URUGUAY
Consolidated Report

Policy Options for Improving the Efficiency of Uruguay’s Railway Sector

Sustainable Development Department
Argentina, Paraguay and Uruguay Country Management Unit
Latin America and the Caribbean Region
World Bank
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# ACRONYMS AND ABBREVIATIONS

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<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AFE</td>
<td>State Railroad Administration</td>
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<tr>
<td>ALAF</td>
<td>Latin American Railway Association</td>
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<td>ANCAP</td>
<td>National Fuel, Alcohol and Portland Cement Administration</td>
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<td>ANP</td>
<td>National Port Authority</td>
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<tr>
<td>CCF</td>
<td>Railway Freight Trading Corporation</td>
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<td>CFU</td>
<td>Rail Corporation of Uruguay</td>
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<tr>
<td>CVU</td>
<td>Road Corporation of Uruguay</td>
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<td>DNV</td>
<td>National Roads Directorate</td>
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<td>DPR</td>
<td>Development Policy Report</td>
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<tr>
<td>FCM</td>
<td>Mesopotamic Railway</td>
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<tr>
<td>ICA</td>
<td>Investment Climate Assessment</td>
</tr>
<tr>
<td>IDB</td>
<td>Inter-American Development Bank</td>
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<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>MIEM</td>
<td>Ministry of Industry, Energy and Mines</td>
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<tr>
<td>MTOP</td>
<td>Ministry of Transport and Public Works</td>
</tr>
<tr>
<td>NGO</td>
<td>Nongovernmental Organization</td>
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<tr>
<td>OECD</td>
<td>Organization for Economic Co-operation and Development</td>
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<tr>
<td>PPI</td>
<td>Private Participation in Infrastructure</td>
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<td>WB</td>
<td>World Bank</td>
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This report on Improving the Efficiency of Uruguay’s Railway Sector was prepared under the direction of Andrés Pizarro with contributions from a team consisting of Julieta Abad, Jorge Champin, Sergio González, and Lou Thompson. It was prepared in close cooperation with officials of the Ministry of Transport and Public Works (MTOP) and the State Railroad Administration (AFE). Financing was provided by the World Bank.

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Finally, the team would especially like to express its appreciation for the ongoing support of Fernando Pasadores to this study. His participation as key counterpart in Uruguay, organizer, and guide was essential to its success.
In late 2007, the World Bank completed the Uruguay Development Policy Review, which included a comprehensive analysis of the current state and future outlook for the country’s energy and transportation infrastructure. Based on the conclusions of that study, the Government of Uruguay requested additional support from the World Bank for a strategic analysis of the rail sector, which had been identified in the assessments as the weakest part of the infrastructure. At the request of the government, this support involved an innovative methodology consisting of a series of Technical Workshops in which all important stakeholders in the rail sector in Uruguay took part: company, unions, Ministry of Transport and Public Works. This nontraditional mechanism was used to achieve two goals: first, to reach a consensus on the key issues for the development of a sustainable strategy for the sector, and, second, to expose the participants to the varied international experience with railroad reform and recent trends in efficient, modern administration of the sector. It was a method of promoting discussion and an exchange of ideas that led to an unusually productive dialogue among the various stakeholders.

This report on Improving the Efficiency of Uruguay’s Railway Sector is part of the ongoing dialogue between the World Bank and the Government of Uruguay. It presents an up-to-date assessment of the rail sector in Uruguay and proposes various short- and medium-term measures that contribute to the modernization of the current railroad and its future development. It is hoped that this report will support the Government of Uruguay in the decisions that it must make to define a national railroad policy that is consistent with an overall transportation policy and with the role it has given to the State Railroad Administration (AFE).

For the reasons explained below, this report does not attempt to solve the structural problem of Uruguay’s railway, but rather is limited to a series of measures constituting a short-term policy defined by the following:

1. In the initial stages of the dialogue with officials of the Government of Uruguay, the World Bank team received a series of government policy definitions that needed to be considered as givens. This naturally reduced the scope of the report’s recommendations. The most important refer to the government’s intention of reviving the railroad, keeping the country’s current rail network in operation, keeping these operations in the hands of AFE in the short term, and rehabilitating the main rail lines using fiscal resources.

2. This report was prepared jointly by specialists of the World Bank and the Government of Uruguay and was developed in the three Technical Workshops described above, in which officials from government institutions participated. The proposals made by the Bank team during these Technical Workshops were set out in three partial reports that attempted to reflect the opinions of the Bank without clashing with the policy definitions previously provided by the Government of Uruguay. Overall, within the limitations described above, the proposals made by the Bank team are feasible to varying degrees, whatever the organizational structure for the sector: entirely government-owned, semi-public, or private.
3. As this was an election year in Uruguay—presidential elections were held in October 2009—it was not possible to obtain policy definitions other than the short-term definitions previously received. The discussions on the needed reforms in the transport sector, in rail transport in general, and in AFE in particular will therefore be left to the next government to define.

Consequently, this report will contain only a modernization plan for the railroad and a plan for changes in AFE, including short- and medium-term measures, and leaves the general policy definitions that will need to be adopted in the coming years for the transportation sector in general and for the rail sector specifically as previously set out, bearing in mind that new information and later analyses could change the government’s views of both aspects of the rail sector, for which the World Bank stands ready to continue any collaborative effort considered useful and necessary.

Finally, one of the important conclusions of this report is that a full study should be conducted of the freight transportation market in Uruguay, a study of the costs of the railroad, and an economic assessment of the social cost effectiveness of rail transport, with reasonable assumptions on its market share. It is only with information from such studies, which is currently lacking, that the Government of Uruguay will be able to make fully informed decisions on the future of the rail sector as a whole.
Executive summary

PROJECT RATIONALE

The Government of Uruguay, through the MTOP, asked the World Bank for technical assistance to help the rail sector design and implement a long-term strategy and action plan and to define a short-term strategy with specific measures to be implemented immediately in AFE. These efforts are oriented to rehabilitate rail transport and prepare for the anticipated significant increases in demand for freight transport in the next few years.

One of the most important findings of this study highlights that the current level of activity of Uruguay’s railways is short of the volume that would financially justify continued operation without some risk. However, preliminary studies suggest that operations are viable under scenarios in which certain volumes of freight and operational efficiency are reached, as discussed in the next section. The GOU is aware of the risks involved, but considers that railway transport is important for the overall viability of the transport sector.

Another important conclusion of this report points to the need to conduct a series of studies to shed light on the current situation of the railway sector. These include: (i) a comprehensive study of Uruguay’s freight market; (ii) a cost study for the railway, and; (iii) an economic evaluation of the social benefits of railway transportation, on the basis of reasonable assumptions about its current and future market share.

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**Analytical Underpinnings**

A number of preliminary studies have analyzed the potential for freight transport, with a focus in forestry products, of Uruguay’s railways. These include the “Study on Demand for Transportation of Forest Products” by Pike and Co., completed in 2007, and the cost-benefit analysis carried out as part of the “Uruguay Development Policy Review” published in 2008. The former is presented in detail further on in the Main Report, while the latter is summarized in the next paragraph. For the purposes of the present study, a new cost benefit analysis on the potential of freight transport of forest products was conducted, taking some of the assumptions from the previous pieces, and adapting some data to reflect more accurately AFE’s current operation. It is relevant to highlight that the recommendations and action plans proposed in this report assume the occurrence of the positive scenarios presented in these analyses.

**Uruguay Development Policy Review.** In 2008, as part of the Uruguay Development Policy Review, the World Bank conducted an analysis of the efficiency of the allocation of resources in land transportation, comparing forest product cargos. Using a cost-benefit analysis, the investments and costs of rail and road operations required to handle the flow of forest products that would be captured by the two modes of transport were calculated. Project evaluation techniques were used in the comparison to calculate the Net Present Value (NPV) of moving traffic by rail or by road. The methodology used the volumes of freight from the forest industry allocated to the railroad in the study conducted by Pike and Co. In the case of road transportation, this demand was added to existing and projected demand for the period under analysis, in order to assess the marginal costs. These were compared with the costs of moving the same demand by railroad, and then were used for a differential analysis of two scenarios:

- **Scenario 1 (with project):** Investments are made in the railroad, adapting AFE to the requirements of the demand for forest products.

- **Scenario 0 (without project):** The works included in the previous scenario are not carried out. It is assumed that road transportation will absorb the demand for the transportation of forest products (the volumes of which and origin-destination pairs are the same as in the previous scenario).

The most relevant assumptions include: (i) in order to be able to capture the projected freight flows, AFE requires infrastructure investments close to US$88 million; (ii) the operating costs for the trains transporting wood products were based on operational parameters of an “efficient AFE”, and were thus significantly lower than the actual operating costs. Although this AFE efficiency assumption may seem strong, it is not; it is based on existing operational characteristics and simple improved management measures, no major reforms or investments are required, and it would only move AFE half way between its present efficiency to the average efficiency indicators of comparable railways.
in the region. The analysis concludes that these two assumptions are necessary conditions for the railway to be able to compete successfully with road freight transport. The analysis also values three types of externalities: (i) cost overruns for urban and suburban infrastructure maintenance not considered in the rest of the analysis in that they involve costs that are not directly incurred by the agency responsible for operations on national road and rail infrastructure; (ii) cost overruns resulting from urban and rural congestion, (iii) cost overruns resulting from rural and urban-suburban accidents. When these externalities are fully considered, in terms of economic efficiency in the use of resources, the analysis concluded that the railroad had a clear advantage over the road network.

**Analysis of AFE’s Operating Results.** To project AFE’s financial viability for the transportation of freight, an additional analysis of revenues and expenses was conducted as part of the current study.

The revenues considered come from the forest products freight that the railroad might attract, based on the DPR’s estimation. The same freight tariffs were used as in the above-mentioned study, i.e., US$0.03 ton/km. There are, however, important differences with regards to the DPR analysis, which include: (i) the current analysis has a purely financial focus, and thus it does not consider the positive externalities of rail transport; (ii) AFE’s operating costs were adjusted to reflect the actual situation, and are not based on an “efficient operation”; (iii) operating costs are applied to the entire AFE network, unlike the previous analysis that allocated these to the Rivera-Montevideo-Fray Bentos section. The results of the first exercise, based on the assumptions listed above show that even in the optimistic demand scenario, rail operations produce an operating loss, which indicates that the State would have to continue to subsidize AFE’s deficits. A second exercise is based on the same demand scenario, but with some more favorable revenue and expense assumptions including: (i) a tariff of US$0.04/ton-km; (ii) average speed of trains increases to 15km/h; (iii) administrative expenses are only 1.4 times higher than they are at present; (iv) a US$300,000/year subsidy is provided to passenger trains. The new scenario yields positive operating margins; however, these are still insufficient to cover required investments to increase efficiency, which amount close to US$152 million (including rolling stock investments, track rehabilitation, and administrative reforms in AFE.)

The results of the analysis confirm an assertion that will be developed in detail in the report, namely that a sizable portion of the network does not have sufficient traffic for viable operation. In practice, the transportation of forest products uses only 836 km of the existing network (51 percent), all of which was included in the previous exercise. If the AFE network were to be reduced to only those sectors with significant volumes of traffic, it would probably show a profit.

When the network is reduced to the portion needed for the transportation of forest products (which also handles limestone and clinker traffic) all costs decline significantly, even considering the tariff of US$0.03/ton-km. The operating income from this option suggests that a project such as this could even help finance a significant part of the
necessary investment in infrastructure (close to 40 percent), although these figures must be validated in a broader study than this analysis based on very preliminary figures.

GOU’s Policy Definitions on the Railway Sector

The government’s policy definitions for the transport system and for the railroad in particular provide a general framework for the solutions included below under the proposed Modernization Plan for the Railroad. The main definitions include the following:

- The Government of Uruguay has determined that the country should have a railway system for freight transport in the long term.
- It has also decided that private participation in freight transport is necessary in the medium and the long term, for purposes of both investment and management.
- The railroad and its international connections should be an integral part of a long-term project to make Uruguay a logistics and service center in the Southern Cone.
- Metropolitan passenger rail service will be maintained in the short term and its inclusion in the metropolitan transport plan for Montevideo will be studied.
- Given the current conditions, it has been determined that the industrial organization of the sector, and of AFE in particular, will undergo no changes in the short term. AFE will retain its monolithic structure and steps will be taken to improve operational efficiency.
- Major investments will be made to rehabilitate and improve (upgrade) infrastructure in sectors with the greatest freight development potential. Some of these investments are already under way.\(^1\)
- In the medium term, a comprehensive modernization of the railroad is proposed.
- Independently of the organization given to the sector in the medium and the long term, essential upgrading and modernizing measures will be adopted in the short term, including the resizing of staff, expanded access to information and the incorporation of modern technology.
- Separate cost accounting should be kept for passengers and freight, in order to determine the economic performance of each service and monitor any subsidies granted.
- A Railroad Regulation Office should be created at the central level (MTOP), with responsibilities related primarily to the regulation of sector competition and safety.

Assessment of the Railway Sector in Uruguay

Background

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\(^1\) A breakdown of infrastructure investments is contained in document CND-RIV-CONSTANTE.xls provided by CFU.
The government has visualized the modernization of rail transport, particularly with a view to preparing it for increased freight from the anticipated development of the forestry sector, through the incorporation of public and private capital and enhancement of AFE’s management capacity with private management for the operation of services. This government policy is set out primarily in Article 206 of Law No. 17,930 of December 2005, Decree 458 of the Ministry of Transport and Public Works of February 2008, and the Prequalification Conditions for the creation of the Public-Private Partnership (PPP) for the marketing of freight transport by rail.

The documents mentioned do not fully define how these guidelines will be implemented, leaving some of them pending, and they are also somewhat ambiguous as regards the real role that the private sector will assume, which is discussed in this report.

As has been customary in processes for transforming government-owned railroads, some of these approaches seem designed to reconcile essential steps for streamlining the railroads with protection of existing employment and with the traditional vision of the social role of the railroad. This makes a task that is already extremely complex—namely, confronting the changes needed in the railroad given its deterioration and the delays in its restructuring—even more difficult. At the same time, a consensus driven approach may lead to outcomes that are more sustainable in the long run.

To date, the actual implementation of private participation in the sector has experienced multiple difficulties and is currently at a halt.

**Overview of AFE’s Current Situation: Assessment Summary**

**Institutional structure**

③ AFE is a monolithic company that corresponds to a model now little used in railroads around the world.
③ It is governed by a three-member board of directors, which does not adequately represent the diversity of interests of its owner.
③ Currently there is no private participation in its operation.
③ For the moment, CFU’s sole role is to channel government investments in railroad infrastructure; despite the fact the legislation creating it is sufficiently flexible to allow it a greater role.

**Rail infrastructure**

③ Approximately half of AFE’s track infrastructure is abandoned.
③ The infrastructure does not meet standards sufficient for current stresses on rail equipment and structures (rails and bridges).
③ The state of the infrastructure is critical; freight loads and velocities are restricted and the derailment rate is between 50 and 100 times that of modern railroads.
③ The infrastructure uses a wide range of materials, which is incompatible with efficient technological development.
Maintenance is provided using own resources, with uneven results.
Attempts to involve private companies in the rehabilitation and maintenance of tracks have been unsuccessful.
No economic (social) evaluations are prepared for infrastructure investment projects to define and prioritize the projects offering the greatest return.

Rolling stock

- The locomotives, with the exception of the GE 2000 models, are old and inadequate; they are used inefficiently (low kilometrage) and their availability rates are very low.
- Freight cars are old and use obsolete technology, in addition to having high tare-to-load ratios.
- Recently purchased rail cars are inefficient and inadequate.

Transport volume

- The current volume of freight transport (stable over the past four years) stands at approximately 1.4 million metric tons annually, at an average density of 180,000 ton-kms/km, which is well below minimum private or social cost effectiveness levels (estimated at over 1 million ton-kms/km, approximately).
- Transport concentrates on 8 products, which represent 99 percent of tonnage.
- With the exception of forest products, there are no signs of a significant increase in freight.
- There are high expectations regarding the growth of demand for transportation of forest products. Based on a study by Pike & Co., a forestry consultant, the demand for rail transport of forest products could total some 4 million metric tons annually.
- There are doubts about the figures provided by this study, which allocates almost all freight to the railroad in its most direct area of influence, given its lower tariffs, without considering basic factors for decision-making regarding modes of transport, such as quality, reliability, and timeliness of service. Moreover, the railroad tariffs have been estimated without using a reliable cost model.

Operations

- The operational organization is inadequate, in that it physically and operationally separates activities that should be closely related (marketing-operations-traffic).
- The scheduling and control of operations are poor and are performed using inadequate resources or simply not performed at all, such as control of the rotation cycles.
- The rotation cycle for rail cars is very high. The average for the entire fleet is 10 days; if high-yield operations (limestone, clinker, cement), which mainly use private equipment, are not taken into consideration, the average for the rest of the fleet is around 22 days.
- The current train movement system requires personnel in all stations. This results in substantial overstaffing and, consequently, higher operating costs.
Management

AFE as a company, and the rail system it owns, are in a state of technical deterioration resulting from many years of outdated management and administration practices, making it extremely difficult to imagine that it will be feasible to bring about a change while the same management model remains in place.

1. Until now, there have been no commercial, economic, or operational targets, nor has there been a management plan.
2. No data are available on operating costs.
3. There is inadequate communication between areas (silo culture).
4. Technical standards are very general (ALAF) and there is no technical or safety standardization plan for the railroad.
5. Resources for management are inadequate and insufficient.
6. A costly suburban passenger service is maintained and expanded without adequate compensation by the government.
7. There is a planning unit and a marketing office that do not participate in the generation and evaluation of projects, and are not involved in the investment decision-making processes.

Personnel

1. AFE has too many employees, whether its staffing levels are measured in relation to the size of the network, the volume of transport, or any other objective parameter.
2. The indicators of staff productivity are very low, and rank among the lowest of all comparable railroads in South America.
3. The influence of Unions over strategic and administrative decision-making goes in some situations beyond the limits of their natural mandate of protecting labor rights.
4. AFE’s policy for resizing its staffing levels has been entirely based on attrition through retirements. In addition to being a very slow process that compromises the company’s operational efficiency, attrition reduces employee morale.
5. In general, employees are not motivated and feel completely left out of the senior management decision-making process. This is especially critical for the professional and technical staff.

Financial performance

1. AFE’s operating losses total approximately US$10 million annually, with a working ratio (costs/revenues) of 2.2.
2. Personnel expenditure amounts to roughly 60 percent of total operating expenditure, which confirms the overstaffing levels. Revenues are not even sufficient to cover personnel costs.
3. The average freight revenues are US¢3.25 per ton-km, which is insufficient to cover direct costs at present traffic levels.
There is no costing model, which means it is not possible to prepare a reliable projection of financial performance.

There are no private or social cost-effectiveness studies that could serve as the basis for a justifiable financial contribution by the government, which until now has been limited to covering the deficit each year.

Private sector participation

So far, the model for private participation in the railway sector has not been clear, as evidenced by some failed attempts to attract private investors described in the following paragraphs. New and more effective arrangements could be made on the basis of Uruguay’s Concession Law, which provides an adequate framework to promote a reasonable scheme for private investment in railroads.

In 2005, the Railway Corporation of Uruguay (CFU) was created as a public company under private law. CFU’s mandate is to channel investments in the railway sector.

A tender for track rehabilitation launched by CFU in 2007 failed, as the specifications and TOR in the call for bids contained a number of ambiguities that resulted in higher than expected bid prices. In 2009 CFU re-designed the call for bids and rehabilitation works are currently underway; with AFE as the contractor in charge of the works in a section of the network to be rehabilitated.

In 2005, the legal basis for the creation of Railway Freight Trading Company (CCF) was established. CCF was intended to be a private company in charge of selling freight services to cargo owners. The model for private sector participation as envisaged with the creation of CCF did not succeed, mostly because train operations –as well as areas that are essential to ensure adequate levels of service- were kept under AFE’s control. In this model, AFE’s structure was not intended to change, perpetuating its current problems. Attempts to implement CCF came to a halt by the end of 2007.

It is essential that an economic feasibility study be conducted for the AFE-CCF-CFU model to determine the amounts by which the government would need to subsidize the system.

The reform process and eventual participation of the private sector have until now been primarily handled by AFE, while international experience shows that successful reforms are generated and implemented by higher levels of government.

A model for private sector investment in freight transport will only be successful if the private operator has complete control the railway operation that underpins the freight service it provides.

**REQUIRED DEFINITIONS FOR A COURSE OF ACTION**

**Role of the Rail Corporation of Uruguay, CFU**

CFU was initially established as an entity similar to the Road Corporation of Uruguay, transposed to railroad infrastructure.
In accordance with the conditions established at the time of its creation, CFU’s role may be highly varied, depending on the government’s policy. One necessary aspect to be included in the analysis is who will be responsible for railroad infrastructure planning—the MOPT, CFU, or another centralized planning agency? It is highly advisable that this function be assigned to a central agency that oversees all the various modes of transport and is responsible for optimizing public investment.

**Role of CCF**

Pursuant to Decree 458 regulating Article 206 of Law No. 17,930, the Railway Freight Trading Company (CCF), as a special purpose corporation (SPC), can play a substantial role in the management of AFE, including the direct management of railroad operations. As noted above, private partners should be given operational control of freight transport.

**Suburban passenger services**

The existing suburban passenger services run by AFE have a very low volume, which does not seem to justify their operation either from a private or social perspective. As a result, this report’s recommendation is to carry out a study on urban and suburban transport in Montevideo, which would allow determining whether integrating the railway to the bus network would make it socially profitable. If the study’s findings are positive, the system should be organized and managed by an agency separate from AFE, subsidized by the State.

**Proposal for a Course of Action**

The current average railway traffic density is approximately one-sixth of the minimum required for economic viability and, with the exception of the potential forestry transport business; it does not appear that any of the country’s economic activities can increase those volumes significantly. The studies carried out to date on the transportation of forest products are very preliminary. Even if the volumes estimated in these studies could be attained, the resulting transport business would only make certain sectors of the network economically viable.

The analysis work mentioned above, as well as other studies conducted internally by the Ministry of Transport and Public Works and AFE show that under certain assumptions the railway can be economically viable. The proposed courses of action below are based on the premise that the favorable scenarios presented in the cost-benefit analyses described materialize. However, and given the preliminary character of these analyses, the initial recommendations of this report focus on the need to carry out more thorough studies on the railway sector.

In view of the foregoing, the possible courses of action involve option(s) that deliver the greatest social benefits for the organization of the railway system and that minimize the
financial costs to the State. The analysis of the four points that follow would be a good first step in this direction.

- **Drafting of a Strategic Study on the Railway Sector in Uruguay**, within the broader context of the country’s transport system. This study would help inform decisions involving public investments in the sector, or major changes in AFEs management. Its findings could be used to make rail transport projections and, therefore, quantify future investments, staffing levels, the fleet of rolling stock, subsidies and, to a certain extent, the most efficient way to organize the railroad, particularly the role that the private sector could play. Its importance lies in the fact that the policy definitions issued to date by the Government of Uruguay indicate not only that it wishes to maintain the railway system, but also that it hopes to expand and modernize it so that it will play a significant role in the country’s economic development.

- **Strategic Study on Passenger and Freight Services provided by AFE.** Regarding passenger services, no document analyzing the economic results of such services has been made available, but it can be safely assumed that they generate substantial deficits. These results are very likely one of the main reasons for AFE’s operating losses, inasmuch as passenger trains account for 25 percent of train-kms and only 3.5 percent of revenues. An analysis of the social benefits of these passenger transport services, which are currently provided only around the capital, would probably reveal that they are neither privately nor socially viable, given their low volume. Since the Government of Uruguay has expressed its intention to maintain these services and even introduce new ones, they should be managed separately from AFE and the resulting losses should be covered by the agency that wishes to maintain them and makes the decision to do so.

  Preliminary analyses on freight transportation show that it could be economically viable, particularly in the case of forestry products, under certain assumptions in terms of volumes, tariffs, and levels of operational efficiency on AFE’s side. Given the large amounts of subsidies and investments involved in passenger and freight services, a comprehensive study analyzing the benefits, costs, and requirements for their provision linked to them should be conducted to inform public decision making.

- **Analysis of Strategic Options with regards to railway infrastructure.** There are many possible approaches to be taken with regard to the ownership, operation and maintenance of infrastructure. Some countries have opted for the complete separation of infrastructure in an organization apart from freight and passenger carriers, with the State retaining ownership.

- **Analysis on the extension of private participation in Uruguay’s railway sector.** International experience overwhelmingly demonstrates that, because railroads play a minor role in the transport market, the most appropriate option for freight transport is to transfer it to the private sector. The cases of State-run enterprises most widely recognized as successful have occurred when they are managed under a private corporate structure, and even in those cases, the question arises of whether it is justifiable for the State to be involved in business activities, given
the frequent risk that in crisis situations such enterprises would become a major burden for taxpayers.

**PROPOSED MODERNIZATION PLAN FOR THE RAILWAY**

The Modernization Plan for the Railroad put forward as a primary outcome of this technical assistance incorporates the current definitions and restrictions of the government’s transport policy relevant to AFE. A number of aspects are identified for which there are as yet no definitions and about which not enough is known. In the near future, then, it will be necessary to adopt clear definitions in order to be able to project rail transport into the medium and the long term.

**Program 1: Transport policy definitions at the national level**

The following elements should be included in the national strategic policy definitions:

1. **Resources** should be sought to increase the levels of investment in transport infrastructure that is socially profitable, with the addition of new sectors in which investment is deficient: railroads, freight and/or passenger terminals, port access, safety improvements, etc. Consequently, where public funds are insufficient, opportunities and conditions for private investment should be identified.

2. **A transport system** should be constructed with market operating rules that create fair and transparent competition, both within each mode of transport and among alternative modes.

3. **An integrated transport system** should be developed. This means searching for ways to encourage modal integration in the transport of freight and passengers, as well as integration of the transport system with the system of economic and social activities. It also means aiming at achieving levels of development in the various modes of transport based on their comparative advantages and seeking a system that is economically and socially more efficient and flexible.

4. **An institutional framework** needs to be created with the capacity to respond to the requirements of the transport policy, in terms of both functions and resources.

Based on the assessment (needs) and definitions formulated in the workshops, the following subprograms are proposed for the implementation of this program:

**Subprogram 1.1: Development of an institutional framework for national transport**

For the MTOP, the following entities should be considered, in addition to those already in place:

a) **Unit responsible for Planning and Evaluating Public Investment Projects in the Transport Sector**
b) Unit responsible for Transport Market Regulation and Oversight (all modes)
c) Railroad Regulation Office
d) Rail Corporation of Uruguay (already in existence, but its role in implementing railway policy needs to be more clearly defined)
e) Railroad Modernization Plan Management Office

Subprogram 1.2: Creation of a competitive transport market

The objective is to establish a regulatory structure for interurban freight transport services that neutralizes negative externalities and prevents unfair competition among operators in a given mode by imposing levels of equivalent requirements across modes to avoid the distortion of intermodal competition.

The following situations need to be addressed:

a) Regulation of competition
b) Regulation of externalities and levels of service
c) Supervision and monitoring of regulations

Subprogram 1.3: Planning and evaluation of public investment projects

This subprogram is intended to:

a) Ensure efficiency in the provision of infrastructure.
b) Ensure that the planning of public and private investment in interurban transport infrastructure reflects national and regional development goals and fulfills efficiency objectives in social terms.
c) Develop and promote new investment formulas and projects that are attractive to private investors, to encourage their participation in socially profitable public infrastructure projects.
d) Construct an efficient fare structure for use in the infrastructure of the interurban transport system (ITS) that eliminates economic distortions across modes and incorporates external costs.
e) Significantly increase management oversight in the ITS infrastructure so as to reduce pressure through larger investments and improve the level of user services.

Program 2: development of a national railway policy

Subprogram 2.1: Creation of the Railroad Regulation Office

Similar to the functions that offices of this type fulfill in other countries, the following functions can be proposed for this office:
a) Issue and monitor compliance with railroad safety regulations pertaining to equipment, the design and use of rail lines, signaling and traffic control, etc.

b) Study, propose, and monitor subjects of primary importance in the area of safety: level crossings, hazmat transport, accidents.

c) Assume responsibility for the granting and inspection of train operating licenses.

d) Collect and analyze data on railway accidents and incidents and convert such information into publicly available statistical reports and analyses.

e) Strategic rail sector planning, encompassing both infrastructure and services.

f) Regulate the railroad market, promote competition in the land transport market and multimodal transport.

Subprogram 2.2: Review and implementation of AFE freight transport investment projects

- Plan to rehabilitate rail lines

It is advisable to review this plan with a view to accomplishing three main objectives:

1. Study potential transport demand by sector to improve the accuracy of the estimates and support those estimates with prior contracts.
2. Prepare a more accurate technical plan to minimize the risk factors. This plan should establish fixed quantities for each of the parties and an official budget based on a unit cost study.
3. Conduct a private and social economic assessment of the investments, for each sector of the system.

