, rates and fares, and finances. The objectives of the Investment Plan were to replace steam by diesel and electric traction; to interconnect and expand the existing electrified network; and to renew the track and antiquated rolling stock. The objectives of the Plan of Action were to eliminate the deficit and achieve financial strength within the

planning period; to implement a structure of rates and fares closer to the economic costs of providing the services; to improve operational efficiency, mainly through personnel reductions and uneconomic line closures; and to obtain an efficient transport coordination through the market system.

The particular characteristic of the Bank's relations with RENFE is that throughout the 1964-73 period the Investment Plan, which the loans helped finance, and the Plan of Action were given the same priority. Both elements of the Modernization Program were officially incorporated in the Loan Agreements and targets related to them were included as loan covenants. Bank supervision also kept a generally adequate balance between objectives related to the Plan of Action and to the Investment Plan.

The first loan (387-SP of 1964) helped finance one-third of the first two years, 1964-65, of the Investment Plan. The list of goods included mainly ties, shunting locomotives and passenger and freight cars. The second loan (507-SP of 1967) helped finance about one-fifth of total commitments in 1967-68. Major items covered by the loan proceeds were rolling stock, electric locomotives, rails and ties and signalling and interlocking equipment. Finally, the third loan (772-SP of 1971) was expected to cover one-fifth of total planned investments in 1971-73 and the list of goods included items similar to that of the second. The terms of these three loans are presented in Table I-1.

Throughout the ten years of the Modernization Program, the Spanish Government, RENFE and the Bank have had a fruitful and continuous dialogue about the implementation and modifications of the Program. This dialogue is summarized in the following chapters where each of the major issues is analyzed. The relative importance of these issues in the dialogue changed according to the problems being faced during implementation. At the outset the subject of RENFE' autonomy was paramount, but in later years RENFE's financial situation and transport coordination took the largest proportion of the time, in view of the slow progress in those areas. The final impression from the nature and impact of this dialogue is that, by and large, it has been useful for the implementation of the Program and explains an important proportion of the achievements described in the following chapters.

TABLE I-1

SPAIN RAILWAY PROJECTS

Basic Data Sheet

		Loan 387-SP	Loan 507-SP	Loan 772-SP
1.	Borrower	The National Railways of Spain (RENFE)	RENFE	RENFE
2.	Guarantor	The Government of Spain	The Government of Spain	The Government of Spain
3.	Amount of Loan	US$65.0 million	US$50.0 million	US$90.0 million
4.	Amount Cancelled	-	-	-
5.	Amount Disbursed	US$65.0 million	US$50.0 million	US$76.73 million *
6.	Date of Loan Agreement	July 31, 1964	August 4, 1967	June 30, 1971
7.	Date of Effectiveness	February 25, 1965	December 15, 1967	December 29, 1971
8.	Closing Date - Original	June 30, 1967	June 30, 1971	June 30, 1974
	- Actual	December 31, 1968	July 31, 1972	(not yet closed)
9.	Term of Loan	20 years	15 years	20 years
10.	Grace Period	4 years	4 years	5 years

* As of October 31, 1974

II. IMPLEMENTATION OF THE INVESTMENT PLAN

RENFE's original Investment Plan called for a total expenditure of Ptas. 62 billion (at the time, US$ 1,033 million) in 1964-73. The final cost of the Plan, including investments over the same period, was Ptas. 84.6 billion, a 36.6% overrun. During implementation, several changes were made in the physical composition of the Plan. Table II-1 summarizes the estimated and actual investments in physical and monetary terms.

Overall, more resources were invested in fixed installations, mainly track renewal (64% of total funds), than in motive power and rolling stock (36%), instead of the original almost equal allocation between these two categories.[1/] Major overruns occurred in track renewal and telecommunications, and the main underrun was in the acquisition of diesel motive power. The large increase in cost under the general administrative expenses category, found particularly since 1969 (Table II-2) is due to direct coverage by RENFE of the cost of the large personnel reduction program, which prior to that year had been financed by the Government. In physical terms, less track was renewed than originally planned (5,746 km against 7,000) although at higher standards, a fact that partially explains the big cost overrun in this category. Conversely, the electrification program, mostly completed before 1967, was larger and implemented faster than expected (1,450 km instead of 1,100 km). The acquisition of diesel motive power and of new rolling stock, on the other hand, was lower than planned. Only 7,790 freight cars were purchased instead of the 14,604 programmed in 1964 (although expenditures on rolling stock were slightly higher than projected) reflecting unforeseen improvements in operations which resulted in reduced equipment requirements, and lower than expected traffic. The only exceptions were certain types of equipment for passenger transport, due to increased demand. Finally, the station and yards' program was drastically reduced in physical terms although, again, there was a relatively small cost overrun. Further details about the accomplishments of the Plan appear in Tables II-2 and II-3.

As regards time schedules, procurement of motive power and rolling stock experienced only minor delays. Greater delay was experienced with track renewal, where the time necessary for training -- including the Spanish contractors -- and for manpower relocation proved unpredictable. Construction of marshalling yards, for which detailed plans were not completed in the early years and numerous revisions were made throughout the period, was also delayed.

Several reasons explain these differences between estimated and actual cost and schedules. The main reason for the cost overrun has been price increases: by 1972 the average increase in price and wages exceeded 70%, as compared to 1964. These increases affected particularly track

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1/ These figures exclude contingencies, miscellaneous and general administrative expenditures.

renewal and more generally, civil works, and the provision of diesel locomotives. Engineering problems explain part of the delays and to a certain extent the overruns of renewal of track, marshalling yards and stations, but their impact has been minor.

Another major reason that explains the differences with the original objectives was that the Plan was modified twice, in 1966 and 1970. In 1966, RENFE proposed, and the Bank agreed, to accelerate the elimination of steam traction in view of the advantages already obtained with the Program. Electrification had been moving at a faster pace than expected the previous three years. The marshalling yard program was reduced because it became clear that with the introduction of unit trains and a better organization of operations the number of yards required would be less than originally planned. Track renewal standards were also upgraded, but the change was not appraised in the revised version of the Investment Plan. The 1970 revision was actually in the form of a new five-year plan for 1971-75. It further accelerated the elimination of steam traction and the extension of electrified lines, but also provided the basis for new types of specialized traffic, particularly containers and iron ore.

These revisions proved, in general, to have been adequate and demonstrated flexibility in modifying the Plan according to changing conditions. The fact that the whole effort had to be evaluated during the preparation and appraisal of the second and third projects provided a welcome opportunity to formalize these revisions.

Disbursements on the three loans were slower than expected due to delays in loan effectiveness resulting from slow approval of the original and revised investment plans by the Government, and to longer than expected tender procedures and lengthy terms of delivery, a result of Government policy in favor of domestically procured goods. The closing date for the first loan was extended from June 30, 1967 to December 31, 1968, and of the second loan from June 30, 1971 to July 31, 1972. The closing date of the third loan has already been extended from June 30, 1974 to December 31, 1974.

Regarding procurement, all goods financed through the three loans have been acquired through international competitive bidding. Goods outside of the IBRD-supported project, however, were required by the Spanish Industrial Protection Law to be procured from Spanish suppliers in cases where quality met specified standards, regardless of the cost. Under the procedures set by the Bank and RENFE, which were discussed at length during negotiations of the first two loans, the Spanish supplier was granted a margin of preference of 15% (or applicable customs duties, whichever was lower). Foreign bids were increased by the amount of the "Tarifa Fiscal" which imposed on imported

goods the indirect taxes levied on the same goods when manufactured in Spain -- a common practice in industrialized countries, allowed under the GATT. In the end, about 60% of all contracts under the Bank loans were awarded to Spanish firms. Of the contracts awarded to Spanish bidders under the first two loans, about 74% of costs were in foreign exchange.

Under the first loan there were problems with tendering of bids, mainly as a result of the Government's policy in favor of domestically procured goods. Bid specifications were complicated and foreign bidders frequently complained, though after lengthy debate the Bank's opinion was usually that the Spanish authorities had satisfactorily carried out the bid evaluation process, thus approving RENFE's choices for award of contracts. Similar problems arose during the early implementation period of the second loan, but no difficulties have appeared under the third loan.

TABLE II-1: RENFE: Investment Plan - Costs and Physical Achievements, Actual vs. Estimated
1964-73

	Physical Units, Main Items			Investment Cost (Pts. Billions)		
	Estimated	Actual	Actual/ Estimated %	Estimated	Actual	Actual/ Estimated %
Category 1						
1. Track Renewal (km)	7,000	5,746	82	15.2	32.5	213
2. Stations and Yards				4.0	4.9	122
3. Electrification of Line (km)	1,100	1,450	132	2.2[1/]	3.3[1/]	150
4. Shops and Storehouses				1.4	2.5	178
5. Telecommunications				0.5	1.5	300
6. Safety Installations				2.0	3.1	155
Subtotal				25.0	47.8	189
Category 2						
1. Diesel Locomotives (no.)	655[2/]	458	70	14.5	12.3	85
Trainsets (no.)	220[2/]	203				
2. Electric Locomotives (no.)	70[2/]	86	123	3.9[1/]	5.9[1/]	151
Trainsets (no.)	220[2/]	273				
3. Rolling Stock (no.)	14,604	7,790	53	7.9	8.6	109
Subtotal				26.3	26.8	102
Miscellaneous				5.8	2.4	41
Contingencies				4.6	0.3	4
Subtotal				10.4	2.6	25
General Administrative Expenses				-	7.4	
TOTAL				61.7	84.7	

1/ Approximate divisions as among all items included under electrification.

2/ To be divided between diesel and electric trainsets.

Source: RENFE: Memorias del Consejo de Administracion. Planned figures as approved by Bank.

Table II-2

RENFE: Loans 387-, 507- and 772-SP

Investment Plan: 1964-1973; Actual vs. Planned by Period

(Ptas. Millions)

	1964-1966			1967-1970			1971-1973			Total 1964-73
	Planned	Actual	% Actual/ Planned	Planned	Actual	% Actual/ Planned	Planned	Actual	% Actual/ Planned	Actual
Track Renewal	3,621	3,807	105	7,437	11,726	158	13,706	16,940	124	32,473
Stations and Yards	1,026	779	76	2,427	1,607	65	1,816	2,543	140	4,929
Diesel Motive Power	4,171	3,748	90	3,975	3,167	79	1,498	1,118	75	8,033
Diesel Train Sets	1,903	1,412	74	1,767	2,125	120	347	728	210	4,265
Rolling Stock	3,283	3,251	99	3,669	2,600	71	2,686	2,706	101	8,557
Shops and Storehouses	853	612	72	1,969	1,184	60	1,296	746	58	2,542
Telecommunications	231	283	122	866	518	60	730	685	94	1,486
Safety Installations	698	486	70	1,652	844	53	2,134	1,773	83	3,103
Electrification, Electric Locomotives and Train Sets	1,980	1,923	97	5,636	3,956	70	4,051	3,355	83	9,234
Housing and Miscellaneous	303	436	144	734	689	94	1,030	1,062	103	2,187
Investment Stores	-	-	-	1,204	821	68	-64	-600	938	221
Subtotal	18,069	16,737		31,376	29,237		29,230	31,056		77,030
(% planned investment completed)			92.6			93.2			106.2	
Contingencies	904	32	3.5	2,067	67	3.2	1,374	139	10.1	238
General Admin. Expenses[1/]	1,517	437	28.8	1,922	2,467	128.3	4,928	4,541	92.1	7,447
Total	20,490	17,206	83.9	35,365	31,771	89.8	35,532	35,736	100.6	84,713

1/ Including cost of Personnel Reduction Program, Consultant Services, Studies, Deferred Maintenance.

Source: RENFE: Memorias del Consejo de Administracion. Planned figures as approved by Bank.

Table II-3

RENFE: Loans 387-, 507- and 772-SP

Investment Plan, Physical Units: 1964-1973; Actual vs. Planned by Period

		1964-1966			1967-1970			1971-1973			Total 1964/73
		Planned	Actual	% Actual/ Planned	Planned	Actual	% Actual/ Planned	Planned	Actual	% Actual/ Planned	Actual
Track Renewal	Km.	2,230	1,623	73	2,736	1,942	71	2,891	2,181	75	5,746
Stations and Yards	No.	3	9	300	10	1	10	1	1	100	11
Diesel Motive Power											
Line Locomotives	No.	147	152	103	148	90	61	75	19	25	261
Shunting Locomotives	No.	133	113	85	89	84	94	16	0	0	197
Diesel Train Sets											
TER	No.	36	30	83	15	0	0	-	-	-	30
Ferrobuses	No.	15	0	0	34	75	220	0	14	1400	89
TALGO	No.	6	6	100	3	3	100	26	75	288	84
Rolling Stock	No.	5,580	3,637	65	3,725	2,397	64	3,182	1,756	55	7,790
Workshops	No.	2	1	50	2	2	100	10	4	40	7
Telecommunications											
Improvement Lines	Km.	1,129	1,352	120	1,790	4,038	226				
New Equipment	No.	245	155	63	172	153	89				
Safety Equipment											
Signalling Lights	No.	64	26	41	120	92	76		n.a.		
CTC	Km.	252	74	29	285	520	182				
Automatic Block	Km.	295	164	56	191	279	146				
Manual Block	Km.	249	114	46	560	844	151				
Remote Control	No.	4	5	125	20	83	415				
Electrification											
New Lines	Km.	346	755	218	346	436	126	389	259	66	1,450
Electric Locomotives	No.	17	24	141	56	52	93	15	10	67	86
	No.	20	20	100	62	37	60	45	0	0	57
	No.	55	60	109	125	116	93	20	40	200	216
	No.	-	-	-	-	-	-	20	0	0	0

Source: RENFE: Memorias del Consejo de Administracion. Planned figures as approved by Bank.

III. IMPACT OF THE PLAN OF ACTION

A. Introduction

The modernization of RENFE was expected to be achieved through the combined effects of the Investment Plan and the Plan of Action. We have already discussed the implementation of the Investment Plan and its impact is analyzed in the next chapter. The purpose of this chapter is to assess the impact of the other three groups of measures included in the Plan of Action, i.e., those dealing with a) RENFE's operations and organization; b) RENFE's finances; and c) transport coordination.

In these fields, the objectives of the Modernization Program were to achieve RENFE's financial independence, an objective that was assumed to require its becoming an autonomous agency under the general guidance of the Government, and to make the enterprise technically efficient so that, in the competitive atmosphere in which it was expected to operate, it would attract that traffic for which railways have a comparative advantage.

The Bank played an important role in the shaping and the revisions of these aspects of the Plan of Action. The emphasis on more specific measures dealing with the financial situation became increasingly important in RENFE-Bank relations as the financial status did not improve and progress was good on the operational side. Similarly, the Bank's attention to the problems of transport coordination increased in the second and third revisions of the Plan as a result of the few advances in the field (Tables III-1 and III-2 summarize the objectives and achievements in these areas). In the remainder of this chapter, we analyze separately the achievements in these three main areas, and the role played by the Bank in some of the actions taken.

B. RENFE's Operational Efficiency

The operational measures included in the Plan of Action were intended to improve overall efficiency and to achieve a high utilization of the new equipment and infrastructure included in the Investment Plan. Following SOFRERAIL recommendations, RENFE and the Bank put special emphasis on personnel reductions and training, to adapt the labor force to the more technically advanced operating conditions expected as a result of the Modernization Program, and on two or three key measures, such as the rationalization of less-than-carload (LCL) traffic, the consolidation of marshalling yards, and the reduction of passenger classes from three to two. However, no specific targets were set about operational standards such as car turnaround time, trainloads, operating speeds or utilization factors.

The Bank was particularly interested in personnel reductions and quite impressed by the progress that was being made although, as we shall see later in this section, most of those reductions did not result from the Investment Plan. Throughout the period, the Bank concentrated its efforts on personnel reduction, LCL and marshalling yards programs, implicitly assuming that RENFE's operational standards were good and no further detailed targets were necessary in the Plan of Action.

Overall, RENFE's operational efficiency improved considerably during the ten-year period, and most of the targets of the Plan of Action have been achieved. The figures in Table III-3 illustrate how in many aspects RENFE is now equal to or better than most European railways. Major improvements have been achieved in the rationalization of LCL traffic, thus eliminating one of the major causes of financial loss; in the system for allocating wagons; in the establishment of a system of unit trains; in staff efficiency (Table III-4), and particularly in the organization of commercial operations. However, progress has been slow or non-existent in areas where it was possible with better planning; for example, in the organization of train services, in order to have bigger trainloads; in the utilization and availability of motive power, and in commercial speeds. In retrospect, the Plan of Action should have been more precise in these areas. In the following sections these points are discussed in more detail.

Efficiency Programs

Personnel Reductions

RENFE's staff had been growing since its establishment, reaching a maximum of 141,000 in the late 1940s. Since 1954, new hiring had not been allowed, and by 1963 the labor force had been reduced to 120,000. Personnel expenditures accounted, on the average, for 48.5% of total operating costs during 1957-63. Any action toward the reduction in personnel would therefore have an important effect on RENFE's finances. Thus, specific targets were included in the Plan of Action.

Renfe has been highly successful in achieving these targets, as shown by the following figures:

Personnel Reduction: Estimated and Actual
(number)

Period	Plan of Action (1964) Forecast	Plan of Action (1964) Actual	Revised Plan of Action (1967) Forecast	Revised Plan of Action (1967) Actual
1964-68	23,500	21,550		
1966-68			11,000	10,250
1968-70			9,000	15,636
1970-73			9,000	5,664 a/
1964-73	36,500	42,865 b/		

a/ 1970-72
b/ 1964-72

In 1972 RENFE's labor force was only 64.2% of the 1963 level, a reduction of 42,865 people. Thus, although there was a policy of personnel reduction before 1963, the most significant efforts were made after 1963. These reductions were not only the continuation of previous actions but the result of a new and stronger policy, as illustrated in Graph 1, which highlights two different time periods, with reductions during 1963-72 following a different trend from those in 1954-62.

This development was an important factor in realizing the labor-saving benefits of the Investment Plan. We have estimated that even with all the new equipment and the implementation of the Modernization Program, the operating expenditures in 1972 would have been 40% higher than the actual if personnel reductions had not taken place.

Two issues are important in relation to this subject: (a) the role played by the Plan of Action and the Investment Plan and (b) the importance of exogenous factors (i.e., general economic conditions of the country) that may have facilitated the personnel reduction effort.