- Purchase of locomotives

This initiative is not supported by a plan and it is therefore impossible to gauge its benefits. Such a plan should be prepared and should consider the actual likelihood of attracting new freight business as well as the possibility of improving the performance of the current locomotives by improving the rail lines. At present, AFE’s more modern locomotives travel an average of approximately 260 km per day, a figure that could be raised significantly by increasing traffic speeds.

- Other freight transport investment projects

Other freight transport investment projects in the future should be handled in much the same way as the approach recommended for the rehabilitation plan, consisting of a preliminary study to quantify the private and social benefits and costs of the project, followed by an economic assessment conducted in accordance with a generally accepted methodology.
Subprogram 2.3: Policy definition and analysis of projects for the development of passenger transport at AFE

a) It will be necessary to define the State’s role in the provision of passenger rail services, in conjunction with the role assigned to AFE in the provision of such services.
   - Will the State subsidize the public Enterprise (be it AFE or another) that provides passenger services (assuming these are socially but not privately profitable?)
   - Will passenger services be integrated with other transport public transport services?
   - Should AFE function like a private enterprise, i.e., require that its services be privately profitable? If the State asks it to provide certain services, will specific payments be established for them?

b) An assessment of urban and suburban transport problems in the city of Montevideo is needed, which will include all modes of transport in the structure of services provided (railroad infrastructure, terminals, vehicles/equipment and rolling stock) and the operation of both public and private transport markets. Based on the results of this assessment and in light of the available information on travel demand and projections thereof, conclusions should be reached concerning the opportunities that rail transport offers for the provision of passenger transport services, and options should be identified with a description and analysis of their main characteristics.

c) The options identified in the assessment should be evaluated from a social standpoint with a view to determining their profitability and supporting the decision of the MTOP and the public financing agencies to approve the project. The evaluation should estimate the investment costs involved in each alternative as well as the operating costs during its useful life. The benefits to users should also be estimated, comparing scenarios with and without the project. Based on the authority’s objectives, it will be necessary to estimate other impacts in areas not necessarily included in the economic values (accidents, environmental effects, urban impacts, etc.). The methodology to be used for the evaluation should be proposed and approved by the MTOP and the public sector entities responsible for project financing and execution. It is important to define the service standards to be specified in the proposed alternatives, the quality of equipment, frequency of service, collection systems, quality of stations, etc., in addition to defining fare policies and integration with other modes of transport.

d) A financial assessment of passenger rail project alternatives should be conducted to estimate their financial viability in terms of investment and operation, as well as any subsidies that the State will have to provide if it decides to provide services for social reasons that are not covered by user fares.

Subprogram 2.4: Policy definition and proposed AFE staff restructuring
The modernization plan for the railroad is aimed, among other objectives, at boosting staff productivity to the level of the international standards for similar railroads, by technically and administratively upgrading the organization. The incorporation of modern train movement, communications and IT systems, as well as the outsourcing of certain activities, will allow for a significant reduction in staffing and fixed personnel costs.

- Staff resizing

The staff resizing problem is complex and can only be addressed in a program well coordinated with the execution of investments and the incorporation of new techniques.

One of the effects to be avoided, if possible, is the offering of improper staff reduction incentives, which often lead to the loss of valuable human resources, inasmuch as railroad experience is a unique professional asset that is difficult to replace.

An effort should also be made to avoid the social problems associated with the separation of staff, as the experience of railroad workers cannot be easily transferred to other sectors.

Special advisory assistance is recommended for this process, so as to develop a staff resizing plan that will include not only the reduction of redundant staff but also the hiring of personnel with special skills not currently available to the railroad and the training of remaining staff in the new techniques to be introduced.

Subprogram 2.5: Definition of medium- and long-term rail sector policy

An explicit public policy should be defined, explaining the role that the Government of Uruguay considers appropriate for the private sector to play in the provision of railway services, for both freight and passengers. The private sector’s involvement could include market access for new enterprises and services, using the current lines (property of the state) or on new lines. The private sector could also participate in the current system managed by AFE by investing in infrastructure and equipment, and/or by managing railway services.

For these purposes, it is advisable to conduct a study of freight transport at the national level, identifying the degree and characteristics of greater long-term efficiency that the freight railway system ought to have.

With regard to passengers, the role of the State and its willingness to subsidize services that are not privately profitable and/or the feasibility of the private sector providing passenger services with or without subsidies should also be defined.
Subprogram 2.6: Railroad safety

The purpose of this subprogram is to develop a railroad safety policy covering both the design and the domestic and international operation of public and private railroads.

This policy will be reflected in the issuance of safety standards by the Railroad Regulation Office, compliance with which will be obligatory for all railroad operators. The office will monitor compliance with these standards, recommend safety measures and have the authority to impose penalties in appropriate cases.

Program 3: Development of AFE modernization projects

The general objective of this program is the comprehensive modernization of AFE, not only from a technical standpoint but also in terms of organization, management, and the evaluation of investment projects, with a view to enhancing its efficiency, management capacity and technical and economic performance.

The proposals in this program are based on the assumption that AFE will continue to be responsible for rail operations as a government-owned enterprise. However, in the case of future private participation, the recommended actions are also necessary and would need to be carried out by the railroad entity regardless of whether it is government-owned, semi-public, or private.

The proposed program includes:

1. The formulation of a technology policy, which is essential for a railroad that has remained on the margins of technical developments in the field of rail transport in recent decades.

   This policy includes the development of technical standards for the rails, concrete structures, design of the rolling stock, signaling, traffic control, communications, and other aspects.

2. The development of a modern information and management system to facilitate timely and informed business decisions.

3. The participation by AFE in the process of evaluating investment projects for freight and passenger transport that are carried out with public funds at the central government level.

**Final Recommendations**

The basic results of the technical assistance provided to the Government of Uruguay, as requested through the MTOP, can be summarized as follows:
1. A Modernization Plan for Uruguay’s Railroad has been proposed, consisting of a series of programs and subprograms designed to respond in a comprehensive and integrated manner to the problem of the railroad in the context of the national transport system. The main recommendation is to have the plan officially approved as an expression of national railway policy and to begin carrying out the activities indicated in the various stages.

2. The proposed modernization plan covers a period of five years, during which time various studies should be conducted and strategic decisions made to enable the formulation of a medium- and long-term plan (20 years).

3. The short-term infrastructure investment projects should be reassessed in light of the recommendations on technical standardization of the railroad.

4. Plans to invest in rolling stock should be put on hold until more information is available concerning potential demand and more is known about the policy on including private investment.

5. As a complement to investment projects aimed at strengthening the capacity of the State-owned enterprise AFE to handle potential increases in the transport of forest products and the initiatives necessary to modernize its management, important decisions concerning the future of the railroad should be tied to opportunities for participation by the private sector.

6. Both international experience and the successive assessments and results obtained concerning the maintenance of AFE’s current monolithic structure clearly recommend the inclusion of private venture capital and management in the railroad. Such a decision is part of the process of implementing the proposed plan in the short term and, to a greater or lesser extent, defines much of the future of the railroad and AFE.

7. The Modernization Plan recommends that definitions concerning the role and scope of private sector involvement in the transport of freight and passengers by rail be based on prior studies identifying the relevant investment opportunities as well as the social and financial profitability of those investments and of the services provided. With these results, the State will be able to justify its decisions concerning private participation and the subsidies that will likely be necessary to compensate for any differences between social and private profitability, especially in the transport of passengers by rail.

8. In light of the cost analyses and income projections in a scenario in which transportation of forest products is captured, it was considered very probable that these volumes would ensure the viability of some sectors of the network, and it is recommended that these sectors be considered separately in the studies mentioned in point 7.
INTRODUCTION

CONTEXT

The Forestry Law of 1987 established a new long-term legal framework for the development of forestry activity in Uruguay, given the favorable international context for this type of industry. The purpose of the new framework was to attract private investment in the sector, exploit areas suitable for forestry, and promote the establishment of industries for the processing of forestry resources. Uruguay’s forestry development strategy was aimed at placing its products (equivalent to 10 to 20 million cubic meters of wood annually) on a favorable international market, where annual volumes total approximately 3.5 billion cubic meters.

An important effect of the increase in forestry cargo is the growing pressure that it places on the road and rail networks. Ensuring efficient shipment of this cargo while, at the same time, avoiding infrastructure deterioration becomes a challenge for transportation policy. Given this context, various analyses have been conducted to obtain objective data and information that will assist the government in the important decision-making process for the sector. A brief summary of these efforts, including the cost-benefit analysis prepared for this report (presented in greater detail in Annex 1), is provided below.

The analysis work mentioned above, as well as other studies conducted internally by the Ministry of Transport and Public Works and AFE, are the basis for the Government of Uruguay’s decision to rehabilitate the trunk line between Montevideo and Rivera, with a second phase covering the branch line between Montevideo and Fray Bentos. In August 2009, the Rail Corporation of Uruguay signed a contract with AFE to carry out these works, the final objective of which is to handle the growing traffic in forest products shipped along this corridor.

This report, and its short-term recommendations for improving the efficiency of the rail sector in Uruguay in particular, are based on the premise that the favorable scenarios proposed in the cost-benefit analyses described below will materialize.

STUDY ON THE DEMAND FOR TRANSPORTATION OF FOREST PRODUCTS

The “Study on the Demand for Transportation of Forest Products” was commissioned by the Ministry of Transport and Public Works from a private consultant and was completed in February 2007.2

This study concluded that of the 10 to 20 million cubic meters of industrial roundwood equivalents exportable by Uruguay, almost two-thirds would be exported in the form of

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wood products (cellulose pulp, sawn timber, boards). It also established that the railroad would only be able to capture the traffic in *wood for pulp or firewood* between the forestry centers of Rivera and Tacuarembó and the industrial centers in Montevideo and Fray Bentos. Of the industrial products, the railroad would capture only the transport of *sawn timber* between the industrial centers located in Rivera and Tacuarembó and Montevideo.³

This study also showed that the projected flows would require adaptation of the transportation infrastructure, particularly:

- the departmental roads on which the roundwood would be moved from the forest to the forestry centers;
- the sections of the national road network that link the forestry centers to the industrial or export centers;
- the rail network that could be used for forest products, i.e., the Montevideo-Rivera line and the connection between this line and Fray Bentos.

This study presents a projection of the demand for forest freight (see Table below) and applies a Logit-type model to determine the distribution between road and rail transportation. Based on this methodology, the relative prices for origin-destination pairs for each transport mode are the criterion for mode selection. Given that this study sought to replicate the decisions of private agents, market prices were used to determine the tariffs of US$3/ton-km and US$5/ton-km for rail and road transportation, respectively. In both cases, it was assumed that these tariffs applied to tons placed on trucks in the field and delivered by truck or rail car to the destination.

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³ A more detailed description of the analysis process used to estimate flows that would be captured by the railroad can be found in Chapter 6, Data Analysis, and Chapter 7, Analysis of Transportation Demand, of the aforementioned “Study on the Demand for Transportation of Forest Products.”
Table 1: Demand for Wood Products Shipped by Rail, 2006-2021

<table>
<thead>
<tr>
<th>Year</th>
<th>Origin</th>
<th>Destination</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Rivera</td>
<td>Montevideo</td>
<td>193,378</td>
</tr>
<tr>
<td></td>
<td>Tacuarembó</td>
<td>Montevideo</td>
<td>208,492</td>
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<tr>
<td></td>
<td></td>
<td>Subtotal</td>
<td>401,870</td>
</tr>
<tr>
<td></td>
<td>Rivera</td>
<td>Fray Bentos</td>
<td>161,449</td>
</tr>
<tr>
<td></td>
<td>Tacuarembó</td>
<td>Fray Bentos</td>
<td>544,331</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtotal</td>
<td>705,780</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1,107,650</strong></td>
</tr>
<tr>
<td>2011</td>
<td>Rivera</td>
<td>Montevideo</td>
<td>532,893</td>
</tr>
<tr>
<td></td>
<td>Tacuarembó</td>
<td>Montevideo</td>
<td>550,124</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtotal</td>
<td>1,083,017</td>
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<tr>
<td></td>
<td>Rivera</td>
<td>Fray Bentos</td>
<td>266,688</td>
</tr>
<tr>
<td></td>
<td>Tacuarembó</td>
<td>Fray Bentos</td>
<td>838,568</td>
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<td>Subtotal</td>
<td>1,105,256</td>
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<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>2,188,274</strong></td>
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<tr>
<td>2016</td>
<td>Rivera</td>
<td>Montevideo</td>
<td>536,087</td>
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<td></td>
<td>Tacuarembó</td>
<td>Montevideo</td>
<td>382,965</td>
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<td></td>
<td></td>
<td>Sub Total</td>
<td>919,052</td>
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<tr>
<td></td>
<td>Rivera</td>
<td>Fray Bentos</td>
<td>197,240</td>
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<td></td>
<td>Tacuarembó</td>
<td>Fray Bentos</td>
<td>537,078</td>
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<td></td>
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<td>Subtotal</td>
<td>734,318</td>
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<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1,653,370</strong></td>
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<tr>
<td>2021</td>
<td>Rivera</td>
<td>Montevideo</td>
<td>576,440</td>
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<td>Tacuarembó</td>
<td>Montevideo</td>
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<td>Subtotal</td>
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<td>Rivera</td>
<td>Fray Bentos</td>
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<td>Tacuarembó</td>
<td>Fray Bentos</td>
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<td></td>
<td>Subtotal</td>
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<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1,332,588</strong></td>
</tr>
</tbody>
</table>

Source: Study on the Demand for Transportation of Forests Products, MTOP, 2007

The analysis shows that rail transportation costs are significantly lower than road transportation costs, resulting in a partition that is very favorable to the railway. Although the model used takes only the tariff effect into account, it gives an idea of the potential market for forest products freight to be shipped by the railroad. Section 2.1.4.2 provides a more detailed analysis on the conclusions of this study.
URUGUAY DEVELOPMENT POLICY REVIEW: ANALYSIS OF THE EFFICIENCY OF LAND TRANSPORTATION OF FOREST PRODUCTS

In 2008, as part of the Uruguay Development Policy Review, the World Bank conducted an analysis of the efficiency in the allocation of resources in land transportation, comparing forest product cargos. Using a cost-benefit analysis, the investments and costs of rail and road operations required to handle the flow of forest products that would be captured by the two modes of transport were calculated. Project evaluation techniques were used in the comparison to calculate the Net Present Value (NPV) of moving traffic by rail or by road.

Evaluation methodology. The methodology is based on the volumes of freight allocated to the railroad in the Study analyzed in the previous section. In the case of road transportation, this demand was added to existing and projected demand for the analysis period for purposes of assessing the marginal costs. These were compared with the costs of moving the same demand by railroad, and then were used for a differential analysis of two scenarios:

- Scenario 1 (with project): Investments are made in the railroad, adapting AFE to the requirements of the demand for forest products.
- Scenario 0 (without project): The works included in the previous scenario are not carried out. It is assumed that road transportation will absorb the demand for the transportation of forest products (the volumes and origin-destination pairs are the same as in the previous scenario).

In the analysis of the scenarios, the costs (economic values) of transporting flows of wood products demand directed at the railroad between 2006 and 2021 were evaluated. The analysis period covers 2008 to 2029, with 2007 as year 0. Works carried out on the railroad in 2008 and 2009 as well as works to maintain and improve routes of interest between 2008 and 2029 were also assessed. Given that with the aforementioned works the railroad would be operational from 2010, the differential flows of the operating costs and externalities are assessed from that year forward. Finally, the NPV of the costs for both scenarios are compared to determine the differential NPV of both.

Operating and investment costs for the railroad: The analysis assumes that, in order to capture a significant volume of forest products transportation, the railroad will require a certain level of investment. Investments to improve 741 km of track to bring it up to the required standards to transport 18 tons per axel at 40 km/h, at a total cost of US$5.3 million per km, are indicated as necessary. These works cover the two variations of the AFE trunk line between Chamberlain and Rivera (via Tres Árboles and via Achar).

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4 Thus four flows were costed (between four origin-destination pairs) for pulpwood (Rivera-Montevideo, Tacuarembó-Montevideo, Rivera-Fray Bentos and Tacuarembó-Fray Bentos). The trains that would handle flows of sawn timber between Rivera and Montevideo and Tacuarembó and Montevideo were costed separately.
and the line from Tres Árboles to Fray Bentos, via Algorta and Haedo. The total amount of the investments used in the economic assessments (including the value of used rails and new rails in stock and ready to be used) is US$87.5 million.

The fact that the operating costs for the trains transporting wood were based on operational parameters involving an “efficient” AFE (in compliance with standards that had also been analyzed in the context of the DPR) is an important factor. The costs that would be incurred if AFE were to capture the additional wood traffic and continue to operate with efficiency parameters similar to the current parameters were also analyzed, with the following conclusions: (i) rail operating costs under AFE’s current parameters would be 62 percent higher in terms of cost per ton-km; (ii) rail infrastructure costs under the 2005 AFE parameters would be 25 percent higher in terms of cost per ton-km as a result of the fact that the largest component of infrastructure cost—investment—is the same for both alternatives; (iii) rail costs under current parameters—operations plus infrastructure—would be 50 percent higher; and (iv) adding the cost of reaching the railway station by road, the total cost under AFE 2005 parameters would be 45 percent higher.

Based on the above, the analysis concludes that AFE would not be competitive with road transport at a cost of US$0.048 per ton-km and would have to charge a tariff higher than US$0.05 ton-km (which is the average tariff for freight transport by road). Therefore, the study concludes that AFE would be obliged to switch to an efficient operating scheme if it were to carry out the track investments.

**Externalities.** In the cited work an economic assessment of three classes of externalities was conducted, using imputed prices:

- Cost overruns for urban and suburban infrastructure maintenance not considered in the rest of the analysis in that they involve costs that are not directly incurred by the agency responsible for operations on national road and rail infrastructure;
- Cost overruns resulting from two types of congestion: rural and urban;
- Cost overruns resulting from two types of accident: rural and urban-suburban.

**Net Present Value of the railroad investment costs.** Using a discount rate of 12 percent, the NPV of total railroad costs was US$175 million when all track investment costs were allocated to wood traffic, and US$155 million when only 70 percent were so allocated. Using a discount rate of 10 percent, the NPV totaled US$192.1 million when all track investment costs were allocated to wood traffic and US$171.7 million [when only 70 percent were]. The NPV of railroad costs was calculated on the assumption that track investment costs for the sectors in which wood would circulate were either totally attributable to this traffic or 70 percent attributable, since other AFE traffic would need to circulate on these improved tracks. The calculation was made using the start of railroad investments (the beginning of 2008) as the “zero” point for purposes of applying the discount.
Summary and results of the comparative economic assessment. Based on the conclusions of the analysis conducted in the DPR, meeting the increased demand resulting from forest products would require additional investment and infrastructure maintenance expenditures of US$104.5 million for the railroad or US$84.2 million for the road network. According to the analysis, moving the projected additional cargo (if the railroad were not involved) would still require a similar level of expenditure in the road network.

The analysis also concluded that the increased rail operating costs were less than half the road operating costs. Rail operating costs would total US$308 million, while the corresponding costs for road transport vehicles stood at US$623 million. In terms of economic efficiency in the use of resources, the analysis concluded that the railroad was clearly more efficient. The unit costs per ton-km were 2.8 cents for the railroad and 5 cents for road freight transport. The summary of the assessments made is presented in the following table, which recapitulates the main results of the work. Rail is the most efficient land transportation option for handling the additional forest products freight anticipated. Finally, the present value of the difference between the two scenarios analyzed (with and without a rail project) totaled US$103.4 million (with a 12 percent discount rate) and US$122.6 million (with a 10 percent discount rate) in favor of the railroad for the period 2008 to 2029.

| Table 1: Comparative Analysis of Efficiency of Land Transportation of Forestry Products |
|-------------------------------|-----|-----|
| **Item** | **Rail** | **Road** |
| **Freight and distances** | | |
| Tons 2010-2029 (million) | 31.46 | 31.46 |
| Average Distance (km) | 459 (rail) | 446 |
| Ton-km 2010-2029 (million) | 14,442 | 14,017 |
| Total Loaded Trips | 32,212 Trains | 1,124,000 Trucks |
| Tons per Loaded Trip | 977 | 28 |
| Average Annual Loaded Trips | 1,611 Trains | 56,183 Trucks |
| Average Daily Loaded Trips | 4.4 Trains | 154 Trucks |
| **Infrastructure and Operating Costs 2010-2029 (US$ million)** | | |
| Truck Operating Cost 2010-2029 (US$ million) | 56.5 | 622.7 |
| Rail Operating Cost 2010-2029 (US$ million) | 251.4 | -------- |
| Infrastructure Cost (Investment + Maintenance) 2008-2029 | 104.5 | 84.2 |
| Total Operating Cost + Infrastructure (US$ million) | 412.4 | 706.9 |
| Total Operating Cost + Infrastructure per Ton (US$) | 13.11 | 22.47 |
| Rail Operating Cost (US¢ per ton-km) | 1.7 | -------- |
| Road Operating Cost (US¢ per ton-km) | 0.4 | 4.4 |
| Total Operating Cost (US¢ per ton-km) | 2.1 | 4.4 |
| Total Operating Cost + Infrastructure (US¢ per ton-km) | 2.8 | 5.0 |
| Cost of Forest Traffic Externalities | -------- | 58.1 |
| NPV of Total Cost at 12% (US$ million) | 174.8 | 278.2 |
| NPV of Total Cost at 10% (US$ million) | 192.1 | 317.4 |
| NPV of Total Cost at 12% (US$ million) 70% Rail Investment | 155.0 | 278.2 |
| NPV of Total Cost at 10% (US$ million) 70% Rail Investment | 171.7 | 317.4 |

Source: own elaboration.
ANALYSIS OF AFE’S OPERATING COSTS AND PROJECTION OF REVENUES AND EXPENSES

To project AFE’s financial viability for the transportation of freight, an additional analysis of revenues and expenses was conducted as part of the current study, using a scenario of increases in the volumes transported (presented in greater detail in Annex 1 of this report).

Revenues and externalities. The revenues come from the forest products freight that the railroad might attract, estimated in the DPR based on the “Projection of Demand for the Transportation of Forest Products”. The same freight tariffs were used as in the above-mentioned study, i.e., US$0.03 ton/km. An important initial difference with the DPR relates to the fact that current analysis has a purely financial focus, unlike the previous analysis which had an economic focus. Thus, this work does not consider the positive externalities of rail transport.

Operating costs. In the current exercise, a detailed analysis was prepared of rail operating costs. The costs indicated in the DPR were adjusted to reflect AFE’s current operations more accurately, using real figures taken from the Annual Reports or international standards. The DPR analysis and the present analysis differ in that the present analysis assumed a level of operating costs of an efficient company. In the case of passenger services, only some operating costs could be allocated to this traffic owing to the available disaggregation, so it was assumed that this traffic remained constant over the entire period. The present analysis also differs from the earlier analyses in that it considers the operating costs of the entire network (not just the River-Montevideo-Fray Bentos sector) in its base scenario. On the first point, the first conclusion suggests that direct operating costs, without infrastructure (transport and maintenance), which are essentially variable, total US$9.77 million, higher than total revenue.

Base scenario and sensitivity analysis. In this exercise, a base scenario and two additional scenarios are presented and their sensitivity to some important variables, such as tariffs and train operating efficiency, is tested. The following table shows the performance of AFE with the anticipated increases in freight volumes, applying the adjusted operating costs (see Annex 1).
<table>
<thead>
<tr>
<th>Item</th>
<th>2005</th>
<th>2011</th>
<th>2016</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freight train personnel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffing level</td>
<td>180</td>
<td>286</td>
<td>244</td>
<td>224</td>
</tr>
<tr>
<td>Average velocity</td>
<td>5.44</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Annual remuneration</td>
<td>11,000</td>
<td>11,000</td>
<td>11,000</td>
<td>11,000</td>
</tr>
<tr>
<td><strong>Personnel expense</strong></td>
<td>1,980,000</td>
<td>3,141,209</td>
<td>2,686,169</td>
<td>2,462,880</td>
</tr>
<tr>
<td><strong>Fuel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liters/year</td>
<td>5,780,675</td>
<td>22,164,656</td>
<td>18,633,869</td>
<td>16,901,300</td>
</tr>
<tr>
<td>Liters/ton-km</td>
<td>0.0175</td>
<td>0.0175</td>
<td>0.0175</td>
<td>0.0175</td>
</tr>
<tr>
<td>US$/lt</td>
<td>0.659</td>
<td>0.757</td>
<td>0.757</td>
<td>0.757</td>
</tr>
<tr>
<td><strong>Fuel expense</strong></td>
<td>3,810,000</td>
<td>16,785,987</td>
<td>14,112,012</td>
<td>12,799,883</td>
</tr>
<tr>
<td><strong>Locomotive maintenance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locomotive-kms</td>
<td>1,113,403</td>
<td>2,855,645</td>
<td>2,441,972</td>
<td>2,238,981</td>
</tr>
<tr>
<td>Unit cost</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td><strong>Locomotive maintenance expense</strong></td>
<td>2,603,136</td>
<td>5,711,290</td>
<td>4,883,944</td>
<td>4,477,963</td>
</tr>
<tr>
<td><strong>Train car maintenance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Train car-kms</td>
<td>22,056,533</td>
<td>89,241,619</td>
<td>74,763,074</td>
<td>67,658,400</td>
</tr>
<tr>
<td>Unit cost</td>
<td>0.04</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Train car maintenance expense</strong></td>
<td>959,459</td>
<td>4,462,081</td>
<td>3,738,154</td>
<td>3,382,920</td>
</tr>
<tr>
<td><strong>Traffic operations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffing level</td>
<td>296</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Annual remuneration</td>
<td>9,190</td>
<td>9,190</td>
<td>9,190</td>
<td>9,190</td>
</tr>
<tr>
<td>Personnel expense</td>
<td>2,720,240</td>
<td>919,000</td>
<td>919,000</td>
<td>919,000</td>
</tr>
<tr>
<td>Other expenses</td>
<td>670,000</td>
<td>670,000</td>
<td>670,000</td>
<td>670,000</td>
</tr>
<tr>
<td><strong>Total traffic</strong></td>
<td>3,390,240</td>
<td>1,589,000</td>
<td>1,589,000</td>
<td>1,589,000</td>
</tr>
<tr>
<td><strong>Track maintenance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track length</td>
<td>1,611</td>
<td>1,611</td>
<td>1,611</td>
<td>1,611</td>
</tr>
<tr>
<td><strong>Track maintenance expense</strong></td>
<td>4,400,000</td>
<td>5,828,781</td>
<td>5,668,805</td>
<td>5,899,755</td>
</tr>
<tr>
<td>Other expenses</td>
<td>530,000</td>
<td>2,032,162</td>
<td>1,708,442</td>
<td>1,549,592</td>
</tr>
<tr>
<td>Expenses allocatable to passengers</td>
<td>417,471</td>
<td>417,471</td>
<td>417,471</td>
<td>417,471</td>
</tr>
<tr>
<td><strong>Administration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>1,210,000</td>
<td>1,815,000</td>
<td>1,815,000</td>
<td>1,815,000</td>
</tr>
<tr>
<td>Other</td>
<td>580,000</td>
<td>870,000</td>
<td>870,000</td>
<td>870,000</td>
</tr>
<tr>
<td>Administration expense</td>
<td>1,790,000</td>
<td>2,685,000</td>
<td>2,685,000</td>
<td>2,685,000</td>
</tr>
<tr>
<td><strong>TOTAL EXPENSES</strong></td>
<td>19,880,306</td>
<td>42,645,408</td>
<td>37,483,981</td>
<td>34,951,251</td>
</tr>
<tr>
<td><strong>Freight revenues</strong></td>
<td>8,550,000</td>
<td>36,681,355</td>
<td>30,618,981</td>
<td>27,644,153</td>
</tr>
<tr>
<td><strong>Other revenues incl. passengers</strong></td>
<td>840,000</td>
<td>840,000</td>
<td>840,000</td>
<td>840,000</td>
</tr>
<tr>
<td><strong>Operating margin</strong></td>
<td>(10,490,306)</td>
<td>(5,124,053)</td>
<td>(6,025,000)</td>
<td>(6,467,098)</td>
</tr>
</tbody>
</table>

Source: Own elaboration
The results of this first exercise show that, even in an optimistic demand scenario, rail operations produce an operating loss, which indicates that should this scenario be produced under the assumed conditions, the State will have to continue to cover AFE’s operating deficits as well as all the resources required for investment in the rehabilitation of the tracks and rolling stock needed for the increase in forest products freight. Transportation of forest products will require a minimum of US$88 million investment in the tracks (DPR figures), as well as investments in locomotives and rail cars. A conservative estimate of the investment needed to improve the rolling stock is US$64 million. The total investment required to improve efficiency would therefore be US$152 million.