Regarding the first, it is our impression that the Bank, through the targets included in the Plan of Action, played an important role in promoting this process. A significant part of the reductions was not the direct consequence of the Investment Plan but of the administrative reorganization and other rationalization measures that were implemented as a result of the Plan of Action (LCL traffic, line closures, etc.). RENFE

has estimated that reductions during 1964-67 were mainly due to elimination of redundant personnel;[1/] they accounted for 35.6% of the total in 1964-72. A more precise idea of the effect of the Investment Plan can be obtained from analysis of personnel reductions by categories:

Personnel Reductions by Category: 1964-72

Category		%
A:	Staff personnel of the Central Administrative Office	1.2
B:	Train crews (excluding engineers) and other personnel working in the stations	32.3
C:	Engineers and personnel working in the workshops	29.2
D:	Track maintenance personnel	16.6
E:	Personnel working in the Commercial Department	4.7
F:	All other personnel	16.0
	TOTAL	100.0

Personnel reductions in Category B, the largest, are mainly the consequence of the reorganization of work at terminals, line closures, etc., and can be attributed only in an indirect way to the Investment Plan. RENFE has estimated that about 86% of the reduction in this category is the result of the reorganization. The same analysis applies to Category C, where 70% of the reduction was induced by workshop reorganization, and only 30% to the dieselization program. Reductions in Category D are more closely related to the investments and are a direct consequence of track renewal and the use of mechanical maintenance.

In summary, at least 47% of the reductions in 1964-72 are the result of the improved administrative and organizational methods brought about to a large extent by the Plan of Action, and 25% can be attributed directly to investments. Due to lack of information, the remaining 28% cannot be clearly attributed to any particular factor, but the characteristics of the activities involved, e.g., general administration, the Commercial Department, temporary workers, etc., suggest that this reduction is more closely related to targets in the Plan of Action.

As regards the second point, the extent to which personnel reduction has been affected by exogenous factors, most of the reductions took place through a system of early retirement options, and practically

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1/ RENFE, "Plan Decenal de Modernizacion Actualizado, 1967" pp. 41, 42.

all workers left RENFE voluntarily. It is likely that the general improvement of the Spanish economy in the 1960s and the creation of new employment possibilities might have acted as an incentive for people to leave RENFE. Another job, plus RENFE's pension, provided an excellent monetary incentive. In any case, the dynamism of the economy and the gradual elimination of structural unemployment drastically reduced the pressures over RENFE to slow down on the program or, even more, to continue to hire more labor.

Uneconomic Line Closures

Traffic density (defined as the ratio between traffic and the length of the network) in Spain is very low, as can be observed in the following figures:

Traffic Density in Selected European Countries (1968)
(Traffic units/km track, million)

Germany	3.16
Belgium	3.31
France	2.72
Holland	3.40
Italy	2.87
England	2.67
Spain	1.49

At the same time, traffic is very concentrated, and 65% of the total net ton-kms are carried on line sections that account for only 30% of the total network. The closing of uneconomic lines was then an important issue at the time of the first loan, and the Plan of Action included several targets on the subject (Table III-1).

RENFE agreed to study for closure 49 low traffic lines, comprising 2,638 km. From 1964 to 1966, progress was delayed as an effective methodology had not yet been developed. By early 1971 studies for 48 of the lines had been completed and RENFE had requested abandonment of 1,089 km, of which 505 had already been closed. Appropriate action had not been taken by the Government, for political considerations, on an earlier 1969 proposal to close 269 km and elimination of passenger services on 203 km. As a condition for effectiveness of the third loan, Government action was required on these proposals. In the end, the lines were closed. The 1971 Plan of Action called for studies on 55 additional lines comprising 4,000 km, and requested

that where the Government, for political or other reasons, forced operations determined by RENFE to be uneconomic, the Government would reimburse RENFE for the financial losses incurred.

In 1964, it had also been agreed to work on a program of phasing out uneconomic stations. Out of a total of 3,000, 1,500 were to be studied and 250 were to be closed each year after 1966. By 1970, 631 stations had been closed or converted to reduced operations, a number that the Bank considered to be satisfactory. Agreement to continue the program was confirmed during negotiations for the third loan.

It was not possible to assess whether the program of line closures was adequate, but the benefit-cost analysis of the Investment Plan concluded that it was clearly not profitable to renew the track in these low density lines.

Less-than-carload Traffic (LCL)

The reorganization of this traffic was called for in the 1964 Plan of Action and it is an excellent example of the substantial gains in efficiency that can be brought about with very little investment and only managerial and administrative changes.

LCL traffic was moved through a system of "Central Stations" which served as distribution centers within each region. Traffic between each station and its corresponding "Central Station" was carried on "trenes colectores" (collecting trains). The operation was considered to be very inefficient: for example, the average wagonload was only 1.5 tons. In 1968, 19.7% of the total freight train-kms was devoted to this traffic while contributing with only 13% of total freight revenue.

In that same year, RENFE started a complete reorganization of LCL transport and as a first step it decided to close to this traffic all stations with a gross annual income of less than Ptas. 300,000. As a result, only 389 stations, accounting for 90% of LCL freight revenues (out of a total of 1,121) continued to handle this traffic. The result was a considerable saving, not only in relation to the train-kms of "trenes colectores" which went down by almost 50%, but also in the other expenditures necessary to handle this traffic in the stations that were closed. By 1972, the benefits of the program were impressive; the average load per wagon went up to 2.5 tons, LCL share of total freight revenue declined slightly to 11%, but the proportion of this traffic in terms of freight train-kms went down to 7.4%. A new, more modern system, which will move LCL traffic only among 21 central stations, with the rest of the transport made by truck, will be implemented shortly.

Efficiency Indicators

Average Trainload

The average trainload is lower in Spain than in most other European countries (Table III-3). The Bank has been concerned about this because it was aware that increased train length is one of the best ways of improving efficiency and major improvements are possible in Spain in spite of topographical difficulties. The Plan of Action contained only one measure that tackled the problem, which was the reorganization of the LCL traffic. However, the improvements have been minor: average freight per train went up from 188 net tons in 1964 to 227 tons in 1972, a growth of 20.7% (Table III-4). The increase that took place between 1964 and 1968 was mainly the result of the replacement of steam traction by electric and diesel, which allow for greater train tonnages, and the increase between 1969 and 1972 can largely be attributed (80%) to the reorganization of the LCL traffic just described, by eliminating short trains.[1/]

Average Carload

The average carload was also lower in Spain than in most other European countries (Table III-3), but there has been an important improvement from 12.5 tons in 1964 to 18 tons in 1972, or 44.2% (Table III-4). The reorganization of the LCL played again an important role in achieving this improvement: the reduction in the number of freight cars devoted to LCL traffic explains about 37% of the observed increase in the average carload.[2/] Thus, another conclusion is that the increase in the average carload in 1964/72, which is not explained by the change in the relative importance of LCL, is only about 28%.[3/]

1/ The average trainload for the whole network can be expressed as a weighted average of the average freight of the LCL trains and the other trains. The weights are the proportion of train-kms corresponding to each category out of the total train-kms. The reorganization of the LCL traffic, by just changing the relative weights of each category of trains, led to an increase in the average freight per train for the whole network.

2/ The methodology is similar to that used for the analysis of the average trainload.

3/ This figure is arrived at by subtracting from the total observed increase of 44%, that part that corresponds to changes in the relative weight of LCL traffic (.44 x .37 = .16).

Speed

The combined effect of the Investment Plan and of the Plan of Action produced significant increases in the average commercial speed of both passenger and freight trains (Table III-4).

One of the benefits resulting from an increase in speed is a reduction in freightcar turnaround time (TAT). In Spain, TAT remained practically constant between 1964 and 1968[1/] as can be seen from the following figures:

Evolution of TAT: 1964 and 1968 (days)

Years	RENFE Freight Cars			Private Freight Cars	RENFE + Private Freight Cars		
	D	O	T		D	O	T
1964	4.41	8.60	6.90	7.74	4.41	8.28	7.04
1968	4.43	8.36	7.25	6.26	4.47	7.76	7.01

D = LCL freight cars
O = all other freight cars
T = total freight cars

However, speed is not the key variable to reduce TAT, because travel time accounts for only about 18% of the total; the increase in speed that took place between 1964 and 1972 would lead to a reduction of only about 6% in TAT. The relative importance of travel time and other items in TAT in 1964 and 1968 was as follows:

Time Spent in	1964	1968
	%	
Trains	18.6	18.1
Intermediate Stops	20.5	16.6
Terminals	60.9	65.3
	100.0	100.0

1/ These are the only two years for which a detailed analysis was available.

The time spent in terminals is the most significant item and considerable savings in equipment could be obtained through its reduction.

An important improvement was a new system for allocating wagons among the different stations. This new system, called "Central de Reparto Centralizado" was developed through the technical assistance of SOFRERAIL and established in 1966. Prior to this change the operation was very inefficient; in 1964 there were about 75,000 cars, but a shortage of material because of the bad allocation system. The average yearly car utilization was 110,000 net ton-kms and the total number of net ton-kms was about 8,376 million. A rough measure of the effects of the new system is given by the comparison of these figures with those for 1968. During that year it was possible to transport 5% more ton-kms than in 1964 with only 87% of the cars. The average ton-kms per freight car increased by 21%.

Availability of Motive Power and Rolling Stock

Table III-3 shows the motive power and rolling stock availability for selected European countries. By comparison, Spain has significantly lower availability, on average, for diesel railcars and passenger and freight cars and shows, moreover, a gradual decline (Table III-4). This decline is to some extent logical in cases like Spain, where a large amount of new equipment is placed in service at the same time. Nevertheless, even under these circumstances maintenance could be planned so that, in the case of diesel locomotives, not more than 7% or 8% are out of service at one time. Similarly, not more than 4% or 5% of the electric locomotives should be undergoing repair. For rolling stock the target should be not more than 5% out of service.

RENFE's lower than average performance in this respect is due to several factors. With regard to diesel locomotives and diesel power units, the difficulty is related to (a) the diversity of equipment, a reflection of inadequate planning, which prevents a smooth and fast repair-shop operation; (b) the inability -- or incapacity -- of suppliers to deliver spare parts and components on schedule; (c) the delay in availability of retrained technicians and skilled workers in those maintenance shops which, under the workshop reorganization plan, were to make major repairs to motive power and rolling stock.[1/]

The possibility of attaining better availability targets is borne out by the fact that the proposed targets have already been surpassed in the case of the Talgo (diesel passenger units) motive power, which had a

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1/ These delays are not entirely due to the training programs, which were in general very efficient, but more to the problem of transferring the labor force from one place to another. This has been a major problem in Spain because people are very reluctant to change their places of residence.

94.7% availability in 1972, thus supporting the advantages of standardization. The two principal workshops visited, the locomotive and power unit main repair shop in Madrid and the specialized two-axle box-car repair shop in Barcelona, reflect the high technological and practical capacity of RENFE in this area. Once it is possible to reduce the many types of locomotives, power units, and other equipment it presently has to contend with, RENFE's efficiency will improve considerably.

C. Institutional Efficiency

Before 1964, RENFE was a semi-autonomous public agency facing an important degree of Government intervention, largely due to its financial weakness. At the time, the Bank thought that to have more autonomy and to be able to operate along commercial lines was an essential ingredient of the Modernization Program. The Bank made this a major issue during negotiations for the first loan, and in 1964 obtained from the Government a new statute for RENFE which largely complied with Bank requirements. The new organization gave RENFE more control on day-to-day operations but the Government still reserved the power to appoint the Chairman and the Board of Directors and the control on tariff policy, line closures and the approval of the annual operating and investment budget.

Direct Government intervention -- aside from general economic policy matters -- declined in the following years, but it still influenced operations in an important way. The frequent changes in the top management adversely affected decision making, especially in the late 1960s. For example, in 1967/70 there were four Chairmen and three General Managers in office. The Bank expressed its concern about this lack of continuity and the Government finally agreed in 1971 to maintain fixed-term appointments for the top management positions. Government intervention was also a major factor explaining the delays in the line closure program, and only as late as 1971 did RENFE obtain adequate freedom to modify its tariffs.

One institution-building approach that produced positive results in this case was the use of a large number of consultants. SOFRERAIL, the leading group, appointed technical advisors to all key management positions and acted as coordinator of the large number of consultants that were employed: between 1964 and 1968, 128 individuals from 12 firms participated in RENFE's modernization efforts. This approach helped also to smooth the process of change in management that took place in 1964, when a number of new people with little railway experience joined the enterprise. Later on, the consultants also helped to set up useful training programs for the top and middle management.

RENFE has now a commercially-oriented organization, the morale of its staff is high and the top management is well qualified. One interesting example of RENFE's transformation into a commercial enterprise is given by the changes that have taken place in the Commercial Department. Before 1964, this Department was just an appendix of RENFE, without much power in operations and with a poor image with the customers. In the late 1960s a major change took place, which transformed it into one of RENFE's leading departments. It became a very aggressive group, maintaining close relations with the big customers[1/] and, more importantly, it began to have an influence in the organization of the railway services. The fact that this influence exists is probably the best indication of the changes in attitude that have taken place in RENFE. Current practice is that in the transport contract with its main customers, RENFE guarantees that the service will be performed according to an agreed schedule. If it is not done, RENFE pays a penalty which is proportional to the delay involved. At the Bank's suggestion, RENFE employed consultants (Transmark of England was finally selected), who helped reorganize the Department and later developed the system for use of containers.

The growing importance of the Commercial Department and its role in the organization of the services are crucial for the success of RENFE as a commercial enterprise. However, there is a serious potential danger because of the lack of a good costing system for the different services that RENFE provides. Misleading information about true economic costs might induce the Commercial Department to make wrong decisions in relation to the services that have to be promoted or the kind of tariff structure that is more convenient. The new administration of RENFE is aware of this problem and a new costing system is being introduced.

1/ RENFE's commercial traffic is very concentrated as can be observed in Table III-5.

D. RENFE's Financial Performance

The original version of the Plan of Action contained a program for achieving financial independence during the 10-year period of the Program consisting of three stages: a) cash operating expenses, including interest, were to be met out of revenues by 1968; b) depreciation by 1971; and c) a return on net fixed assets of 3.6% by 1973. The projected attainment of these targets was based on a series of measures (summarized in Table III-1) such as a revision of the level and structure of rates and fares, application of commercial rates to Government traffic, a clarification of the financial relations of RENFE with the Government, incorporating Government contributions -- past and future -- as RENFE equity and settling the mutual debt, and revaluation of assets.

However, progress in the financial area has been from the very beginning slower than expected. The original targets have since been revised twice. In 1966, it was agreed to postpone the date by which cash operating expenses should be covered to 1969, although depreciation was still expected to be covered ahead of schedule, in 1970. The lack of progress resulted in a serious reappraisal of the financial situation in 1970. At that time, it was projected that RENFE would be able to earn operating revenues sufficient to cover cash operating expenses and interest only by 1973, and depreciation by 1977. The operating ratio was not to exceed 100 in 1975.

RENFE's financial situation improved slowly between 1964 and 1973 (Tables III-6 and III-7). The net deficit hovered around Ptas. 4 billion and only in 1973 was it reduced to 2.42 billion (the reduction in real terms has been higher because of inflation). As a consequence, the operating ratio remained above 100 during the whole period and most of the targets set in the three projections described above were not achieved. The improvement in 1973 is also reflected in a working ratio for that year of 97 indicating that the target set in 1970 of covering cash operating expenses in 1973 had been achieved.1/ These accumulated deficits continued to have a negative impact on the overall financial position of RENFE: the current ratio declined from 1.9 in 1964 to 1.2 in 1971, and the liquid ratio has been under 1.0 most of the period, largely because of Government delays in making the necessary payments to cover the deficits. In terms of trends, RENFE's financial situation remained relatively stable between 1964 and 1966, it deteriorated considerably in 1967 and 1968, but

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1/ Financial ratios since 1971 have been calculated without including income from the Canon de Coincidencia, a special duplication tax that had to be paid to RENFE by the owner of a road service parallel to a railway line.

since 1969 it has shown a slow but steady progress. Preliminary indications about 1974 suggest that the improvement has continued.

In retrospect, the revisions of the financial situation in 1966 and 1970, largely promoted by the Bank, were clearly necessary in view of the changing conditions at the time. However, a review of the difference between estimated and actual revenues and costs (Tables III-8 and III-9) suggests that the first three projections consistently underestimated the growth of expenditures, particularly of labor costs. The latter continued to grow in spite of personnel reductions because the average expenditure per worker grew at a very fast pace, 34% between 1964 and 1966 alone. Also, the first two projections underestimated the savings in fuel that would be obtained from the phasing out of steam traction, a reflection of the faster than expected implementation of the dieselization program. Total revenues were, by and large, correctly predicted in 1964-66 and 1971-73, and overestimated in 1967-70, but the evolution of freight and passenger revenues has been somewhat different. Estimates of income from freight traffic were about right the first two years of the program but too optimistic until 1972, reflecting the fact that the projections overestimated the traffic and tariff levels. Revenues from passenger traffic were better than expected for the first three years, largely on account of a higher than expected increase in traffic, but there was an important shortfall between 1967 and 1972.1/

Several reasons have been given to explain RENFE's slow progress in the financial area, but the increasing impact of road competition appears as the central cause of RENFE's difficulties. The optimistic bias of the financial projections was also to a large extent due to the failure to take this impact fully into account.

Road competition has affected RENFE's financial situation in several ways. First, traffic has grown very slowly: freight movement has been less than expected (8.7 billion ton-kms against 10.6 billion expected in 1968 and 9.7 and 11.2 billion, respectively, in 1972) and only passengers have shown some unexpected dynamism -14.4 billion passenger-kms against 12.0 billion planned, in 1972 (Table III-10). Second, competition has not allowed RENFE to raise its rates and fares to cover the increase in costs: average revenue per passenger-km has declined 15% in real terms between 1964 and 1972, and revenue per ton-km has declined 30% over the same period. RENFE and the Bank spent a considerable amount of time negotiating with the Government for greater freedom in raising rates and fares. This

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1/ This high growth in passenger traffic until 1966 was unusual in light of past trends. The existing evidence suggests that it was due to the improved quality of the service, which was beginning to be noticeable at the time, and the expanding tourist trade.

negotiation was, in retrospect, largely academic, because when that freedom was finally achieved in 1971, RENFE was not able to raise tariffs in any significant way. Third, RENFE has been concentrating on the transport of bulk commodities which pay lower tariffs than the high value commodities that have been lost to the trucking industry.

Another reason for RENFE's poor financial performance has been the higher than expected increase in labor costs. The projections underestimated the increase in wages in real terms and compounded the problem by assuming that whatever raises would take place could be compensated for by tariff increases, thus neglecting the effect of road competition.

A factor that has been frequently mentioned in explaining RENFE's financial difficulties is the Government anti-inflationary policies, which kept tariffs at low levels. However, our analysis suggests that this factor did not play a major role during the period under study because of the overwhelming importance of road competition. Its only significant influence was through the negative impact of inflation on the Government finances, which delayed the transfer of funds to RENFE, thus complicating its cash position.

In spite of these negative developments,progress did take place in preparing the basis for better financial management through several of the measures included in the Plan of Action. The financial relations with the Government were normalized: Government contributions have been incorporated as RENFE's equity since 1967, mutual debts were settled in that same year, and Government traffic is now charged commercial rates. The structure of rates and fares has been simplified and made more flexible, in passenger traffic through the establishment of two classes only, and in freight through more commercially-oriented contracts with RENFE's major customers. Assets have been finally revalued, although with considerable delay, and economic cost studies are underway and will be available shortly.