The following Table shows AFE’s performance with the same demand scenario but with some more favorable revenue and expense assumptions:

1. The average tariff for the transportation of forest products is US$0.04/ton-km.
2. The average velocity of the trains is 15 km/h.
3. Administrative expenses are only 1.4 times higher than they are at present.
4. A subsidy of US$300,000/year is provided for passenger trains.
Table 3: Analysis of AFE’s Operating Performance – Volume of Demand Projected in the DPR – Favorable Revenue and Expense Assumptions

<table>
<thead>
<tr>
<th>Item</th>
<th>2005</th>
<th>2011</th>
<th>2016</th>
<th>2021</th>
</tr>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Staffing level</td>
<td>180</td>
<td>190</td>
<td>163</td>
<td>149</td>
</tr>
<tr>
<td>Average velocity</td>
<td>5.44</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Annual remuneration</td>
<td>11,000</td>
<td>11,000</td>
<td>11,000</td>
<td>11,000</td>
</tr>
<tr>
<td>Personnel expense</td>
<td>1,980,000</td>
<td>2,094,140</td>
<td>1,790,780</td>
<td>1,641,920</td>
</tr>
<tr>
<td><strong>Fuel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liters/year</td>
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<td>0.757</td>
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<td>296</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<td>9,190</td>
<td>9,190</td>
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<td>Personnel expense</td>
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</tr>
<tr>
<td>Other expenses</td>
<td>670,000</td>
<td>670,000</td>
<td>670,000</td>
<td>670,000</td>
</tr>
<tr>
<td>Traffic expense</td>
<td>3,390,240</td>
<td>1,589,000</td>
<td>1,589,000</td>
<td>1,589,000</td>
</tr>
<tr>
<td><strong>Track maintenance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track length</td>
<td>1,611</td>
<td>1,611</td>
<td>1,611</td>
<td>1,611</td>
</tr>
<tr>
<td>Track maintenance expense</td>
<td>4,400,000</td>
<td>5,828,781</td>
<td>5,668,805</td>
<td>5,899,755</td>
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<td>Other expenses</td>
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<td>2,032,162</td>
<td>1,708,442</td>
<td>1,549,592</td>
</tr>
<tr>
<td>Expenses allocatable to passengers</td>
<td>417,471</td>
<td>417,471</td>
<td>417,471</td>
<td>417,471</td>
</tr>
<tr>
<td><strong>Administration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>1,210,000</td>
<td>1,694,000</td>
<td>1,694,000</td>
<td>1,694,000</td>
</tr>
<tr>
<td>Other</td>
<td>580,000</td>
<td>812,000</td>
<td>812,000</td>
<td>812,000</td>
</tr>
<tr>
<td>Administration expense</td>
<td>1,790,000</td>
<td>2,506,000</td>
<td>2,506,000</td>
<td>2,506,000</td>
</tr>
<tr>
<td><strong>TOTAL EXPENSES</strong></td>
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<td>41,419,339</td>
<td>36,409,591</td>
<td>33,951,291</td>
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<tr>
<td>Freight revenues</td>
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<td>37,975,308</td>
<td>34,008,871</td>
</tr>
<tr>
<td>Other revenues incl. passengers</td>
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<td>1,140,000</td>
<td>1,140,000</td>
<td>1,140,000</td>
</tr>
<tr>
<td>Operating margin</td>
<td>(10,490,306)</td>
<td>5,779,135</td>
<td>2,705,717</td>
<td>1,197,580</td>
</tr>
</tbody>
</table>

Source: Own elaboration
The operating margin shows high sensitivity to rail transport prices and, naturally, to demand levels. In the analysis of an increase in transportation tariffs to US$0.04/ton-km, the operating margin is positive; although in no case does it cover investment costs.

The results of the analysis confirm an assertion that will be developed in detail in the report, namely that a sizable portion of the network does not have sufficient traffic for viable operation. In practice, the transportation of forest products uses only 836 km of the existing network (51 percent), all of which was included in the previous exercise. If the AFE network were to be reduced to only those sectors with significant volumes of traffic, it would probably show a profit.

The following Table shows the results projected in the scenario in which the network is reduced to the portion needed for the transportation of forest products (the Rivera-Montevideo corridor and the Piedra Sola-Fray Bentos branch line) and current limestone and clinker traffic. In this scenario, the cost of train personnel, rolling track maintenance, train movement and fuel and general expenses all decline, leading to a profit in all years, even with a tariff of US$0.03/ton-km.

The operating income from this option suggests that a project such as this could even help finance a significant part of the necessary investment in infrastructure (close to 40 percent), although these figures must be validated in a broader study than this analysis of very preliminary figures.

Based on the analyses presented, the Government of Uruguay decided to revive rail transport, as there were sufficient indications that this mode of transport—even with a partial rail network—was the most efficient from an economic point of view in the current context. Based on these indicators, further analyses would need to be conducted to determine how the revitalization of the railroad should be implemented and which railroad should be involved.
## Table 4: Analysis of AFE’s Operating Performance – Volume of Demand Projected in the DPR; Operating Expenses Applied to Restricted Sections of the Network

<table>
<thead>
<tr>
<th>Item</th>
<th>2005</th>
<th>2011</th>
<th>2016</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Freight train personnel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffing level</td>
<td>180</td>
<td>128</td>
<td>100</td>
<td>87</td>
</tr>
<tr>
<td>Average velocity</td>
<td>5.44</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Annual remuneration</td>
<td>11,000</td>
<td>11,000</td>
<td>11,000</td>
<td>11,000</td>
</tr>
<tr>
<td>Personnel expense</td>
<td>1,980,000</td>
<td>1,407,688</td>
<td>1,104,328</td>
<td>955,468</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fuel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liters/year</td>
<td>5,780,675</td>
<td>16,383,981</td>
<td>12,853,194</td>
<td>11,120,625</td>
</tr>
<tr>
<td>Liters/ton-km</td>
<td>0.0175</td>
<td>0.0175</td>
<td>0.0175</td>
<td>0.0175</td>
</tr>
<tr>
<td>US$/lt</td>
<td>0.659</td>
<td>0.757</td>
<td>0.757</td>
<td>0.757</td>
</tr>
<tr>
<td>Fuel expense</td>
<td>3,810,000</td>
<td>12,408,101</td>
<td>9,734,126</td>
<td>8,421,997</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Locomotive maintenance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locomotive-kms</td>
<td>1,113,403</td>
<td>1,919,574</td>
<td>1,505,901</td>
<td>1,302,910</td>
</tr>
<tr>
<td>Unit cost</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Locomotive maintenance expense</td>
<td>2,603,136</td>
<td>3,839,148</td>
<td>3,011,802</td>
<td>2,605,821</td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Train car maintenance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Train car-kms</td>
<td>22,056,533</td>
<td>67,185,085</td>
<td>52,706,540</td>
<td>45,601,867</td>
</tr>
<tr>
<td>Unit cost</td>
<td>0.04</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Train car maintenance expense</td>
<td>959,459</td>
<td>3,359,254</td>
<td>2,635,327</td>
<td>2,280,093</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Traffic operations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffing level</td>
<td>296</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Annual remuneration</td>
<td>9,190</td>
<td>9,190</td>
<td>9,190</td>
<td>9,190</td>
</tr>
<tr>
<td>Personnel expense</td>
<td>2,720,240</td>
<td>919,000</td>
<td>919,000</td>
<td>919,000</td>
</tr>
<tr>
<td>Other expenses</td>
<td>670,000</td>
<td>670,000</td>
<td>670,000</td>
<td>670,000</td>
</tr>
<tr>
<td>Traffic total</td>
<td>3,390,240</td>
<td>1,405,200</td>
<td>1,405,200</td>
<td>1,405,200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Track maintenance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track length</td>
<td>1,611</td>
<td>968</td>
<td>968</td>
<td>968</td>
</tr>
<tr>
<td>Track maintenance expense</td>
<td>4,400,000</td>
<td>3,634,478</td>
<td>3,477,058</td>
<td>3,399,812</td>
</tr>
<tr>
<td>Other expenses</td>
<td>530,000</td>
<td>1,502,162</td>
<td>1,178,442</td>
<td>1,019,592</td>
</tr>
<tr>
<td>Expenses allocatable to passengers</td>
<td>417,471</td>
<td>417,471</td>
<td>417,471</td>
<td>417,471</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Administration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>1,210,000</td>
<td>1,694,000</td>
<td>1,694,000</td>
<td>1,694,000</td>
</tr>
<tr>
<td>Other</td>
<td>580,000</td>
<td>812,000</td>
<td>812,000</td>
<td>812,000</td>
</tr>
<tr>
<td>Administration expense</td>
<td>1,790,000</td>
<td>2,148,000</td>
<td>2,148,000</td>
<td>2,148,000</td>
</tr>
<tr>
<td>TOTAL EXPENSES</td>
<td>19,880,306</td>
<td>30,121,501</td>
<td>25,111,754</td>
<td>22,653,454</td>
</tr>
<tr>
<td>Freight revenues</td>
<td>8,550,000</td>
<td>36,681,355</td>
<td>30,618,981</td>
<td>27,644,153</td>
</tr>
<tr>
<td>Other revenues incl. passengers</td>
<td>840,000</td>
<td>1,140,000</td>
<td>1,140,000</td>
<td>1,140,000</td>
</tr>
<tr>
<td>Operating margin</td>
<td>(10,490,306)</td>
<td>7,699,854</td>
<td>6,647,227</td>
<td>6,130,700</td>
</tr>
</tbody>
</table>

Source: Own elaboration
PROJECT rationale

The Government of Uruguay, through the MTOP, asked the World Bank for technical assistance to help the rail sector design and implement a long-term strategy and action plan and define a short-term strategy with specific measures to be implemented immediately in AFE. These efforts are oriented to rehabilitate rail transport and prepare for the anticipated significant increases in demand for freight transport in the next few years.

The project was divided into three stages. Each consisted of a preliminary report, which was followed by a Technical Workshop in which that report was analyzed in a series of meetings, the results of which provided the basis for the subsequent report and workshop.

The first Technical Workshop, held on January 22 and 23, 2009, presented Report No. 1, which provided background and a detailed assessment of the railway sector in Uruguay.

This first report was aimed primarily at reviewing the recent history of the railroad in Uruguay and the steps taken to try to improve the efficiency of the sector, identifying the main barriers to its development. The basic data underlying the report were collected in visits and interviews with various AFE officials, provided by AFE itself, and taken from the DPR prepared by the World Bank in 2008.

The second Workshop, held on April 15 and 16, 2009, presented Report No. 2, which focused mainly on presenting the international experience with railroad policies and forms of private participation under various institutional structures, along with strategic definitions and the identification of options for the Uruguay’s railroad, and for AFE in particular.

The main purpose of this second Workshop was to obtain definitions on the various policy options presented in the Report from the Uruguay’s authorities. The basic data underlying the report were based on the experience of the World Bank consultants.

Finally, Workshop No. 3, held on July 29 and 30, 2009, presented Report No. 3, which proposed a Modernization Plan for Uruguay’s Railroad, in terms of both general transport policies and specific policies for the rail sector and individual projects for its development within AFE.

This paper consolidates the three reports and their conclusions.
Assessment OF THE RAILROAD IN URUGUAY

OVERVIEW OF URUGUAY RAILWAY SECTOR

Project guidelines

The Government of Uruguay has expressed its intention of creating an efficient multimodal transport system by reactivating and integrating its various parts: primarily ports, railroads, and roads. As part of this vision, the government is seeking to develop a Strategy and Action Plan to reform the rail sector and bring it up to levels of competitiveness that meet the country’s needs.

The Government is also seeking to develop the rail subsector to provide a cleaner, safer, and more efficient transportation alternative while helping to protect investments in the road network, including both new projects and the rehabilitation and maintenance of previously built roads. Apparently implicit in the government’s vision is the need for this subsector to operate profitably in economic and social terms for the transportation of both freight and passengers, so as to justify financial support for the provision of these services in cases where they are not privately profitable.

The government has visualized the modernization of rail transport, particularly with a view to preparing it for increased freight from the anticipated development of the forestry sector, through the incorporation of public and private capital and supplementation of AFE’s management capacity with private management for the operation of services. This government policy is set out primarily in Article 206 of Law No. 17,930 of December 2005, Decree 458 of the Ministry of Transport and Public Works of February 2008, and the Prequalification Conditions for the creation of the Public-Private Partnership (PPP) for the marketing of freight transport by rail.

The documents mentioned do not fully define how these guidelines will be implemented, leaving certain of them pending, and they are also somewhat ambiguous as regards the real role that the private sector will assume, which is discussed in this report.

As has been customary in processes for transforming government-owned railroads, some of these approaches seem designed to reconcile essential steps for streamlining the railroads with the protection of existing employment and with the traditional vision of the social role of the railroad. This makes a task that is already extremely complex—namely, confronting the changes needed in the railroad given its deterioration and the delays in its restructuring—even more difficult. At the same time, a consensus driven approach may lead to outcomes that are more sustainable in the long run.
Current situation in AFE

Overview

This analysis of the situation in AFE is considered necessary to establish a conceptual framework that will support and justify the various measures that are proposed in this study. It is based on the Development Policy Report (DPR) prepared by the Bank in 2007 and the research done by the Bank’s consultant team.

Institutional structure

AFE, the State Railroad Administration, is a government enterprise established by Decree Law No. 14,369 of 1975, whose function is to provide freight and passenger transportation services, and maintenance, administration, and operation of the country’s railroad infrastructure.

AFE reports to the Ministry of Transport and Public Works (MTOP). It has a three-member Board of Directors, with one member acting as the chairman. The directors, including the chairman, are appointed by the President of the Republic.

More recently, in a form that parallels the management of AFE, the Rail Corporation of Uruguay (CFU) was created with the primary aim of investing in railroad infrastructure, in the same way as the Road Corporation of Uruguay (CVU) invests in roads.

Rail infrastructure

AFE has a network of about 3,000 km of tracks, approximately 1,600 km of which are in operation. The tracks are medium or standard gauge (1,435 mm); they are single tracks, with the exception of 11 km close to Montevideo, where there are double tracks; and the grade ranges from 1.5 percent to 2 percent, with numerous curves and counter-curves.

The lines in service can be grouped into three sectors. The largest sector is the Montevideo–Rivera corridor (563 km), which links up with the metric-gauge ALL lines in Livramento, Brazil. The coastal lines, located west of this corridor, connect with the Mesopotamic Railway (FCM) in Salto Grande, Argentina, which uses the same gauge as AFE, and with the towns of Paysandú and Fray Bentos. The eastern lines consist of the Montevideo–Río Branco corridor, a former international connection that is now not operational.

The rails on these lines have various profiles with differing standards and technology. A large portion consists of originally English rails, with light rail weights ranging from 57 to 75 lb/yd.

Subsequently, some of these rails were replaced without following a defined standardization policy, which means that currently in the network there are English profile rails, rails based on the UIC standard, some based on the ASCE standard, and
Russian profile rails. The weights vary from 28 kg/m to 51 kg/m. These rails have different degrees of toughness; different rail head and rail foot shapes; and, naturally, their accessories are not interchangeable.

The rails are laid in 12-, 24- and 36-m lengths. The ties are hardwood and are laid on beds of crushed stone in most sectors, with earth ballast in some sectors. The fasteners are screw spikes and elastic spikes, although track spikes are used on some segments of older lines and others use Pandrol Gaugelock® fasteners.

The axle load is limited to 18 tons on the Montevideo–Rivera and Montevideo–Río Branco lines, and 14 tons on the coastal lines with the exception of a short segment between Queguay and Paysandú (30 km), which can handle 18 tons/axle.

The main barrier to increasing axle load is the bridges, since at current velocities the rails would support greater axle loads.

Infrastructure maintenance is performed by AFE’s own employees using its own resources. There is apparently a personnel allocation that duplicates standards considered normal for such activities.5

Given the poor condition of the infrastructure, which results in frequent derailments and velocity restrictions, it is clear that maintenance activities are not adequate, whether owing to organizational deficiencies, lack of resources, or other causes that remain to be identified.

The derailment rate for AFE is 143 per million train-kms, or more than 100 times the standard for modern railroads.

In apparent confirmation of the above, personnel expenditure amounts to approximately 70 percent of total infrastructure expenditure (US$3 million out of a total of US$4.4 million in 2005), revealing a disproportion between personnel and supplies.

Moreover, annual expenditure is equivalent to US$2,750/km considering only the lines in service, which is low, even for lines carrying the volume of traffic that AFE does. The poor condition of the tracks, velocity restrictions, and frequent derailments confirm this assessment.

**Rolling stock**

The passenger and freight rolling stock consists of a wide range of equipment from various countries. With only a few exceptions, the stock is old, inadequate, and insufficient for the requirements that AFE is hoping for in the short term, making it one more barrier to the development of the company. Tables 5 and 6 present the freight transportation equipment.

---

5 Analysis done in the WB 2008 DPR.
Table 5: AFE Locomotives

<table>
<thead>
<tr>
<th>Type</th>
<th>Power (HP)</th>
<th>Fleet</th>
<th>Average Number in Service</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2006</td>
</tr>
<tr>
<td>GE 2000</td>
<td>2,000</td>
<td>10</td>
<td>7.6</td>
</tr>
<tr>
<td>GE 1500</td>
<td>1,500</td>
<td>9</td>
<td>2.8</td>
</tr>
<tr>
<td>Alsthom</td>
<td>800</td>
<td>19</td>
<td>12.5</td>
</tr>
<tr>
<td>GE 44T</td>
<td>400</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>GE 25T</td>
<td>150</td>
<td>4</td>
<td>2.8</td>
</tr>
</tbody>
</table>

(1) Only five of these locomotives are in service.
Source: AFE Peñarol Workshops

The GE 2000 locomotives are the newest and are in the best state of repair, constituting the core of the fleet. Despite their more modern technology, dating from the 1990s, their availability rate is low (77 percent). For locomotives of this type and age, an availability rate of at least 90 percent is expected.

The available units cover some 8,000 km per month (96,000 km per year), which is acceptable if the two remaining units are permanently out of service, but very low if those units are temporarily removed for repair or maintenance.

The GE 1500 locomotives are very old (over 50 years) and expensive to maintain because they are equipped with Alco 244 motors, which are obsolete. Their availability rate is very low (22 percent), which is explained by the fact that many of them are no longer in service. The appropriateness of rehabilitating the five locomotives that are still in service should be assessed, or whether the entire series should be removed from service.

The annual kilometrage for these locomotives is very low (46,000 km per year), even considering only those that are in service. It is important to analyze whether this results from a lack of reliability or from operational problems.

The Alsthom locomotives, which are also quite old (45 years), are not very powerful and are costly to operate and maintain. Their availability rate is also insufficient (62 percent) although, considering their number and their light weight, which enables them to operate on light rails, it would appear useful to rehabilitate the recoverable units.

As in the case of the GE 1500 locomotives, the kilometrage for the Alsthom locomotives is very low (54,000 km per year), which is explained in part by their use with passenger trains. However, as will be seen below, there is no systematic control over the use of these locomotives.

The five minor locomotives are not used with trains.

The locomotives are maintained using AFE’s own resources in AFE workshops. During this study there was no opportunity to visit the workshops and therefore to evaluate their
equipment and procedures, but the low availability rate of locomotives would seem to indicate maintenance problems. In addition, the World Bank DPR contains no information on locomotive maintenance.

### Table 6: AFE Freight Cars

<table>
<thead>
<tr>
<th>Type</th>
<th>Fleet</th>
<th>Bearings</th>
<th>Brakes</th>
<th>Weight (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F</td>
<td>R</td>
<td>V</td>
</tr>
<tr>
<td>Light boxcar</td>
<td>563</td>
<td>167</td>
<td>396</td>
<td>525</td>
</tr>
<tr>
<td>Heavy boxcar</td>
<td>80</td>
<td>-</td>
<td>80</td>
<td>-</td>
</tr>
<tr>
<td>Flat car</td>
<td>257</td>
<td>257</td>
<td>-</td>
<td>257</td>
</tr>
<tr>
<td>Wood</td>
<td>215</td>
<td>215</td>
<td>-</td>
<td>215</td>
</tr>
<tr>
<td>Container 1</td>
<td>24</td>
<td>-</td>
<td>24</td>
<td>-</td>
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<tr>
<td>Container 2</td>
<td>99</td>
<td>17</td>
<td>82</td>
<td>99</td>
</tr>
<tr>
<td>Container 3</td>
<td>9</td>
<td>-</td>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td>Tank</td>
<td>74</td>
<td>8</td>
<td>66</td>
<td>74</td>
</tr>
<tr>
<td>Grain hopper</td>
<td>20</td>
<td>-</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Cement hopper</td>
<td>9</td>
<td>-</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Domestic hopper</td>
<td>27</td>
<td>4</td>
<td>23</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td>1,377</td>
<td>692</td>
<td>685</td>
<td>1,250</td>
</tr>
</tbody>
</table>

F= friction  R= roller  V= vacuum  CA= compressed air  
Source: AFE Peñarol Workshops

Apart from the fleet indicated in the above Table, there are 81 special hoppers. The figures differ slightly from those indicated in the 2006 Annual Report, apparently because these data are more recent.

Vacuum brakes, which are used in very few places in the world, are used on 91 percent of cars. More modern cars have compressed air brakes, and the co-existence of the two systems creates serious compatibility problems that make the system more difficult and more expensive to operate. Moreover, the fleet of cars includes cars with AAR and UIC brakes, which creates incompatibility problems at speeds over 20 km/h.

Two types of wheels are used on the cars: monoblock wheels and wheels with tires. The co-existence of two braking systems weakens the tires owing to excess heat and results in flat tires.

Based on the information provided by AFE, various types of brake shoes are used, both cast iron and composite. The use of shoes with different friction coefficients should be studied, as this could provide an explanation for the problem of the braking rates for cars.

In addition, half of the rail cars still have friction bearings, a technology that has been obsolete for some decades. AFE has been gradually replacing these bearings with roller bearings, but more than 600 cars still have friction bearings.

AFE uses European-type screw couplings. This type of coupling has limited capacity, is complicated to use, and is riskier for the workers than the AAR-type automatic couplings. AFE does not have plans to replace these couplings.
As indicated for the locomotives, rail cars are maintained in AFE workshops. The average availability rate for rail cars is 75 percent, which is barely acceptable even considering the age of the fleet.

*Operations and traffic*

The Operations and Traffic areas are not only separated within AFE’s organizational structure, they operate from different locations. Apparently this situation results from the separation of the infrastructure area from the rest of AFE by a previous government, which moved Traffic and Tracks to the MTOP. This separation was reversed as of January 2006.

The Operations area, which is not set up as a Management Office headed by a Manager, is responsible for train scheduling, distribution of the rolling stock, and assignment of rail employees. Although it has experienced employees, its procedures are inadequate—basically handwritten spreadsheets—and, as a result, quite inefficient. In addition, there is little communication with other areas, such as Traffic and Marketing, with which they should be in close interaction.

AFE closed the office responsible for tracking and evaluating the rotation cycles for the rolling stock. This means that, at this time, there is no systematic control over the operation and use of locomotives and cars, or, as a result, of the factors to be taken into account in the rotation cycle: loading and unloading processes, monitoring of travel times, shunting and shifting, and the availability, appropriateness, and capacity of the rolling stock, which are fundamental factors in the operation of the railroad. All of this results in low kilometrage for locomotives and rail cars and lengthy rotation cycles.

The average rotation cycle for AFE rail cars is reported to be 8.8 days. Taking into account the fact that there are cars with quite efficient rotation cycles, such as clinker hoppers, some of these cars must have cycles that exceed 15 days.

The trains are moved using lighted electric signals in the area around Montevideo and using point-to-point telephone communications by radio or telephone in the rest of the network. Traffic control is done manually from an office in Sayago, where traffic control is centralized, currently separated into two zones. As of January 2008, only the functions of the Paso de los Toros controller remained to be transferred for full centralization of traffic control.

*Sale of services*

The volume of AFE freight transport, after falling to a low 823,000 tons in 2002, increased rapidly, reaching its current level of 1.3 million tons in 2005, a return to 2000 levels.
The following Table indicates freight traffic from 2006 to 2008.

<table>
<thead>
<tr>
<th>Product</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>268,455</td>
<td>223,507</td>
<td>269,002</td>
</tr>
<tr>
<td>Barley</td>
<td>88,240</td>
<td>69,300</td>
<td>37,560</td>
</tr>
<tr>
<td>Cement</td>
<td>140,268</td>
<td>121,504</td>
<td>138,133</td>
</tr>
<tr>
<td>Clinker</td>
<td>333,957</td>
<td>387,724</td>
<td>392,042</td>
</tr>
<tr>
<td>Fuel and lubricants</td>
<td>121,368</td>
<td>121,401</td>
<td>127,510</td>
</tr>
<tr>
<td>Containers</td>
<td>44,332</td>
<td>55,852</td>
<td>57,843</td>
</tr>
<tr>
<td>Timber and firewood</td>
<td>81,360</td>
<td>85,611</td>
<td>76,570</td>
</tr>
<tr>
<td>Limestone</td>
<td>313,107</td>
<td>304,392</td>
<td>288,208</td>
</tr>
<tr>
<td>Other</td>
<td>2,228</td>
<td>7,959</td>
<td>3,353</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1,393,315</strong></td>
<td><strong>1,377,250</strong></td>
<td><strong>1,390,221</strong></td>
</tr>
</tbody>
</table>

Source: AFE 2006 Annual Reports and data provided by the Office of the General Manager of AFE

Freight moved by train amounts to approximately 9 percent of total freight transported throughout the country by all modes of transport. Despite the small volume, its participation in the transport market is similar to that of European railroads and higher than that of most of the South American railroads.

AFE freight traffic concentrates on 8 mainly bulk products: rice, barley, cement, clinker, fuel and lubricants, timber and firewood, limestone, and containers. In total, these products make up more than 98 percent of the total tonnage and 99 percent of the ton-km.

In addition to concentrating on a few products, the railroad concentrates on a few origins and destinations (O/D):

1. The destination for rice is Montevideo, coming mainly from Treinta y Tres, Tacuarembó, Vergara, Río Branco, and Salto.
2. Clinker has a single O/D, between Verdúm and Montevideo.
3. Fuel has a single origin, Montevideo, with Durazno, Verdúm and Treinta y Tres as destinations.
4. Barley is shipped between Paysandú and Rivera.
5. Almost all cement is transported between Verdúm and Manga.
6. Limestone has two O/Ds, Verdúm to Montevideo and mostly between Queguay and Paysandú.
7. Finally, almost 90 percent of the little wood that was shipped in 2006 was transported between Rivera and Montevideo.

As shown by the analyses, AFE cannot increase its freight transport volumes owing to a lack of capacity, which means that it constantly has to turn down new customers. This would appear to be confirmed by the stagnation of traffic in the past four years.
Nevertheless, as discussed below, if the rotation cycle could be reduced to 5 days, which is reasonable for transport with an average distance of around 200 km, the transport capacity of the railroad would increase by more than 70 percent. Similarly, the kilometrage of the locomotives is relatively low and would allow for greater transport capacity.

It is interesting to note that there are apparently no transport contracts. There are tariff agreements in some cases, to which is applied a parametric function based on the price of fuel, wages, the CPI, and the value of the US$.

In addition to the freight described above, AFE transported 549,000 passengers, or 13.6 million passenger-kms in the Montevideo area in 2006, for an average distance of 25 km. Passenger traffic is analyzed below.

**Income and expenditure**

Income from freight transport totaled US$8.55 million in 2005 and US$9.87 million in 2006, equivalent to US¢3.25 per ton-km. This traffic used 930,000 and 890,000 train-kms, respectively.

In contrast, income from passenger transport totaled US$280,000 in 2005 and US$452,000 in 2006, equivalent to US¢2.73 per passenger-km, using 177,000 and 323,000 train-kms, respectively. As indicated, in 2006 passengers accounted for 4.4 percent of revenues and 27 percent of train-kms.

It should be noted that income increased substantially in 2005, when tariffs were increased by as much as 50 percent in some cases without an immediate impact on demand.

At the same time, operating expenses—i.e., the expenses involved in operating the railroad, not including investments or depreciation—totaled US$19.88 million in 2005, with the main component being personnel expense (55.8 percent), followed by fuel (19.2 percent). Spare parts and supplies, infrastructure, and traffic, not including personnel costs, represented 15.9 percent of expenses.

The above figures resulted in an operating deficit of US$10.49 million and an operating ratio (operating expenses/operating revenues) of 2.12. If AFE’s financial profits are taken into account, the operating deficit falls to US$8.31 million.

This deficit was apparently reduced in 2006, primarily owing to higher revenues.

**Administration and management**

As indicated on the AFE webpage, AFE’s organizational structure currently consists basically of a Board of Directors, to which a Secretariat and a General Manager report.
The AFE law calls for a three-member Board of Directors, although the Annual Report mentions only the Chairman and Vice-Chairman. As observed, the Chairman of the Board of Directors has executive powers that he exercises at all levels of the AFE’s organization.

The organization chart indicates that the Office of the General Manager supervises six areas: Rolling Stock, Operations, Traffic, Infrastructure, Administration, and Logistics. Area Managers have not been appointed. The organization chart appears to reflect a period of transition, since elsewhere there is mention of Management Offices that apparently existed in a previous organizational structure. Some parts of this organizational structure are no more than nominal, such as Marketing and Planning, which have almost no resources to perform their work.