One important consequence of RENFE's poor financial situation has been that its contribution to the financing of the Investment Plan has been practically non-existent. Originally, it was expected that RENFE would contribute 37% of the cost of the Plan, mainly through retained earnings (largely depreciation), foreign loans would finance 20% of the costs, and the Government the rest (Table III-11). In practice, since RENFE did not have profits, the Government financed a large proportion of the Plan. In the 1966-72 period (the period for which figures are fully comparable), foreign loans financed 18% of the expenses and the Government the remaining 82%, of which 28% was financing of depreciation and 54% a direct contribution to equity.

The Bank has played an important role in the achievement of whatever progress has taken place in the financial field. The request for detailed financial projections and for their continuous revision had been an important institutional contribution to RENFE. Some of the measures promoted by the Bank have been particularly useful, such as the normalization of the financial relations with the Government and the efforts, particularly since 1966, to make sure that funds from the Government were delivered to RENFE on schedule.1/ However, the Bank's major effort regarding the level of rates and fares seems to have been partly misguided in view of the preponderant influence of road competition in determining those rates and fares.

E. Transport Coordination

An important set of the targets included in the Plan of Action dealt with transport coordination. At the time of the first appraisal, the Bank had a wide interest in the transport sector, and the apparent bias in favor of the railways was a problem which the Bank thought it could help solve. Legislation dealing with transport until 1964 considered the railway the basic means of transportation and attempted to protect it from the emerging competition from the roads. The basic laws were: a) Ley de Coordinación de los Transportes Mecanicos (1947) and b) Ley de Ordenación de los Transportes Mecanicos por Carretera (1947). The first dealt with the coordination of land transport and the second with the organization of the road transport industry.

Both laws were highly protective of RENFE. They established that, in principle, road transport services parallel to railway lines already in existence should not be authorized, giving RENFE the right to decide whether a new transportation service was needed (derecho de tanteo). The laws also established the special duplication tax (Canon de Coincidencia).

In the early 1960s the increasing competition from road transport, despite this legal protection, led RENFE to ask for further safeguards. However, during their initial contacts, the Bank pressed hard for the elimination of this protective approach, and during negotiations it convinced the Spanish authorities that the most efficient way of obtaining coordination was through market forces. This approach required that the Government should

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1/ During negotiations for the second loan in 1966, it was agreed that the Government would make advance quarterly payments to RENFE to cover its deficits, debt service and investment, and to provide the necessary funds for making the cash working capital not less than 12% of its annual operating expenses by 1969. This latter objective was achieved only in 1972, and the former has been generally complied with, particularly in the last years.

be "neutral" with respect to road and rail, that is, both modes should be taxed or subsidized in the same way. Also, technical standards on both modes should be similar and at a good level. Thus, the Bank's approach to transport coordination at the time of the first appraisal was to propose several studies designed to clarify the existing situation, to assess how "neutral" Government policy was, and to provide the bases for regulating the technical aspects of road transport. In the 1967 revision of the Plan of Action other studies were added to help ensure that investments in road and rail would be made under the same principles. It was expected that these studies would serve as a basis for the formulation of a better transport policy. Table III-1 summarizes the objectives of the Plan of Action in relation to transport coordination and the achievements to date.

In order to undertake the studies and implement these measures it was first necessary to set up a coordinating body. This was done in January 1964 with the creation of the Superior Council of Land Transport (CSTT). The Council, with a permanent staff, operated mainly in an advisory capacity and was in charge of organizing and carrying out studies on all aspects of land transport coordination. In order to cover other modes, the CSTT was expected to interact with the Commission for Transport Coordination organized in 1963 and composed of the Under Secretaries of the relevant ministries.

The studies on rates, taxes and fuel prices were to have been completed by 1966, but were barely underway by the end of that year mainly as a result of the 1965 change of Government. In that year the Chairman of the CSTT was replaced and the new Chairman, not familiar with transport coordination problems, delayed the studies. A second problem was a shift in emphasis by the new Government away from overall coordination and towards urban transport. The Government thought that the country's economic growth required vast amounts of transport services and little coordination was necessary. For these reasons, the three studies, in slightly revised form, were carried over to the 1967 Revised Plan of Action.

More progress was made with highway regulatory policy during the early years. Numerous regulations were enacted during 1965 and 1966; however, enforcement was weak, especially for weight and size limitations, use of approved contract format by truckers, and for freight services claiming regular operations. The Government explained the shortfall in enforcement mainly as a result of the small-enterprise nature of Spanish trucking, which made uniform regulation difficult.

At the time of the second loan, transport coordination became even more important for the Bank because of the negligible progress in the previous period. The 1967 Revised Plan of Action was devoted almost entirely

to the formulation and implementation of measures in this field. They can be classified into three groups: a) completion of the studies on tax neutrality; b) a set of studies to determine investment priorities in transportation; and c) implementation of the road transport regulations.

The studies on tax neutrality faced the problem of finding an adequate definition of "neutrality." The Bank played a useful role in developing the methodology that was finally applied and the studies, most of which were completed by 1971, concluded that there was no discrimination against RENFE as a result of the existing tax structure (Table III-1).

The studies designed to determine investment priorities helped define the investment criteria, as well as detailed guidelines for investment in highways and railways. Three other studies designed mainly to provide a better basis for investment decisions, on inter-city freight traffic, transport market performance, and freight flows by commodity, route and transport mode, were also undertaken. However, their use for investment planning and policy formulation has been limited; no follow-up to their conclusions has been established.

Finally, the regulatory measures dealing with road transport that were developed in 1964/66 began to be applied. Weight and size regulations were made the responsibility of the police in an effort to strengthen enforcement. Implementation of the Plan developed in 1966 for systematic vehicle inspection had been delayed by problems in land acquisition for the location of inspection facilities and in procurement of equipment, and was still not fully operational. A new uniform accounting system for larger trucking enterprises was distributed to private operators, but adoption of its use was optional since truckers were already operating under general Government-prescribed accounting methods.

At the time of the third loan, the Bank concluded that in order to implement the recommendations arising from the studies already completed, it was necessary to create a new transport coordination agency, which should be located in the MPW. However, in the end it was decided to broaden the functions of the CSTT to enable it to perform this function. In addition, a new program of studies for the CSTT was prepared in 1972 in consultation with the Bank, covering the following points: a) inter-regional flows of freight traffic; b) road transport costs and road user charges; c) economies of scale in road transport; d) public and own account road transport; and e) structure of inter-urban public transport.

In 1971, a Government decree imposed restrictions on the increase in the capacity of the bus and trucking industry by limiting the number of licenses issued each year. These restrictions created, for a while, an

artificial demand for railway services and resulted in an increase in the size of trucks.1/ The Bank expressed great concern about this discriminatory measure and by 1972 the restrictions were eased.

Our findings, which on this subject are very general, confirm the conclusions of the Bank-sponsored studies. We do not see a major distortion in the market for transport services derived from Government actions. If anything, the railway seems to have been favored throughout most of the period, especially after the 1971 measures. Progress has been slow in implementing the regulatory measures in highway transport and in eliminating some distorting elements such as the Canon de Coincidencia.

The Bank deserves most of the credit for the elimination of the excessive railway protection that was beginning to emerge in the early 1960s, for the measures taken to regulate the technical aspects of the road transport industry, and for the better information now available about transport in Spain. It is conceivable that the studies now underway will serve as a basis for the formulation of a more up-to-date transport policy and for the elimination of the remaining discriminatory measures.

1/ The restriction was only in relation to the number of trucks, but not to their capacity.

TABLE III-1

RENFE ACCOMPLISHMENTS OF THE PLAN OF ACTION IN OPERATING AND FINANCIAL AREAS

OBJECTIVES		ACTIONS RECOMMENDED	ACHIEVEMENTS
OPERATING EFFICIENCY	1964 Version	1 Reduce labor force from January 1963 by 21,000 permanent and 2,500 temporary workers by 1968, and, by an additional 11,000 permanent and 2,000 temporary by the end of 1973	Reductions proceeded satisfactorily. Labor force reduced by almost 12,000 between 1964 and 1966
		2 Improved recruitment and training	Programs for recruitment and training of personnel established
		3 Consolidation of marshalling yards, construction of six new yards, replacement of steam locomotive repair shops with smaller number of modern shops, phasing out of service at uneconomic stations and lines	Modernization of marshalling yards was in progress, though later discontinued because apparently not necessary Construction of a new yard at Vicalvaro completed in 1972 The number of repair shops was reduced and 90 uneconomic stations closed or operations reduced by 1966
		4. Modernization of pick-up and delivery of local freight traffic through centralization of stations	35 stations were planned, 9 were in operation by 1966 progress satisfactory
		5 Improved safety by stricter regulation and supervision	Railway safety improved, accidents decreased
		6 Reduction of 3 to 2 class passenger service	Elimination of third class on 40 trains, 1964-1966 and on 30 more in 1967, progress satisfactory.
	1967 Revision	1 Progressively achieve a reduction of RENFE labor force of about 9,000 permanent and 2,000 temporary workers between the end of 1966 and the end of 1968 A further reduction of about 9,000 by the end of 1970 and an additional net reduction of at least 9,000 by the end of 1973	Labor force was reduced more than forecast in the two plans, without any Government restrictions
		2 A restudy of RENFE personnel needs by 1969, to determine desirability of further reduction	Study completed further reductions were to be made recruitment and training were satisfactory
	1971 Revision	1 Complete studies on 51 lines to be closed totalling 3,244 km by December 31, 1972	Complete
		2 Complete studies on 10 additional lines to be closed totalling 765 km On a case by case basis, the Borrower will promptly submit to the Guarantor an application for total or partial closure of each line and for payment of losses if authority to curtail service is withheld or delayed for more than six months after submission of such application -- December 1974	9 complete by end 1973
		3 Take appropriate action to reduce losses on unprofitable passenger services	Progress satisfactory, studies made
		4 All normally scheduled trains to be hauled by diesel or electric locomotives, and complete phasing out of all steam workshops by December 31, 1972	Complete dieselization achieved in 1974 Additional delay results from need to serve unforeseen increase in demand
		5 Desired staffing level 1971 - 81,100 1972 - 76,900 1973 - 72,600 1974 - 68,500 1975 - 65,300	Actual staffing level 1971 - 78,972 1972 - 76,960
FINANCIAL EFFICIENCY	1964 Version	1 Revision of rate and fare structure based on transport costs, and establishment of a costing system	A costing section was established in RENFE's management control section, concerned mainly with annual average costs of freight and passenger services, cost analysis of uneconomic lines and passenger trains, costs of commodity movements vis-à-vis shippers contracts and tariffs, which were to be reset in 1968
		2 Increase of rates and fares of local traffic by stages until a total of 20% was reached	Accomplished
		3 Application of normal commercial rates to Government traffic and mail	Accomplished
		4 Increase of rates and fares by 1 5% per year, beginning in 1965, to reflect improved services	Accomplished for fares and special commodity rates Adjustment of general freight rates to be made after completion of cost studies
		5 12% increase in passenger revenues, as part of initiation of 2-class system	Progress satisfactory, a 10 5% increase had been attained by 1966 and the full 12% was expected for 1968
		6. Increase in passenger fares by 6.5% in 1970 and 10% in 1973	Passenger fares were increased by 11% in 1970
		7 Compensation by the Government for loss of revenue on passenger services being carried at less than commercial rates	Not necessary, normal commercial rates applied throughout
		8 Incorporation of Government contributions made to RENFE (before the Loan Agreement) as RENFE Equity	Accomplished by 1967
		9 All funds for capital expenditure granted by the Government to RENFE after the Loan Agreement were to be in form of equity contribution	Accomplished by 1967
		10. Settlement of mutual debts between RENFE and the Government as of 1964, and conversion of balance, if any, in favor of Government, into equity contribution to RENFE capital	Accomplished by 1967
		11 Periodic revaluation of RENFE assets to reflect realistic economic values	Revaluation was not undertaken until 1968
		12 Establishment of a modern mechanized commercial accounting system, to reflect accurately the financial position of RENFE.	A new system was installed in 1965, with computers Progress was slow due to introduction of new procedures and mechanization simultaneously Problems remained in 1967 with property and depreciation accounts, and accounts receivable from the Government
	1967 Revision	1 Government should take compensating steps to offset loss to RENFE caused by any reduction in Canon de Coincidencia Revenues	No reduction in Canon
		2 Government was to make quarterly payments, in advance, to RENFE, as approved in the yearly budgets, for deficits, debt service and capital investments. Use of RENFE by the Government was to be paid in advance, each two months	Government was incurring delays in respect of quarterly payments.
	1971 Revision	1 (a) Convert operating expense accounts to a functional basis and (b) undertake a study of accounting for, and reporting of, operating revenues on the same bases as those on which unit costs are determined	(a) Achieved (b) Progress satisfactory.
		2 Include in accounts and financial statements (i) the evaluation data of all assets made as of December 31, 1970, and (ii) separately state operating and non-operating fixed assets, including land, accumulated depreciation, revenues and expenses.	Achieved

TABLE III-2 TRANSPORT COORDINATION MEASURES INCLUDED IN PLAN OF ACTION. SUMMARY OF ACHIEVEMENTS

Plan of Action	Actions Recommended	Achievements
ORIGINAL 1964	1 Review of tax on highway passenger services paralleling the railway.	Delay due to change in Government, incorporated into 1967 Plan of Action.
	2. Revision of fuel prices in line with a policy of neutrality among modes of transport.	Dela, due to change in Government, incorporated into 1967 Plan of Action.
	3 More effective regulation of highway transport	
	a) minimum entry conditions for highway transport	Effectiveness of a decree defining minimum competence and financial qualifications for new truckers operating nationally or regionally
	b) more effective weight and size regulations.	Slow progress, incorporated into 1967 Plan of Action.
	c) creation of a better inspection system to ensure sound mechanical condition of vehicles	Plan completed by 1966, system was not expected to be fully operational until 1969
	d) requirement of written contracts for highway freight.	Contract format prescribed for national operations with more than one customer; for small truckers, Government believed it would be impossible to enforce such agreements and hoped instead to encourage their consolidation into associations as a first step towards regulation.
	e) better regulation of freight forwarders through adequate performance bonds.	Regulations requiring performance bonds effected. Government proposed that private freight forwarders should undertake the implementation of trucking operations regulations
	f) regulation of adequacy of services which claimed to be operating with fixed rates and schedules.	Adequate regulations were issued, but methods of enforcement had not been defined.
	g) assurances that highway transport meet minimum labor conditions.	Government study showed adequate labor conditions for large operations and that regulation of numerous small operator owners was not possible.
	h) minimum insurance requirements.	Requirements established
	i) establishment of a uniform accounting system for highway transport.	Plan completed, legislation enacted by end 1967
	4. Study rates and tax policy on all modes of transport, to ensure fiscal neutrality.	Study delayed. Incorporated into 1967 Plan of Action.
REVISED 1967	1 To effect greater neutrality with regard to fiscal and other policy as regards their impact on the various modes of transport through study and action taken on.	
	a) Road user charges as related to highway costs.	Completed, showed that road users covered all costs, and that overtaxation existed for all vehicles
	b) Fuel prices as related to fuel costs.	Study completed.
	c) Rate and fare policy for all transport modes as related to cost of providing the service.	This study excluded RENFE, ports and air transport, it dealt only with alternative rate regulations for trucking services; it suggested that the the small enterprise nature of Spanish trucking resulted from the lack of economies of scale, where fixed costs were a small part of total costs Without entry restrictions, prices were closely related to costs, and consumers benefited from technological improvements through lower prices.
	d) Taxation of transport services (after road user charges had been accounted for) including the gas/oil tax and the tax on highway passenger services	Study completed, it discussed all taxes borne by road and rail and analyzed the 1965 road user taxes collected as allocated to groups using inter-urban roads, concluding that fiscal treatment of the railways, vis-a-vis the roads was not unfair.
	e) Price differential for different modes of transport as regards purchase of Spanish versus other equipment, to determine if one mode was bearing an unfair burden	Study completed, it concluded that for both road and rail, procurement of Spanish equipment was equally expensive as a result of the industrial protection law.
	2. Achievement of uniform investment policy for more effective transport coordination, through study and action as follows	
	a) Establishment of criteria for investment in transport by 1968	Completed; in addition to general guidelines, two sub-studies related to rail and road investment were transformed into specific guidelines.
	b) Cost of investment in, and operation of, level crossings as shared by road and rail	Completed, concluded that there were 4 areas of conflict between road and rail and generally that expenditures should be borne by each mode in proportion to benefits received.
	c) Need for pipeline regulation, including user charges.	Results showed that the role of pipelines in Spain was insignificant.
	d) Compilation of road transport statistics for inter-city freight.	Completed
	e) Study of transport market performance to show why shippers choose a particular mode	Study consisted in three surveys of the users market, road transport and intermediaries - using samples.
	f) Study of freight traffic flows by mode of transport, by major routes and by commodity for one year.	A field survey was carried out in 1969 by the National Inst. of Statistics on 45,000 trucks, nation-wide. The results were to assess potential markets for porential RENFE container services.
	g) Study of combined highway-railway-port facilities, and use of containers, pallets, cranes, etc	Completed, used by RENFE to implement container services.
	3. To achieve effective regulation and policies of highway transport as follows	
	a) Implementation of minimum conditions of entry.	Those measures introduced in 1966 were satisfactory, they had been put into use.
	b) Enforcement of weight and size regulations	Scales were set up at the Spanish borders, and orders placed for 2 scales in each of the provinces, but implementation was incomplete
	c) Ensure sound condition of vehicles and a system of inspection	A plan for inspection was developed, implementation was slow, due to delay in acquiring equipment and land for stations.
	d) Uniform accounting system for large transport enterprises.	Completed for large trucking enterprises and distributed by Government to private operators, adoption of the system was, however, optional as general national accounting rules were already used by trucking enterprises
REVISED 1971	Enforce weight, axle load and safety regulations for motor vehicles	Fixed weighing stations built. Progress is satisfactory
	Broaden and strengthen the functions of the Consejo de Transportes	Progress is satisfactory Decree reorganizing Consejo has been passed
	Restrictions on road transport imposed only for limited and defined periods, and to carry out appropriate studies on Interregional Flows of Freight Traffic, Economies of Scale in Road Transport, Public and Own Account Road Transport, Structure of Public Transport of Inter-Urban Passengers, Road Costs and Road User Charges.	Some restrictions on availability of new licenses Slow progress of studies

Table III-3

OPERATING STATISTICS OF SELECTED EUROPEAN RAILWAYS

	Average Cargo per Freight Car; Commercial Traffic: 1958, 1965, 1967, 1970 (Tons)				Average Net Cargo Per Train: 1958, 1965, 1967 (Tons)		
	1958	1965	1967	1970	1958	1965	1967
Germany	14	18	19	20	271	303	308
Austria	15	16	16	19	240	265	265
Belgium	18	21	22	24	300	311	315
France	15	18	20	26	273	294	301
Italy	12	12	14	15	244	244	273
Sweden	12	16	17	22	246	313	301
Spain	12	14	15	20	146	181	189

Availability of Motive Power and Rolling Stock 1963, 1967 and 1970; % Available (in working order) of Total

	Steam Locomotives			Diesel Locomotives			Elect. Locomotives			Diesel Railcars			Electric Railcars			Passenger Cars			Freight Cars		
	1963	1967	1970	1963	1967	1970	1963	1967	1970	1963	1967	1970	1963	1967	1970	1963	1967	1970	1963	1967	1970
Germany	87	85	79	94	95	94	95	95	95	93	92	92	94	94	90	94	94	92	97	95	95
Austria	77	61	75	86	89	90	90	90	90	82	88	87	90	90	91	91	92	93	95	93	92
Belgium	96	-	-	96	98	98	96	96	99	85	97	99	96	96	98	91	91	92	92	98	90
Denmark	98	99	100	96	94	97	-	-	-	93	93	95	96	97	97	91	90	93	96	97	97
Finland	95	58	72	93	92	94	-	-	-	94	93	87	-	-	92	95	91	95	96	96	96
France	87	91	85	95	93	91	92	92	91	91	91	91	92	92	93	89	92	93	91	92	94
Great Britain	79	100	-	85	85	84	73	77	80	90	93	94	91	91	93	91	91	92	94	n.a.	94
Italy	57	76	64	85	83	77	88	88	86	87	88	84	85	85	80	86	86	84	91	92	90
Luxembourg	91	-	-	85	91	91	90	89	84	78	93	94	-	-	-	95	96	94	90	92	97
Sweden	64	45	33	87	86	83	89	87	88	90	89	85	86	85	84	96	n.a.	97	99	98	98
Switzerland	94	93	-	93[a/]	91	90	92[a/]	92	90	67	67	100	90	86	88	96[a/]	97	96	99[a/]	96	99
Spain	74[d/]	71	73	88[a/]	92	85	91[a/]	86	88	79	73	79	90	91	94	82[a/]	79	83	87[a/]	83	74

a/ Data for 1964.