The rest of the organization of the company seems to be insufficiently structured. There is no fluid communication between areas that should work together closely, such as Marketing, Traffic, and Operations, and for the moment the Office of the General Manager is not able to provide the necessary direction and coordination, which leaves AFE operations up to the initiative and experience of the employees.

The mission observed the lack of communication and involvement of AFE Management Offices (especially Marketing and Planning) in decisions related to investments in infrastructure or rolling stock, which tend to be centralized at the Board of Directors level.

There are other technical deficiencies, such as the lack of a computer system, which requires a modest investment in equipment but an enormous staff training effort, probably with minimal results owing to the traditional railroad culture, which has developed with manual operations. Some efforts have been made, such as, for example, the Office of the Manager of Marketing, where freight origin-destination data are processed (in a DOS operating system) and data are stored in case of problems with customers. However, these appear to be individual efforts, and none of the information is used by other units within the organization.

The following chart shows the organizational structure of AFE.
Chart 1: AFE Organization Chart

Source: AFE Annual Report, 2006
**Personnel**

In general, career personnel are competent and experienced and, with appropriate direction, could provide valuable input into the restructuring of the railroad. However, owing to AFE’s circumstances and the lack of adequate institutional communications, most of the staff is unmotivated and is not committed to the plans being developed.

As indicated by various studies, the staff is aging and there is no replacement generation. When the majority of the experienced staff retires, —and this has occurred in other countries—an important part of the railroad knowledge base will be lost.

On the other hand, it has been shown empirically that for AFE’s current and projected levels of activity, it has excess staff in almost all areas, even though in some areas there is a substantial amount of overtime. The reason for this apparent paradox is staff productivity, since with the current organizational structure and resources the number of staff could be adequate and could -and even insufficient in some areas.

The explicit policy communicated by AFE management is not to reduce staff, but to rely on natural attrition through retirements, which is expected to take 5 to 7 years. In addition to being a very slow process that compromises the company’s operational efficiency, attrition reduces employee morale. Reassignment, which was another mechanism considered is impractical in many cases given the specialization of a significant proportion of the work force.

**Investments**

*Project development*

Based on the information received, there has been no background research to support the decisions taken in recent years, i.e., plans for investment in equipment and infrastructure rehabilitation projects are not supported by technical and economic studies, demand estimates, cost-benefit analyses, economic indicators, or other traditional indicators used to support decision-making processes, and key professionals in the company, such as staff from infrastructure, operations, traffic, and marketing, were not involved. This situation further reflects a company that has not been modernized in some time and has for some decades not built up the capacity to introduce up-to-date technologies.

*Infrastructure investment between 1995 and 2005*

During this period, 188 km of track were renewed, involving the replacement of 40 kg/m track with UIC 50 track welded into 36m lengths, the replacement of 300 ties per kilometer, and the addition of ballast. The investment totaled some US$150,000 per km, for a total of US$28 million.
Of this 188 km, 98 km were on the Montevideo–Rivera line and 54 km were on the Montevideo–Río Branco line.

The apparent result is that the first segment of the Montevideo–Rivera line (as far as Chamberlain, km 289) remained in reasonable condition, bearing maximum speeds of between 40 and 60 km/h. Between Chamberlain and Rivera (km 563), the line was not rehabilitated and cannot bear speeds of more than 25 km/h.

**Investments in rolling stock**

In 2006, 80 boxcars purchased in Italy at little more than scrap iron prices entered into service. These cars, which were very old, had been removed from service by the Italian railroads.

Despite their low price, the appropriateness of their purchase is debatable, since they are wooden cars, with a relatively high tare-to-load ratio (0.51), and are a closed boxcar model that is used less and less on railroads around the world.

Similarly, some Czech container cars were purchased, measuring 18 m in length, with a capacity to hold three 20-feet containers or one 40-foot container plus one 20-foot container. As the global trend is toward 40-foot containers, these cars will probably end up transporting only one container, thus wasting capacity and unnecessarily increasing the mobilized tare weight.

These purchases suggest that they were taken without consideration for operational efficiency and market trends, thus jeopardizing the ability of AFE to make its operations profitable.

**Proposed infrastructure rehabilitation**

CFU and AFE prepared a track rehabilitation plan, separating the lines into four 240-km sectors, with a total investment of US$150 million.

A call for bids was issued in August 2006 to rehabilitate three of these sectors, but the contracts have not yet been awarded. Apparently the rehabilitation projects were put forward based on minimum standards and not based on current and potential traffic density, since there are no thorough economic or technical feasibility studies to justify the investments.

At the time of writing of this report (August 2009), a contract had been signed between CFU and AFE under which AFE would take responsibility for the rehabilitation of some 400 km of track on the trunk line between Montevideo and Rivera using its own workers.

The Government of Uruguay considers the investment in the rehabilitation of track to be essential to keeping the railroad in operation. Although this decision was taken before this project was started, at the very least an estimate of potential demand by sector is
considered necessary to prioritize investments and, possibly, specify the technology and type of rehabilitation that each sector will receive, always with a view to overall optimization of rail operations.

In addition, the technical conditions for the rehabilitation must be standardized, especially in terms of the materials that the contractors will provide. The CFU specifications establish that the contractor will provide new 40 or 45 kg/m rails without indicating whether they will be UIC profile, AREA profile, or another standard, the only requirement specified being the moment of inertia for the section. This could result in the purchase of lower quality rails, in little used sections, with inadequate toughness, etc., exacerbating the current problem of various kinds of rails on the AFE network and losing an opportunity to standardize infrastructure that will not present itself again for many decades.

Similarly, the supply of rail equipment (deflection units) is not sufficiently specific. The tangent of the deflection unit, type of junction, rail section, length of the switch rail, etc., should be indicated.

The contracts consider having AFE supply the R50 rails that it is keeping. Although these rails do not correspond to the more common standards in rail technology (AREA and UIC), it is recommended that similar sections be used in the rest of the sector, given the quantity of these sections already in use. The problem of the technical standardization is dealt with in more detail below.

*Proposed equipment investments*

AFE had begun a process of incorporating private capital into the rail operations through the creation of the Railway Freight Trading Company (CCF), initially identifying the need for an investment of approximately US$50 million in rolling stock—locomotives and rail cars. The aim of these investments was to renew obsolete equipment and increase freight capacity to meet the anticipated higher demand, mainly from the forestry sector.

However, as indicated below, the conditions proposed for the incorporation of private capital did not produce any investor interest and, as of the date of writing of this report, (August 2009) this process had come to a complete standstill.

Subsequently, as part of an AFE modernization project proposed to the government, the direct purchase of new locomotives and rail cars was considered. There were no prior technical and economic feasibility studies for this project. Such studies are essential before any decision can be made in this regard.
Transportation market projections

Current rail transport

The analysis provided below is based on O/D data provided by AFE for 2006. The total figures for 2007 are similar. The following table shows traffic in tons and ton-kms, by product.

<table>
<thead>
<tr>
<th>Product</th>
<th>Tons</th>
<th>Ton-kms</th>
<th>AD (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>268,455</td>
<td>108,490,000</td>
<td>404</td>
</tr>
<tr>
<td>Barley</td>
<td>88,240</td>
<td>32,610,000</td>
<td>370</td>
</tr>
<tr>
<td>Cement</td>
<td>140,268</td>
<td>19,063,000</td>
<td>136</td>
</tr>
<tr>
<td>Clinker</td>
<td>333,957</td>
<td>39,073,000</td>
<td>117</td>
</tr>
<tr>
<td>Fuel</td>
<td>121,368</td>
<td>29,947,000</td>
<td>247</td>
</tr>
<tr>
<td>Containers</td>
<td>44,332</td>
<td>19,024,000</td>
<td>429</td>
</tr>
<tr>
<td>Timber and firewood</td>
<td>81,360</td>
<td>42,244,000</td>
<td>519</td>
</tr>
<tr>
<td>Limestone</td>
<td>313,107</td>
<td>13,160,000</td>
<td>42</td>
</tr>
<tr>
<td>Minor traffic</td>
<td>2,228</td>
<td>113,000</td>
<td>51</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,393,315</strong></td>
<td><strong>303,723,000</strong></td>
<td><strong>218</strong></td>
</tr>
</tbody>
</table>

Source: AFE 2006 Annual Report

The chart on the next page shows a diagram of freight density on the rail network currently in operation, based on O/D flows in 2006. As can be seen, the segments carrying the most freight are located close to Montevideo and achieve rates of less than 900,000 tons per year (Estación Central–Sayago, Manga–Toledo, Toledo–Verdúm, and Sayago–Manga). The segment farthest from Montevideo with the highest traffic is between Queguay and Paysandú, with 306,000 tons per year. These figures are indicative of the low volumes of freight that the rail system currently moves.

Forest products freight

The market studies carried out emphasize the potential for forest products traffic. Specifically, the “Study of the Demand for Transportation of Forest Products” calculates the distribution between road and rail transport based on a Logit-type model.

Based on this study, the railroad could take a significant portion of the transportation market for forest products at a tariff of US¢3/ton-km, compared with the truck tariff of US¢5/ton-km.
Although the modeling done takes account only of the tariff effect, it gives an idea of the potential market.

With a view to evaluating a possible scenario, the next chart shows the maximum freight that the railroad could carry, based on current volumes (2006 figures) plus the forest products freight that is projected to be carried by rail by 2011, which is one of the years with the highest projections.

The segment carrying the most freight is in the sector between Tacuarembó and Piedra Sola, which would reach 2,421,000 tons per year. In this sector, the forest products
freight going to Montevideo and that going to Fray Bentos are totaled. Next is the sector between Sayago and Estación Central with close to 2,000,000 tons per year. Other segments between Piedra Sola and Sayago and between Tres Árboles and Fray Bentos carry between 1,100,000 tons and 1,300,000 tons per year respectively.

It should be mentioned that the demand estimates for rail transport of forest products freight are based on the following assumptions:

1. It is deemed feasible to transport by rail only the forest products freight that has easy access to the railroad, which results in a reduced number of origins/destinations.
2. The distribution by mode of transport of freight that could be transported by rail is estimated on the basis of a discrete choice model (multinomial logit), in which the utility function selected is based solely on relative prices between pairs of origins and destinations for the railroad (considering combined transport) and road. The cost and tariff assumptions make the railroad cheaper than trucks, meaning that the distribution by mode of transport is highly favorable to the railroad.

However, the resulting estimates of rail forest products freight give rise to some doubts:

1. Experience shows that the price or tariff for freight is not the only factor considered by the shipper in selecting the mode of transport. The cost for the company includes other factors not covered by the tariff, and there are also business strategies that can be decisive in selecting the mode of transport or the distribution between the two modes of transport.
2. The rail tariff is not estimated on the basis of a reliable cost model, in the way that the road tariff is, which means that there can be a substantial margin of error. Transport markets, particularly for road and rail transport, are competitive markets, which is to say that they respond to changes in competition with technological and tariff changes.
3. The economic and financial estimates prepared bearing in mind the possible capture of forest transport are based on unworkable assumptions, or at least assumptions that are very difficult to achieve, such as the railroad taking 100 percent of the forest products freight, or the average transport distance increasing to 500 km.

There is a clear demand risk in the analysis prepared that must be explained to consider anticipated future investments by both the public sector and private sectors.

If it were possible for the railroad to capture this demand, which represents a significant increase over current freight volumes, it would require major changes in the rail system, not only in terms of investment in infrastructure but also in terms of organization.

These volumes involve tripling the freight currently carried by the railroad and bringing the Montevideo–Rivera and Piedra Sola–Fray Bentos corridors to traffic densities compatible with a self-sufficient rail operation.
However, considering current conditions at AFE, the consultants do not consider the organization of an efficient operation in the sector to be very feasible, even in the scenario in which the entire track network would be rehabilitated and sufficient rolling stock would be available. International experience has repeatedly shown that, by their very organization, government enterprises have not been able to generate appropriate and sufficient incentives to organize and operate efficiently. One likely scenario is that the Government of Uruguay would invest substantial sums in AFE without being able to provide the service required by the forestry companies and without achieving the objective of minimizing the negative impact on road transportation.
In any event, before undertaking any sizable investment in infrastructure and equipment, it is necessary to ensure the transport of forest products freight under specific tariff and level of service conditions by means of direct contracts with shippers.

**Projection of operating income in a scenario in which forest products traffic is captured**

Annex 1 presents an estimate of AFE’s operating income (reasonably applicable to a private company as well) in a scenario in which the volumes of freight transported increase as a result of the capture of a significant proportion of forest products freight, based on estimates made in the DPR (World Bank 2007).

The adjustment in the operating expenses in light of these increases in transport volumes is based on the same DPR (World Bank 2007), with the addition of simplified criteria and based on the consultants’ experience in simulating the behavior of an efficient company. The conclusions reached are:

1. This exercise—in which the rail freight tariff is that used in the DPR, i.e., US$0.03/ton-km—shows that significant operating losses result, and therefore there is no option of covering the necessary investment costs for this transport. Testing the sensitivity of these results to an increase in the cost of transport to US$0.04/ton-km and improving the operating efficiency of the trains results in an operating profit, but still no capacity to finance investments. Finally, an estimate was made of the results in a scenario in which the forest products freight operation is not used to pay for maintenance of tracks not used for such traffic. Even if the freight tariff is maintained at US$0.03/ton-km, an operating profit results and it is feasible to cover a significant proportion of the investment (close to 40 percent).

2. It is estimated that this transport will require track investments amounting to at least US$88 million (DPR figures), as well as investment in locomotives and rail cars.

3. A conservative estimate, which considers an improvement in the efficiency of the use of the existing GE 2000 locomotives, puts the necessary fleet at 30 line locomotives (20 additional) and 1,000 flat cars (600 additional) based on a rotation cycle of approximately 5 days. These investments total some US$64 million.

4. In the Modernization Plan for the Railroad (see Chapter [7]), a program to modernize AFE is proposed (Program 3). Its objective is to fully modernize AFE, not only from a technical point of view but also from an organizational, management, and investment project analysis capacity standpoint, with a view to improving its efficiency, its management capacity, and its technical and economic results. This program would need to be implemented if AFE is to operate freight services at a level of efficiency that is consistent with the cost estimates.
5. A very preliminary analysis shows that these internal adjustments, including the studies needed for their implementation, could require an estimated investment of around US$14 million.

6. It is concluded from the preliminary analysis of operating profitability and the investments in infrastructure, rolling stock, and modernization of the company needed to cover an increase in forest products transport that it is essential that more in-depth private and social assessments of these projects be completed. Based on their results, the strategies to be followed and the roles of the private sector and the State should be defined, using a business model that the government ultimately agrees to adopt for the rehabilitation of the railroad.

PROPOSED PRIVATE SECTOR INVOLVEMENT

Overview

In an unsuccessful effort to involve the private sector in rail transport, the previous government had separated infrastructure and traffic from AFE, transferring it to the MTOP along with the employees concerned. Subsequently, in 2006, the government decided to centralize the organization once again, returning infrastructure and traffic management to AFE, which would appear to indicate an intention to maintain the company as an operational unit. Since 2006, AFE has been seeking ways of rehabilitating its infrastructure, renewing the rolling stock, and modernizing and increasing the efficiency of operations and planning, without altering the current structure of the company.

Infrastructure rehabilitation and maintenance

Bidding process

For purposes of rehabilitating the infrastructure, the AFE network has been divided into six segments. The first segment consists of track considered nonoperational, which will be lifted or maintained in reserve. The second segment, consisting of some 600 km of track and covering the eastern portion of the network, will be repaired and directly maintained by AFE. In the four remaining segments, measuring approximately 240 km of track each, a bidding process was initiated for their rehabilitation and possible maintenance by contractors for a period to be defined later in the process.

To be able to transfer the investment funds and complete this bidding process, the Rail Corporation of Uruguay (CFU) was created. It is a wholly government-owned company, although governed under private law. The bidding process begun in 2006 covered the awarding of contracts for the first three segments:

(i) Pintado–Piedra Sola, 239 km
(ii) Tres Árboles–Rivera, 242 km
(iii) Chamberlain–Ombucitos, 237 km
The estimated amount of the investment in these three segments was approximately US$150 million.

For these segments, the standard requirement was that all of them have an axle load capacity of 18 t/axle at velocities of around 40 km/h minimum. The contracts had five-year terms, during which the first two years covered the works and the following three corresponded to the warranty period and included maintenance. During the process, the possibility of extending the maintenance period to be covered by the private contractor to a fifth year would be added.

Under the bidding conditions, from the government’s point of view, the financing of the works would be as follows:

1. An initial contribution by the Ministry of Economy and Finance of Uruguay.
2. A periodic contribution by AFE in the form of a partial transfer of the budget appropriations made annually by the Ministry of Economy and Finance of Uruguay to the rail system.
3. A monthly payment by AFE in the form of the partial transfer of funds from track usage rights, intended to supplement the funds needs to repay the investment made.
4. A monthly payment by AFE to cover the infrastructure maintenance under its responsibility.

The work would be paid for directly by CFU to the contractor, via monthly payment vouchers.

The bidding process encountered difficulties owing to a lack of clarity in the terms of reference, apparently causing the bidders to incorporate their perception of the risks involved in their prices, which thus significantly exceeded the initial estimates. In the end this brought the process to a standstill.

Predictably, it was then proposed that AFE undertake the rehabilitation work using its own workers, a solution that would enable it to perform the works within the established time frame and costs, and at a level of quality comparable to that of the contractors. The discussions lasted almost a year and resulted in the previously mentioned contract between AFE and CFU.

*Involvement of private operators in track rehabilitation*

Contracting out the rehabilitation and maintenance of the tracks to third parties does not, strictly speaking, constitute the involvement of private operators in management of the railroad, but rather is simply a process of outsourcing services that railroads in the region began more than 30 years ago.

The complete self-sufficiency of railroads was normal in the era of the so-called monolithic companies. One of the first services that companies outsourced was in fact
track maintenance. Subsequently major repairs to locomotives and rail cars were also outsourced, as were construction and maintenance of electrical systems (electrification, signaling, and communications). Track maintenance and rehabilitation contractors are in reality a kind of supplier of goods and services and their use only indirectly and tangentially constitutes a process of involvement of private operators in the management of the railroad.

It should be remembered that, even if taken to its fullest extent, this initiative does not imply total outsourcing of track rehabilitation and maintenance, since AFE will maintain some 600 km of track under its direct management, constituting almost half of the network currently in service.

In any event, using contractors to perform rehabilitation and maintenance work was to be an important step in the process of streamlining AFE management. The company does not currently have the technical capacity, personnel, or equipment to take on a track rehabilitation plan that covers works of a scope many times greater than the works that it has been undertaking in recent years.

However, CFU, the corporation by means of which the project will be implemented, is an organizational structure with interesting prospects. By channeling government contributions to the transportation infrastructure to an entity separate from AFE, the groundwork is being laid for a model similar to that used by European governments: RFF in France, Banverket in Sweden, ADIF in Spain, Network Rail in the U.K., and other similar entities.

**Rolling stock**

Given that the rolling stock must also be updated to allow for an efficient operation and a substantial increase in freight capacity, AFE has been pursuing an unconventional approach to private sector participation. Under this proposed approach, a process of creating a separate company—the Railway Freight Trading Company (CCF), which would be bid out as a majority privately controlled company—was initiated. This company, in which AFE would have a minority holding, would provide additional rolling stock—rail cars and locomotives—which would be operated by AFE, and it would make various kinds of payments to AFE: a levy for exclusive trading rights, a tariff for use of the infrastructure, a tariff for efficient operation of the trains, and a tariff for efficient equipment maintenance. Its revenues would come from the collection of a market-based tariff from shippers. Investments in rolling stock, which would be necessary for the anticipated increases in freight, were estimated initially at approximately US$50 million.

As of the date of writing of this report (August 2009), this process had been suspended. However, its presentation is interesting as it illustrates the complexity this process has involved, probably owing to the restricted access with which private participation in AFE was visualized at that time.
The Prequalification Conditions for the participation of interested private sector parties in this company establish several criteria for awarding the contract:

1. Highest percentage of CCF shares offered to AFE.
2. Highest additional percentage offered over and above the Efficiency Payment to be paid by CCF to AFE.
3. Largest capitalization value offered by the bidder with a minimum of US$40 million.
4. Shortest lifespan for CCF.

The definitive Contract Award Criteria would be defined at the close of the Data Room and would be duly detailed in the corresponding Bidding Conditions.

Finally, it was noted that AFE will not alter its structure, that is, it will remain a government corporation responsible for the operation and administration of the infrastructure, tracks, stations, control center, etc., and will define operating and planning processes and procedures that will enable it to become an efficient company with management capacity that will use cutting-edge technology. For labor policy reasons, the personnel will not be reduced; rather the current process of attrition will be maintained and is expected to be completed in 5-7 years, owing to the seniority of the staff.

The contract award criteria set out in the Prequalification Conditions and conversations held with AFE directors in 2008, as well as unofficial statements in 2009, clearly show that the company's intention is to use this private investment primarily as a way of financing its rolling stock in order to increase its transportation capacity. AFE would like to have the largest possible stake in the Marketing Company, to maximize its investment, and in the contract award mechanisms to reward the bid that minimizes the lifespan of the company. These criteria do not appear to point to permanent private participation in activities.

However, the CCF Bidding Conditions contain ambiguities that could result in a failed attempt at private participation, or private participation under terms that will end up making AFE’s already precarious financial position even worse. For example, CCF is required to plan, coordinate, and control train movement operations, as well as train and infrastructure maintenance, all of which will remain under AFE's management. In addition, CCF is required to purchase and control fuel consumption, as well as spare parts, without having train operation under its responsibility. It will also maintain the workshops, without having responsibility for the maintenance work.

As for the payments by CCF to AFE for the exclusive right to market freight, the conditions state that CCF will pay "efficiency values" for the movement of freight and for train maintenance. It will also pay an amount for "use of the freight infrastructure." Given that these documents also guarantee a reasonable level of return on the required private investment, it is highly probable that revenues will not cover CCF’s expenditures, let alone allow it to be profitable, with some risk that the system will need to be subsidized by the government. It is therefore highly recommendable that prior technical
and financial feasibility studies be prepared for this or any other business model that invites private sector participation.

An initial impression of this business model, which is seeking to attract private investment and management capacity, is its extreme complexity, particularly in the management of risks and incentives. Moreover, it includes no explicit dispute resolution mechanisms to protect the interests of the investors.

It should be noted that the legal framework and the provisions set out in Decree 458 of the MTOP (February 2008) are considerably broader as regards the options for private participation in AFE than are reflected in the bidding conditions. In both cases, the creation of a majority privately owned company is mentioned, the purpose of which is to develop and operate rail transportation throughout the territory of the Eastern Republic of Uruguay, without restrictions as to its scope.

The subject of private participation in the management of the railroad is discussed further below.

**SUMMARY OF THE ASSESSMENT**

**Institutional structure**

① AFE is a monolithic company that corresponds to a model now little used in railroads around the world.
② It is governed by a three-member board of directors, which does not adequately represent the diversity of interests of its owner.
③ Currently there is no private participation in its operation.
④ For the moment, CFU’s sole role is to channel government investments in railway infrastructure; despite the fact the legislation creating it is sufficiently flexible to allow it a greater role.

**Rail infrastructure**

① Approximately half of AFE’s track infrastructure is abandoned.
② The infrastructure does not meet standards sufficient for current stresses on rail equipment and structures (rails and bridges).
③ The state of the infrastructure is critical; freight loads and velocities are restricted and the derailment rate is between 50 and 100 times that of modern railroads.
④ The infrastructure uses a wide range of materials, which is incompatible with efficient technological development.
⑤ Maintenance is provided using own resources, with uneven results.
⑥ Attempts to involve private companies in the rehabilitation and maintenance of tracks have been unsuccessful.
⑦ No economic (social) evaluations are prepared for infrastructure investment projects to define and prioritize the projects offering the greatest return.
Rolling stock

3 The locomotives, with the exception of the GE 2000 models, are old and inadequate; they are used inefficiently (low kilometrage) and their availability rates are very low.
3 Freight cars are old and use obsolete technology, in addition to having high tare-to-load ratios.
3 Recently purchased rail cars are inefficient and inadequate.

Transport volume

3 The current volume of freight transport (stable over the past four years) stands at approximately 1.4 million annual metric tons at an average density of 180,000 ton-kms/km, which is well below minimum private or social cost effectiveness levels (estimated at over 1 million ton-kms/km, approximately).
3 Transport concentrates on 8 products, which represent 99 percent of tonnage.
3 With the exception of forest products, there are no signs of a significant increase in freight.
3 There are high expectations regarding the growth of demand for transportation of forest products. Based on a study by Pike & Co., a forestry consultant, the demand for rail transport of forest products could total some 4 million annual metric tons.
3 There are doubts about the figures provided by this study, which allocates almost all freight to the railroad in its most direct area of influence, given its lower tariffs, without considering basic factors for decision-making regarding modes of transport, such as quality, reliability, and timeliness of service. Moreover, the railroad tariffs have been estimated without using a reliable cost model.

Operations

3 The operational organization is inadequate, in that it physically and operationally separates activities that should be closely related (marketing-operations-traffic).
3 The scheduling and control of operations are poor and are performed using inadequate resources or simply not performed at all, such as control of the rotation cycles.
3 The rotation cycle for rail cars is very high. The average for the entire fleet is 10 days; if high-yield operations (limestone, clinker, cement), which mainly use private equipment, are not taken into consideration, the average for the rest of the fleet is around 22 days.
3 The current train movement system requires personnel in all stations. This results in substantial overstaffing and, consequently, higher operating costs.

Management

AFE as a company, and the rail system it owns, are in a state of technical deterioration resulting from many years of outdated management and administration practices, making it extremely difficult to imagine that it will be feasible to bring about a change while the same management model remains in place:
Until now, there have been no commercial, economic, or operational targets, nor has there been a management plan. No data are available on operating costs. There is inadequate communication between areas (silo culture). Technical standards are very general (ALAF) and there is no technical or safety standardization plan for the railroad. Resources for management are inadequate and insufficient. A costly suburban passenger service is maintained and expanded without adequate compensation by the government. There is a planning unit and a marketing office that do not participate in the generation and evaluation of projects, and are not involved in the investment decision-making processes.

Personnel

AFE has too many employees, whether its staffing levels are measured in relation to the size of the network, the volume of transport, or any other objective parameter. The indicators of staff productivity are very low, and rank among the lowest of all comparable railroads in South America. The influence of Unions over strategic and administrative decision-making goes in some situations beyond the limits of their natural mandate of protecting labor rights. AFE’s policy for resizing its staffing levels has been entirely based on attrition through retirements. In addition to being a very slow process that compromises the company’s operational efficiency, attrition reduces employee morale. In general, employees are not motivated and feel completely left out of the senior management decision-making process. This is especially critical for the professional and technical staff.

Financial performance

AFE’s operating losses total approximately US$10 million annually, with a working ratio (costs/revenues) of 2.2. Personnel expenditure amounts to roughly 60 percent of total operating expenditure, which confirms the overstaffing levels. Revenues are not even sufficient to cover personnel costs. The average freight revenues are US¢3.25 per ton-km, which is insufficient to cover direct costs at present traffic levels. There is no costing model, which means it is not possible to prepare a reliable projection of financial performance. There are no private or social cost-effectiveness studies that could serve as the basis for a justifiable financial contribution by the government, which until now has been limited to covering the deficit each year.
**Private sector participation**

③ So far, the model for private participation in the railway sector has not been clear, as evidenced by some failed attempts to attract private investors described in the following paragraphs. New and more effective arrangements could be made on the basis of Uruguay’s Concession Law, which provides an adequate framework to promote a reasonable scheme for private investment in railroads.

③ In 2005, the Railway Corporation of Uruguay (CFU) was created as a public company under private law. CFU’s mandate is to channel investments in the railway sector.

③ A tender for track rehabilitation launched by CFU in 2007 failed as the specifications and TOR in the call for bids contained a number of ambiguities that resulted in higher than expected bid prices. In 2009 CFU re-designed the call for bids and rehabilitation works are currently underway; with AFE as the contractor in charge of the works in a section of the network to be rehabilitated.

③ In 2005, the legal basis for the creation of Railway Freight Trading Company (CCF) was established. CCF was intended to be a private company in charge of selling freight services to cargo owners. The model for private sector participation as envisaged with the creation of CCF did not succeed, mostly because train operations—as well as areas that are essential to ensure adequate levels of service—were kept under AFE’s control. In this model, AFE’s structure was not intended to change, perpetuating its current problems. Attempts to implement CCF came to a halt by the end of 2007.

③ It is essential that an economic feasibility study be conducted for the AFE-CCF-CFU model to determine the amounts by which the government would need to subsidize the system.

③ The reform process and eventual participation of the private sector have until now been primarily handled by AFE, while international experience shows that successful reforms are generated and implemented by higher levels of government.

③ A model for private sector investment in freight transport will only be successful if the private operator has complete control the railway operation that underpins the freight service it provides.

**Conclusion**

As can be inferred from the above paragraphs, AFE’s current situation is very delicate and the potential solution must go beyond a simple internal restructuring of the company. Only with a profound change in the legal, regulatory, and institutional framework of the rail sector in Uruguay is there any prospect for improvement.

The first priority for confronting the challenges of the rail sector in Uruguay should be focused on the development of public policies that show that the State is able to take on its multiple roles with respect to the railroad: policy designer, regulator, owner, and customer. The design of an impartial government policy for the transportation sector
(road and rail) and the establishment of a favorable environment for the participation of the private sector could be the basis for the potential revitalization of the system.
international experience

OVERVIEW

It is important to bear in mind that the critical state of AFE and the need for Uruguay to improve its railroads is not unprecedented, since most countries have had similar problems in past decades and few have as yet completed their change processes. Uruguay is only unusual in that the reform process has been so much delayed and has been unsuccessful to date. Clearly, AFE does not provide the services that Uruguay needs and so far the proposed solutions to the problem have not been effective; a broader range of options than has been provided until now is needed. The aim of this section is to review the international experience, which could be relevant to Uruguay’s needs.

THE RAIL INDUSTRY CRISIS

Structural causes of the crisis

Over the past 60 years the role of the railroad has changed significantly. From being a monopoly mode of transport for all things, the railroad has, due to the development and extraordinary increase in the efficiency of road transport, become a means of transport specializing in moving large volumes, regardless of distance. The key factor in the viability of modern rail systems is transport volume. This is true both for passenger transport and freight.

The inability of monolithic government enterprises to adapt to this new reality has been the main cause of the problems of the railroad.

In practice, only a few railroads survive with small transport volumes. They survive thanks either to a lack of competition, which enables them to charge higher tariffs, or to government subsidies, or a combination of both.

In a process that began in the 1950s and continued through the 1990s, all railroads across the globe suffered ever stronger competition from trucks for the transport of freight and from buses, cars, and airplanes for passenger transport. The strength of this competition was intensified by the fact that most trucking and airline companies were private, as are most automobiles and intercity bus companies, and because taxes and tolls on road transportation frequently do not represent the total cost of the use of highways. The end result was that railroad companies, which were too large and were controlled politically, could not compete with their privately owned and managed rivals. By 1990, many of the world’s railroads were in a serious state of decline.

The developing crisis

Almost all countries around the world experienced a railroad crisis in the last two or three decades of the 20th century.
Prior to World War II, there were a large number of private railroads, in some cases coexisting with government-owned railroads. In the first stage of the adjustment, the response of governments was, with few exceptions, to nationalize the railroads, giving rise to most of the national railroads across the globe.

Initially, the financial viability of the railroads was maintained with government subsidies. When the increase in the volume and cost of transport required ever larger government subsidies, to the point where the subsidies in some cases became one of the largest items in government budgets, governments began to attempt the first reforms.

Government enterprises initially attributed their deficits to the age and obsolescence of their equipment and facilities and in the early 1960s convinced governments to make major investments in modernizing the railroads. When it appeared that the anticipated financial returns were not achieved, despite the investments made, the reverse reaction resulted and governments began to require railroad companies to be profitable or at least to break even in private terms. This gave rise to a series of reforms in the 1970s, which resulted in staff reductions, a freeze on investments, outsourcing of some activities, the closing of less profitable sectors and lines of business and, in general, a decline in rail activity.

Although these reforms resulted in some retrenchment in the rail companies, they did not have the desired results. The companies continued posting operating deficits, although on a smaller scale, and the railroads gradually lost relevance on the transportation market. Governments began to see the national companies as an unnecessary burden, since the transportation market was adequately served by alternative privately owned modes of transport.

Years of misguided regulation and mandatory cross subsidies of freight and passenger transport had practically bankrupted the North American rail system prior to 1970. In 1991, the European Commission decided that the community railroads were in danger of being reduced to a costly irrelevance and began a restructuring program. In 1992, the Government of Argentina (followed by Chile, Brazil, and Mexico) concluded that its railroad system would collapse and disappear entirely without reform. In 1993, the Government of the United Kingdom decided that the former British Rail had served its purpose and would be unable to meet the needs of the British economy, especially the growing need for passenger services. None of these problems had occurred through any fault on the part of the rail professionals; rather, the fault lay with government financial programs and policies, combined with a railroad structure that was no longer appropriate to meet the transportation challenges.

** Reform of the rail sector

** Structural reforms
The situation described above gave rise to the massive reforms of the 1980s and 1990s, which included various forms of private participation in freight services, the elimination of less profitable passenger services, and the justification of subsidies for reasons of social welfare.

Two kinds of reforms were implemented: changes in the structure of the railroads and changes in the ownership of the various assets of the railroads.

Reform criteria

The structural changes initially involved dividing the monolithic structure into systems in which the main operator remained merged with the infrastructure, while one or more of the remaining services was provided by external operators that paid for use of the infrastructure and other facilities. The second stage of the structural changes involved separating the infrastructure from all operators, so that all operators paid for access to the infrastructure. The separation could be an accounting separation, or could consist of completely separate institutions for each type of service. The new operators might have exclusive use of the facilities, or the infrastructure might be opened without restriction to any company that wished to provide rail services (open access).

The changes in ownership could involve concessions or franchises, in which ownership of the assets is kept in the hands of the government but is handed over to a private entity, or genuine privatization, in which the assets are sold outright to a new owner. The new entity might be a Public Private Partnership (PPP) or entirely private. Almost by definition, concessions or franchises imply some degree of exclusivity in the use of the assets, while privatization may or may not limit the entry of third parties to the system.

Concessions and franchises are considered competition by the market, in that the system delivered under the concession or franchise is subject to competitive bidding, while privatizations tend to result in competition in the market, with access for various operators to the system. In most cases, the results have been mixed, depending on the country’s transportation needs and the attitudes toward competition and the role of the private sector.

The final selection of one approach or another has depended on a series of factors:

- **Efficiency of the railroad and its competitors.** If the railroad was inefficient, and especially if its competitors were efficient and private, the monolithic government enterprise has needed more drastic changes, usually involving the use of private operators in the freight sector and some arrangement of clearly separate operators in the passenger sector.
- **Market objectives.** Where a clear definition and focus on specific markets has been required, some organizational separation has been necessary. This is especially relevant when the railroad offers a wide range of different services, such as intercity passenger and freight services and various suburban and regional services.
• **Various kinds of services.** The improvement in freight services has involved the private sector, basically because of the competition from trucks and barges, which were already private, and the fact that slow and amorphous public entities could not compete effectively. Where socially important passenger services existed and especially where state subsidies were required, although many countries still opted for state management of these services, a clear separation of costs was necessary.

• **Size.** Size and complexity are related: the smaller the railroad the simpler the solution should be. Only large railroad systems can justify the additional cost of institutional separation, with access fees for the various agencies.

• **Separation of roles.** When rail services must be dealt with separately, such as when the necessary subsidy needs to be itemized and justified, this has usually resulted in management by type of service (or line of business). In many cases, institutional separation of services requiring subsidies has been chosen because governments did not entirely trust the cost accounting of the railroads.

*Structural reforms*

Structural reforms of government railroads have essentially taken three forms:

1. Maintenance of the monolithic railroad, in which the infrastructure and all operations were integrated under the same control. This was the point of departure for most of the national railroads, although today it exists on a large scale (in the form of a national railroad) in very few countries. However, this structure is maintained with some important variations among the entirely private railroads.

2. A mix of integration and concession holders, in which the dominant user remains integrated with the infrastructure, but the remaining services are provided by concession holders that operate on this infrastructure and pay access fees. Amtrak in the United States and VIA Rail in Canada are examples of this arrangement. In both cases, passenger services that are publicly owned and financed operate (paying a toll) on the tracks of private freight railroads, integrated vertically.

3. Various kinds of open access or vertically separated structures in which the infrastructure is organized and operated independently, with all operators having equal (neutral) access via payment of an access fee. This is the model in the European Union as well as in a number of other countries, such as Russia, that have been influenced by the European Union model. It is important to emphasize that the main objective of the EU was to create competition on the same tracks, to break down the "national strongholds" of the existing government enterprises, and to clarify and limit the use of fiscal resources.

*Ownership reforms*

In parallel to the structural reforms, there have been a series of changes in ownership. In some cases this has involved direct privatization. For example, the Government of Canada sold its shares in Canadian National Railroad (CN), and the Government of Japan sold its shares in three of the largest passenger railroads. The British Government privatized the rail infrastructure (Railtrack), privatized the rolling stock (ROSCOs),
privatized the freight operator (ESW), and offered the operation of all passenger services to the private sector under concessions. A minor rail privatization occurred in Chile with the sale of the metric gauge railroad Ferronor, and in Estonia with the sale of a majority of the shares in Estonian Railroads (although it was subsequently renationalized for political reasons). In other cases, the private sector has been given a role in operating various services, both passenger and freight, in the form of concessions or franchises. As in the example of the United Kingdom, many countries ended up with various mixes of privatization, concessions and franchises, with government ownership and operation. Moreover, even the role of the State has changed, and planning and operational controls (and part of financing) have been transferred from central control to regional state or even local control.

The diagram below illustrates the existing options for the structure and ownership of the railroads. Clearly, there is no single useful criterion (there is at least one example in each cell) and the appropriate solution has always been adapted to local conditions. In the end, it must be said that the only option that has always ended in failure has been inaction.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Infrastructure Ownership</th>
<th>Passengers Ownership</th>
<th>Freight Ownership</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated (monolithic)</td>
<td>Government ownership</td>
<td>Government ownership</td>
<td>Government ownership</td>
<td>Almost entirely abandoned as a model</td>
</tr>
<tr>
<td></td>
<td>Government operation</td>
<td>Government operation</td>
<td>Government operation</td>
<td></td>
</tr>
<tr>
<td>Freight operators</td>
<td>Government ownership</td>
<td>Government ownership</td>
<td>Private ownership</td>
<td>European Union model</td>
</tr>
<tr>
<td></td>
<td>Government operation</td>
<td>Government operation</td>
<td>Private operation</td>
<td></td>
</tr>
<tr>
<td>Regionial freight concessions</td>
<td>Government ownership</td>
<td>Government ownership</td>
<td>Private ownership</td>
<td>Infrastructure operated by the dominant operator</td>
</tr>
<tr>
<td></td>
<td>Private ownership</td>
<td>Government operation</td>
<td>Private operation</td>
<td></td>
</tr>
<tr>
<td>Passenger and freight concessions</td>
<td>Government ownership</td>
<td>Private ownership</td>
<td>Private ownership</td>
<td>U.K. model Passenger franchises</td>
</tr>
<tr>
<td></td>
<td>Private operation</td>
<td>Government ownership</td>
<td>Private ownership</td>
<td></td>
</tr>
<tr>
<td>Vertical integration</td>
<td>Private ownership</td>
<td>Government ownership</td>
<td>Private ownership</td>
<td>U.S. and Canadian model</td>
</tr>
<tr>
<td></td>
<td>Private operation</td>
<td>Government operation</td>
<td>Private ownership</td>
<td></td>
</tr>
</tbody>
</table>

Source: Own elaboration

In practice, various approaches have been adopted depending on the needs of the country and the political environment. The above matrix shows the various structure and ownership options. Some specific examples explain this matrix.

- **Argentina, Brazil, Mexico, Bolivia, and Peru.** In these cases, the most important assets have been kept under public ownership, but have been given to private operators under concessions, for both freight and passenger services. These processes have mainly taken the form of competition *by* the market, although Mexico has attempted competitive access to the tracks without much success, and freight
operators in Argentina use passenger tracks and vice versa, both paying a toll. In all cases, the size of the concessions is not sufficient to justify complex situations, such as competition in the market (on the same tracks) with significant access fees, price regulation, etc. Moreover, competition from trucks, buses, and cars is sufficiently strong to make price regulation unnecessary.

• **The general European Union model.** In 1991, the European Commission ordered all railroads in the European Union to separate rail infrastructure from operations (either on an accounting basis or institutionally) and to allow open access without discrimination against new operators. Initially, access was limited, but today entry is essentially open for freight and intercity passenger transport. The Commission has signaled that it will permit the exclusive use of infrastructure for suburban and rural services for social reasons, as long as there is competition by the market. Of the 25 countries subject to EU policies, no two have adopted exactly the same model. There are holding companies that control infrastructure and all of the various operational services, as in the case of Deutsche Bahn. There are countries in which the government maintains ownership of and operates the infrastructure, with government passenger companies and otherwise owned freight companies, such as the Netherlands. In practice, the German freight company (DB Cargo, today called Railion) owns the freight companies in the United Kingdom, the Netherlands, Denmark, and Sweden. It is interesting to note that the result in Chile is a kind of EU model, in which infrastructure and passenger services remain in the hands of the government, but private operators handle freight. In practice, freight operators have open access in that competitors can appear if markets open up that cannot be served adequately by existing operators.

• A special example is the United Kingdom, where infrastructure is completely separate from all operators. Passenger services are provided under private franchises, and the government covers losses under certain conditions. Freight operators are private. Infrastructure was initially privatized, but currently is owned by a Public-Private Partnership. Passenger rolling stock was sold to three leasing companies (ROSCOs), which in turn lease the equipment to the franchises. There is no regulation over freight tariffs, while passenger tariffs are regulated and controlled by the terms of the franchise contracts.

• The United States and Canada are the extreme example of privatization, at least for freight. In both countries freight infrastructure is private, as are all freight operations (one of the largest Canadian railroads, CN, was privatized in [1995]). Each owner has complete control over its infrastructure, with exceptions where competitive access (trackage rights) has been negotiated by both parties or has been ordered by the national transportation regulatory agency. However, even in North America, intercity passenger services are provided by subsidized government enterprises, which pay for access to the private freight infrastructure.

• In Japan, the former Japanese National Railroad was separated into six regional passenger companies, each of which owns its infrastructure. In addition, a freight company was created, which operates on the tracks of the regional passenger companies. Subsequently, the three largest passenger companies were privatized.

• AFE. Until very recently, AFE has been an example of a typical monolithic company, with all of the problems that monolithic organizations have in the complex,
competitive economies that emerged in the late 20th century. Recent attempts to reform AFE have failed, essentially because they have not changed anything: they have been merely cosmetic.

Solutions in practice

Some examples of practices are shown in the following diagram.

<table>
<thead>
<tr>
<th>Integrated (monolithic)</th>
<th>Government Ownership</th>
<th>Companies</th>
<th>Private Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>China, Belarus, South Africa, and AFE (today)</td>
<td>India Railway Container Corp, freight and passenger concessions in Latin America and Africa</td>
<td>Small North American freight railroads (500), East Japan, Central Japan and West Japan</td>
<td></td>
</tr>
</tbody>
</table>

| Integrated dominant operator, separate external operators | Amtrak and VIA Rail, Japan freight, Russia | Commuter railroads in the U.S. on freight tracks, FEPASA in Chile | Most of the U.S. railroads; includes the collection of tolls to create competition |

| Vertical separation (open access) | Standard model in the EU | Some franchises in the U.K., Network Rail? | Most U.K. franchises, Railtrack (but not Network Rail), EWS |

Source: Own elaboration

There are a number of other relevant examples:

③ In Argentina, the former Ferrocarriles Argentinos was divided into several integrated concessions divided between freight and suburban passenger transport. One freight operator (Belgrano) could not be transferred to private control and the operations of intercity passenger trains were transferred to provincial control or closed. The new law on the railroads in Argentina is trying to change this situation to move closer to the EU model, which will probably have negative effects on rail activity.

③ In Brazil, the former RFFSA was separated into a series of individual freight concessions, as was the former FEPASA in Sao Paulo. The Rio subway and suburban passenger operations also became concessions.

③ In Chile, concessions were awarded for freight operations (today there are two private freight operators, FEPASA and TRANSAP), while infrastructure and passenger operations remained in the hands of the government.

③ In Bolivia, the system was separated into two concessions, the Andes Network and the Eastern Network.

③ In Peru, there are two freight concessions and one passenger concession.

③ In Mexico, there are two large freight concessions and several smaller concessions, along with a possible suburban passenger concession in Mexico City.

③ As indicated, Canadian National Railroad was privatized in [1995]. All North American freight railroads are (and have been) privately owned with little or no
government intervention. In practice, in the Americas, as a result of the wave of privatization in the 1990s, there are no freight railroads in the hands of governments with the exception of AFE.

3. Currently there are 12 freight concessions in Africa, some of which also operate passenger services contracted out by the governments.

3. The EU has ordered the national railroads to separate infrastructure from operations and requires separate accounts for commercial operations and subsidized operations.

3. In the United Kingdom, the government privatized freight operations and infrastructure, and issued 25 passenger franchises. A number of governments, including Sweden, the Netherlands, and Germany, have begun to award concessions for local passenger operations.

3. The Russian Railroads have been separated into infrastructure and operations, and passenger operations have been organized separately from the freight operator. Recently, a second freight operator has been organized, which will increase private participation to 44 percent of the market.

It would not be accurate to say that all of these changes have been entirely successful, but one thing is clear: many of the attempts have been quite successful and very few, if any, have resulted in a situation that was worse than the status quo. All have been successful in rapidly increasing traffic, and the productivity of the assets and employees of the railroads under concessions is considerably higher than that of the government railroads. In all cases, significant increases in traffic and reductions in tariffs have been accompanied by substantial decreases in and even the elimination of government contributions.

**Economic results of the reforms**

The privatized freight services have concentrated on higher-profit lines of business, abandoning areas and activities that could have been socially beneficial, but were not so in private terms. Over time, it has been demonstrated that the high cost of rail infrastructure can be covered privately in the long-term only when two conditions are simultaneously present:

1. The volumes mobilized are above a critical threshold, which depends on local costs and circumstances, but in general are around 1 million ton-kms/km.
2. There are no significant distortions in the transport market and alternative modes of transport pay at least the private costs that they incur.

In the case of passenger transport services, long-term social profitability appears feasible only in the case of suburban and commuter services around large capitals. In all other cases, even for high-speed trains, services can survive only with significant government support, which means periodic substantial investments in infrastructure, a lack of competitive intercity services, and direct subsidies for operations. There are some exceptions, such as the Japanese railroads, although these exceptions are probably the result of semi-monopolistic positions and special conditions in their markets.
These changes have brought governments to an intermediate stage in the reform of the railroads.

Experience has confirmed the advisability of leaving freight transport rail services in private hands, precisely because most transport in this sector was already in private hands before the reform (trucks, barges, and coastal shipping). There is increasing awareness of the social benefits provided by rail transport and, when combined with measures to eliminate distortions in the market, governments are ready to consider some subsidies for infrastructure in cases where tariffs do not cover all costs but the social benefits are higher than the deficits.

For passenger services, the approach is similar, with the difference that governments have continued to subsidize them. These services are provided by private organizations (concessions, franchises), public-private partnerships, and local (regional, municipal) or state organizations. In this case as well, governments—be they national or local—are only prepared to subsidize services when the social benefits exceed their deficits, recognizing that formal estimates are rarely made.

**ALTERNATIVE PRIVATE PARTICIPATION MODELS**

There are many ways in which the private sector can participate in the operation of the freight railroads. The most important option is the privatization of infrastructure and all operating assets. In practice, the largest and most efficient railroads in the world—the North American railroads—are entirely private and operate essentially without government funds.

In the United States, there are nine so-called Class I railroads (with revenues exceeding US$250 million per year); more than 500 regional railroads; and the so-called "short line" railroads, all totally private (there are some small railroads that operate on infrastructure leased from local public entities). All of the regional railroads and many of the short line railroads are larger and move more traffic than AFE.

The three largest passenger railroads in Japan are entirely private, along with a large number of small freight railroads (approximately 30 percent of km-routes), which have always been private. Similarly, many of the large capacity railroads in Australia are privately owned and operated.

Although total privatization has until now been a practice primarily in developed countries, it is worth discussing why, independently of historic or ideological considerations, AFE could not simply be privatized. In this discussion, the specific objectives that could be better achieved through concessioning or continued government operation than through privatization should be identified, as well as the greater risks that privatization would present compared with concessioning or government operation. The objectives and risks could well justify the continued participation of the government, but a detailed discussion would be useful to decide where the public/private borderline should really be.
The second option—based on the experience of Argentina, Brazil, Bolivia, Peru, Guatemala, and Mexico—is total concessioning of freight infrastructure and operations. In all of these cases, with the exception of Guatemala, countries divided their originally unified railroads into a series of concessions based almost entirely on the original operational divisions of the former national railroads. Considering that most (if not all) of these concessions are larger than AFE, and that AFE has a network with a single gauge, there appears to be no reason to divide AFE into more than one concession.

Although the result was the same, each country followed a slightly different model to design and award the concessions. Some granted concessions over the infrastructure; others sold shares in concession companies previously established by the government. Some leased the rolling stock, while others sold it outright. Some granted 50-year concessions with the option of 50-year extensions; others granted 30-year concessions with limited extension possibilities.

Perhaps the most significant thing is that, although all the concessioning programs included provisions to cushion the impact on employees (generally employee levels were reduced to half or less), the solutions ranged from reducing staff levels with compensation packages before the concession to allowing the concession holder to reduce personnel using its criteria under predefined conditions. The method of payment of the concession also varied considerably, from an initial total payment, to guaranteed annual payments over the term of the concession, to a simple percentage of gross revenues. The specific solution depended on a complex assessment of the objectives and local circumstances, together with a careful analysis of the risks that the concession holder would be taking compared with the risks that the government would maintain.

The third option, generally following the European model, with variations in Chile and Australia, involved the separation of infrastructure from operations. After the separation, infrastructure can be privatized (U.K.) or kept under government control (most of Europe, Chile, some Australian railroads). Freight operators can be privatized (EWS in the U.K.) or placed under concessions (Argentina, Brazil, Mexico). Franchises have been awarded for passenger operations (U.K., the Netherlands, Germany, Sweden, Brazil, Argentina). Combinations are common, with private operators on government infrastructure (Chile and the EU) and government operators on private infrastructure (Amtrak and VIA Rail).

Based on the third option, it would be entirely possible to grant a complete freight concession (including infrastructure) in Uruguay, with AFE continuing to operate passenger services (paying a toll for use of the tracks). Alternatively, it would be possible to replace AFE with a private franchise that would operate on the tracks of the freight concession. It would also be possible to keep infrastructure in the hands of the government (as in Chile), with a freight concession and public passenger operations.
Experience has shown that there is no one "correct" answer. Nor have all the reform processes been uniformly "successful." However, there are some general conclusions that could be useful for Uruguay’s decisions:

③ As indicated above, the only option that is not successful is inaction, i.e., the only option that will fail in Uruguay—as it has failed consistently in the past—would be to maintain AFE without any changes. Palliative measures, such as making investments in the system, may reduce problems, but as has happened elsewhere (in Chile, for example), investing more money in an organization that does not have a clear mission or efficient analytical tools is a clear recipe for a loss of resources.

③ The most important question that must be resolved—and only the government can resolve it—is to define objectives, i.e., to identify the exact result that the government wishes to achieve with the reform process.

If one of the objectives is efficiency in the transport sector, it will be easier to identify those options that are efficient and those that are not. Based on solid evidence in Latin America, concessions or privatization will no doubt improve efficiency and reduce the cost of transport.

If an objective is to reduce the burden of the railroads on the national budget, maintaining government ownership and operation has proven to be a less promising option.

If the objective is to increase the role of the railroad in the freight transport sector, experience shows that a privately administered railroad can compete much more effectively with private road transport. On the other hand, it is also clear that a completely private passenger railroad will fail because passenger services are not privately profitable: financial assistance from the government is required if social objectives are to be met and in this the role of public policy is essential.

If one of the objectives is to reduce the impact of the reform on the employees, public operation is one way (albeit a very costly way) of achieving this. Alternatively, there are large number of options to cushion the impact of the change on workers that have been used successfully in nearby countries in Latin America.

This is not intended to be a complete list of potential objectives or an assessment of their relative importance; the point is to emphasize the need that those responsible for formulating government policies in Uruguay bear these issues in mind.

③ An equally important issue for the success of the concessioning or privatization is how to define and share the risks. Probably the single most common cause of problems in concessions or privatization is an unrealistic understanding of which risks can be shared (and at what cost) and which risks cannot be transferred by the government. Governments typically look for a high price for the concession or assets and also want the new administrator or owner to take all of the risks that are currently borne by the government. Clearly, most of the risks can be transferred, but only at a
price. If, for example, the government would like to receive payment in cash immediately, the total payment will be less than if the government accepts monthly or annual payments. If the government wishes the concession holder to guarantee a rehabilitation program at a fixed price, the concession holder will ask for more than if the scope and development of the program is left in its hands, to be managed based on the needs of the business. The point is that the time taken at the outset to identify the potential risks and develop a definite plan sharing them will be time well spent.

3 Another important factor is simplicity. In the United Kingdom, the government created 25 passenger franchises, 3 freight companies, 1 infrastructure company, 3 rolling stock leasing companies, 7 track maintenance companies, 3 regulators, and many other small companies. The end result was a tremendously complex and costly process that took several years to consolidate. Uruguay should have a simpler process.

3 A final factor for success is to understand that concessions and franchises, and even privatizations, are actually associations, not confrontational relationships. Too often in the reform process, governments see private operators as rivals and try to make unreasonable demands, to conceal information, or to establish intrusive regulations so as to finally declare that they have been the “winner” in the process. This is particularly true when the government railroad is allowed to control the bidding process, as was the case with AFE. The concession process should not be seen as a zero-sum game; with a suitable attitude and appropriate terms, it can be a quite positive process.

3 Based on international experience, there is little doubt that there are options that would function in the Uruguayan context. There is no single "recipe" that can be applied mechanically. Moreover, there is nothing unusually large or complex about the AFE operation, and AFE is not as critical for the economy of the country as were the rail systems in other countries. Uruguay has much to gain from a carefully developed reform process.

CONSIDERATIONS FOR THE PRIVATE PARTICIPATION MODEL

At the time of writing of this report (August 2009), the process of involving the private sector in railroad activity had come to a standstill. Notwithstanding the above, the following considerations may be useful in understanding why the government's expectations were not met.

AFE presented the World Bank mission with a private participation model in which, essentially, the entire current structure of AFE would remain the same, with the possible exception of the Office of the Manager of Marketing (consisting of four persons), which would be replaced by CCF once privatized.
This attempt to maintain a direct role for AFE in freight transport through the creation of CCF failed because it violated the principle of simplicity and because the role proposed for the private operator left it defenseless against unpredictable actions by AFE.

The practical result of the process showed that the mechanism chosen was not suited to the goals pursued, namely, to considerably increase the efficiency of the railroad. The following considerations support this conclusion.

**Size of the market**

The size of the current transport market in Uruguay and the volume transported by rail in comparison with the size of the network are very far from levels that would make a rail operation privately profitable. In gross figures, a rail system is self-sufficient with a minimum volume of about 1 million ton-kms/km. Currently, the AFE network has an average density of 185,000 ton-kms/km, and to reach an equilibrium volume it would need to move six times its current traffic. The freight market for the railroad in Uruguay is clearly very small to justify multiple operators. In practice, except for the potential wood traffic, this market is probably too small to justify more than one operator.

Under these circumstances, to make private participation feasible, transport provided by AFE must be assigned a much lower-than-market value, to cover payment of the investments to be made by CCF, thus perpetuating the losses and corresponding contributions from the government.

**Efficiency of AFE as a government enterprise**

AFE’s efficiency parameters are very low, as has been demonstrated by the various studies and as indicated above. The World Bank’s DPR includes a benchmarking exercise comparing AFE’s management with that of various railroads in the region. AFE’s management not only has the poorest indicators of all the railroads, but its indicators are far poorer than the poorest of those: the Mesopotamic Railway (which coincidently is connected with AFE on the same gauge), a railroad that is far from being economically viable.

The CCF proposal leaves precisely the most critical aspect of railroad management in the hands of AFE: train operation and maintenance of the rolling stock, in addition to maintenance of half of the infrastructure. Various governments, both in Europe and the Americas—and especially in the Americas—have systematically privatized freight transport services, convinced that government-owned railroads are not in a position to organize them efficiently. Passenger services have been kept in the hands of government enterprises only because they are not privately profitable and must be subsidized, but the trend is also to privatize these services, subsidies included.

The international experience is clear in this regard. There is no case in which a deteriorating public enterprise such as AFE has been transformed into an efficient rail company from within.
It is believed that in the hands of the government AFE will not be able to significantly change its management and operating indicators. Although the massive investments that the program calls for could yield improvements, the most probable outcome is that it will return to similar levels in a short period of time. International experience has repeatedly borne this out.

**Investor guarantees**

The CCF model proposed in the Prequalification Conditions means that it has to market transport services that it does not produce, but only plans, coordinates, and nominally controls. The conditions state that the responsibility for movement of the trains and for maintenance of the rolling stock remains in the hands of AFE.

What is more, CCF will have to make substantial investments, a portion of which might be unnecessary if the existing equipment were operated efficiently and if the investments in the tracks were to materialize. Finally, it will have to make purchases for the railroad—mainly fuel, lubricants, and spare parts—with no direct control over the way in which these supplies will be consumed.