(Note: All other traction and rolling stock as used on standard gauge rail)

Source: International Railway Statistics, International Union of Railways, Paris, 1964, 1968 and 1971 editions.

TABLE III-4

RENFE: SELECTED OPERATING STATISTICS

	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Operating Efficiency																	
Average Cargo per Freight Car (1964=100)	82.9	84.0	86.4	88.0	91.2	95.2	96.8	94.4	100.0	104.8	108.0	119.2	124.8	132.8	142.4	146.4	144.2
Average Cargo per Train (1964=100)	98.9	99.9	100.4	92.3	90.5	94.1	94.6	96.8	100.0	101.1	98.9	106.4	106.9	118.1	124.9	120.2	120.7
Average Speed, Passenger Trains																	
Commercial:																	
Average of Steam, Electric, and Diesel (km/h)						38.2	38.4	38.9	39.9			42.7	44.1	45.4	46.3	47.4	46.9
Running:																	
Steam (km/h)									48.1		50.3	49.8	48.9	48.7	46.4	46.1	
Electric (km/h)									52.5		56.6	57.4	58.2	60.2	61.1	61 2	
Diesel - Line (km/h)									53.7		52.5	51.6	52.5	53.2	53.1	53.3	
- Talgo (km/h)									78.8		81.5	80.6	80.5	80.0	82.1	82.2	
Average Speed, Freight Trains																	
Commercial:																	
Average of Steam, Electric, and Diesel (km/h)						18.4	18.5	18.2	17.8			19.7	20.9	22.3	23.8	24.1	24.1
Running:																	
Steam (km/h)									36.4		37.3	34.5	34.9	36.5	38.6	36.3	
Electric (km/h)									38.7		41.3	40.4	40.9	41.6	41.3	41.4	
Diesel (km/h)									39.2		36.7	37.2	37.3	38.4	39.0	39.1	
Availability																	
Steam Locomotives (%)									73.8	72.3	68.7	70.8	70.6	71.1	72.6	61.0	63.2
Electric Locomotives (%)									90.8	87.4	84.3	85.8	83.4	84.5	88.0	90.4	87.6
Talgo Locomotives (%)									100.0	97.2	92.9	88.1	93.1	94.6	94.7	89.5	94.7
Diesel Locomotives (%)									88.1	87.6	91.7	92.2	91.4	86.4	84.8	85.5	85.7
Passenger Cars (%)									81.6	79.3	78.8	78.7	78.0	80.1	82.9	73.6	80.8
Freight Cars (%)									87.3	85.6	79.3	83.0	67.1	70.0	74.2	84.1	87.2
Utilization																	
Steam Locomotives (%)											21.3	20.0	19.5	19.1	18.7	18.4	36.6
Diesel Shunting Locomotives (%)											58.3	60.4	60.8	57.1	61.3	53.9	63.5
Diesel Line Locomotives (%)											46.8	48.8	52.0	51.8	52.4	62.8	61.3
Electric Locomotives (%)											41.4	42.9	41.0	39.9	40.3	43.0	54.2
Electric Units (%)											22.7	22.5	24.0	26.1	26.1	31.0	35.1
Average (%)											28.5	31.6	32.9	35.4	37.7	40.8	47.9
Average Without Steam Locomotives (%)											39.8	41.0	40.1	41.6	40.4	43.2	48.8
Staff Efficiency																	
Traffic Units per Hour Worked	54.5	57.6	58.7	56.6	47.0	50.0	55.7	69.0	71.1	74.9	87.0	95.4	88.9	96.6	127.6	131.6	147.1

Source: RENFE, Memorias

Table III-5

RENFE: ACTUAL TRAFFIC BY COMMODITY: 1963-1972
(Million Ton-Km)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Petroleum Products	686	823	897	828	942	1008	1072	1380	1305	1453
Iron & Steel	207	366	542	585	804	767	941	982	903	1151
Minerals	529	543	577	540	726	978	980	1226	1413	1161
Fertilizers	471	508	513	520	631	603	571	515	483	581
Cement, Lime, etc.	205	246	307	339	379	392	339	310	342	522
Coal	1398	1216	1168	988	979	890	871	1115	883	743
Beverage	176	164	149	150	179	170	142	156	145	151
Sugar Beets	135	188	156	168	210	166	156	840	267	221
Grain, Flour, etc.	615	635	624	640	768	626	589	547	492	653
Sub-total	4422	4689	4933	4758	5618	5600	5661	6471	6323	6641
Other Commercial Traffic	1759	1919	1820	1966	2116	1935	2100	2599	1990	1793
Total Commercial Traffic	6181	6608	6753	6724	7734	7535	7161	9070	8313	8434
RENFE Supplies	-	911	1061	895	646	534	491			
Mail	205	224	225	260	274	279	297	306	330	334
Service Traffic	1598	633	413	389	427	396	473	730	818	930
Total	1803	1768	1699	1544	1347	1209	1261	1036	1148	1264
GRAND TOTAL	7984	8376	8452	8268	9081	8744	9022	10106	9461	9698

Source: RENFE, Memorias

Table III-6

RENFE ESTIMATED (1964-1973) AND ACTUAL (1956-1973) REVENUES, EXPENSES, AND NET INCOME
(Million Pesetas)

	1956	1957	1958	1959	1960	1961	1962	1963	1964 Est.	1964 Act.	1965 Est	1965 Act	1966 Est	1966 Act	1967 Est.	1967 Act.	1968 Est.	1968 Act.	1969 Est.	1969 Act	1970 Est.	1970 Act.	1971 Est.	1971 Act	1972 Est.	1972 Act	1973 Est.	1973 Act
Operating Revenues																												
Passenger	1829	2345	2606	2763	3053	3244	3627	4097	4870	4899	5530	5838	5750	6636	7837	6982	8930	7096	9780	7576	10560	8338	9410	9078	10007	10008	10340	12200
Freight	3841	5047	5685	5927	5700	5732	5907	6049	6880	6934	7430	7592	7950	7171	8170	7750	9310	7790	10170	7817	11010	8406	9010	8773	9740	9841	10190	11681
Miscellaneous																												
Mail	194	241	335	455	526	562	576	599		643		621		745		757		770		830		843		903		943		1020
Canon Coincidencia	151	172		216	251		342	390								659		747		880		1015		1550		1902		2103
Other	___	150	237	228	269	518	244	271	___	875	___	1046	___	1005	___	595	___	728	___	726	___	727	___	1530	___	1846	___	1661
Total Miscellaneous	345	563	572	899	1046	1080	1162	1260	1437	1518	1250	1667	1290	1750	1753	2011	1800	2245	1800	2436	1740	2584	3630	3983	4660	4691	5120	4784
Total Operating Revenues	6015	7955	8863	9589	9799	10056	10696	11406	12980	13351	14210	15097	14990	15557	17760	16743	20040	17131	21750	17829	23310	19329	22050	21834	24407	24540	25650	28665
Operating Expenses																												
Personnel	3523	4524	4762	4912	5365	5358	6701	8114	8300	8632	8340	9497	8380	9879	11330	11551	11180	12167	11190	12096	11240	12178	14910	14690	15340	16188	14500	17830
Power	2098	2811	3000	2818	2722	2908	3098	3016	3370	2987	3330	3624	3290	3154	2910	2842	3520	2311	2910	2008	2850	1926	1920	1991	1888	2058	1860	2263
Others	1952	2529	3077	3277	3131	2923	2688	3097	3740	3703	3680	3052	3610	3980	4820	4938	4900	5879	4780	4775	4660	5480	5870	4834	5512	5044	5450	5558
Total Operating Expenses (Excluding Depreciation)	7573	9864	10839	11007	11218	11189	12487	14227	15410	15322	15350	16173	15280	17013	19060	19331	19310	20357	18880	18879	18750	19584	22700	21515	22740	23290	21810	25651
Net Cash Operating Revenues (Deficit)	(1558)	(1909)	(1976)	(1418)	(1419)	(1133)	(1792)	(2821)	(2430)	(1971)	(1140)	(1076)	(290)	(1456)	(1300)	(2588)	730	(3226)	2870	(3050)	4560	(263)	(650)	319	1667	1250	3840	3014
Interest			691	787	875	991	1020	1120	590	598	630	623	710	645	730	739	910	429	1020	561	1100	656	750	693	730	752	950	1025
Net Cash Income (Loss)			(2667)	(2205)	(2294)	(2124)	(2811)	(3941)	(3020)	(2569)	(1770)	(1699)	(1000)	(2101)	(2030)	(3327)	(180)	(3655)	(1850)	(3611)	3460	(919)	(1400)	(374)	937	498	2890	1989
Depreciation Expenses									1470	1470	1660	1700	1880	1950	2110	2240	2350	2790	2600	2611	2840	2870	3850	3130	4070	3860	4370	4410
Net Income (Loss									(4490)	(4039)	(3430)	(3399)	(2880)	(4051)	(4140)	(5567)	(2530)	(6045)	(750)	(4222)	620	(3789	(5250)	(3504)	(3133)	(3362)	(1480)	(2421)
Ratios																												
Operating (%) 2/									130	126	120	118	114	122	119	129	108	103	99	121	93	113	130 1/	121 1/	120 1/	120 1/	113 1/	113 1/
Working (%) 3/	126	124	122	115	114	111	117	125	119	115	108	107	102	109	107	115	96	119	88	106	80	101	111	106 1/	102 1/	103 1/	94 1/	97 1/

Source Estimates for 1964-1966 Appraisal Report TO-420 (Loan 387-SP)
1966-1970 Appraisal Report TO-595 (Loan 570-SP)
1971-1972 Appraisal Report PTR-89 (Loan 772-SP)

Actuals for 1964-1970 - From above Bank Appraisal Reports, Actuals for 1971-1972 - From Renfe "Memoria" (1971-73)

1/ Without taking into account the revenue from the Canon de Coincidencia

2/ Defined as the ratio of total operating revenues to total operating expenses (including depreciation).

3/ Defined as the ratio of total operating revenue to total operating expenses (excluding depreciation)

Table III-7

RENFE: OVERALL VIEW OF ESTIMATED AND ACTUAL FINANCIAL EVOLUTION

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
1. Net Surplus or Deficit (Billion Ptas.)										
1964 Estimate	-4.49	-3.47	-2.88	-2.45	-1.20	-0.87	-0.23	0.29	0.65	1.90
1967 "				-4.14	-2.53	-0.75	0.62	1.53	1.98	3.10
1971 "								-5.25	-3.13	-1.48
Actual	-4.04	-3.39	-4.05	-5.56	-6.04	-4.22	-3.78	-3.50	-3.36	-2.42
2. Operating Ratio										
1964 Estimate	130	120	114	110	101	99	95	93	91	87
1967 "				119	108	99	93	89	87	85
1971 " 1/								130	120	113
Actual	126	118	122	129	133	121	113	121 2/	120 2/	113 2/
3. Working Ratio										
1964 Estimate	119	108	102	97	88	85	80	78	76	71
1967 "				107	96	88	80	76	74	71
1971 " 1/								111	102	94
Actual	115	107	109	115	119	106	101	106 2/	103 2/	97 2/
4. Current Ratio										
1964 Estimate	1.29	1.28	1.27	1.27	1.29	1.29	1.31	1.33	1.38	1.87
1967 "				1.58	1.69	1.89	2.00	1.98	1.97	3.90
1971 "								2.55	2.39	2.20
Actual	1.90	1.92	1.79	1.37	1.36	1.43	1.39	1.21	n.a.	n.a.
5. Liquid Ratio										
1964 Estimate	0.77	0.84	0.84	0.84	0.83	0.83	0.82	0.80	0.78	1.22
1967 "				0.89	1.02	1.15	1.18	1.12	1.06	2.02
1971 "								1.34	1.36	1.10
Actual	1.24	1.08	0.91	0.77	0.81	0.93	0.99	0.66	n.a.	n.a.

1/ The 1971 estimates do not include the revenue from the Canon de Coincidencia.
2/ Without including the revenue from the Canon de Coincidencia.

Source: Appraisal reports and Tables III.6 and III.8.

Table III-8

RENFE: ESTIMATED AND ACTUAL BALANCE SHEET: 1964-1971
(Billion Pesetas)

	1964		1965		1966		1967		1968		1969		1970		1971	
	Est.	Act.	Est.	Act.	Est.	Act.	Est.	Act.	Est.	Act.	Est.	Act.	Est.	Act.	Est.	Act.
ASSETS																
Current Assets																
Cash	1.15	.23	1.53	.23	1.61	.34	2.58	.51	3.15	1.06	3.29	1.52	3.27	.35	2.89	.25
Securities	.01	.04	.01	.04	.01	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	
Accounts Receivable	1.36	5 59	1.35	4.69	1.34	3 73	1.83	4.62	1.61	5.84	1.47	7.27	1.43	10.27	1.60	5.02
Stores	1 75	3.20	1.60	4.41	1.60	4.73	4.27	4.98	3.72	4.82	3.47	4.83	3.72	4.95	4.07	5.17
Other Current Assets	.17	.20	.17	.76	.17	.82	1.07	1.29	.84	.26	.64	.27	.54	1.63	-	-
Total Current Assets	4.44	9.26	4.66	10.13	4.73	9.67	9.80	11.45	9.37	12.03	8.9?	13.94	9.01	17.25	8.61	9 69
Fixed Assets																
Gross Value	48.49	61.90	55.44	67.38	63.69	75.46	83.60	82.67	92.56	91.40	101.76	99.45	110.53	98.75	108.45	107.64
Less Accumulated Depreciation	1.47	14.67	3.13	16.38	5.01	18.33	20.44	20.45	22.79	22.76	25.39	25.56	28.23	15.06	18 90	18.18
Work in Progress								1.04		.75		1.01				
Net Fixed Assets	47.02	47.23	52.31	51.00	58 68	57.13	63.16	63.26	69.77	69 9	76.37	74.90	82.30	83.69	89.55	89.46
Deferred Assets								.09		.96		.86		.49		.36
Investment Stores																4.09
Total Assets	51.46	56.49	56.97	61.13	63.41	66.80	72.96	74 80	79.14	82.38	85.29	89 70	91 31	101.90	98.16	101.35
LIABILITIES																
Current Liabilities																
Accounts Payable	2.40	3.21	2.62	3.02	2.74	3.44	2.81	4.41	2 35	5.65	2.38	6.29	2 40	6.03	2.68)	
Accrued Wages and Social Security	1 00	.61	1.00	.31	.95	.22	.40	.31	.45	.26	.45	.08	.45	.62	.12)	5 64
Deposits and other Creditors	-	.45	-	.65	-	.71	.20	1.28	.18	.60	.16	1.04	.14	1.13	57)	
Other Current Liabilities	.03	.60	.03	1.30	.03	1.03	2.80	2.37	2.55	2.36	1.74	2.36	1.51	4.66	.01	2 35
Total Current Liabilities	3.43	4.87	3.65	5.28	3.72	5.40	6.21	8.37	5.53	8.87	4.73	9.77	4.50	12.44	3.18	7 99
Long-Term Debt																
Bonds 1946-1957	12.81	12.82	12.68	12.67	12.54	12.52	12.36	12.50	12.19	-	12.02	-	11.84	-	-	
U.S. Loans and EXIMBANK	1.01	.91	1.04	.83	.96	.75	65	1.25	.54	1.71	.43	1.97	37	1 97	1.99	
IBRD Loans	80	-	2.60	.44	3.90	1.87	3.64	2.89	5.26	4.32	6.30	5.46	6.51	6.11	7 17	
Other Long-Term Debt	.40	.29	.50	.32	1.60	47	.63	.28	.79	.28	1.77	.27	3.03	.25	64	
Total Long-Term Debt	15.02	14.02	16.82	14.26	19.00	15.61	17.28	16.92	18.78	6.31	20.52	7.70	21.75	8.36	9.60	8.93
Total Liabilities	18.45	18.89	20.47	19.54	22.72	21.01	23.49	25.29	24.31	15.18	25.25	17.47	26.25	20 80	12.98	16.92
EQUITY																
Reserves																
Amortized Bonds	1.32	1.33	1 4?	1.48	1.62	1.63	1 79	1.66	1.96	-	2.13	-	2.31	-	-	
Debt Redemption	-	.09	-	.19	-	.27	.37	35	.55	.54	.82	.80	1.06	1.07	1.57	
Housing Construction	-	.05	-	.06	-	07	.08	04	.10	.04	.12	.06	.14	07	07	
Other Reserves	-	.50	-	.14	-	-	-	-	-	-	-	-	-	-	-	
Total Reserves	1.32	1.97	1.47	1.87	1.62	1.97	2.24	2.05	2.61	.58	3.07	.86	3.51	1.14	1.64	1 59
Earned Surplus or (Deficit)	-	(5.36)	-	(9.26)	-	(13.18)	(17.32)		(19.85)		(20.60)		(19.98)		-	
Unearned Surplus (Revaluation)	-	12.89	-	12.89	-	12.89	12.89	12.89	12.89	12.89	12 89	12.89	12.89	12.89	12.89	
Old Bonds - Assumed by Government								-		14.16		14.16		14.16	14.16	
Written Off Assets (Negative)								(13.20)		(13.20)		(13.20)		(13.20)	(13.20)	
Capital	31.69	28.10	35.03	36.09	39.07	44.11	51.66	47.77	59.18	52.77	64.88	57.52	69.64	66.11	69.69	82.84
Total Equity	33.01	37.60	36.50	41.59	40.69	45.79	49.47	49.51	54.83	67.20	60.04	72 23	65.06	81.10	85.18	94.63
Total Liabilities and Equity	51.46	56.49	56.97	61.13	63.41	66.80	72.96	74.80	79.14	82.38	85.29	89.70	91.31	101.90	98.16	101.35
Ratios																
Current	1 29	1.90	1.28	1 92	1.27	1.79	1.58	1.37	1.69	1 36	1.89	1.43	2.00	1.39	2.55	1 21
Liquid	0 77	1.24	0.84	1.08	0.84	.91	.89	.77	1.02	.81	1 15	.93	1.18	.99	1.34	.66
Debt/Equity	31/69	27/73	32/68	26/74	32/68	25/75	32/68	25/75	31/69	9/91	30/70	10/90	29/71	9/91	13/87	10/90

Source Estimates for 1964-1966. Appraisal Report TU-420a (Loan 387-SP)
1966-1970: Appraisal Report TO-595a (Loan 507-SP)
1971-1972. Appraisal Report PTR-89 (Loan 772-SP)

Actuals for 1964-1970. From above Bank Appraisal Reports, Actuals for 1971 From Bank Supervision Report of June 28, 1972.

Table III-9

RENFE: ACTUAL REVENUES AND EXPENDITURES AS A PERCENTAGE OF FORECASTS

	Revenues			Expenditures		
	Passengers	Freight	Total	Labor	Fuel	Total
1964	100	101	103	104	87	99
1965	106	102	106	114	109	105
1966	115	90	104	118	96	111
1967	89	95	94	102	98	101
1968	79	84	85	109	71	105
1969	77	77	82	108	69	99 1/
1970	79	76	83	108	68	104 1/
1971	96	97	99	98	104	94 1/
1972	100	101	100	105	109	102 1/
1973	118	114	111	123	122	119 1/

1/ These results are not strictly comparable with those of the previous years because of some change in the definition of operating expenses. In 1969 the expenditures as a result of personnel reductions (about Ptas. 854 million or 4.5% of the total actual expenses of that year) were taken out of the accounts and written off as "activo inmobilizado" and financed through reductions in investments. From 1970 onwards the Government took care of these payments and they are no longer included in the accounts. In the same way, other expenditures previously listed as "conservacion extraordinaria" were also excluded.

Table III-10

RENFE: TRAFFIC PATTERNS AND EVOLUTION OF NETWORK

		1964	1965	1966	1967	1968	1969	1970	1971	1972
I. Network										
Total Route Kms	(km)	13,300	13,385	13,386	13,391	13,668	13,672	13,649	13,476	13,504
Double Track	"	n.a.	961	798	774	597	615	591	602	620
Single Track	"	n.a.	9,748	9,669	9,669	9,950	9,935	9,981	9,783	9,760
Electrified Lines	"	2,200	2,676	2,919	2,948	3,121	3,122	3,077	3,091	3,124
Double Track	"	n.a.	956	1,120	1,149	1,322	1,356	1,412	1,414	1,475
Single Track	"	n.a.	1,720	1,799	1,799	1,779	1,766	1,665	1,677	1,649
II. Passenger Traffic										
Total Passengers	(mln.)	169	174	176	156	148	159	164	167	178
Passenger-km	"	11,820	12,198	12,523	12,437	11,836	12,647	13,293	13,533	14,391
Average Distance of Trip	(km)	70	70	71	80	80	80	81	81	81
Passenger-km per Route-km	('000)	889	911	936	929	866	925	974	1,004	1,068
III. Freight Traffic										
Total Net Tons	(mln.)	29.3	31.2	31.2	32.4	27.8	27.3	28.0	28.9	31.2
Net Tons-km	"	8,376	8,452	8,268	9,081	8,744	9,022	10,106	9,461	9,698
Net Tons-km Steam Traction	"	5,153	4,782	3,673	3,084	2,360	1,618	1,092	517	530
Net Tons-km Diesel Traction	"	492	692	1,117	1,910	2,437	2,912	3,959	4,001	3,943
Net Tons-km Electric Traction	"	2,731	2,978	3,478	4,087	3,947	4,492	5,055	4,943	5,225
Average Haul	(km)	286	271	265	280	314	330	361	327	311
Net Tons-km per Route-km	('000)	630	631	618	678	640	660	740	702	720
IV. Operations										
Locomotive-km	('000)	158,784	163,794	169,139	170,999	167,891	167,991	170,922	174,467	179,469
Total Train-km, Passenger	"	66,200	71,500	75,358	77,884	78,904	80,688	80,497	81,565	84,313
Steam Train-km, Passenger	"	25,600	25,400	18,963	12,936	8,706	4,959	1,905	783	584
Diesel Train-km, Passenger	"	17,800	21,700	29,916	36,263	39,674	44,164	46,871	47,006	47,135
Electric Train-km, Passenger	"	22,800	24,400	26,479	28,685	30,524	31,565	31,721	33,776	36,594
Total Train-km: Freight	"	44,554	44,507	44,169	45,393	43,465	41,842	43,209	41,875	42,867

Source: RENFE, Memorias, 1964-1973.

TABLE III-11

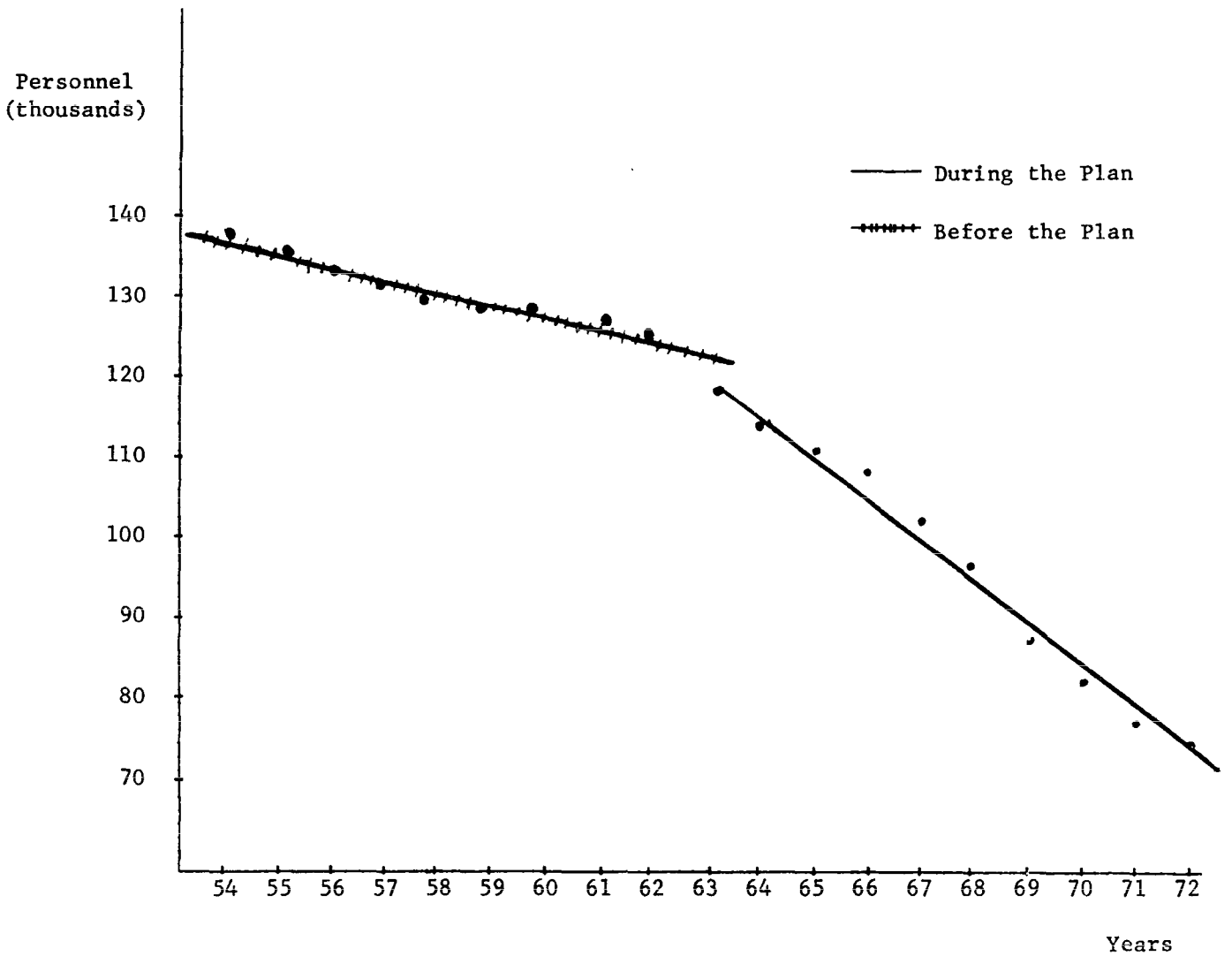
RENFE: FINANCING OF THE INVESTMENT PLAN: 1966-72
(Billions of current Pesetas)

	1966	1967	1968	1969	1970	1971	1972	Total 1966/72
Foreign Loans	1.53	1.31	1.89	1.65	0.89	1.00	2.67	10.94
Government								
Contributions to Equity	4.06	3.67	5.00	4.75	4.89	3.37	6.11	31.85
Financing of Depreciation	2.05	2.47	1.40	1.62	2.23	3.18	3.18	16.13
TOTAL	7.64	7.45	8.29	8.02	8.01	7.55	11.96	58.92

Source: RENFE, Memorias 1966-72

GRAPH 1

RENFE: Evolution of the Labor Force, 1954-72



IV. BENEFIT-COST ANALYSIS

A. Introduction

The purpose of this chapter is to present the results of a new estimate of the rate of return of the Investment Plan. The rates of return have been recalculated using, whenever possible, the same principles used in the three appraisals, but modifying them when actual practice suggests that some benefits had to be added or subtracted. We have also added a rather detailed sensitivity analysis in order to assess the relative importance of different factors. The Harvard Railway Simulation Model, already used in other evaluation studies of railway projects, was used as a tool to obtain some of the newly estimated rates of return, particularly of the components of the Plan, and the sensitivity analysis.

Due to time and resource constraints for preparing this audit, we have made a new calculation of the benefit-cost analysis only for the Plan as a whole and for the investments in track renewal, diesel motive power and electrification. These last three items comprise 64% of the investment.

B. Return of the Investment Plan

The economic justification for RENFE's Investment Plan given in the 1964 appraisal report, and maintained with only minor variations in the other two projects, was that "a significant part of the nation's traffic can be carried most economically by railway, that this traffic is likely to increase in the next 10 years, and, most important, that the Investment Plan will make it possible to carry the traffic at substantially lower costs and improve the quality of service" (Appraisal Report, page 18). It was also expected that about three-quarters of the total investment would increase RENFE's efficiency through a 33% reduction in operating costs, and the remainder would increase capacity. The overall rate of return for the Plan was estimated at 15%, the same rate implicitly used in the second appraisal, and explicitly in the third. Table IV-1 summarizes the expected and actual returns of the Plan and its components and the benefits considered in the calculation.

The original estimate included as part of the benefits the impact of some measures of the Plan of Action because of the impossibility of separating them; it considered that in the absence of the Investment Plan operating costs would remain at the 1963 levels -- a very optimistic assumption -- and it did not add other benefits such as time savings and improvements in the quality of service. In this audit we have tried to separate as much as possible the effects of the investments from those of the Plan of Action, but the other two assumptions have been maintained,

although the quality of service, especially for passengers, has improved considerably.

The overall return of the Plan can then be estimated through savings in operating costs, broken down into different categories: a) savings in direct operating costs, including not only those derived from the change in traction (dieselization or electrification) but also the benefits from higher speed and average trainload; b) savings in track maintenance; and c) savings in terminal costs (including operations at terminals) and administrative expenditures.[1/]

Two alternative methods were used for estimating the total cost savings. The first was to build up the total from the statistics that reflect the changes that have taken place in operations: speeds, types of traction, average trainloads, etc., and the second was to attempt an aggregated estimation of total savings by comparing the actual cost figures for each year in the 1964-71 period (in 1971 pesetas) with the expenditures in each major item estimated from a trend line adjusted to the period 1956-63. The projection is considered in this second alternative the "without situation", because it indicates the way costs would have evolved if the operational efficiency in the 1956-63 period had been maintained. Thus, the benefits for each year in the 1964-72 period were the difference between projected and actual costs.

The end product of these calculations has been a set of rates of return which are summarized in Table IV-2. Our "best estimate" about the overall Investment Plan's rate of return is 12% (Alternative C_4 in the aggregated analysis, assuming an investment lifetime of 25 years, which seems to be the most reasonable figure in light of the investment composition). This rate is remarkably close to the appraisal estimate of 15%, especially if one takes into account that both calculations are mixed in an unknown amount with the effects of operational improvements which might or might not be independent from the Investment Plan. In this estimate about half of the costs of the track renewal program has been considered current expenditure and not investment, because it was a kind of deferred maintenance necessary to keep the railway going. However, the other half, which was used to upgrade the track standards to allow for higher speeds of passenger trains, is clearly an investment and must be included in the calculation. If all track renewal costs are taken into account, the rate of return falls to about 9% (Alternative C_2 in the aggregated analysis).

1/ By attributing all the increases in speed and average trainload and the reduction in terminal and general expenditures to the investment program, we are overestimating the benefits because part of those improvements have been achieved through increases in operating efficiency which require only minor investments.

2/ The detailed analysis is included in the Methodological Annex.

An analysis of the extreme positions in the set of rates of return is useful to help interpret the results. For example, to consider that the Investment Plan had no impact on terminal or fixed expenses will reduce the return to 6% (Alternative C_2, B_2). Similarly, if only half of the track renewal cost is included, all other benefits, and an average lifetime of 35 years is used in the calculation, the return increases to 15% (Alternative C_4, B_3). The overall conclusion is that the Plan as a whole has been for Spain a worthwhile effort, obtaining a return equal to or higher than alternative investments. A more detailed analysis of the return of the main investment components will permit a fuller interpretation of these results.

C. Track Renewal Program

Track renewal was the largest item in the Investment Plan, comprising 38% of the total. It was also one of the most important because there was a serious backlog in maintenance, resulting in difficult operating conditions and high costs. By the end of 1963 only 3.2% of the track was equipped with heavy rail (54.4 kg/m), the type suitable for high-speed passenger trains and high axle loads. The section with the new track corresponded to that with the highest traffic and was laid mainly after 1958.

The 1964-73 Investment Plan included renewal of 7,000 km of track. In the first appraisal it was justified as an indispensable investment to keep the railway going. The second appraisal predicted that better tracks would lower train operating costs by preventing frequent slowdowns and reducing wear and tear of rolling stock, in addition to a reduction in maintenance and repairs. RENFE estimated a rate of return of 8%. In the third appraisal, benefits of the track rehabilitation included in the Plan at that time (renewal of 2,639 kms and reballasting of 579 kms) were defined as a) reduced track and rolling stock maintenance, b) improved safety of operations, c) higher speeds and d) reduced fuel consumption. The estimated rate of return ranged from 12% to 17% for different sections.

By the end of 1973, however, only 82% of this program had been accomplished. Track renewal evolved as follows:

Year	Kms of track renewed
1964	620
1965	570
1966	433
1967	351
1968	296
1969	531
1970	764
1971	686
1972	948
1973	547
Total	5,746

In this audit we have included as benefits of the track renewal program lower track maintenance costs and higher speeds. The latter, in turn, results in lower equipment requirements and operating costs, particularly fuel consumption. As for track maintenance, the new track allowed the change from manual to mechanical systems, a major step which has been one of the main causes of personnel reductions and has resulted in a reduction of average maintenance costs per km from Ptas. 181,000 to Ptas. 110,000. Regarding speed, the right indicator is average running speed, because average commercial speed is influenced by other measures unrelated to the Investment Plan, such as reduction in intermediate stops or suppression of slow trains. Even average running speed is influenced by many other factors, particularly the change in traction. However, the running speed by type of traction does not seem to have changed much, with the exception of electric and Talgo passenger trains (Table IV-3), in spite of important acquisitions of motive power and rolling stock.[1/]

For the best estimate of the rate of return, only half of the costs of the renewal program, which correspond (approximately) to the upgrading portion, have been included in the calculation. Even under this favorable assumption, and considering an economic lifetime of 40 years and a growth rate of 3% per annum for the benefits stemming from higher speeds, the rate of return is 6%, lower than originally expected (Table IV-1). The reasons for this low return are the higher than expected investment and, to a lesser extent, the relatively low impact, in practice, on average running speeds.[2/] The inclusion of other minor benefits, such as reduction in accidents, will not change this conclusion. If all costs of the track renewal program are included in the calculation, the rate of return is 1%. These results suggest that the track has been renewed to standards that are too high and used in practice only by a small number of high-speed passenger trains.

D. Dieselization Program

In 1963, RENFE was still a steam-traction railway. At the end of that year it had only 228 diesel locomotives compared with 3,173 steam. Of these diesel, 183 were shunting and 4 Talgo passenger units (Table IV-4). Only 17.5% of the train-kms used diesel traction and most of the existing equipment was concentrated in the transport of minerals in Orense, in the

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1/ The effects of track renewal on speed have been overestimated because we have attributed all the increase in running speed to this investment, while in practice it is the result of many factors including, for example, the scrapping of very old wagons. Data availability has limited the analysis of changes in speed up to 1971. Thus, we have considered investments up to that year only.

2/ See Table 17 of the Methodological Annex for the detailed analysis of the change in average running speeds.

northwest (54%) and in the Sevilla region (38%).[1/]

Dieselization moved very fast after 1963: in 1967, 40% of the train-kms used diesel traction, and 56% in 1972. The fast absorption of a relatively complex technology such as diesel traction, with its problems of retraining personnel for operations and maintenance, has been one of RENFE's main accomplishments during the Modernization Program.

The 1964 appraisal did not contain a detailed analysis of the return of these investments, but it expected, in light of experience in other countries, that dieselization would have a return of about 30%. The second appraisal was based on a more precise estimate and arrived at the same rate, specifying also that the 757 diesel and electric locomotives to be bought in the 10-year Investment Plan could replace 3,000 steam locomotives, a ratio of practically 4 to 1.

In making a new estimate of the return of this investment we were faced again with the same problem of attribution of some of the benefits, especially speed and average trainload which, as indicated, are the effects of several other investments and administrative actions. Thus, we have used four basic alternatives for the analysis.[2/] Their description and the rates of return obtained for the dieselization program are as follows:

Alternative	Economic Lifetime	
	20 years	15 years
1. Upper limit. All increases in speed and trainload attributed to dieselization	27.7%	27.2%
2. Lower limit. None of the increases in speed and trainload attributed to dieselization	23.2%	22.5%
3. Only increased trainload attributed to dieselization	27.5%	27.0%
4. Only increased speed attributed to dieselization	23.5%	22.7%

1/ For full details, see Table 5 of the Methodological Annex.