The economic success of a company that operates under these conditions can be achieved only with very strong guarantees for recoupment of the investment no matter what, whether these guarantees be financial or the form of high fines for failure to meet the agreed standards. The guarantees and conditions that potential investors would probably require will only worsen AFE's current financial position. Bearing in mind that the company's revenues—and, consequently, its ability to amortize its investment—will depend on the proper and timely performance of transport operations, the conclusion is that it is essential that it have effective control over management of those operations.

Poor management of the rolling stock, which results in lengthy rotation cycles, would require additional investment in equipment to capture new transport services, which could be done without these investments but with adequate management. Under these conditions, unless the marketing margins are very large—unlikely given the cost structure of the railroad—the natural tendency of the private operator will be to minimize its investments and make use of any guaranteed minimum revenues.

This model results in a situation that has no precedent in known private participation models. There is no relation between the investor and the business risks; that is to say, economic success does not depend on the investor's management. As a result, it will necessarily have to cover itself at an additional cost for AFE that will certainly leave it in a worse situation than it is now.

As proposed, CCF would have no operational functions. This would lead to:

③ CCF having no ability to guarantee the proper delivery of the freight it contracts with its customers
③ the control rail operations assigned to CCF not being supported by any effective mechanism, whether it be stimulative or punitive in nature
③ CCF having no role in ensuring efficient use of the rolling stock purchased with its investment resources
③ CCF having no involvement at all in ensuring efficient use of inputs (oil, spare parts)
③ despite its majority participation, CCF not being able to make management decisions on its own, as they require the prior approval of AFE, meaning that the majority participation is simply nominal.

The conclusion of this analysis is that a scheme to bring private capital into AFE without including management control of the company will not be successful. What AFE should seek, probably even more than private capital, is to introduce a structural change in its management that can only come from private companies that have experience in rail transport and that operate with a direct link between successful management and financial results.

**Economic viability of the model**

It is very unlikely that the tariffs charged rail customers can be substantially higher than they are now (approximately US¢3/ton-km). These tariffs should cover the following:

(a) contractual operating costs (the conditions leave open the possibility of setting a contractual cost that is different from the real cost)
(b) capital costs for investment in rolling stock
(c) sales costs (marketing management)
(d) costs of purchases
(e) administrative costs (including planning and control of operations)
(f) administrative profits

It should be noted that currently AFE covers approximately half of its costs with its operating revenues, and the deficit must be covered with government contributions. Its current costs do not include capital costs (equipment is fully depreciated); sales costs (marketing management is almost nonexistent: the Office of the Manager of Marketing has only two staff); planning and control costs (currently nonexistent functions); or profits.

Even without data on AFE’s costs, it is not possible from a rough analysis to make out how the system could be financed, which appears to indicate that an indirect government subsidy is being factored in from the outset. Without the basic functions of the rail system being separate, it will be very difficult to discern the real costs and, therefore, unless a complicated costing system that includes transfers between AFE and the PPP is implemented, the government subsidy will continue to be an overall subsidy, with the distortions that this implies.
REQUIRED definitions FOR A COURSE OF ACTION

GENERAL ANALYTICAL FRAMEWORK

Basic concepts

In the process of planning and implementing major publicly approved projects, as in the case of the future of the national railway system, three operating hierarchies can be identified within the sphere of government management. The first hierarchy encompasses the strategic level, in which public policy guidelines are defined for the country as a whole. These are implemented by the institutions responsible for taking long-term strategic, political, and legislative decisions. Next is the programmatic level, consisting of intermediate-level agencies responsible for defining inter- and intra-sectoral plans and programs. The third level is operational, where programs and projects responding to specific sectoral goals—which must conform to the definitions established at the higher levels—are executed.

Within this context, the planning and execution of public investment projects or programs must conform to a structure, consisting essentially of the following:

1. Defined public policies, which are general guidelines that serve as a roadmap for the actions of the entire system.
2. Objectives (and indicators) representing the targeted achievements. Their importance derives from their role in orienting the process of selecting the best projects (improving the relevant indicators by changing some of the characteristics) and because they facilitate comparisons between what is planned and what is accomplished.
3. Designed plans, programs and projects responding to specific needs, either at the national level or within given geographic areas.
4. Technical criteria necessary for comparing and evaluating alternatives in accordance with generally accepted standards, as well as for choosing among those that satisfy certain parameters.

The literature and recent successful cases of transport planning have helped build consensus on the definition and usage of the terms “plans,” “programs” and “projects.” The definitions, which are given below, support, order and make transparent all government actions in the sector, making it possible, as a result, to better orient the activities of the private sector and the market. These concepts will be used in the plan for railway modernization in Uruguay.

Plan

A plan consists of a series of programs and projects (investment, management, legal, normative, institutional, and others), the execution of which is to take place within a

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6 Pacheco and Contreras, ILPES, 2008.
given geographic area during a given period of time. In this specific case, the plan in question is the 2010-2030 Modernization Plan for Uruguay’s Railways.

Program

This is a series of interrelated projects and actions, administered in a coordinated manner with a view to obtaining benefits that could not be achieved if they were carried out separately. For example, the Modernization Plan for the Railroad could consist of programs such as: program for institutional modernization of the railroad, program for improvement of the competitiveness of inter-urban freight transport, program for the modernization of AFE freight transport, program for the modernization of AFE passenger transport, program for modernization of the company’s management, human resources, etc. Each program should aim at specific objectives, to guide the selection of the component projects and actions, and should also have a budget for each period. Programs should include a series of activities to be carried out consecutively, should have a manager (and his or her team), and do not necessarily have an ending date. In the formulation of a plan, a program is a strategic activity.

Project

Projects are time-limited initiatives, undertaken for the purpose of creating a single product or service. A project has a beginning and an end and should be part of one of the programs that make up the plan. Projects have a broader scope than physical projects, such as those aimed at improving infrastructure. Any action—whether of a legal, regulatory, economic, supervisory or other nature—that is intended to have an effect on a specific railway situation can be included in this definition. For example, the AFE freight transport modernization program can comprise one or more railway infrastructure investment projects, a new traffic control system, a legal change, etc.

Elements for the definition of objectives

It has been mentioned that one of the basic stages in developing a transport plan, as well as in evaluating the specific projects it encompasses, is that of preparing and prioritizing the targeted objectives. Typical objectives considered in the analysis of transport systems are (by way of reference):

1. **Overall economic efficiency.** This objective is aimed at efficiency in the use of financial resources or resources that can be expressed in financial terms. Primarily, although not exclusively, this refers to resources used for investment, for management and administration of the public infrastructure, and for the operation of transport markets (vehicle operating costs), as well as the resources contributed by users of the transport system (passenger and freight travel time). With this objective in view, an effort is made to minimize the resources allocated to transport by choosing the most efficient mode of transport, based on the relevant characteristics: volume and type, origin/destination, etc. It is important to adopt policies that promote equitable competition among modes of transport, as well as the greatest possible
reduction of the externalities that distort conditions in an otherwise efficient market. At the same time, it is important that investments in transport infrastructure (railroads and highways) be made within a framework of social cost effectiveness, which will ensure its efficiency. This objective can also be expressed in terms of “rehabilitating the national railway system within a framework of overall economic efficiency in the ground transportation system.”

2. **Social equity.** The aim of this objective is to contribute—through development of the transport system—to the national objective of achieving better income distribution and/or supporting specific social groups.

3. **Safety.** This objective is aimed at improving the safety of passengers and freight in the transport system. The goal is to reduce the number of deaths, injuries, equipment damage and, in general, accidents. Policies adopted and laws, regulations, investment projects, etc. should incorporate safety standards that are appropriate and ensure levels of equity among the various modes of transport.

4. **Environment.** The focus of this objective is preservation and stewardship of the environment, natural resources, and the national and cultural heritage. Policies adopted and laws, regulations, investment projects, etc. should incorporate environmental standards that are appropriate and ensure levels of equity among the various modes of transport.

5. **Quality of the inter-urban transport system.** The aim of this objective is to establish minimum quality standards for the transport system (vehicles, infrastructure, services, user information). It can also include aspects related to the reliability and/or vulnerability of transport systems. Policies adopted and laws, regulations, investment projects, etc. should incorporate quality standards that are appropriate, in particular for the transport of passengers, and ensure levels of equity among the various modes of transport.

6. **Other objectives.** This category defines objectives not included in the above but which are taken into account in the decision-making process. For example, geopolitical objectives concerning use of the national territory (territorial integration, integration with other countries), without the necessity of investments being socially cost effective or providing access to a given population center. In general, national or regional objectives can be included, provided they are explicit and to some extent quantifiable. Other objectives: energy savings (energy independence), domestic territorial integration and integration with neighboring countries, etc.

To address the challenge of restructuring Uruguay’s railway system, and AFE in particular, a decision was made to include in the design an analytical framework based on implementation of the above-mentioned stages. **In this case there is no specific investment project, but rather a plan for structural reorganization that necessarily involves aspects related to transport policy and the role of the State, with a long-term horizon and broad impacts on the entire national transport system.**
ELEMENTS FOR EVALUATING THE SOCIAL COST EFFECTIVENESS OF RAILROAD PROJECTS

Recent efforts to modernize the railroad have included various investment projects, with plans to formulate others in the future. Evaluation of the social cost effectiveness of projects is the response that economic theory provides for the efficient allocation of resources, especially in the case of investments in infrastructure, where the market and competition cannot provide a response. Maximum efficiency is achieved by identifying the largest number of possible options and choosing the most profitable project alternative, relative to a given basic or reference situation. Similarly, in the case of publicly funded projects (purchase of equipment, operation of services, etc.), the tool used to support decision-making is evaluation of the social cost effectiveness of projects, without ignoring the importance of the private assessment, which allows for analyzing financial viability, determining the possible need for subsidies, etc.

The evaluation stage of a project provides for a structured consideration of how well the goals and objectives of a project are being met. The basic purpose of the evaluation is to make changes in the project so as to enable it to meet or possibly exceed its goals in the future, which makes it an essential component of effective project management. Evaluations, depending on the stage of the planning process in which they occur, can be quantitative and/or qualitative and should highlight both the positive and the negative impacts of a project and, in particular, any contentious aspects. Evaluations are most effective when goals and objectives are clearly stated and measurable, and all the parties involved are in agreement.

The evaluation should be considered an integral part of the project development process and, therefore, should be included in each phase, prior to each stage in which a decision is to be made. Experience shows that more reliable results are obtained and assured when the evaluations are carried out by an independent party with no personal interest in the project.

In the case of railway services, as in other traditional transport markets, the usual benefits provided by projects are saving travel time for passengers and freight, savings on vehicle operating costs (energy, maintenance, etc.) and fewer accidents. These are generally considered profitability indicators. However, a large number of externalities are also recognized in transport markets, such as environmental impacts, congestion, and personal injuries (not economically quantifiable), which must be taken into account in evaluating and comparing alternatives.

From a methodological standpoint, evaluation of the social cost effectiveness of projects should be consistent with national and sectoral transport policy definitions and should prioritize alternatives based on the specific objectives they identify. In many cases, it is not possible to express all the objectives in figures, in which case a multi-criteria analysis is recommended to supplement economic outcomes with indicators that reflect the impact on other objectives.
An additional and complementary aspect that must be taken into account in formulating and evaluating one or more projects—in this case related to the restructuring of the national rail system—is consideration and analysis of the parties involved (those who benefit and those who are harmed). This analysis should allow for identifying the different behaviors of those who are related to the project, which will make it possible to improve how they are handled by foreseeing and resolving potential problems. The following steps are recommended for this type of analysis (Pacheco and Contreras, ILPES, 2008):

1. Identify the parties involved.
2. Classify the parties involved.
3. For each, determine:
   - ① position (in favor or against)
   - ② strength (power to affect the project)
   - ③ intensity (degree of involvement in the project)
4. Compare the alternatives or options being analyzed.
5. Develop strategies.

**Strategic definitions for AFE**

The earlier stages of this study included an assessment of AFE’s situation and of the main initiatives adopted for the development of Uruguay’s railway system, as well as the various approaches taken at the international level to restructure railroads. Two main conclusions emerge from this analysis: the first is that, given the fact that the Government of Uruguay does not want to change the current operating scheme, AFE is in urgent need of a restructuring that is consistent with the recovery and sustainability that the country’s railway system requires, as well as with national policies on the passenger and freight transport systems. The aim is to ensure efficiency in the allocation of public resources to the national railway system. The second conclusion, arrived at by analyzing international experience, reveals the diversity of options selected in the processes of restructuring the world’s railroads, which should also be analyzed for AFE. The definitions concerning the role of the State and of public and private enterprises encompass virtually every possible option, in terms of the ownership of the tracks and equipment, the planning and execution of investments, the management and maintenance of tracks and equipment, as well as the operation of passenger and freight services.

Despite the various assessments performed, no detailed study is yet available of AFE’s situation from the perspective of its private and social rates of return. Nor has a specific proposal been assessed concerning the best option for the future of AFE, including investments in infrastructure, equipment, operations, market share, and private and social profitability, which could serve as a guide and a point of reference for the identification and selection of options for AFE.

In selecting the best option for the national railway system, and AFE in particular, it is important to begin by examining a series of factors, such as the following:
1. The current status of the national railway system and of AFE in particular, as well as the relevant trends (assessment of infrastructure, equipment, services, financial results, etc.).

2. Projections for the passenger and freight transport market, in which the railroad has the potential to share, viewed in parallel with competing modes of transport.

3. Definitions of national passenger and freight transport policies. In the case of Uruguay in particular, and owing to their impact on the railway system, it will be useful to know what the policies are with respect to roads, as well as the policies on public passenger transport in the city of Montevideo and its environs. Although it appears that there are no specific written policies, they may be inferred from the actions taken by the State: investments, laws, standards, institutions and their powers, subsidies, concessions granted and the related contracts, taxes, management of public enterprises, plans and projects, national economic policy framework, public financing, etc.

4. Specific policies concerning the railroad and AFE in particular. These policies should explain the role of the State in the railway system, as well as the role of AFE and the private sector, taking due account of the topics of financing and management in the short, medium, and long terms. Aspects such as self-sufficiency, private and/or social cost effectiveness, subsidies, sources of investment funds, responsibility for management, etc.

5. An essential stage in the formulation of policies as well as in studies and decision-making concerning specific actions (policy instruments such as proposals, laws, standards, etc.) is the definition of strategic objectives and the relevant priorities. A clear definition of objectives and of the associated indicators allows for consistently and unanimously determining what policy options and what specific projects are the most appropriate for Uruguay’s railroads.

6. Structure the Modernization Plan for the Railroad for a period to be defined, as well as the series of programs it should contain, with their explicit objectives, budget (initial) and a preliminary identification of actions and projects for each program, which together address the problems identified. Along with the development of this Plan, the institutional organization, the personnel and, in particular, the public resources that will be available should be defined. Having a budget is critical when the time comes to define and select the program and project alternatives that will make up the modernization plan.

**PRELIMINARY ANALYSIS**

Based on international experience and the assessment of AFE, a number of preliminary recommendations can be made for consideration in analyzing options for Uruguay’s railway system. These preliminary recommendations are implicit in the preceding analysis:

- **Simplicity.** The solutions chosen should employ the simplest criteria that are compatible with the objectives indicated by the government.

- **Passenger services.** Because the volume of passenger services is very small and the level of revenue from potential passengers is low, this service is not privately
profitable and very likely is not socially cost effective either. This suggests the creation of a separate entity to provide passenger services, which could be a State-run enterprise or a concession similar to those found in Buenos Aires, Rio de Janeiro or the United Kingdom.

3 Infrastructure. The government wishes to retain ownership and, at least in the short-term, control of the maintenance of infrastructure. This seems to favor the creation of a national infrastructure agency with engineering systems and effective and well-established procurement methods. The simplest solution and the one most widely adopted is for the freight operator to perform maintenance, either on a contractual basis or, if the volume of traffic justifies it, without government subsidies except on lines that would otherwise be abandoned or where the quality of the line needs to be upgraded for passenger services.

3 Freight services. The failure to receive an acceptable response from potential investors in freight transport was predictable in light of the success of various consecutive programs in other places, where freight services have been privatized or placed under the exclusive control of a concession holder. This suggests the establishment of a single freight operator, either by granting a concession or through privatization, with an appropriate agreement with the State for the use and maintenance of the infrastructure and taking into account any infrastructure costs not covered by freight revenues.

3 Regulation. The State may wish to regulate or control a number of different things:
  o Safety in the maintenance of tracks, especially where passenger services are operated.
  o Safety in the operation of freight and passenger trains.
  o The condition of the tracks, when there are requirements concerning minimum conditions that must be maintained in certain areas or on certain lines.
  o The production of data necessary to ensure that operators provide services effectively and efficiently. This includes production data (tons and ton-kms per product, freight transport revenues; passengers; passenger-kms, passenger transport revenues), assets (km of lines, condition of the lines, rail cars by type and age, locomotives by type and age), safety (accidents and derailments), finances (account statements and balance sheets of operators and of the infrastructure if it is separate from operations), employment, etc.

Given the level of competition and the railroad’s minimal role in national freight services, it is unlikely that railroad tariffs need to be regulated, although some monitoring of the demand for services may be necessary. Passenger fares should be covered by an agreement between the government and the passenger carrier, with a balance struck between the fares and the subsidies granted.

Identifying and selecting options for Uruguay’s railroads requires the prior establishment of a series of strategic definitions, which are discussed below.
ROLE OF THE RAIL CORPORATION OF URUGUAY, CFU

CFU was initially established as an entity similar to the Road Corporation of Uruguay, transposed to railroad infrastructure.

In addition to its assigned functions, which can be summed up essentially as channeling government funds for the construction, rehabilitation, and maintenance of the railroad infrastructure, CFU offers a number of interesting options for the management of that infrastructure.

In other sections of this analysis mention was made of the various models adopted by other countries to manage their railway systems. Most of them separate infrastructure from operations, with the State retaining ownership of the infrastructure and either granting concessions for it—as is the case in Argentina—or managing it directly, as in the European Union.

In accordance with the conditions established at the time of its creation, CFU’s role may be highly varied, depending on the government’s policy. One necessary aspect to be included in the analysis is who will be responsible for railroad infrastructure planning—the MOPT, CFU, or another centralized planning agency? It is highly advisable that this function be assigned to a central agency that oversees all the various modes of transport and is responsible for optimizing public investment.

ROLE OF CCF

Pursuant to Decree 458 regulating Article 206 of Law No. 17,930, the Railway Freight Trading Company (CCF), as a special purpose corporation (SPC), can play a substantial role in the management of AFE, including the direct management of railroad operations. It is stated that the National Development Corporation (CND) is authorized to operate as a corporation engaged in railway development and operation throughout the territory of the Republic, with broad and unrestricted functions, subject to obtaining the express approval of AFE in matters related to infrastructure.

The current prequalification conditions for the establishment of this public-private corporation limit its action in various fields, in particular with regard to direct operation of the railroad (operation of trains) and other aspects. Clearly, this definition is a determining factor in the selection of an option for including private capital and/or management in the railway system.

SUBURBAN PASSENGER SERVICES

From a private perspective, passenger transport services generally run a deficit, especially suburban services. The latter may, however, provide a number of social benefits owing to externalities not considered in private assessments, which make State support desirable in order to cover private losses, insofar as such services are socially cost effective.
Traditionally, governments have assigned the provision of these services to State railroad companies, which must absorb passenger service deficits into their overall deficits, with the result that the authorities cannot ultimately quantify the real cost of such services, much less exercise control over basic parameters such as service quality, production costs, adaptation to changing market conditions, level of compliance with government social policies, etc.

With this in view, the world’s railroads have been separating suburban services in various ways, all of which have the common factor of more or less disconnecting them from the company, for purposes of exercising effective control of the above-mentioned parameters. These various approaches may include the following, for example, which must be phased in:

1. Establish a cost center for passenger services within the company’s accounting.
2. Establish a business unit for these services, with the separation of resources internally and the establishment of transfer values.
3. Create a wholly-owned State subsidiary (similar to Merval in Chile).
4. Create a subsidiary to privatize some or all of the activities, on previously established grant terms.
5. Create a public or mixed company (PPP, for example) on previously established grant terms.
6. Take bids for franchises to operate suburban passenger services, on grant terms that may be included in the invitation to bid, which may in turn be private or public.

The above examples are merely illustrative. There are other solutions based on similar schemes.
POSSIBLE OPTIONS FOR A COURSE OF ACTION

GENERAL DESCRIPTION OF OPTIONS

The current average railway traffic density is approximately one-sixth of the minimum required for economic viability and, with the exception of the potential forestry transport business; it does not appear that any of the country’s economic activities can increase those volumes significantly. The studies carried out to date on the transportation of forest products are very preliminary. Even if the volumes estimated in these studies could be attained, the resulting transport business would only make certain sectors of the network economically viable.

The analysis work mentioned above, as well as other studies conducted internally by the Ministry of Transport and Public Works and AFE show that under certain assumptions the railway can be economically viable. The proposed courses of action below are based on the premise that the favorable scenarios presented in the cost-benefit analyses described materialize. However, and given the preliminary character of these analyses, the initial recommendations of this report focus on the need to carry out more thorough studies on the railway sector.

In view of the foregoing, the possible courses of action involve option(s) that deliver the greatest social benefits for the organization of the railway system and that minimize the financial costs to the State.

The first question to be asked in view of AFE’s performance in recent years concerns the scope of the institutional reform necessitated by the problem. AFE is a company of minor importance in the national economy, and operating it requires a relatively small government contribution of US$10 million annually. A conservative approach, therefore, would be to maintain the status quo, adopt administrative rationalization measures, and retain the current policy of staff attrition, which will continue to reduce the deficit as redundant staff retire. By keeping the annual deficit under control, the current situation could be prolonged indefinitely.

This approach is incompatible with the viewpoint of the government and within AFE, that the railroad should play a major role in the country’s economic development, given its advantages in terms of energy, the environment, safety, resource consumption, land use, etc. However, this viewpoint is not supported by detailed economic studies. It is reasonable to assume that decisions concerning the railroad that may involve significant public investment resources or fundamental changes in the management of the company should be preceded by a strategic study of rail transport in Uruguay within the broader context of the national transport system.

The results of such a study could be used to make rail transport projections and, therefore, quantify future investments, staffing levels, the fleet of rolling stock, subsidies and, to a certain extent, the most efficient way to organize the railroad, particularly the
role that the private sector could play. Its importance lies in the fact that the policy definitions issued to date by the Government of Uruguay indicate not only that it wishes to maintain the railway system, but also that it hopes to expand and modernize it so that it will play a significant role in the country’s economic development.

One of the major topics that the proposed study could elucidate is expansion of the railway network in the long term. At present, AFE operates approximately half the network, while the rest is practically abandoned. The part of the network believed to be of no immediate use but which could prove valuable in the future should be preserved via appropriate measures. The rest should be pulled up.

The second question to be addressed concerns the transport services provided by AFE.

Regarding passenger services, no document analyzing the economic results of such services has been made available, but it can be safely assumed that they generate substantial deficits. These results are very likely one of the main reasons for AFE’s operating losses, inasmuch as passenger trains account for 25 percent of train-kms and only 3.5 percent of revenues.

An analysis of the social benefits of these passenger transport services, which are currently provided only around the capital, would probably reveal that they are neither privately nor socially viable, given their low volume. Since the Government of Uruguay has expressed its intention to maintain these services and even introduce new ones, they should be managed separately from AFE and the resulting losses should be covered by the agency that wishes to maintain them and makes the decision to do so.

Regarding freight transport services, again, there are no studies analyzing their economic performance, although in light of AFE’s overall operating results it is likely that they, too, generate private deficits. Moreover, given the current volumes, it is likely that these services are not socially cost effective either.

As indicated above, a study of the freight market relevant to the AFE network should be carried out, as well as an assessment of private and social cost effectiveness to determine which flows are potentially profitable. This study is necessary in any case, whether the freight services are operated directly by AFE or by a concession holder.

The third strategic question to be posed refers to infrastructure. As mentioned above and examined below, there are many possible approaches to be taken with regard to the ownership, operation and maintenance of infrastructure. Some countries have opted for the complete separation of infrastructure in an organization apart from freight and passenger carriers, with the State retaining ownership. In others, infrastructure remains in the hands of the State, along with the operation of passenger services. Without separate accounting for the two activities, the latter combination has proven to be disadvantageous. In other systems, an infrastructure concession is granted to exclusive or primary operators, without the State giving up ownership. In still others, the infrastructure is completely privatized.
The fourth question and basic issue that arises concerns the extension of private participation in this project. International experience overwhelmingly demonstrates that, because railroads play a minor role in the transport market, the most appropriate option for freight transport is to transfer it to the private sector. This is borne out by the undeniable fact that state enterprises have not in the past been able to adapt to conditions in a rapidly changing market, and it is difficult to imagine how they could do so in the future. The cases of State-run enterprises most widely recognized as successful have occurred when they are managed under a private corporate structure, and even in those cases, the question arises of whether it is justifiable for the State to be involved in business activities, given the frequent risk that in crisis situations such enterprises would become a major burden for taxpayers.

Currently, the role most often assigned the State is that of regulator, responsible for correcting, to the extent possible—no correction can be complete—market distortions, including the cost of externalities (such as congestion, accidents, environmental issues) and leaving the business benefits and risks of the activity to private operators. At the same time, it is necessary to ensure that public infrastructure investments are made efficiently and based on criteria applicable to all modes of transport, without creating distortions in the private markets. This can be accomplished to a greater or lesser extent, depending on the government’s policies, but it undoubtedly ensures a more efficient use of public and private resources.

**PERSONNEL POLICY**

As stated previously, AFE’s staff is too large and not sufficiently qualified to ensure performance reaches the levels of a modern railway operation. The disadvantages of the policy followed to date—namely, staff reductions through attrition—were examined in the assessment chapter.

Some of the options for dealing with this problem are:

1. Continue the attrition policy without taking any additional steps. According to information collected at AFE, within a period of five to ten years more than 500 of the company’s 1,100 employees will be eligible for retirement. This length of time seems incompatible with the current reform requirements, and there is no guarantee that it will end with the requisite staffing structure in place.

2. Carry out the reforms, select qualified staff, boost staffing levels as necessary by hiring new personnel, and assign surplus staff to auxiliary or redundant functions (some of these actions are under way now) and decrease their numbers through attrition. The cost of a policy of this type is not only economic, as it could be financed with a specific contribution from the State, it also has a high cost in terms of social and union problems, not to mention the effect on employee morale.

3. Assign surplus staff to other government units, with additional training for reintegration into the workplace. It must be borne in mind that railroad employees
have skills that are not easily applied to other activities (railroad engineers, for example), so that training is essential.

4. Develop a plan to encourage early retirement. This is usually an advantageous solution, which in the long run entails stable or lower costs for the State and allows for rapid staff reductions. This plan can also include incentives to retain qualified personnel, but depending on the degree of private participation, it is to be hoped that such personnel would be hired by the private operators.

5. Supplement the early retirement plan with special packages to separate staff not eligible for retirement.

6. Mixed solutions, which will depend on the degree of private participation. It is possible to encourage early retirement and also agree with private enterprises on the hiring of some AFE staff, or assign them to temporary positions in those enterprises.

**Suburban Passenger Services**

The advantage of separating passenger transport services both administratively and in the accounting has been pointed out. In some cases such services may be socially profitable, but they are distinctly unprofitable from a private standpoint. The most significant options were mentioned in point 4.7.

It is essential to study and assess alternative proposals for suburban railway services, based on the objectives of the Government of Uruguay and within the context of all the other modes of passenger transport, both public and private. The results should be used to support the decisions of the Government of Uruguay regarding the design of a model enterprise, possible private participation, the amounts of investments and/or subsidies involved, expected market share, etc.

**Treatment of Infrastructure**

**Basic Options**

There are three basic options for infrastructure:

1. Infrastructure wholly owned and managed by the State. In this model, the trains can belong to a single company (monolithic railways, such as AFE) or to different companies, public or private (European model).

   This arrangement has the advantage of making it possible to channel State investments directly to the railroad infrastructure, in order to compensate operators for externalities and make activities feasible that are not privately profitable but may be socially profitable.

   In the case of monolithic railroads, which usually have a special relationship with the government, it is often the case that investments are not made systematically. Long periods without investments, resulting in the gradual deterioration of assets and the general obsolescence of infrastructure, are followed by heavy one-off investments to
“modernize” the railroad, which are frequently made without an adequate assessment of the situation and result in over-investment.

In models where there are private freight operators and the State enterprise (such as AFE) is responsible for overall management of the infrastructure (investments, maintenance, operation) as well as passenger services, infrastructure investments often benefit the services operated by the State enterprise, to the detriment of the private operators. There are clear differences between the public and private views of a transport business, be it from the perspective of an operator or a shipper.

Specifically to avoid this problem, in various countries infrastructure has been completely separated from operations, and separate organizations have been created for this purpose. In the European model, these organizations include Banverket (Sweden), ADIF (Spain), RFF (France), Network Rail (United Kingdom), and others. Such organizations make sense in a large network, where investments are constant and sizable and traffic is heavy.