2/ These alternatives are developed more fully in the Methodological Annex.

These estimates have been made including as benefits the difference in operating costs between diesel and steam traction, plus the impact on speed and trainload as described above. Growth of benefits after 1973 has been extrapolated on the basis of the trend in the 1964-72 period.

The best estimate of the rate of return should be in the 23-24% range, lower than estimated during appraisal but still a successful program. The reason for selecting a best estimate on the low side of the 22-27% range presented above is that the effect of the investment on trainload is more important than the effect on speed, and the variation in the average tonnage per train is largely explained by the overall increase in RENFE's efficiency after 1964.1/

The main reason for these high rates of return is the inefficient way in which steam traction was being operated (very low tonnage per train, low locomotive utilization factor, etc.). Thus, it is interesting to explore other ways through which a reduction in costs could have been achieved even with steam traction. One way is through an increase in the average tonnage per train. From the data used for the analysis of the returns for dieselization, it is possible to estimate the increases in average tonnage of trains using steam traction (with respect to the 1964 figure) that would produce benefits in relation to freight traffic similar to those derived from dieselization. The results of this exercise are as follows:

% Increase in Average Tonnage of Steam Trains over the Level of 1964	Savings per ton-km as a % of those Obtained from Dieselization
117	100
78	80
37	50
28	40
12	20

For example, an increase of only 28% in the average tonnage of steam trains would lead to savings per ton-km amounting to 40% of those obtained with the dieselization program. What this calculation means is

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1/ One benefit not added to the calculation is the scrap value of the old steam engines, a factor that could increase the rate of return by 10-15%.

that any program for increasing the average trainload in that proportion will have a rate of return similar to that for dieselization if its cost is equal to 40% of the dieselization costs. If the cost is smaller than 40%, the program will have even higher returns than dieselization. The results also suggest that a stronger effort at increasing trainloads will result in a major reduction in the needs for diesel motive power.

E. The Electrification Program

In 1964, RENFE had 2,474 kms of electrified lines (18.2% of the network), which included 824 kms of double track. These lines correspond in general to those with the highest traffic density in the country, but some sections were not interconnected and as a consequence equipment utilization was not as high as it could be. Thus, one of the main purposes of the electrification works included in the Investment Plan was to interconnect the electrified sections in the northern part of the country, and the lines between Madrid and Cordoba. The six lines finally included in the program and their main characteristics are described in Table IV-5. Freight traffic on these lines accounted for 18.5% of the total net ton-kms transported in 1964, while they represented only 4.6% of the total network.

SOFRERAIL studied the electrification issue as part of its preparatory work for the Modernization Program. They compared the cost of electrification against that of providing the service with diesel traction. Their conclusion was that the capital costs of both alternatives were very similar but electrification involved lower operating costs. This assessment depended heavily on the assumption that with diesel traction gross tonnage per train was only 75% that of electric trains, and the higher requirements in terms of diesel locomotives made capital investments in both alternatives similar. In the third project, two additional lines -- not analyzed in this study because they are not yet fully in operation -- were added: Valencia-Tarragona and Madrid-Guadalajara. A new calculation of their benefits and costs arrived at a rate of return of 12%.

Our estimates are also based on a comparison between the economic cost of providing a given amount of services by electric or diesel traction. Since there are different possibilities or ways of defining benefits and costs we have considered four alternatives. The definition of these alternatives and the corresponding rates of return are presented in Table IV-6.

While Alternative 1 can be considered the basic estimate, because all operating conditions are assumed to be the same with diesel and electric traction, Alternatives 3 and 4 are more realistic, in the sense that the economic lifetime of electric locomotives is longer than diesel, and

that for certain sections the better use of existing equipment was an important benefit of the interconnection. Finally, Alternative 2 is similar to Alternative 1, with the exception that the average net trainload in the case of diesel traction is assumed to be 75% of the one corresponding to electric traction.

The returns by section range from 9% on Segovia-Medina to 17% on Medina-Vta de Baños, one of the sections with the highest traffic density in the network (Alternatives 3 and 4). Our best estimate of the return of the electrification program is 12% which, again, is remarkably close to the estimates made for other electrification work included in the third project.1/

Two issues are important in the interpretation of these results. First, the benefits of electrification are higher for RENFE than for the economy as a whole because of the high level of the tax on gas-oil. Total cost savings increase by about 45% if taxes are included.

Second, the level of benefits is directly proportional to the traffic density, in the sense that given a certain tonnage to be transported, the lower the average trainload, the higher the number of daily trains that are necessary to move the traffic. Since the benefits are measured by the difference between the social operating costs of the total number of diesel and electric-powered trains that were required, the lower the average trainload and consequently the less efficient the system, the higher will be the benefits from electrification and, for that matter, of all the other investments. In practice, it is not possible to interpret properly the return of an investment when it is based on conditions that are not fully efficient. This issue, and the importance of the Plan of Action, are raised again in the next chapter.

1/ This calculation has been based on market prices for the factors of production, excluding taxes and subsidies. We have not analyzed in detail the type of fuel used to generate electricity; however, the important proportion of hydroelectric power generation in Spain and the recent increase in oil prices suggest that electrification will have an even higher return than what has been estimated in this audit.

TABLE IV-1. RENFE's Investment Plan. Estimated and Actual Rates of Return

Investment Items	Actual Investment Cost		Appraisal Estimates		Audit Estimates		Observations
	Total (Million Pesetas)	% of Total	Rates of Return	Benefits Included	Rates of Return	Benefits Included	
1. Total Program	84,713		15% in first appraisal 17% in second appraisal 14% in third appraisal	Savings in total costs per traffic unit. Comparison of 1964 cost structure without investment with 1973 cost structure with investment.	12% best estimate, including only half of track renewal costs.	a) Replacement of steam traction by electric and diesel b) Savings in track maintenance c) Increase in operating efficiency	Two approaches: aggregated, based on comparison of total cost trends in 1958-72, and disaggregated analysis by cost item.
2. Track Renewal	32,473	38.3	Not measured in first appraisal 8% in second appraisal 12-17% in third appraisal	Savings in track and equipment maintenance; increase in speed	6% best estimate. 1% if total track renewal costs considered	a) Savings in track maintenance b) Increase in speed	It was assumed that half of the program costs are current expenditure.
3. Diesel Motive Power (including train sets)	12,298	14.5	30% throughout	Savings in train operating costs	23-24% best estimate	a) Savings in train operating costs b) Increases in speed and trainload	Estimate based on detailed analysis of sample covering 43% of freight train-kms and 26% of passenger train-kms.
4. Electrification	9,234	10.9	No quantification in first appraisal 12% in third appraisal	Savings in train operating costs as compared with diesel traction	12% best estimate Return on individual links range from 9% to 17%	Savings in train operating cost as compared with diesel traction. Investments in third loan not analyzed	No analysis of indirect effects dealing with fuel used to produce electricity.
5. Rolling Stock	8,557	10.1	No estimate in first appraisal 14-15% in second appraisal 16% in third appraisal	Maintenance savings	Not analyzed in detail		
6. Stations and yards	4,929	5.8	15% in first appraisal	Savings in train formation costs	Not analyzed in detail		

Table IV-2

RENFE: INVESTMENT PLAN 1964-73

New Estimates of Rates of Return

Benefit Alternatives / Cost Alternatives	Detailed Analysis									Aggregated Analysis		
	B_1			B_2			B_3			B_4		
	Years			Years			Years			Years		
	35	25	20	35	25	20	35	25	20	35	25	20
C_1	8.8	6.4	3.0	9.4	7.2	4.2	13.8	12.4	10.4	11.8	10.0	7.4
C_2	7.8	5.0	1.4	8.4	6.0	2.6	12.6	11.0	8.6	10.6	8.6	5.6
C_3	11.2	9.4	6.6	12.0	10.4	8.0	17.0	16.2	14.8	14.8	13.6	11.6
C_4	9.8	7.6	4.6	10.6	8.6	5.8	15.4	14.2	12.4	13.2	11.6	9.2

Explanation of Benefit and Cost Alternatives

Benefits

- B_1: Savings in operation costs, all trains
- B_2: B_1 + savings in track maintenance
- B_3: B_2 + savings in terminal and fixed costs

Costs

- C_1: Direct investment costs
- C_2: C_1 + all contingencies and general expenses
- C_3: C_1 - 50% cost of track renewal
- C_4: C_2 - 50% cost of track renewal

TABLE IV-3

RENFE. ACTUAL AVERAGE RUNNING SPEEDS, BY TYPE OF TRAIN
(km/h)

	1964	1966	1967	1968	1969	1970	1971
Passenger Trains							
Steam	48.1	50.3	49.8	48.9	48.7	46.4	46.1
Electric	52.5	56.6	57.4	58.2	60.2	61.1	61.2
Diesel	53.7	52.5	51.6	52.5	53.2	53.1	53.3
TALGO (diesel)	78.8	81.5	80.6	80.5	80.0	82.1	82.2
Freight Trains							
Steam	36.4	37.3	34.5	34.9	36.5	38.6	36.3
Electric	38.7	41.3	40.4	40.9	41.6	41.3	41.4
Diesel	39.2	36.7	37.2	37.3	38.4	39.0	39.1

Source: RENFE

Table IV-4

RENFE: MOTIVE POWER AND ROLLING STOCK

	1963	1966	1968	1970	1972
I. Motive Power					
Locomotives	3,741	2,726	1,857	1,712	1,398
Steam	3,173	1,857	850	642	339
Diesel	228	506	633	686	693
Electric	340	363	374	384	367
Electric Trainsets	197	236	293	287	304
Diesel Trainsets	74	353	407	565	n.a.
Diesel Railcars	88	250	356	393	373
II. Rolling Stock					
Passenger Cars	3,445	3,134	2,616	2,325	1,967
Baggage and Mail Cars	2,624	1,721	1,400	1,053	820
Commercial Freight Cars[1/]	66,148	57,055	52,006	46,421	36,027
Service Freight Cars[2/]	1,727	2,119	2,156	1,965	2,050
Private Freight Cars[3/]	12,739	12,274	11,831	10,597	10,485

1/ Commercial freight cars include: flatcars, boxcars, cattlecars, tankcars, and hoppers.

2/ Service freight cars include: hoppers, mobile stations, tank and special cars.

3/ Private freight cars include: flatcars, boxcars, cattlecars, hoppers and special cars.

Source: RENFE: Memorias, 1963-1972.

Table IV-5

RENFE - Characteristics of the Lines Included in the Electrification Program

	Segovia-Medina	Avila-Medina	Medina-Vta. Baños	Vta. Baños-Leon	Palencia-Alar	Vta. Baños-Miranda
Kilometers	79.1[b]	85.8[a]	78.9[a]	134.2[a]	79.0[b]	173.0[a]
Average Daily Trains						
1964						
Freight	8	22	34	31	10	25
Passengers	16	27	32	15	9	18
1968						
Freight	6	24	36	28	11	24
Passengers	11	24	47	18	11	29
1971						
Freight	3	31	38	29	11	28
Passengers	13	31	47	23	11	32
Average Net Tonnage per Freight Train (Tons)						
1964	187	240	265	280	320	232
1968	167	211	247	254	290	240
1971	187	226	260	280	363	250
Average Running Speed (km/h)						
1964						
Freight	33	33	33	33	35	36
Passengers	50	56	63	57	56	60
1968						
Freight	40	48	48	45	48	50
Passengers	58	78	67	74	66	73
1971						
Freight	40	48	48	45	48	50
Passengers	58	78	67	74	66	73

a/ Double track
b/ Single track

Source: RENFE, "Informacion Estadistica para Movimiento, 1964, 1968, 1971".

Table IV-6: RENFE ELECTRIFICATION PROGRAM. NEW ESTIMATES OF RATES OF RETURN

A. Operating Conditions	Alternatives in Relation to Operating Conditions			
	1	2	3	4
Average tonnage per freight train	same for both types of traction	diesel 75% of electric	same as in Alternative 1	same as in Alternative 1
Average gross tonnage per passenger train	"	same for both types of traction	same for both types of traction	same for both types of traction
Average running speed	"	"	"	"
Economic lifetime of equipment	"	"	20 years for diesel 30 years for electric	"
Locomotive utilization factor	actual average for each traction	same as in Alternative 1	same as in Alternative 1	30% of the traffic is carried by the equipment already available
B. Rates of Return (%)				
Link				
Segovia-Medina	0.6	2.2	4.9	9.1
Avila-Medina	10.9	18.9	13.3	n.a.
Medina-Vta. Banos	14.9	26.4	16.9	n.a.
Vta. Banos-Leon	9.5	16.1	11.7	n.a.
Palencia-Alar	3.5	8.4	7.7	12.7
Vta. Banos-Miranda	9.9	15.9	12.3	n.a.
All sections	9.9	16.3	12.3	n.a.

V. CONCLUSIONS

The appraisal report of the first project summarized the purpose of RENFE's 1964-73 Modernization Program, for which the Bank made the three loans audited in this study, stating that it was "designed to transform RENFE from an antiquated enterprise operating at a large deficit and providing inadequate service into an efficient and modern railway system earning a reasonable return on its investment." If the conclusions of the study are presented in relation to that statement, we can say that the Modernization Program has largely succeeded. RENFE is now a technically efficient and modern undertaking, comparable to other European railways, although it has still to earn a reasonable return on its investments. Progress on the technical and institutional items has been better and faster than on the financial. However, this general statement requires two important clarifications.

First, by saying that progress has been good in the technical and institutional areas, we are not describing fully the changes that have taken place. RENFE was truly an antiquated enterprise, yet another agency in an archaic public administration, supposedly providing a "public service" but without having clear objectives and standards of efficiency. Its objective -- to operate as a commercial undertaking -- is now clear and the enterprise is beginning to enjoy the advantages of the recently acquired financial independence. Perhaps more importantly, there is a change of attitude that permeates most levels of operation. RENFE is no longer considered part of the public administration, but a company that is competing with road transport, that must show a profit, and be efficient. The impact of this change of attitude is difficult to assess, but our impression is that it probably explains a considerable proportion of the improvements that have taken place.

The second clarification deals with the importance in terms of resource allocation of the delay in achieving the financial targets set in the Plan of Action. The issue is raised by economic theory, which concludes that there is no reason why an activity with increasing returns to scale -- as is most probably the case of RENFE -- and charging marginal costs for its services, should show a financial profit. Moreover, a profit could be interpreted as a misallocation of resources. It is possible, then, that the delay in achieving those financial objectives did not have the importance given to it by the Bank. However, with the existing knowledge about RENFE's cost structure it is difficult to assess clearly whether its poor financial performance was due to the application of marginal cost pricing or to a bad tariff policy that includes cross-subsidization or railway services. Our impression is that the competitive nature of transport in Spain ensures that tariffs might be closer to marginal costs than what

is generally accepted. The issue has serious practical implications, because the profit objective is an excellent test of operational efficiency and should not be easily abandoned, but it is likely that other objectives, for example, to maximize output subject to the constraint that the enterprise should not incur losses, are as meaningful operationally and might result in a better allocation of resources.

The main reason why progress in the technical and institutional areas was faster than in the financial is that efforts related to the former can be internalized better, and the influence of elements exogenous to the enterprise can be minimized. The main factor that explains the slow progress in the financial field was road competition, and RENFE had in practice little control over the evolution of road transport since 1964. The only way that RENFE could successfully compete with road transportation, which was through an aggressive commercial policy, could not be applied until the 1970s, when RENFE's commercial activities were greatly strengthened. Other, although less important factors that explain RENFE's financial evolution were the increase in real wages in Spain and the Government's anti-inflationary policies, both also outside RENFE's control.

The basic approach of the Modernization Program, of having an Investment Plan and a Plan of Action which in principle were given the same priority, proved to have been right. On this, the Bank deserves most of the credit. The point also confirms the adequacy of present Bank railway lending policy, in which plans of action are integral parts of projects.

The issue of the interactions between the Investment Plan and the Plan of Action kept appearing in the course of the study. Did the more modern technology derived from the Investment Plan trigger further improvements in other areas? To what extent did the potential benefits of the investments materialize because of the measures included in the Plan of Action? In practice, the interactions were so many that it was not possible to separate the impact of one program from that of the other. It was as unrealistic to expect that the Plan of Action alone, without investments, could have achieved much progress, as it was to assume that the investments alone, without any improvement in operational efficiency, could have been of any use. What has also been important in Spain is the catalytic effect of the Program: a few of the improvements in operational efficiency have been the result of programs not included in the Plan of Action or in any of its revisions. For example, the new system for the allocation of freight cars, which "freed" thousands of wagons; the unit trains and the consequent elimination of many of the investments in marshalling yards, or the system of "planning by objectives" now being implemented. However, it seems that these interactions between investments and operational improvements were

not adequately analyzed during the preparation of the Modernization Program or subsequent revisions. If the effects of the operational improvements included in the Program had been studied in detail, planned investments in rolling stock and motive power could have been reduced considerably. Investment in these items was subsequently reduced, but in a less systematic way than what would have been possible with better planning.

Finally, at the general level, the slowest progress took place in the measures dealing with transport coordination. Main reasons were administrative changes in the Government and the lack of interest in the subject at the political level, especially between 1965 and 1970, based on the judgment that Spain required all the transport it could get, thus making coordination unnecessary. On the basis of the very simple analysis that we have made of the subject, it seems that no major distortion in the intermodal allocation of traffic derived from Government intervention has taken place.

Regarding the Investment Plan, probably the main reason why it had a relatively high return (12%) is the inefficient "without investment" situation against which benefits have been measured: RENFE's old and antiquated equipment in 1964 obviously implied that better equipment, if adequately utilized, would have a reasonable return. However, this result has to be interpreted with care, because it is based on conditions of relative inefficiency in both the with and without investment situations, a point illustrated by the apparent paradox that returns will go up if trainloads are smaller, thus increasing traffic density.

The return of the different investment components suggests that probably too much was invested in track renewal and that the high standards at which the program was implemented might not be justified. In retrospect, the construction delays might turn out to have been economically justified. The Bank does not seem to have pressed enough for an in-depth reappraisal of track renewal during the 1966 and 1970 revisions of the Program, particularly on the issue of higher track standards which were to be used largely by high-speed passenger trains. Conversely, the faster pace of the dieselization program appears to have been justified in light of its high return. Finally, some elements were missing from the Investment Plan, particularly items designed to increase train length in some sections of the network where heavier unit trains were justified. These investments are, for example, longer sidings or wagons with better brake systems.

The Plan of Action had the catalytic effect described above, but in its original version and successive revisions it was too much oriented towards financial targets and issues related to transport coordination. The Bank probably spent too much of its time discussing these two subjects. More precise targets related to operational efficiency, of the type used in more recent railway loans, might have helped to speed up progress in operations. Relatively few detailed studies dealing with operational efficiency were done by consultants.

Nevertheless, RENFE can show some impressive achievements in its operational efficiency. Perhaps the most important is the reduction in personnel -- one of the points included in the Plan of Action -- which is the result of several investments and administrative measures. Another improvement that has had important effects in reducing the need for uneconomic trains has been the rationalization of LCL traffic through the creation of a few collecting stations. There is still, as always, major room for improvement, especially in the coordination of the Commercial Department with train operations, in the possibility of operating even more unit trains, and in further streamlining terminal operations.