In the case of AFE, where such conditions do not exist, the creation of an infrastructure agency seems unwarranted. However, since the Rail Corporation of Uruguay already exists, it is worthwhile to analyze the option of converting CFU into a state railway infrastructure agency.

CFU, in its new role, would report to the MTOP, like the Road Corporation of Uruguay (CVU), and as an agency would significantly facilitate the evaluation and coordination of investments in transport infrastructure.

In a scenario of this type, AFE could retain its traffic and passenger transport functions, or just passenger transport, or could simply be eliminated.

2. Infrastructure wholly owned by the State but operated by third parties under a concession arrangement. In this model, the trains can belong to the concession holder itself or to other operators, public or private (model adopted in Argentina, Mexico, etc.).

In this arrangement, a concession for infrastructure operation and maintenance is granted through public bidding (competition by the market). This approach has two important advantages: it frees the State from the obligation of managing and maintaining the infrastructure, and social resources are better distributed owing to the intrinsic greater efficiency of the private operator. The main disadvantage of this arrangement is that it complicates competition in the market, since the primary operator will have to look after its own interests first and consider those of any other operators only secondarily. However, in the case of the Uruguayan railroads, competition in the market makes little sense because of its small size. This situation makes it conceptually simple for the State to grant subsidies to the concession holder to compensate for differences between private and public profitability in social interest projects, whether they involve passengers or freight.
This arrangement can succeed whether the infrastructure remains in the hands of AFE or CFU. However, since the investments will be made through CFU, it seems more logical for CFU to bear responsibility for the investments, coordinated by the MTOP.

3. Completely private infrastructure. In this type of system the trains can belong to one company or to several different companies that pay a toll to the owner of the line (U.S. model).

This is probably the simplest solution, as it completely frees the State from railway management and from the associated operating and investment costs. Privatization (or transfer) of the infrastructure does not prevent the establishment of social interest services, nor does it rule out the possibility of helping private infrastructure managers optimize the social benefits of rail transport.

Moreover, it may not be feasible to transfer all the lines, especially those that are currently out of service, which could continue to be held by the State, through AFE or CFU.

The appropriateness of one solution or another depends on conditions in the rail sector. However, it seems logical to conclude that freight transport, which is the most important railroad activity, should be handled by private operators, whether or not they make the necessary investments. This approach is not as simple as it seems, for if private operators are not compensated in some way for externalities, they will drop any activities that are not privately profitable, even though they may be profitable from a social standpoint. It is possible, however, to set up a compensation scheme to optimize railroad operations.

The Rail Corporation of Uruguay, CFU

According to the legal instrument establishing it, CFU is an entity that offers an interesting series of options for railway infrastructure management.

As determined at the time of its creation, the role of CFU can be highly varied. Considering its potential responsibilities in increasing levels of involvement, it may:

1. Exclusively channel fiscal contributions to the construction, rehabilitation, and possibly the maintenance of the railway infrastructure. In this scenario, CFU will have no role in investment planning or in infrastructure management.
2. Formulate, propose, and implement the State’s short-, medium-, and long-term policy regarding the railway infrastructure, under the direction of the MTOP in coordination with the road infrastructure.
3. Invest in and maintain the railway infrastructure.
4. Consolidate the entire railway infrastructure, providing AFE and any other operators with infrastructure supply services (traffic and maintenance) against payment of a toll representing a determined percentage of total infrastructure costs.
5. Also retain ownership of the infrastructure, which would make CFU the equivalent of European railway infrastructure organizations (Network Rail, RFF, ADF, Banverket, etc.).
6. Grant a concession covering all or part of the infrastructure, in the event of the establishment of vertically integrated services.

The above examples are merely illustrative; CFU is a flexible organization that could give rise to various other solutions. In practice, CFU could serve as the basis for adopting any of the three options set out in 5.4.1.

**SCOPE OF PRIVATE PARTICIPATION**

**General considerations**

The worldwide growth of private involvement in freight and passenger transport by rail is justified for reasons both conceptual and practical:

- The subsidiary role of modern governments, which limit their business activities to those that the private sector cannot provide or has no interest in developing.
- The relative rigidity of State enterprises in terms of adapting to constantly changing market conditions.
- The structure of the transport market, especially the freight component, inasmuch as road transport predominates and is 100 percent privately owned.
- The constant deficit in investment resources and in the operating results of state railway companies, which constitutes a significant drain on the national treasury.
- The positive results of experiments that include the private sector in rail transport.

A broad range of options are available for involving the private sector in railway operations:

1. In monolithic, State-owned enterprises the private sector participates significantly in the provision of rolling stock, supplies and parts, and possibly in the provision of construction and maintenance services.
2. The processes of including the private sector in railway activities were begun by the freight transport services, inasmuch as railroad activities can be self-sufficient. There are various ways of including the private sector:
   
   (a) Create a public-private partnership (PPP) to provide freight transport services under a concession agreement, on terms that may or may not be exclusive. Under this arrangement the State enterprise contributes the rolling stock and the concession holder pays a toll for using the lines on which it operates.
   
   (b) Take bids directly for a freight services concession, including the rolling stock in the price of the concession. Under this arrangement, the concession holder is 100 percent privately owned and becomes the owner of the rolling stock it acquires. It also pays a toll for using the lines on which it operates. In cases such as this the concession is usually exclusive.
(c) Take bids for a freight services concession, including the rolling stock in the price of the concession and also including an infrastructure concession. Under this arrangement, the concession holder is responsible for the operation and maintenance of the lines. This concession is also usually exclusive.

(d) Transfer all or part of the railway network through an international bidding process. Under this arrangement, all freight transport activities are transferred to the private sector, with the State retaining only those sectors not included in the bidding.

3. In a second stage, various national railway companies have granted concessions for passenger transport services. These concessions may include arrangements similar to freight concessions, with the difference that the activity is not self-sufficient—except in very rare cases—and is normally subsidized by the State.

   This approach has one important advantage: an agreement can be reached in advance on the amount of the subsidy and its periodic revisions, with the result that the State knows beforehand the exact cost of such services.

4. Private participation in infrastructure was examined in point 5.4 above.

**Railway Freight Trading Company (CCF)**

The creation of CCF represents the actualization of option 2b above concerning the creation of a private-public partnership (PPP) for freight transport. Although the World Bank understands that AFE’s efforts in 2008 to interest the private sector were unsuccessful, it believes that the initiative, properly modified, is a valid alternative for private involvement in the enterprise.

In the above analysis, it was pointed out that the prequalification conditions governing the organization of this corporation limited its range of action in a number of fields, particularly with regard to direct operation of the railway. Under the above-mentioned conditions, CCF’s role was limited to making investments in rolling stock, providing commercial management services and supplies, and planning and overseeing railroad operations and maintenance, which would be performed by AFE.

Success in establishing a PPP would require a complete revision of the terms governing private participation as set out under this scheme.

According to the available information, AFE did not conduct an economic assessment of this private participation model. A superficial analysis of the figures shows that the economic compensation arrangement considered on the original bases does not, in practice, allow for the generation of sufficient surpluses to cover the PPP’s operating and capital costs.
In these circumstances, the private sector’s lack of interest was completely predictable. It is therefore essential to reformulate the expected role of the private sector, if this Public-Private Partnership (PPP) arrangement is to be pursued.

The preparation of an operational project is key to determining the costs of the system, the investments that will be necessary, the amount of the subsidies involved, and the private and social profitability such a system would have.

In the future, and depending on how freight transport and the government’s policies evolve, AFE’s shares in the revamped PPP could be divested in order to make the PPP a 100 percent private entity.

**POSSIBLE SCENARIOS**

Analysis of the factors contributing to the rail transport problem yields a series of possible scenarios, a number of which are set out and analyzed below.

1. **Scenario 1: AFE continues as a monolithic enterprise**

   AFE continues to operate its infrastructure, continues providing passenger and freight services, and continues performing maintenance for its rolling stock and possibly the infrastructure, using its own resources.

   This scenario is the current situation optimized, without structural changes, and is the route currently being taken by General Management.

   The only advantage of this option is that it does not require any type of structural change, as the current situation can be optimized using the available legal and administrative means.

   The disadvantages of this option are:

   ③ The GoU will need to continue covering AFE’s annual deficits.
   ③ All investments, both in infrastructure and in equipment, must be financed by the State, without this obviating the need for an assessment of their social cost effectiveness in a medium- and long-term scenario.
   ③ The State’s known problems in managing a company such as AFE would very likely result in rail transport remaining a minor player and continuing to compete with road transport on unequal terms.
   ③ The conflict between state-run rail transport and private road transport will accentuate distortions in the allocation of transport infrastructure resources.

   These difficulties suggest that this option is not a real solution to the rail transport problem.
2. **Scenario 2: private participation in freight transport**

AFE continues to operate passenger services and manages the infrastructure. Freight services are assigned to a concession holder, which may be entirely private or a public-private partnership (PPP).

The advantages of this option are, essentially:

- Responsibility for investing in freight rolling stock is transferred to the private sector.
- AFE’s deficit from freight operations is reduced.
- The private sector is in a position to improve the competitiveness of rail transport.
- Some of the responsibility for investing in railway infrastructure can be transferred to the private sector.
- Resources for investment in transport infrastructure can be better allocated.

The main disadvantages of this option are:

③ It does not entirely solve the rail transport problem, as AFE must continue to manage the infrastructure and deal with the shortage of passenger services.
③ The problem of reducing AFE’s staff must still be solved.
③ A carefully prepared competition or bidding process is required to ensure a successful concession.
③ Some degree of State supervision of the freight concession(s) is required.
③ The State continues to be responsible for the railway infrastructure.

3. **Scenario 3: private participation in freight services and transfer of the infrastructure to CFU**

CFU assumes responsibility for the provision of infrastructure (investments and maintenance). AFE continues to operate passenger services and manage traffic. As in Scenario 2, freight services are transferred under a concession agreement to a private operator or a PPP.

The advantages of this option are, essentially:

- Responsibility for investing in freight rolling stock is transferred to the private sector.
- AFE’s deficit from freight and infrastructure operations is reduced.
- The private sector is in a position to improve the competitiveness of rail transport.
- Responsibility for some of the investments in railway infrastructure can be transferred to the private sector.
- Resources earmarked for investment in transport infrastructure can be better allocated, as both investment and maintenance are CFU responsibilities.
The main disadvantages of this option are:

① It does not entirely solve the rail transport problem, as AFE must continue dealing with the shortage of passenger services.
② It does not ensure efficient investment in infrastructure because infrastructure and operations are not under the same administration.
③ The problem of reducing AFE’s staff must still be solved.
④ A carefully prepared competition or bidding process is required to ensure a successful concession.
⑤ Some degree of State supervision of the freight concession(s) is required.
⑥ The State continues to be responsible for the railway infrastructure through CFU.

4. **Scenario 4: passenger services are spun off to a subsidiary**

Suburban passenger services are transferred to an AFE subsidiary or to an independent State enterprise, which will be subsidized directly by the entities involved (state, cities). As in Scenarios 2 and 3, freight services are transferred under a concession agreement to a private operator or a PPP. CFU assumes responsibility for the provision of infrastructure (investments and maintenance and possibly traffic management). AFE may (perhaps) retain responsibility for traffic management (movement of trains).

The advantages of this option are, essentially:

- AFE’s deficit is eliminated.
- It completely solves the rail transport problem.
- Responsibility of investing in freight rolling stock is transferred to the private sector.
- Responsibility for some of the investments in railway infrastructure can be transferred to the private sector.
- The private sector is in a position to improve the competitiveness of rail transport.
- Resources earmarked for investment in transport infrastructure can be better allocated, as both investment and maintenance are CFU responsibilities.
- The cost of passenger services and, therefore, the amount of the subsidies required can be determined.
- Resources earmarked for investment in suburban passenger transport can be better allocated.

The main disadvantages of this option are:

③ The problem of reducing AFE’s staff must still be solved.
③ It does not ensure efficient investment in infrastructure because infrastructure and operations are not under the same administration.
③ A carefully prepared competition or bidding process is required to ensure a successful concession.
③ Some degree of State supervision of the freight concession(s) is required.
③ Some degree of State supervision of the passenger service(s) is required.
③ The State continues to be responsible for the railway infrastructure through CFU.

5. Scenario 5: vertical integration by sector

Scenario 5 is practically the same as Scenario 4, but in this case the infrastructure is included in the freight and passenger concessions, by sector. CFU makes social interest investments in infrastructure, which remains the property of the State, and AFE assumes responsibility for administering the concession contracts and supporting the MTOP’s planning function.

The advantages of this option, in addition to those indicated in Scenario 4, are:

- The freight and passenger concession holders exercise operational control over their sectors, with greater coordination.
- CFU retains those sectors of the infrastructure for which no concessions have been granted owing to lack of interest, as well as those sections that are out of service.

The main disadvantages of this option, in addition to those indicated in Scenario 4, are the following:

- A contract is needed for freight trains to use passenger rail lines.
- Some degree of State (AFE?) supervision and coordination of the freight and passenger concessions is required.

The following table summarizes the situation in each of the scenarios.
Table 11: Railroad Reform Scenarios

<table>
<thead>
<tr>
<th>Function</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tr>
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<td>Mixed</td>
<td>Operators</td>
</tr>
<tr>
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<td>State</td>
<td>State</td>
<td>Operators</td>
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<tr>
<td>Operation</td>
<td>State</td>
<td>State</td>
<td>State</td>
<td>State</td>
<td>Operators</td>
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<tr>
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<tr>
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<td>Partial</td>
<td>Partial</td>
<td>Total</td>
<td>Total</td>
</tr>
</tbody>
</table>

Source: Own elaboration

In the above-described scenarios, private participation is phased in. There are other possible combinations as well, inasmuch as the spinning off of passenger services can be carried out separately from the granting of freight concessions or the transfer of infrastructure management to CFU.

How the various factors are handled will depend on the decision ultimately adopted.

**Creation of a Railroad Regulation Office**

Under almost any option selected for the future of Uruguay’s railroad, institutional adjustments will be absolutely essential. One of these addresses the lack of a railway regulatory agency, such as exists in countries where rail transport is more advanced. This function has to do with activities that must be managed centrally and which, owing to their nature, cannot be entrusted to a railroad company in particular. This problem was solved by creating a Railroad Regulation Office with the following primary functions:

③ Strategic rail sector planning, encompassing both infrastructure and services, while ensuring healthy competition among the various modes of transport and correcting externalities and other market distortions.

③ Participate actively in the evaluation and selection of investment projects involving the commitment of public funds, as well as plans for private participation in the national railroads.

③ Analyze and study the establishment of transport services of social interest, and propose State participation, including possible subsidies.

③ Issue and monitor compliance with railroad safety regulations.

③ Conduct and support research aimed at improving railroad safety.

③ Assume responsibility for studying, proposing and monitoring subjects of primary importance in the area of safety: level crossings, hazmat transport, accidents, etc.

③ Develop a process for the technical standardization of railroad activities.

③ Assume responsibility for granting train operating licenses.
GOU’s Policy Definitions on the Railway Sector

The government’s policy definitions for the transport system and for the railroad in particular provide a general framework for the solutions included below under the proposed Modernization Plan for the Railroad. The main definitions include the following:

- The Government of Uruguay has determined that the country should have a railway system for freight transport in the long term.
- It has also decided that private participation in freight transport is necessary in the medium and the long term, for purposes of both investment and management.
- The railroad and its international connections should be an integral part of a long-term project to make Uruguay a logistics and service center in the Southern Cone.
- Metropolitan passenger rail service will be maintained in the short term and its inclusion in the metropolitan transport plan for Montevideo will be studied.
- Given the current conditions, it has been determined that the industrial organization of the sector, and of AFE in particular, will undergo no changes in the short term. AFE will retain its monolithic structure and steps will be taken to improve operational efficiency.
- Major investments will be made to rehabilitate and improve (upgrade) infrastructure in sectors with the greatest freight development potential. Some of these investments are already under way.\(^7\)
- In the medium term, a comprehensive modernization of the railroad is proposed.
- Independently of the organization given to the sector in the medium and the long term, essential upgrading and modernizing measures will be adopted in the short term, including the resizing of staff, expanded access to information and the incorporation of modern technology.
- Separate cost accounting should be kept for passengers and freight, in order to determine the economic performance of each service and monitor any subsidies granted.
- A Railroad Regulation Office should be created at the central level (MTOP), with responsibilities related primarily to the regulation of sector competition and safety.

\(^7\) A breakdown of infrastructure investments is contained in document CND-RIV-CONSTANTE.xls provided by CFU.
proposed MODERNIZATION PLAN FOR THE RAILROAD

INTRODUCTION

The Modernization Plan for the Railroad put forward as a primary outcome of this technical assistance was structured in such a way as to respond to the assessment of problems identified by the consulting team in the course of reviewing the available documents, making specific visits to various AFE units, attending meetings at the ministerial level (MTOP) and holding participatory workshops. The proposed plan incorporates the current definitions and restrictions of the government’s transport policy relevant to AFE. A number of aspects are identified for which there are as yet no definitions and/or concerning which not enough is known. In the near future, then, it will be necessary to adopt clear definitions in order to be able to project rail transport into the medium and the long term. For these reasons, the duration of the proposed plan should be no longer than five years, during which time the pending policy definitions can be resolved by the government.

The main aim of the Modernization Plan for the Railroad is to create a new legal, institutional, and organizational framework for the development of a modern rail system in Uruguay, based on various generally accepted economic principles and government policies.

As determined in the assessment of the status of rail transport in Uruguay, there are three levels of actions and projects that will require the adoption of specific programs: an initial level pertaining to national transport policy, a second level relating to national railway policy, and a third level involving a policy aimed at modernizing AFE. In all these programs specific courses of action are proposed which are derived directly from the assessment and which should be explained in detail in subsequent stages of this study. Together, these courses of action constitute a reference framework for modernizing and upgrading the national railway system, first in the short term (five years), followed by an update and projection into the medium and the long term.

Based on the Government of Uruguay’s current policy definitions (under which AFE maintains its monolithic structure), primary responsibility for implementation of the Plan lies with the government and will require a significant commitment on its part. It is especially important to formulate the national policy definitions contained in Program 1, which constitute the basis for developing the transportation sector and which are relatively independent of the institutional organization of the railroad. The policies required in Program 2, in contrast, refer only to rail transport and are dependent on the viability analyses and studies set out in that program. Finally, the measures proposed in Program 3 refer specifically to AFE as a government-owned enterprise, although they are also valid in a private participation scheme.
PROGRAM 1: TRANSPORT POLICY DEFINITIONS AT THE NATIONAL LEVEL

Strategic policy bases need to be defined at the national level to support the Modernization Plan for the Railroad, including the role to be assigned to AFE in particular. Both the Modernization Plan for Uruguay’s Railroad and the changes considered necessary in the State-owned railway company, AFE, must be aligned and consistent with national policies concerning the transport sector. Its viability and long-term sustainability depend in large part on this factor.

The following elements should be included in the national strategic policy definitions:

1. Resources should be sought to increase the levels of investment in transport infrastructure that is socially profitable, with the addition of new sectors in which investment is deficient: railroads, freight and/or passenger terminals, port access, safety improvements, etc. Consequently, where public funds are insufficient, opportunities and conditions for private investment should be identified.

2. A transport system should be constructed with market operating rules that create fair and transparent competition, both within each mode of transport and among alternative modes.

3. An integrated transport system should be developed. This means searching for ways to encourage modal integration in the transport of freight and passengers, as well as integration of the transport system with the system of economic and social activities. It also means aiming at achieving levels of development in the various modes of transport based on their comparative advantages and seeking a system that is economically and socially more efficient and flexible.

4. An institutional framework needs to be created with the capacity to respond to the requirements of the transport policy, in terms of both functions and resources.

Based on the assessment (needs) and definitions formulated in the workshops, the following subprograms are proposed for the implementation of this program:

Subprogram 1.1: Development of an institutional framework for national transport

An institutional framework needs to be designed at the central government level that is consistent both with the role defined for that level and with the overall and specific transport policies to be applied to rail transport.

The main institution in the transport system is the Ministry of Transport and Public Works, which is responsible for defining and implementing sectoral polices. These policies must be consistent with national economic and social policies and take into account the restrictions imposed by the agencies responsible for the government budget. Transport policies should reflect and be coordinated with the sectoral policies for productive development and with regional and/or local policies.

For the MTOP, the following entities should be considered, in addition to those already in place:
f) Unit responsible for Planning and Evaluating Public Investment Projects in the Transport Sector (for all modes)

\[\text{g) Unit responsible for Transport Market Regulation and Oversight} \]

\[\text{h) Railroad Regulation Office} \]

\[\text{i) Rail Corporation of Uruguay (already in existence, but its role in implementing railway policy needs to be more clearly defined)} \]

\[\text{j) Railroad Modernization Plan Management Office} \]

**Subprogram 1.2: Creation of a competitive transport market**

The objective is to establish a regulatory structure for interurban freight transport services that neutralizes negative externalities and prevents unfair competition among operators in a given mode by imposing levels of equivalent requirements across modes to avoid the distortion of intermodal competition.

Regulation implies both the issuance of appropriate standards to promote competition and control monopolistic situations, as well as the establishment of a supervisory structure that ensures a high degree of compliance with the standards for all modes.

The following situations need to be addressed:

\[\text{a) Regulation of competition} \]

The objective is to avoid monopolistic practices and ensure fair competition within each mode and across modes with a view to promoting economic efficiency in freight transport markets. Accordingly, the following elements must be in place:

\[\text{(i) payments for infrastructure (tolls or other forms of payment)} \]

\[\text{(ii) standards governing infrastructure use} \]

\[\text{(iii) taxation} \]

\[\text{(iv) labor laws and standards} \]

\[\text{(v) market access} \]

\[\text{(vi) safety standards} \]

\[\text{(vii) environmental standards} \]

\[\text{(viii) public investment decisions based on intermodal comparisons and a multimodal perspective} \]

\[\text{b) Regulation of externalities and levels of service} \]

The objective is to neutralize negative externalities not identified in the assessment of private costs. The aim of this regulation is to ensure that the standards established are comprehensive and proportional for both providers and modes of transport, avoiding regulations that entail inefficient additional costs or distort competition. One policy approach is to absorb external costs into the production of freight transport services within each mode (standards governing safety, the environment, congestion, etc.). The
service levels of the various modes of transport can be defined via standards—generally minimal—that are also aimed at ensuring fair competition.

c) Supervision and monitoring of regulations

Ensure the effectiveness and efficiency of standards, ensure that they are properly applied, and monitor compliance in a context of equity among the various participants and modes.

Subprogram 1.3: Planning and evaluation of public investment projects

The objective is to ensure efficiency in the provision of infrastructure, that is, that the government budget provided maximizes social profitability.

Ensure that the planning of public and private investment in interurban transport infrastructure reflects national and regional development goals and fulfills efficiency objectives in social terms.

Develop and promote new investment formulas and projects that are attractive to private investors, to encourage their participation in socially profitable public infrastructure projects.

Construct an efficient fare structure for use in the infrastructure of the interurban transport system (ITS) that eliminates economic distortions across modes and incorporates external costs.

Significantly increase management oversight in the ITS infrastructure so as to reduce pressure through larger investments and improve the level of user services.

With regard to the evaluation of public investment projects, social and financial evaluation methodologies need to be developed for all modes of transport to ensure an equitable multimodal perspective and guarantee the implementation of the best, most profitable projects.
PROGRAM 2: DEVELOPMENT OF A NATIONAL RAILWAY POLICY

Subprogram 2.1: Creation of the Railroad Regulation Office

There are circumstances in which decisions concerning rail transport must be addressed at the central level, particularly those related to the definition and monitoring of compliance with safety standards, public investment decisions, level crossings, and others. Similar to the functions that offices of this type fulfill in other countries, the following functions can be proposed for this office:

- Issue and monitor compliance with railroad safety regulations pertaining to equipment, the design and use of rail lines, signaling and traffic control, etc.
- Conduct and support research aimed at improving railroad safety.
- Study, propose, and monitor subjects of primary importance in the area of safety: level crossings, hazmat transport, accidents.
- Assume responsibility for the granting and inspection of train operating licenses.
- Collect and analyze data on railway accidents and incidents and convert such information into publicly available statistical reports and analyses.
- Strategic rail sector planning, encompassing both infrastructure and services.
- Regulate the railroad market, promote competition in the land transport market and multimodal transport.
- Participate actively in the evaluation and selection of investment projects that involve public resources, as well as schemes involving private participation in the national railroad. Its role in evaluation processes should be to provide a vision of the rail policy, strategic planning, and market regulation in the evaluation processes, supporting the planning and evaluation of public investment projects.
- Any others determined by the ministerial authority.

These functions can be incorporated gradually following the creation of the Railroad Regulation Office, in accordance with a program that assigns the highest priority to the most important functions. The professional and administrative personnel needed to carry out the defined functions, as well as the necessary resources, will come from the program established to set up the office.

Subprogram 2.2: Review and implementation of AFE freight transport investment projects

Plan to rehabilitate rail lines

The plan to rehabilitate AFE’s rail lines, formulated with input from CFU and partially initiated, includes the renovation of a number of lines in the western sector of the system.

The determination of the sectors to be renovated and the specifications of such renovations were not based on a detailed engineering plan and an economic assessment,
but were, apparently, only an outcome of the establishment of minimum standards. It should be borne in mind that the potential volumes of forest products to be transported are merely estimates, for as yet there are no transport contracts to back them up. It is considered necessary, before making investments, to base the demand estimates in the relevant studies on prior contracts.

Moreover, the terms of reference of the international invitation to bid for performance of the work contain some inaccuracies that can be traced to the lack of a technical plan, a situation that usually encourages bidders to reflect the uncertainty in higher prices. In this event, the amount of the bids considerably exceeded AFE’s expectations and practically brought the process to a halt.

For these and other reasons, a decision was made to begin the renovation work using AFE’s own funds in one of the sectors, an approach that usually involves longer timeframes and causes quality control problems.

Given the size of the investments, which exceed US$150 million, it is advisable to review this plan with a view to accomplishing three main objectives:

4. Study potential transport demand by sector to improve the accuracy of the estimates and support those estimates with prior contracts.
5. Prepare a more accurate technical plan to minimize the risk factors. This plan should establish fixed quantities for each of the parties and an official budget based on a unit cost study.
6. Conduct a private and social economic assessment of the investments, for each sector of the system.

Purchase of locomotives

The rehabilitation project also includes the purchase of diesel locomotives. The justification for this initiative is, apparently, the lack of tractive power on the railroad, which would make it difficult to attract freight business in the current demand environment.

This initiative is not supported by a plan and it is therefore impossible to gauge its benefits. Such a plan should be prepared and should consider the actual likelihood of attracting new freight business as well as the possibility of improving the performance of the current locomotives by improving the rail lines. At present, AFE’s more modern locomotives travel an average of approximately 260 km per day, a figure that could be raised significantly by increasing traffic speeds.

Other freight transport investment projects

Other freight transport investment projects in the future should be handled in much the same way as the approach recommended for the rehabilitation plan, consisting of a
preliminary study to quantify the private and social benefits and costs of the project, followed by an economic assessment conducted in accordance with a generally accepted methodology.

This approach should be taken for all projects involving the investment of public funds.

**Subprogram 2.3: Policy definition and analysis of projects for the development of passenger transport at AFE**

*Public policy definition for passenger rail services*

It will be necessary to define the State’s role in the provision of passenger rail services, in conjunction with the role assigned to AFE in the provision of such services.

Will the State or the public enterprise provide rail transport services for passengers?

If so, must those services be socially cost effective, particularly if new services are involved?

If the services are socially cost effective but not privately profitable, will the State subsidize the enterprise that provides them (AFE or other)?

Will passenger services be integrated with other public transport services? Will a minimum service standard be established?

Should AFE function like a private enterprise, i.e., require that its services be privately profitable? If the State asks it to provide certain services, will specific payments be established for them?

These and other questions must be answered in order to define a government policy that allows for identifying, assessing and operating services, either directly by AFE (in an initial phase) or possibly by another public or private enterprise in the future.

*Assessment and identification of options for the development of passenger transport services by rail*

An assessment of urban and suburban transport problems in the city of Montevideo is needed, which will include all modes of transport in the structure of services provided (railroad infrastructure, terminals, vehicles/equipment and rolling stock) and the operation of both public and private transport markets. Based on the results of this assessment and in light of the available information on travel demand and projections thereof, conclusions should be reached concerning the opportunities that rail transport offers for the provision of passenger transport services, and options should be identified with a description and analysis of their main characteristics. The options should indicate the need for investing in track improvements, purchasing or upgrading equipment, traffic control systems and many other aspects involved in the execution of a passenger rail
project, as well as considering the necessity of its integration with the city’s transport system.