One of the improvements that is a good reflection of the changes in attitude discussed above is the new role being played by the Commercial Department. This Department not only is a sales organization, but is also beginning to have an influence on "production", that is, train services. Operations no longer decides which trains to run and Commercial is expected to do its best to sell the available space, but there is now an emerging dialogue between the two departments which has had several positive results, for example, the increasing importance of unit trains. However, this dialogue has at this stage several dangers because of the slow progress in having adequate cost estimates that could be used as a basis for rate fixing. For this reason, the dialogue between Commercial and Operations has still to be tentative and Commercial should avoid imposing changes in train operations that look dubious to the staff that has to plan operations and account for equipment use.

Another structural change that has taken place in RENFE is in management. Aside from the obvious effects of modern management on operations, already described in previous sections, its real impact can be best summarized by the fact that RENFE "took-off" into a period of self-sustained progress. No doubt the Modernization Program triggered that progress, but by the early 1970s RENFE was already capable of pursuing and improving the Program on its own.

The reasons that explain the good results achieved by RENFE, compared to other not so successful railway programs are, first, RENFE's internal efficiency, especially in management and the technical aspects of operations. Second, the Bank's approach in this case was particularly adequate for the circumstances, largely because it was based on consultants'work (SOFRERAIL) of generally good quality. Third, the consultants were able to remain the several years required to see some of the measures implemented; similarly, the Bank's attention in the last 10 years has been sustained and timely. Finally, an important proportion, impossible to determine, of RENFE's success is explained by the rapid growth of the Spanish economy, which made politically and socially possible the massive program of personnel reduction, without which the potential benefits of many of the investments and of parts of the Plan of Action could not have materialized. In addition, the large increase in the total demand for transport services allowed RENFE to experience a moderate traffic growth in spite of a steadily declining share of total movements. Also, the expanding industrial base helped RENFE to acquire part of its supplies internally without noticeable reduction in quality, and without having to endure the problems faced by railways in other countries with their imports of equipment and parts.

In fact, RENFE has been faced with few negative factors during the period under analysis. The most important from the viewpoint of RENFE (but probably not from the standpoint of the economy as a whole), has been road competition, which depressed RENFE's growth and had a negative impact on its financial situation. Other negative factors, such as the Government's delays in providing funds on schedule, or the anti-inflationary policies, were less important. The lack of a well-structured transport policy does not seem to have affected RENFE in any significant way, although the studies undertaken as part of the Plan of Action served to assess the relative position of each mode and probably to avoid discriminatory policies in favor of one particular mode.

Finally, although the lessons derived from RENFE's experience have been discussed in the course of the audit, we would like to briefly highlight a few points which we consider to be of particular interest.

First, the Plan of Action should have put relatively more emphasis on the technical aspects of railway operations and probably less emphasis on RENFE's financial goals. The Plan of Action did contain several operational measures that proved to be of high priority, such as the plan to rationalize less-than-carload traffic. However, more detailed targets on train length, wagon utilization and turnaround, or rationalization of yard operations, would have had a positive impact on RENFE's operations

Second, personnel reductions were a key factor in achieving the objectives of the Modernization Program, otherwise most of the potential benefits would not have materialized. The dynamic growth of the Spanish economy was central in allowing the reductions to take place, because labor could be absorbed by other activities,but the fact that the reductions were planned and incorporated in the Program was essential in establishing the necessary discipline.

Third, the financial projections included in the Modernization Program should have been based on a more in-depth study of the effects of road competition, and to a lesser extent of the effects of the Government's anti-inflationary policies, on RENFE's possibility of raising rates and fares to compensate for cost increases. The basic assumption on which the projections were based, that higher expenditures could be compensated through increases in tariffs, proved to be unrealistic.

Fourth, the low return of the track renewal program suggests that this investment should have been reappraised in more detail during the 1966 or 1970 revisions of the Program. This reappraisal would have allowed RENFE to make a better decision about the way in which the renewal program should have been continued, and about the provision of high-speed passenger trains, the main users of the higher standard track.

Last, the improvement of RENFE's commercial capability should have been given a higher priority in the Modernization Program and achieved several years earlier. This measure would have allowed RENFE to react more positively to road competition and to be more mature commercially in the years that will follow, when road transport will continue to grow rapidly in Spain. After all, its degree of competitiveness is what will basically determine RENFE's future role in the Spanish economy.

BENEFIT-COST ANALYSIS METHODOLOGICAL ANNEX

I. Rates of Return to the Whole Program

A. Benefits

The overall savings as a result of the modernization plan were broken down into the following categories for purposes of analysis:

- Savings in operating costs, including not only the change in the operating costs per ton-km for freight and per train-km for passengers resulting from changes in the type of traction, but also the benefits associated with higher speed and higher average cargo per train.1/

- Savings in track maintenance.

- Savings in terminal costs and administrative expenditures.2/

By summing the sources of savings, we obtained the total attributable to the modernization plan for each year. Two methods were used to estimate that total: first, we estimated, in detail, each source of savings from the data we had on train operating costs, speeds, average cargo per train, etc.; secondly, we calculated an aggregate estimate of total savings by comparing the actual cost figures for each year in the period 1964/71, in constant pesetas of 1971, with the expenditure for each major item estimated from a trend line adjusted to the period 1956/63.

Detailed Analysis

1. Savings in Operating Costs

The major savings in relation to freight traffic, savings per ton-km, resulted from two main factors:

a) changes in the relative importance of the different types of traction.

b) increases in average cargo per train and in speed for each type of traction.

1/ Attributing all of the increase in average cargo and speed to the investment program would clearly have overestimated its benefits, because those changes were attributable, to some extent, to an overall increase in efficiency that would have taken place anyway.

2/ These are other items for which inclusion would have led to an overestimation of benefits because these savings were mainly the result of general administrative and operational reorganizations that could have taken place anyway.

The combined effect of both factors induced reductions in the average costs per ton-km in 1968 and 1971 as compared with 1964. Costs per ton-km were estimated on the basis of the actual technical conditions of operation for the different types of traction as shown in Table 1 below:

Table 1

Technical Operating Conditions by Type of Traction

	Year	Type of Traction		
		Steam	Diesel	Electric
Average net cargo per train (tons)	1964	171	228	226
	1968	186	191	231
	1971	170	218	248
Average running speed (km/h)	1964	36	39	39
	1968	39	37	41
	1971	39	39	41

The operating cost of each type of traction,[1/] estimated on the basis of these technical characteristics, in conjunction with a weighting by relative importance for each type of traction and transport service, led to the calculation of savings shown in Table 2, as against 1964 operating costs.

Table 2

Savings in Operating Costs
(Millions Ptas. 1971)

Year	Freight	Passengers	Other Services	Total
1965	165	150	124	439
1966	504	585	426	1,515
1967	935	613	606	2,154
1968	1,268	1,250	986	3,504
1969	1,539	1,480	1,026	4,045
1970	2,009	1,650	1,081	4,740
1971	2,025	1,808	1,106	4,939
1972	2,122	1,897	1,174	5,193

1/ Including expenditure, net of taxes, on fuel, oil, crew and equipment maintenance.

2. Savings in Track Maintenance Costs

For track maintenance, the estimates derived in the section of the text on track renewal (Table 16, Page 17).

3. Savings in Terminal Costs and Other Fixed Expenditures

This item comprised general administrative expenses and the expenses for stations and train organization. The method used was to compare the 1968 and 1971 expenditures for these items with those of 1964 (after adjustments for salary increases, in order to convert to 1971 pesetas). We then considered as a benefit the total difference between expenditure amounts for those years and for 1964. The estimated savings for 1968 and 1971 amounted to Ptas. 673 million and Ptas. 2,582 million, respectively.

4. Total Benefits

The total benefits are summarized in Table 3.

Table 3

Total Benefits of the Program
(Millions Ptas. 1971)

Item	1965	1966	1967	1968	1969	1970	1971	1972
Savings in operating costs	439	1,515	2,154	3,504	4,045	4,740	4,939	5,193
Savings in track maintenance	44.0	84.0	115.2	140.1	161.1	198.8	253.1	301.8
Savings in fixed costs	98	289	480	673	1,312	1,948	2,582	2,582
TOTAL SAVINGS	581.0	1,888.4	2,749.2	4,317.1	5,518.1	6,886.8	7,774.1	8,076.8

Aggregate Analysis

For this estimate, analysis was concentrated on projecting, for the 1964/72 period, the most important expenditure items (personnel and fuel which accounted for 75% of total expenditures). The projection was based on the trend of the evolution of expenditures on these items during the period 1956/63. It represented the basic "without" situation, indicating

the possible evolution of costs if the organizational structure of the 1956/63 period had been maintained. The benefits for each year in the period 1964/72 were the difference between projected and actual costs, as shown on Table 4. The first step in calculating the projections consisted in converting all the actual costs to 1971 prices. For that purpose, we derived two main sets of deflators: (1) for personnel the deflator used was an index of average expenditure per worker with base 1971 = 100; and (2) for fuel we used an index of the price of coal, fuel oil, gas-oil and electricity with base 1971 = 100 for each type.

Table 4

Aggregated Estimates of Total Savings
(Millions 1971 pesetas)

Years	Personnel		Fuel		Total Benefits
	Actual	Projected	Actual	Projected	
1956	24,958		6,990		
1957	23,314		6,244		
1958	23,224		6,664		
1959	23,061		6,260		
1960	23,321		5,668		
1961	22,897		6,058		
1962	23,103		5,250		
1963	21,695		4,944		
1964	21,580	21,877	4,595	4,847	549
1965	20,645	21,585	4,646	4,589	997
1966	20,161	21,292	3,942	4,331	1,520
1967	19,577	20,999	2,991	4,078	2,509
1968	18,434	20,706	2,432	3,815	3,655
1969	16,345	20,413	2,070	3,557	5,555
1970	15,415	20,120	1,926	3,299	6,078
1971	14,690	19,997	1,991	3,016	6,332

B. Estimate of the Ex-post Rate of Return

The rates of return were estimated using the following hypotheses in relation to benefits and costs:

Detailed Analysis

Benefits

B_1: Savings in operating costs, all trains

B_2: B_1 + Savings in track maintenance

B_3: B_2 + Savings in terminal and fixed costs

Costs[1/]

C_1: Investment costs

C_2: C_1 + contingencies and general expenses

C_3: C_1 - 50% of the cost of track renewal

C_4: C_2 - 50% of the cost of track renewal

Aggregate Analysis

The benefits used were those shown in Table 4; with reference to costs, the same hypotheses were used as for the detailed analysis.

II. Dieselization

At the end of 1963, RENFE had a total of 228 diesel locomotives of the following types: 41 line locomotives, 183 shunting locomotives and 4 talgo locomotives. The relative share for diesel traction out of total train-kms had been growing, as can be observed in the following table, but the substantial increases took place after 1964.

Table 5

Relative Importance of Diesel Traction to Total Train-km
(%)

1961	13.5
1962	14.6
1963	17.5
1964	20.8
1967	40.0
1969	52.2
1972	56.2

1/ The reduction of the costs by 50% of the expenditure in track renewal under alternatives C3 and C_4 was made to account for the improvements in standards that led to important cost increases.

The majority of diesel line locomotives in existence in 1963 were concentrated in the Northwest part of the country (54%) and in the South (38%) where they were used for transporting minerals.

Ex-post Benefits of Dieselization

Analysis of the social benefits associated with the replacement of steam by diesel traction was undertaken in two steps: (1) We first established the average social cost savings per ton-km for freight and train-km for passengers on the basis of a sample of 10 lines of the Spanish network, selected so as to combine lines with high and low traffic densities and with variable degrees of change in average cargo and speed. Table 6 shows the main characteristics of the lines involved. In 1971, they accounted for 43% of the freight train-km corresponding to diesel traction, 42% of the net ton-km transported by diesel trains and 26% of the total passenger train-km corresponding to diesel trains. (2) We then applied the estimated social cost savings, as derived in (1), to the actual traffic diverted each year from steam to diesel traction.

The years for which we attempted to measure such benefits were 1968 and 1971 and in all cases our basic "with" situation was based on the actual traffic flows for those years. By comparing the total social costs of that traffic hauled by diesel or steam traction we have probably overestimated the corresponding benefits.

(1) Average Social Cost Savings

The cost savings per ton-km on any particular line depended upon the changes in average speed and average cargo per train brought about by the use of diesel traction, and were expressed as:

$$\text{Savings/ton-km} = \frac{1}{\text{AVCS}} \left[\text{CTRKMS} - \frac{\text{CTRKMD}}{\lambda} \right] \qquad (1)$$

where AVCS is the average cargo per steam train, and CTRKMS and CTRKMD are the cost per train-km corresponding to steam and diesel traction, including fuel and oil, crew, and locomotive and car maintenance, all of which were clearly a function of speed. Finally "λ" is the average cargo of diesel trains as a proportion of that corresponding to steam trains.

The data on average speed and average cargo indicated a general improvement, when comparing 1971 with 1964, but dieselization was not the only change in the system between these years. There were also important investments in other items such as new freight cars, track renewal, etc., which may also have had an effect on average cargo. By comparing these indicators for steam traction in 1964 with those corresponding to diesel traction in 1968 and 1971 we have attributed all improvements to dieselization and thereby overestimated the benefits of this program.

Table 6

CHARACTERISTICS OF THE LINES SELECTED FOR THE ANALYSIS OF THE BENEFITS OF DIESELIZATION

	Distance km	Net ton-km 1971 (10^3)	Daily Freight Trains 1971	Freight Train km 1971	Daily Passenger Trains 1971	Passenger Train-km	Average Cargo/Train Tons		Average Speed Freight Trains		Average Speed Pass.-Trains	
							1964	1971	1964	1971	1964	1971
Valencia - Tortosa	193	140,890	13	915,785	26	1,831,570	170	180	36	38	47	48
La Encina - Valencia	113	123,735	15	618,675	36	1,484,820	175	250	32	36	50	50
Linares - Almeria	242	264,990	15	1,324,950	9	794,970	117	200	23	25	38	40
Calatayud - Casetas	83	90,885	11	333,245	21	636,195	200	272	37	48	58	68
Alcazar - Albacete	131	239,075	17	812,855	17	812,855	253	280	46	46	62	62
Aranjuez - Valencia	353	51,538	3	386,535	14	1,803,830	100	130	26	31	44	48
Miranda - Zaragoza	224	327,040	16	1,308,160	18	1,471,680	230	250	35	48	52	63
Zaragoza - Valencia	344	200,896	8	1,004,480	7	878,920	170	200	30	38	42	42
Madrid - Baides	123	134,685	12	538,740	34	1,526,430	154	250	40	48	58	68
Baides - Calatayud	122	133,590	11	489,830	17	757,010	164	270	35	48	54	60
TOTAL	1,928	1,707,324		7,733,255		11,998,280						

The definitions of the "with" and "without" situations used for purposes of isolating the effect of average speed and cargo were as follows:

With Situation: diesel traction with the actual operating efficiency (speed and average cargo) corresponding to the year under analysis.

Without Situation:

Alternatives	Basic assumptions on operating efficiency.	Assumptions with respect to the benefits when compared to the "with" situation.
Alternative 1.	Steam with the average cargo and speed of 1964.	We attributed the total increase in speed and average cargo to dieselization, setting an upper limit to the benefits.
Alternative 2.	Steam with the speed and average cargo of diesel.	This set a lower limit to the benefits of dieselization by assuming that the total increase in speed and average cargo was due to other factors.
Alternative 3.	Steam with the average cargo of 1964, but the speed of diesel.	We assumed that the increase in speed was the result of other investments, track renewal, etc.
Alternative 4.	Steam with the speed of 1964, but the average cargo of diesel.	We assumed that the increase in average cargo was independent of dieselization and would have taken place in any case due to an overall increase in efficiency.

For each year we calculated four different estimates of the savings per ton-km on each link. Finally, by combining these estimates for the 10 links we obtained an average social savings per ton-km for each year. The social savings per ton-km for 1968 and 1971, obtained by comparing the cost per ton-km of diesel traction with that corresponding to each of the four basic "without" situations are shown below:

Table 7

Dieselization: Average Social Savings Per Ton-km

"Without" Situation	Savings (Ptas./ton-km) 1971	1968
Alternative 1	0.293	0.257
Alternative 2	0.165	0.174
Alternative 3	0.286	0.253
Alternative 4	0.171	0.180

Benefits under Alternative I, the upper limit, were reduced by 43% and 32% in 1968 and 1971, respectively, in terms of Alternative 2, the lower limit.

Average cargo per train was more important than speed in determining the level of the savings. In 1968, for example, the only change between Alternatives 1 and 3 was speed; it led to a reduction in savings of only 2.3% while a change in the average cargo (Alternatives 1 and 4) diminished them by 41.6%. Similar results were found for 1971.

In relation to passenger trains, we have estimated the savings per train-km as a result of the substitution of steam traction by diesel for each of the links under analysis.[1/] The basic "with" situation corresponded to diesel traction with the actual diesel speed for the year under analysis while for the "without" situation we assumed steam traction with the speed of steam in 1964. The savings per train-km turned out to be Ptas.45.11.[2/]

(2) Social Savings Applied to Actual Traffic Diverted from Steam to Diesel

In order to arrive at total savings in any particular year, it was necessary to establish what proportion of the ton-km transported in that year by diesel traction would have been transported by steam if the investment had not been made. The actual ton-km relating to diesel traction in 1964 for freight and the actual passenger train-km for passengers, were the base for our estimate of the traffic diverted each year from steam traction. As an approximation we assumed that the total increase in ton-km of diesel traction since 1964 would have been transported by steam. A similar assumption was made in relation to passenger train-km. The following table shows the estimated diversion of traffic from steam to diesel traction for each year.

Table 8

Traffic Diverted from Steam to Diesel Traction

Year	Net ton-km, freight trains (millions)	Pass. train-km (thousands)
1965	204	3,900
1966	625	12,116
1967	1,418	18,463
1968	1,945	21,874
1969	2,420	26,364
1970	3,467	29,071
1971	3,509	29,206
1972	3,981	29,335

1/ We took as given the number of yearly trains for each link; the benefits were simply the difference between the cost of running these trains with steam and with diesel traction.

2/ It should be noted that to the extent that part of the increase in passenger-km could be attributed to improving the service (more comfort, faster trains, etc.), we have underestimated the total benefits by computing only the savings in train operating costs.

Combining the information of the preceding table with our savings per ton-km and passenger train-km for the different alternatives we obtained the following streams of benefits (10^3 Pesetas):

Freight	1965	1966	1967	1968	1969	1970	1971	1972
Alternative 1	52,428	160,626	364,426	499,865	650,980	974,227	1,028,137	1,166,430
Alternative 2	35,496	108,750	246,732	338,430	406,560	592,857	578,985	656,865
Alternative 3	51,612	158,125	358,754	492,085	642,120	953,425	1,003,574	1,138,566
Alternative 4	36,720	112,500	255,240	350,100	428,340	603,258	600,039	680,751
Passenger	175,929	546,552	832,865	986,736	1,189,820	1,311,392	1,317,482	1,323,301

Finally, the investment in diesel motive power, excluding shunting locomotives, is shown in Table 9.

Table 9

Investments in Diesel Motive Power
(Ptas. million)

1964	943.80
1965	1,199.20
1966	2,076.80
1967	1,530.40
1968	1,089.00
1969	1,102.20
1970	722.00
1971	495.00
1972	687.20

In relation to the rate of growth of the benefits after 1972, we assumed the following:

Benefits from:	Rate of Growth
Freight traffic	The same as ton-km in 1964-72
Passenger traffic	The same as passenger train-km in 1964-72

The corresponding rates of return are shown in the table below. (To each alternative for freight traffic, benefits were added for passenger traffic for calculation of the rate of return.)

Ex-post Rates of Return to Diesel

Alternative	Useful Life 20 years	Useful Life 15 years
1	27.7	27.2
2	23.2	22.5
3	27.5	27.0
4	23.5	22.7

III. ELECTRIFICATION

The lines included for electrification in the Modernization Plan were those connecting Madrid with Leon and Miranda in such a way as to integrate the electrified section in the northern part of the country with Madrid and Cordoba, and are shown below.

Table 10

Description	Kms	Planned Construction Period	1964 Average Daily Traffic: Freight Tons	Freight No. trains	Passengers No. trains
Avila-Medina	85.8[a/]	1964/66	6,200	22	27
Medina-Vta. Banos	78.9[a/]	1964/66	9,000	34	32
Vta. Banos-Miranda	173.0[a/]	1967/70	5,800	25	18
Vta. Banos-Leon	134.2[a/]	1964/66	8,900	31	15
Palencia-Alar	79.0[b/]	1964/66	3,200	10	9
Segovia-Medina	79.1[b/]	1964/66	1,500	8	16

a/ Double track
b/ Single track

Freight traffic on those lines accounted for 18.5% of total net ton-km transported in 1964, while their length as a portion of the total network was only 4.6%. It is clear, then, that their traffic density was well above the average for the whole network.

A. Ex-post Benefits

We measured the social benefits of electrification as the difference between the social costs of providing the transport service with diesel and electric traction. Estimates were based on the actual traffic flows for 1968

and 1971, interpolating for the interim and projecting for the following years. The basic assumption was that dieselization of these lines would have taken place anyway. Since the service provided by both types of traction can be regarded as equivalent, we considered the observed traffic flows as given, that is to say, independent of whether the electrification had taken place or not.

The technical characteristics of the train operations (average cargo, speed, etc.) were the actuals for 1968 and 1971 and the following was assumed in relation to the operating conditions for diesel and electric traction:

Table 11

Operating Conditions	Alternatives in Relation to Operating Conditions			
	1	2	3	4
Average tonnage per freight train	same for both types of traction	diesel 75% of electric	same as in Alternative 1	same as in Alternative 1
Average gross tonnage per passenger train	"	same for both types of traction	same for both types of traction	same for both types of traction
Average running speed	"	"	"	"
Economic lifetime of equipment	"	"	20 years for diesel 30 years for electric	"
Locomotive utilization factor	actual average for each traction	same as in Alternative 1	same as in Alternative 1	30% of the traffic is carried by the equipment already available

The following table summarizes the main indicators of actual train operations on the lines under analysis:

TABLE 12: Main Characteristics of the Lines Included for Electrification

	Average Daily Traffic (no. of trains)						Average Net Cargo per Freight Train (Tons)			Average Running Speed (km/h)					
	1964		1968		1971					1964		1968		1971	
	Freight	Pass.	Freight	Pass.	Freight	Pass.	1964	1968	1971	Freight	Pass.	Freight	Pass.	Freight	Pass.
Segovia - Medina	8	16	6	11	3	13	187	167	187	33	50	40	58	40	58
Avila - Medina	22	27	24	24	31	31	240	211	226	33	56	48	78	48	78
Medina - Vta. Baños	34	32	36	47	38	47	265	247	260	33	63	48	67	48	67
Vta. Baños - Leon	31	15	28	18	29	23	280	254	280	33	57	45	74	45	74
Palencia - Alar	10	9	11	11	11	11	320	290	363	35	56	48	66	48	66
Vta. Baños - Miranda	25	18	24	29	28	32	232	240	250	36	60	50	73	50	73

Source: RENFE, "Informacion Estadistica para Movimiento, 1964, 1968, 1971."

The social savings in operating costs of electric, as compared to diesel traction, were measured as the difference between the following cost items (net of taxes) for each type of traction: fuel and oil, crew and locomotive maintenance.[1/]

The main source of benefits was fuel consumption, a result of the important price differential between both sources of energy (electricity and gas-oil)[2/] leading to a much higher fuel expenditure per km for diesel than for electric locomotives. The following table shows the composition of savings for a typical link, Venta de Baños-Leon:

Fuel and oil*	58.0%
Crew	5.1%
Locomotive maintenance	36.9%

* including the tax on gas-oil

The tax on fuel-oil played an important role in fuel savings. When taken out, the savings on this item was reduced by about 50%.

An interesting factor to note was that the magnitude of savings per ton-km on the different links depended heavily on the operating efficiency of each (defined in terms of the average cargo per train). An inverse relation between the magnitude of the savings and the operating efficiency was found. The higher the average cargo per train, the smaller the savings. It is simple to show the validity of this proposition; the savings/ton-km of a given link can be expressed as the ratio between:

1. the number of trains per unit of time x the savings per train and per km x distance, and,

2. ton-km to be transported per unit of time,

where the number of trains is the ratio between total tons and average cargo per train (AC). The savings per ton-km can then be expressed as the ratio between the savings per train-km and the average cargo.

The main factor explaining the differences in the savings per ton-km among the different links was, therefore, the average cargo per train. Comparison of the savings per ton-km for each link with the average cargo per freight train, as seen in the following table, shows clearly that the greater savings corresponded to the more inefficient links.

1/ We did not include the savings in car maintenance nor car depreciation as we assumed the same average speed for both types of traction, thus cancelling out those savings.

2/ The prices for 1971 were: electricity, 0.5 Pesetas/kwh and gas-oil 7 Pesetas/liter.

Table 13

Electrification Program: Estimated Cost Savings per ton-km
(Ptas)

Link	1968 Without Tax	1968 With Tax	1971 Without Tax	1971 With Tax
Segovia-Medina	0.126	0.190	0.105	0.158
Avila-Medina	0.129	0.187	0.087	0.127
Medina-Vta. Baños	0.080	0.117	0.084	0.123
Vta. Baños-Leon	0.078	0.115	0.072	0.106
Palencia-Alar	0.067	0.098	0.048	0.073
Vta. Baños-Miranda	0.078	0.113	0.075	0.108

The savings per ton-km in 1971 (without taxes) varied between Ptas. 0.048 and Ptas. 0.105. The difference in savings among the links reflected not only their different physical conditions, but also the fact that the operating efficiencies of the rail links were different, as can be observed in Table 12. A similar situation was observed when we compared for each given link the savings per ton-km corresponding to 1968. The overall increase in efficiency in RENFE led to an increase in the average cargo per train between 1968 and 1971 and as a consequence the savings per ton-km went down.

Another important factor was the high sensitivity of the savings to the elimination of the tax on fuel. The reduction in total savings was roughly 30%, when the gas-oil tax was deleted, as can be observed in Table 13.

B. Ex-post Returns to Electrification

The following table summarizes the information used for the estimation of the ex-post returns to the electrification in the basic case, Alternative 1.

Table 14

Social Benefits and Costs of Electrification Program: Alternative 1

	Total Investment Cost (10^3 Ptas.)	Date of Completion	Total Social Benefits (Pass. + Freight) (10^3 Ptas.)[a/] 1968	1971	Annual Electrification Maintenance Cost[b/] (10^3 Ptas.)
Segovia-Medina	136,794	1966	8,061	6,670	5,403
Avila-Medina	255,152	1966	27,853	28,457	11,721
Medina-Vta. Baños	234,632	1966	34,152	35,419	10,779
Vta. Baños-Leon	398,489	1965	35,547	39,016	18,307
Palencia-Alar	117,465	1965	9,123	8,461	5,396
Vta. Baños-Miranda	514,467	1968	45,427	52,299	23,635

a/ The benefits are estimated net of taxes and subsidies.

b/ As there were no figures available with regard to the maintenance cost of the electrified lines under analysis, we had to use an average expenditure per km derived from the total expenditure on this item and the length of the electrified network. The annual maintenance expenditure, was Ptas. 68,310.

Total benefits were estimated on the basis of the actual runs for commercial trains on the lines under analysis; there were also other runs -- service trains, locomotives alone, etc. In order to get the total benefits, we had to increase the commercial train-km by the ratio, total trains-km:commercial train-kms, for electric locomotives.[1/]

The following table shows the estimated rates of return under the different hypotheses.[2/]

Table 15

Ex-post Rates of Return to Electrification
(%)

Rates of Return	Alternatives 1	2	3	4
Link				
Segovia-Medina	0.6	2.2	4.9	9.1
Avila-Medina	10.9	18.9	13.3	n.a.
Medina-Vta. Baños	14.9	26.4	16.9	n.a.
Vta. Baños-Leon	9.5	16.1	11.7	n.a.
Palencia-Alar	3.5	8.4	7.7	12.7
Vta. Baños-Miranda	9.9	15.9	12.3	n.a.
All sections	9.9	16.3	12.3	n.a.

1/ This ratio was about 1.30 in 1971

2/ In all cases the benefits are net of taxes and subsidies.

IV. Track Renewal

A. Benefits

The main sources of benefits in relation to track renewal were:

a) a decrease in track maintenance and its costs
b) higher speeds
c) reduction in accidents
d) lower cost of maintenance for locomotives and units of rolling stock

Lower Track Maintenance Costs

The new track was responsible for a reduction in maintenance cost per km, not only because it was of improved quality, but also because maintenance had been mechanized. RENFE estimated an average cost per km of maintenance of Ptas. 110,000 for new track; whereas, the average cost of maintenance for old track was Ptas. 181,000, 64.5% higher. The savings in maintenance costs were estimated at about Ptas. 71,000/km, and the annual savings are shown in the following table.

Table 16

Savings in Track Maintenance Costs
(Ptas. mln.)

1964.....	44.0
1965.....	84.4
1966.....	115.2
1967.....	140.1
1968.....	161.1
1969.....	198.8
1970.....	253.1
1971.....	301.8

Higher Speed

One of the most important direct benefits made possible by investment in track renewal was the increase in speed. This in turn led to better utilization of both personnel and equipment. Table 17 shows the changes in average commercial speeds during the period from 1964 to 1971.

Table 17

Increases in Average Commercial Speeds

Period	Passengers	Freight
1964/68	10.5%	17.4%
1968/71	7.5%	15.3%
1964/71	18.8%	35.4%

The main reasons for the changes in average commercial speeds seem to have been the change in type of traction (replacement of steam traction) and reduction of intermediate stops. This general conclusion has been derived from the fact that the actual average running speed of the different types of trains did not change substantially, as can be seen in Table 18, and these changes were much lower than the changes in commercial speed. As the latter may have reflected the effect of changes other than track renewal (suppression of intermediate stops, suppression of trains with low speeds, etc.), we based our measure of the benefits as a result of track renewal on the changes in the actual running speed. By attributing all the changes in actual running speed to track renewal, we overestimated the actual change and the benefits from this investment mainly because other factors such as new rolling stock, new motive power, etc., may also have had an effect on the running speed of each type of train.

The following table shows the changes in the actual running speed for each type of traction:

Table 18

Increases in Actual Running Speeds

Type of Train	1964/68	1964/71
Passenger Trains		
Steam	-	-
Diesel	-	-
Electric	10.8%	16.5%
TALGO	2.1%	4.3%
Freight Trains		
Steam	-	-
Electric	5.6%	6.9%
Diesel	-	-

The impact of savings realized from the higher speeds was reflected in the reduction of the number of locomotives and rolling stock needed to carry the same volume of traffic prior to the increase in speed, and a reduction in the crew expenditure per km as a result of the higher average number of km that each crew was able to travel.1/

Table 19 shows the average savings per train-km associated with the higher speeds (Table 17), as we compared the train operating costs for 1968 and 1971 with those corresponding to 1964.

Table 19

Average Savings per Train-km as a Consequence of the Increase in Speed
(Ptas/train-km)

Type of Train	1968	1971
Passenger		
Electric	2.65	4.05
TALGO	0.71	1.46
Freight		
Electric	1.37	1.71

Combining these savings per train-km with the actual train-km for 1968 and 1971, we obtained the following total savings as a result of the higher speeds:

Table 20

Savings in Train Operating Costs 1968, 1971
(millions Ptas)

	Passengers	Freight	Total
1968	82.643	23.422	106.065
1971	141.509	34.102	175.611

Reduction in Accidents

The data available indicated a substantial decrease in accidents, but once again, not wholly attributable to track renewal. The new rolling

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1/ By ignoring the changes in fuel consumption and equipment maintenance, and their probable higher costs, we overestimated the benefits from higher speeds.

stock used for passenger traffic also played an important role in this process.[1/]

The number of passengers injured per each 10^9 passenger-km was reduced from an average of 42.3 in the period 1954/63 to 16.6 in the following period (1964/73).

Table 21

Evolution of the Number of Passenger Injuries per 10^9 Passenger-km

1954	46.2
1958	29.2
1960	47.4
1962	21.0
1963	34.0
1964	20.9
1965	34.3
1966	22.2
1967	20.6
1968	23.7
1969	10.0
1970	6.1
1971	4.1
1972	7.6

We did not attempt to estimate the benefits accruing from accident reductions, so that total benefits from track renewal were underestimated in this respect.

B. Ex-post Rate of Return to Track Renewal

The total benefits from track renewal were measured by summing benefits resulting from higher speeds and reductions in the cost of maintenance. Table 22 shows total benefits and costs for track renewal: The rate of return to track renewal, assuming a useful life of 40 years, and a growth rate of 3% per annum for the benefits accruing from higher speeds after 1971,[2/] was 1%. As an alternative, we took into account the fact that part of the investment in track renewal was absolutely necessary in order to guarantee a minimum degree of safety in train operations, by considering only the upgrading of standards, allowing for the running of faster passenger trains and representing 50% of the total investment in track renewal. The estimated rate of return in this case is about 6%.

1/ The replacement of wooden passenger cars by metal ones was a major factor in reducing casualties.

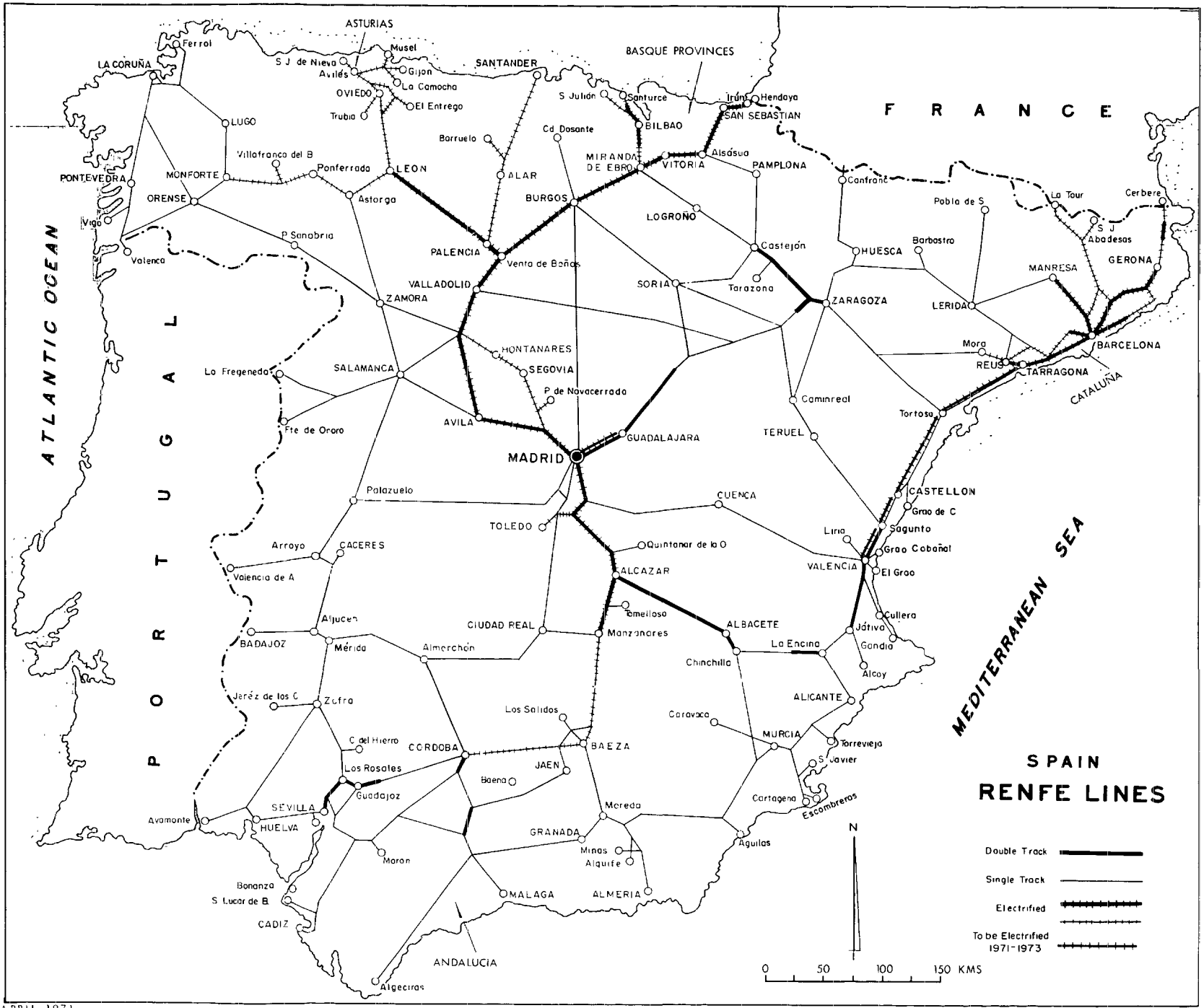
2/ 3% was the average growth rate for total train-km in the period 1964/72.

Table 22

Track Renewal: Total Benefits and Costs
(Ptas million)

	1964	1965	1966	1967	1968	1969	1970	1971
Total Investment	765.6	1,211.8	1,483.2	1,496.0	1,964.0	2,457.9	3,542.5	3,888.0
Benefits from Higher Speeds 1/	28.4	54.3	74.9	89.3	106.1	115.9	149.3	175.6
Benefits from Savings in Maintenance Costs	44.0	84.4	115.2	140.1	161.1	198.8	253.1	301.8
Total Benefits	72.4	138.7	190.1	229.4	267.2	314.7	402.4	477.4

1/ The figures for all years, except 1968 and 1971, have been interpolated in proportion to the km of track renewed each year.



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