**Evaluation of options**

The options identified in the assessment should be evaluated from a social standpoint with a view to determining their profitability and supporting the decision of the MTOP and the public financing agencies to approve the project. The evaluation should estimate the investment costs involved in each alternative as well as the operating costs during its useful life. The benefits to users should also be estimated, comparing scenarios with and without the project. Based on the authority’s objectives, it will be necessary to estimate other impacts in areas not necessarily included in the economic values (accidents, environmental effects, urban impacts, etc.). The methodology to be used for the evaluation should be proposed and approved by the MTOP and the public sector entities responsible for project financing and execution. It is important to define the service standards to be specified in the proposed alternatives, the quality of equipment, frequency of service, collection systems, quality of stations, etc., in addition to defining fare policies and integration with other modes of transport.

**Financial assessment of the project**

A financial assessment of passenger rail project alternatives should be conducted to estimate their financial viability in terms of investment and operation, as well as any subsidies that the State will have to provide if it decides to provide services for social reasons that are not covered by user fares.

**Subprogram 2.4: Policy definition and proposed AFE staff restructuring**

**Proposed actions**

In the workshops held during the course of this project, questions were raised about the conclusion reached in various assessments that AFE is overstaffed. In fact, some areas are described as being understaffed, which requires staff to work overtime.

However, the conclusion in question is based on a comparison (benchmarking) made in the said assessments with similar railroad productivity standards in South America.

The reason for these divergent opinions resides precisely in staff productivity. It is possible, in the current organization and with the resources available, that AFE is appropriately staffed, and there may even be shortages in some areas.

The modernization plan for the railroad is aimed, among other objectives, at boosting staff productivity to the level of the international standards for similar railroads, by technically and administratively upgrading the organization. The incorporation of modern train movement, communications and IT systems, as well as the outsourcing of
certain activities, will allow for a significant reduction in staffing and fixed personnel costs.

**Staff resizing**

The staff resizing problem is complex and can only be addressed in a program well coordinated with the execution of investments and the incorporation of new techniques.

One of the effects to be avoided, if possible, is the offering of improper staff reduction incentives, which often lead to the loss of valuable human resources, inasmuch as railroad experience is a unique professional asset that is difficult to replace.

An effort should also be made to avoid the social problems associated with the separation of staff, as the experience of railroad workers cannot be easily transferred to other sectors.

Special advisory assistance is recommended for this process, so as to develop a staff resizing plan that will include not only the reduction of redundant staff but also the hiring of personnel with special skills not currently available to the railroad and the training of remaining staff in the new techniques to be introduced.

**Policy on the handling of surplus staff**

Some options for the handling of surplus staff have been indicated:

1. Continue with the attrition policy. Reaching appropriate staffing levels with this system could take 5-10 years. This length of time seems incompatible with the current reform requirements, and there is no guarantee that it will end with the requisite staffing structure in place.
2. Assign surplus personnel to auxiliary or redundant functions within the rail system and decrease their number through attrition. Policies of this type have a high cost in terms of worker morale and create problems with unions.
3. Transfer surplus staff to other government units, with additional training for reintegration into the labor market.
4. Develop an incentive plan to encourage early retirement. This is usually an advantageous solution, which in the long term results in stable or lower costs for the government and allows for a quick reduction in staffing. This plan should also include incentives to retain qualified personnel.
5. Supplement the early retirement plan with special packages for separate staff not eligible for retirement.

All these solutions require the direct backing of the central government in two areas: in the economic area, to cover the costs involved, and in the area of State management and administration, to reduce the social and political costs.
Subprogram 2.5: Definition of medium- and long-term rail sector policy

An explicit public policy should be defined, explaining the role that the Government of Uruguay considers appropriate for the private sector to play in the provision of railway services, for both freight and passengers.

The private sector’s involvement could include market access for new enterprises and services, using the current lines (property of the state) or on new lines. The private sector could also participate in the current system managed by AFE by investing in infrastructure and equipment, and/or by managing railway services.

There are many forms of private participation in the railway market, ranging from the full ownership of railway assets and management of the business aspects, to simply providing services under time-limited concession arrangements. It helps in adopting a policy definition in this area to have a forward-looking vision of the socially most efficient role that the railroad can play in the national transport system. For example, if this role involves boosting capacity, which in turn involves large investments that the State may not be willing to make (because of other social interest commitments), or if a high degree of management efficiency is required to guarantee the continuing viability of the railroad, the decision may incline toward encouraging the private sector to contribute investment resources and/or its experience in management and participation in competitive markets.

For these purposes, it is advisable to conduct a study of freight transport at the national level, identifying the degree and characteristics of greater long-term efficiency that the freight railway system ought to have.

With regard to passengers, the role of the State and its willingness to subsidize services that are not privately profitable and/or the feasibility of the private sector providing passenger services with or without subsidies should also be defined.

Subprogram 2.6: Railroad safety

Purpose and scope

The purpose of this subprogram is to develop a railroad safety policy covering both the design and the domestic and international operation of public and private railroads.

This policy will be reflected in the issuance of safety standards by the Railroad Regulation Office, compliance with which will be obligatory for all railroad operators. The office will monitor compliance with these standards, recommend safety measures and have the authority to impose penalties in appropriate cases.
Registration of accidents

For statistical purposes, railway accidents are divided into internal accidents, in which only railroad equipment and facilities are involved, and external accidents, in which non-railroad individuals and property are also involved.

The above notwithstanding, internal and external accidents in which personal harm or injury occurs are treated as one, with police involvement and registration, depending on the legislation of the country in question.

Internal railway accidents involving only damage to equipment and facilities are registered and investigated internally. The investigation has two basic objectives:

1. Determine the causes in order to take corrective action
2. Estimate the amount of the damages.

External accidents mostly involve collisions at level crossings or accidents involving persons who are crossing the tracks or walking on the right-of-way. These accidents are usually registered by the police, who must follow-up on the condition of the injured. In these cases, the objectives indicated for internal accidents are not pursued, as such cases must be handled by a State agency responsible for traffic safety.

The procedures for registering internal and external railway accidents should be analyzed to improve the compilation and processing of data, with a view to taking the necessary steps to reduce the occurrence of accidents, based on their seriousness, as duly assessed in terms of the amount of the damage and the social costs.

The problem of level crossings

The problem of level crossings is of concern to authorities the world over, as it is, for many, the most important safety problem related to the railroad.

Accidents at level crossings are usually considered a railroad problem. However, in Uruguay, the increase in accident rates at level crossings is attributable essentially to the increase in the number of vehicles on the road, as railway traffic has either remained constant or has decreased.

Various measures have been considered to reduce the frequency of these accidents:

1. Permanent policies to eliminate level crossings or construct over/underpasses.
2. Protection and signaling at level crossings, consistent with the volume of traffic.
3. Improvement of standards at existing crossings.
4. Education campaigns for drivers and pedestrians.

Level crossings can be eliminated by providing alternatives or building over/underpasses. Both of these solutions require modifying the road system and are usually financed by the
road sector. Conversely, when new rail lines are built, road crossings are financed by the railway project.

Various level crossing protection and signaling solutions are available, depending on the road and railway traffic and the characteristics of the crossings.

The so-called Moment of Traffic indicator, which is obtained by multiplying the number of road vehicles by the number of railway vehicles using a crossing in 24 hours, is used to prioritize crossings. Some countries use more sophisticated indicators that are also based on the Moment of Traffic, but which incorporate aspects such as visibility, angle of approach, slopes, etc. Given the conditions at level crossings in Uruguay and the volume of current and projected traffic, the Moment of Traffic is considered an appropriate indicator.

Depending on the Moment of Traffic (MT) values, increasing levels of protection and signaling can be adopted (each solution includes the one before it):

- Low values: Fixed signaling (warning signs)
- Medium values: Automatic lighted signage
- High values: Automatically activated barriers
- Very high values: Engineer warning devices

It is recommended that the current system of indicators be studied and that a safety standard be issued specifying the level of protection at level crossings, based on the values of said indicators.

The reference to standards at existing crossings concerns the geometric standards (visibility, angle between the road and the tracks, gradients and approach slopes, etc.) and the quality of the pavement.

Standard solutions should be developed for pavements and specific projects for the geometrical improvement of critical crossings.

Lastly, it should be kept in mind that education campaigns in other countries have yielded significant results in terms of reducing level crossing and trespassing accidents. Of particular interest is Operation Lifesaver, which was developed in the United States as a joint effort of the Federal Railway Administration, state governments, and the railroads. In addition to public campaigns targeting drivers and pedestrians, Operation Lifesaver is involved in educational activities in schools and community organizations.

One final consideration to be borne in mind is that many accidents occur at unauthorized level crossings. The creation of these clandestine crossings does not seem to be sufficiently addressed by the law and, therefore, the steps taken by the railroad to close them only have a temporary effect, as they are reopened by their users.
Some of these crossings serve real needs in the communities that have sprung up along the railroad. In such cases, the problem should be solved either by making the crossings legal or by developing alternative solutions with the competent authorities.

The recommendations, in short, are to:

- Study the legal status of level crossings and possibly amend the legislation governing them
- Develop a national plan to eliminate level crossings
- Review and possibly modify the indicators of traffic levels and the dangerousness of level crossings
- Establish a safety standard for the protection and signaling of level crossings, based on the level of traffic
- Formulate a nation plan to improve existing crossings
- Develop education campaigns for drivers and pedestrians

Environmental safety

The transport of materials labeled hazardous entails risks for both humans and the environment in the event of accidents involving spillage.

Industry uses a number of hazardous materials, the transport of which is subject to international regulations. Hazardous materials are divided into nine classes:

Class 1: Explosive substances and articles
Class 2: Compressed, liquefied, dissolved or cryogenic gases
Class 3: Flammable liquids
Class 4: Flammable solids
Class 5: Combustible substances, organic peroxides
Class 6: Poisonous and infectious substances
Class 7: Radioactive substances
Class 8: Corrosive substances
Class 9: Miscellaneous dangerous goods

The provisions governing the transport of these materials are contained in U.S. Department of Transportation (DOT) Tariff BOE-6000. These provisions are practically identical to those in force in Europe. In addition, there is a series of regulations governing the handling of vehicles carrying hazardous materials in emergency situations.

Given the intrinsic greater safety of rail transport, the trend worldwide is to transport hazardous materials primarily by rail. The cellulose industry requires a variety of hazardous materials, such as sulfuric acid, chlorine, sodium chlorate, etc., which should in the future be transported chiefly by rail.
**Other safety standards**

The Railroad Regulation Office (ORF), the establishment of which is recommended, will be responsible for issuing Railroad Safety Standards. These standards set out minimum requirements that railroad equipment and facilities must satisfy.

In the past, AFE was governed by the ALAF (Latin American Railway Association) standards, but these standards, which were the focus of a major effort by that entity, have become obsolete in some respects and inadequate in others.

It is therefore recommended that the ORF revise the safety standards by comparing them with the corresponding standards of the Federal Railroad Administration (FRA), so that the railroads will have up-to-date regulations consistent with the country’s needs. It should be remembered that the ALAF standards, because they must reconcile local conditions in different countries, tend to establish very general requirements and less exacting standards.

**Summary**

Railroad safety is one of the most important responsibilities of the ORF. To fulfill those responsibilities, the following is recommended:

- Revise the procedures for registering railway accidents, both internal and external (police, etc.).
- Formulate a national plan to improve safety at level crossings, taking into account any specific recommendations put forward.
- Analyze the national standards governing the transport of hazardous materials and the handling of emergency situations as they pertain to rail transport.
- Revise and update the current ALAF safety standards and AFE’s own standards.

**PROGRAM 3: DEVELOPMENT OF AFE MODERNIZATION PROJECTS**

The general objective of this program is the comprehensive modernization of AFE, not only from a technical standpoint but also in terms of organization, management, and the evaluation of investment projects, with a view to enhancing its efficiency, management capacity and technical and economic performance.

The proposals in this program are based on the assumption that AFE will continue to be responsible for rail operations as a government-owned enterprise. However, in the case of future private participation, the recommended actions are also necessary and would need to be carried out by the railroad entity regardless of whether it is government-owned, semi-public, or private.
The proposed program includes:

1. The formulation of a technology policy, which is essential for a railroad that has remained on the margins of technical developments in the field of rail transport in recent decades.

   This policy includes the development of technical standards for the rails, concrete structures, design of the rolling stock, signaling, traffic control, communications, and other aspects.

2. The development of a modern information and management system to facilitate timely and informed business decisions.

3. The participation by AFE in the process of evaluating investment projects for freight and passenger transport that are carried out with public funds at the central government level.

Details on the various actions recommended in this program are provided in Annex 2.
IMPLEMENTATION OF SHORT-TERM MEASURES

Introduction

Given the Government of Uruguay’s decision to maintain AFE’s current status and organizational structure in the short term, a program for implementation of the recommended measures is proposed for two reasons:

(a) to improve AFE’s operating procedures with a view to reducing its costs and making them more transparent, simplifying its management, increasing its efficiency, and, as a result, increasing its value as a company;
(b) to move the reform process forward without creating conditions that will make future private participation in rail operations and its investments more difficult or impede it altogether.

There are many possible scenarios; the report considers the following to be the most representative:

1. Scenario 1: continuation of AFE as a monolithic company
2. Scenario 2: private participation in freight transport
3. Scenario 3: private participation in freight transport and transfer of the infrastructure to CFU
4. Scenario 4: passenger service spun off to a subsidiary
5. Scenario 5: vertical integration by sector

These five scenarios can be summed up in three basic situations: (a) continuation of AFE as a monolithic company, (b) partial private participation of the railroad, and (c) total privatization of the railroad.

Three programs are proposed for the modernization of the rail sector:

Program 1: Transport policy definitions at the national level
Program 2: Development of a national railway policy
Program 3: Development of AFE modernization projects

These programs include subprograms that are analyzed from the point of view of their relationship with the three basic situations derived from the long-term scenarios proposed above.

As well, some of the problems that could be faced by these initiatives during the implementation process are indicated.

Program 1: Transport policy definitions at the national level

Strategic policy bases need to be defined at the national level to support the Modernization Plan for the Railroad, including, in particular, the role to be assigned to
AFE. Both the Modernization Plan for Uruguay’s Railroad and the changes considered necessary in the State-owned railway company, AFE, must be aligned and consistent with national policies concerning the transport sector. Its viability and long-term sustainability depend in large part on this factor.

This program consists of the following subprograms:

(1) Development of an institutional framework for national transport
(2) Creation of a competitive transport market
(3) Planning and evaluation of public investment projects

The main institution in Uruguay’s transport system is the Ministry of Transport and Public Works, which is responsible for defining and implementing sectoral polices.

For the MTOP, the following entities should be considered, in addition to those already in place:

(i) Unit responsible for Planning and Evaluating Public Investment Projects in the Transport Sector
(ii) Unit responsible for Transport Market Regulation and Oversight
(iii) Railroad Regulation Office
(iv) Rail Corporation of Uruguay (already in existence, but its role in implementing railway policy needs to be more clearly defined)
(v) Railroad Modernization Plan Management Office

Among these new units, it is proposed that priority be given to the unit responsible for planning and evaluating projects, which should take responsibility in the short term for evaluating investment projects in freight rail services and the continuation of passenger services. The evaluation methods should be consistent with evaluations conducted in other modes of transport and with the national and sectoral policy priorities.

Creation of the Railroad Regulation Office (ORF), which is considered in Program 2, is also a priority. As part of the rail policy definitions, a role should also be assigned to the existing Rail Corporation of Uruguay (CFU), particularly its responsibility for managing investment projects and future projects involving private participation in AFE.

Finally, the Railroad Modernization Plan Management Office needs to be created as the unit responsible for all programs and subprograms of this Plan, and a Manager and professional team need to be appointed.

Along with the political will to develop rail transport, particularly freight transport, all of the proposed scenarios (with no, minor, or significant private participation) require appropriate competitive conditions for the railroad. To this end, studies should be conducted and regulations issued to ensure effective competitive conditions and avoid unfair competition between modes of transport. The following need to be addressed in the short term:
1. Regulation of competition; payments for infrastructure, standards governing infrastructure use, taxation, labor laws and standards, market access, safety regulations, environmental standards, public investment decisions.
2. Regulation of externalities and levels of service.
3. Supervision and monitoring of regulations.

There is no doubt that implementing these regulations presents serious difficulties and that few countries have been successful in adjusting the operation of the transport market in line with such regulations. It is proposed that priority be given to those that relate most directly to economic performance, such as payment for the use of infrastructure, taxation, labor laws and standards, market access, safety regulations, and the decision-making process for public investments.

The greatest difficulty may be the availability of professional capacity to analyze and make the required changes. However, the necessary information should be available. In a scenario involving private sector participation, the development of these regulations may be an important factor in attracting private investors.

The program for planning and evaluating public investment projects seeks to ensure efficiency in the provision of infrastructure; that is, it seeks to ensure that the government budget provided maximizes social profitability.

For this purpose, social and financial evaluation methodologies must be developed for all modes of transport to ensure an equitable multimodal perspective and guarantee implementation of the best, most profitable projects.

One of the major limitations of this program, as for other programs, will be finding suitable professionals to take on the various responsibilities and technical studies and obtaining the necessary funding. Consultants and experts with experience in developing methodologies can be contracted to work with local specialists so as to generate knowledge and self-sufficiency in the national institutions of Uruguay.

**Program 2: Development of a national railway policy**

Six subprograms are proposed for this program:

1. Creation of a Railroad Regulation Office
2. Review and implementation of AFE investment projects
3. Policy definition and analysis of passenger transport projects
4. AFE staff restructuring
5. Definition of medium- and long-term rail sector policies
6. Railroad safety

These six subprograms are fully compatible with any organizational structure for the rail sector that may be decided by the Government of Uruguay, whether it involves
maintaining AFE as a monolithic government-owned enterprise or partially or fully privatizing it. All are aimed at establishing an institutional framework to formulate, develop, and implement a rail policy within the framework of the general transportation policy set out in Program 1.

A consensus apparently exists in the Government of Uruguay on the need to establish a Railroad Regulation Office (Subprogram 2.1). This Office, which should report to the MTOP, would have the functions set out in this report and would be responsible for implementing the rail policy that it would help to formulate. In the event that the Government of Uruguay should decide to create this Office, no major problems are foreseen in its implementation. However, it is important to bear in mind that if this Office is created, it should be given the necessary resources to adequately perform its functions and the political support it needs to lead the reform effort.

One of the first actions of the Railroad Regulation Office, ORF, should be to review the AFE investment projects (Subprogram 2.2). The need to review and reevaluate these projects has been mentioned above, as they were designed without adequate evaluation, especially in the case of the purchase of rolling stock. It is considered essential that this review and reevaluation be conducted with the help of an external consultant, as it is highly unlikely that the ORF will initially have sufficiently trained personnel for this work. The main problems that will be encountered relate to the advancement of the infrastructure rehabilitation project, on which work has already begun, and AFE’s resistance to any changes to projects that it has developed and that it considers essential for the rehabilitation of the company in the monolithic form that has been defined for the short term.

The problem of passenger transport (Subprogram 2.3) should also be given high priority. Suburban services are not only the source of a significant deficit for AFE operations, but also are of doubtful social profitability. The MTOP, presumably via the ORF, should prepare an economic and social assessment of the services, determine their profitability, and make the required decisions, whether they involve establishing an integrated system with other modes of transport, providing subsidies, or eliminating these services. As in the case of the investment projects, this assessment should be conducted with the help of an external consultant, for which the corresponding resources will be necessary.

One of the biggest problems that will be faced in implementing this subproject is the traditional vision of the social role of the railroad, which translates into the provision of services at all costs. If the Government of Uruguay wishes to resolve this problem it must be prepared to support and implement the solution or solutions that come out of this study.

The possibility of establishing suburban services in other areas of the country has also been mentioned. Based on an initial analysis and bearing in mind Uruguay’s population density, no passenger rail transport service appears to be socially justified. Therefore, any such initiative should be accompanied by a justifying study.
The AFE staff restructuring (Subprogram 2.4) is a process that exceeds AFE’s competence and capacities. This restructuring should include a significant reduction in the existing staff and a readjustment of staffing levels. For this purpose, a study should be done outside AFE with the help of an external consultant. The study will need to consider the Government of Uruguay’s policy definitions regarding AFE’s organizational structure in the short term, which in all cases will lead to a significant reduction in staff, as can be inferred from the benchmarking done in the DPR. Other scenarios can be looked at, depending on the guidance provided by the Government of Uruguay, but it is important to bear in mind that the solutions adopted will serve as a precedent for future actions.

There will be complex problems with the implementation of this subprogram. To start with, there will be union opposition, something that has historically had a significant influence on AFE management. AFE workers do not agree with the conclusions of the studies that show that AFE has much more staff than is needed for an efficient company, and they maintain that the increase in transportation of forest products will not only justify current staffing levels but will result in a need for additional personnel. AFE’s restructuring in any scenario will have to deal with this problem.

Furthermore, AFE is not in a position to cover the cost of such a staff reduction. This report proposes various options for implementing this process, all of which will have costs that will ultimately need to be covered by the State. There are various examples of similar restructurings in Latin America, the cost of which has varied, depending on the solution selected, but an amount on the order of US$100,000 per person is suggested.

The definition of medium- and long-term rail sector policies (Subprogram 2.5) exceeds the scope of this report and, rather, is a basic function of the MTOP and ORF. It will depend on the guidelines provided by the Government of Uruguay in the general transport policy framework that is covered in Program 1.

The actions relating to railroad safety, described in Subprogram 2.6, are ongoing responsibilities of the ORF and will depend basically on the resources provided to this Office. In other countries in which there was a national rail company, these functions were carried out by the company itself and the existence of an organization such as the ORF did not appear to be necessary. In this case there is a risk that AFE’s current structure will be considered permanent and that the ORF will delegate some—or all—of its functions to the AFE, owing to a lack of resources.

Program 3: Development of projects to modernize AFE’s management

The three subprograms included in this Program are fully compatible with any organizational structure that the Government of Uruguay may decide on for the rail sector, whether it involves maintaining AFE as a monolithic government-owned enterprise or partially or wholly privatizing it.
Subprogram 3.1 involves the development of a technology policy consistent with modern railroad techniques and adjusted to Uruguay’s transportation needs. This is considered essential for the rail sector, regardless of how it is organized. Whether the current structure is maintained or whether some aspects of its operation are handled by the private sector, a consistent technology policy will mean greater operating efficiency and lower costs. Even in the event of total privatization, including privatization of the infrastructure, the eventual private owner will need to develop an integrated technology policy, and if the policy recommended in this Subprogram is developed on the basis of the general technological criteria in force in Uruguay, it should be appropriate.

The problems that will be faced in implementing this subprogram relate basically to the lack of trained personnel in AFE. The attrition process that has been ongoing for some years has meant that staff reductions have not been selective, and AFE’s professional capacity has been declining and is barely sufficient for daily operations. In this case, as in the previous cases, the help of an external consultant is deemed necessary, along with the appropriate resources.

Subprogram 3.2 involves the development of a modern information and management system. The basic component of this system is a cost information system that will not only enable AFE to operate its assets rationally and efficiently, but will also serve as a basis for any future decisions on investments, new services, and other operating modalities, and will make it easier to estimate the company’s economic value in case of partial or total divestment of the company. The development of this system should, in all of the scenarios, take place before any major decision is made on AFE’s future.

The problems that arise with the implementation of this subprogram are basically the same: AFE’s lack of capacity and the resources needed both to contract the necessary professional capacity and to implement the project itself, which involves the purchase of hardware and development of ad hoc software.

Finally, Subprogram 3.3 considers AFE’s participation in the evaluation of rail investment projects involving public funds. This is a function that corresponds to MTOP, specifically the ORF, although AFE’s participation in it is essential, both for the development of projects and for the provision of technical information, cost data, and information on operating procedures. Without prejudice to the possibility that the technical and economic studies will be carried out by external consultants, AFE’s role is essential.

The problems with the implementation of this subproject, which will be ongoing, relate to the aforementioned lack of professional capacity in AFE, which should be eased by the adjustment of staffing levels. Nevertheless, a situation that often arises in monolithic companies should be avoided, i.e., that the company develop, evaluate, manage, and implement its own projects.
Implementation program

The short-term measures described above should be implemented within a maximum of five years. However, depending on the priority that the Government of Uruguay gives to these reforms, most of them could be implemented earlier, within two or three years. The Gantt chart below sets out a tentative program, without giving a specific starting date.

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program 1</td>
<td>Subprogram 1.1 Institutional framework</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subprogram 1.2 Transportation market</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subprogram 1.3 Project evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program 2</td>
<td>Subprogram 2.1 ORF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subprogram 2.2 Investment projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subprogram 2.3 Passenger transport</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subprogram 2.4 AFE personnel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subprogram 2.5 Rail policy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subprogram 2.6 Railroad safety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program 3</td>
<td>Subprogram 3.1 Technology policy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subprogram 3.2 Information and management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subprogram 3.3 Investment projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own elaboration

Cost of the short-term plan

Program 1

The cost of Program 1 relates to the creation of a new institutional framework, consisting of various offices that will need to be established, monthly operating expenditures and fees, and expenditures for studies to support the implementation of the various activities included in the subprograms. The cost of setting up each of these new offices has been budgeted at an initial US$50,000, along with the professional and administrative staff with a monthly budget of US$20,000 for the five years covered by the Modernization Plan. In addition, a budget for studies has been included in each of the subprograms.

Program 2

This program assumes that the created institutional framework is already operating and supplements its monthly operating expenditure (included in Program 1) with a special budget for the studies needed in support of decision-making and the activities that the
Railroad Regulation Office will need to carry out. The subprogram with the highest budget is the AFE staff reduction program, which is necessary for the modernization of the company.

The tentative structure proposed for the ORF is similar to that of other new offices included in this Plan, i.e., a permanent staff of three professionals, three technical specialists, and three administrative assistants. Legal and other nonspecialist functions will be assumed by the MTOP structure. The permanent staff will be responsible for counterpart functions in studies, collaborating in the development of rail policy, and developing safety standards.

AFE staff reduction costs, estimated at US$50 million, are included separately. The real cost may be different, depending on the time frame selected and the solution adopted. In practice, countries have adopted very diverse solutions, from reassigning surplus staff to other public entities, to paying the entire remuneration of such staff for the time necessary for them to meet retirement conditions. The figure provided is a gross estimate based on the latter option.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent staff:</td>
<td>390,000</td>
<td>US$/year</td>
</tr>
<tr>
<td>Investment project evaluation studies (2):</td>
<td>400,000</td>
<td>US$</td>
</tr>
<tr>
<td>Passenger transport evaluation study:</td>
<td>300,000</td>
<td>US$</td>
</tr>
<tr>
<td>AFE staff restructuring study:</td>
<td>400,000</td>
<td>US$</td>
</tr>
<tr>
<td>Other studies involving external consultants:</td>
<td>150,000</td>
<td>US$</td>
</tr>
<tr>
<td>Other expenditures:</td>
<td>100,000</td>
<td>US$/year</td>
</tr>
</tbody>
</table>

Program 3

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology policy study:</td>
<td>200,000</td>
<td>US$</td>
</tr>
<tr>
<td>IT project (including implementation):</td>
<td>3,000,000</td>
<td>US$</td>
</tr>
<tr>
<td>AFE management project:</td>
<td>2,000,000</td>
<td>US$</td>
</tr>
</tbody>
</table>
## Summary

Table 13: Cost of Short-Term Programs (US$)

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program 1</td>
<td>Subprogram 1.1 Institutional framework</td>
<td>200,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program 1</td>
<td>Subprogram 1.2 Transportation market</td>
<td>240,000</td>
<td>240,000</td>
<td>240,000</td>
<td>240,000</td>
<td>240,000</td>
</tr>
<tr>
<td>Program 1</td>
<td>Subprogram 1.3 Project evaluation Management plan</td>
<td>440,000</td>
<td>440,000</td>
<td>240,000</td>
<td>240,000</td>
<td>240,000</td>
</tr>
<tr>
<td>Program 1</td>
<td>Other expenditures Management plan</td>
<td>340,000</td>
<td>340,000</td>
<td>340,000</td>
<td>340,000</td>
<td>340,000</td>
</tr>
<tr>
<td>Program 2</td>
<td>Subprogram 2.1 ORF</td>
<td>390,000</td>
<td>390,000</td>
<td>390,000</td>
<td>390,000</td>
<td>390,000</td>
</tr>
<tr>
<td>Program 2</td>
<td>Subprogram 2.2 Freight investment projects</td>
<td>200,000</td>
<td>200,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program 2</td>
<td>Subprogram 2.3 Passenger transport AFE personnel</td>
<td>150,000</td>
<td>150,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program 2</td>
<td>Subprogram 2.4 Other expenditures Studies and other</td>
<td>100,000</td>
<td>100,000</td>
<td>250,000</td>
<td>100,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Program 3</td>
<td>Subprogram 3.1 Technology policy Information</td>
<td>100,000</td>
<td>100,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program 3</td>
<td>Subprogram 3.2 Information</td>
<td>1,500,000</td>
<td>1,500,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program 3</td>
<td>Subprogram 3.3 Management of investment projects</td>
<td>1,000,000</td>
<td>1,000,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total (</strong>)**</td>
<td>US$</td>
<td>4,860,000</td>
<td>4,660,000</td>
<td>1,460,000</td>
<td>1,310,000</td>
<td>1,310,000</td>
</tr>
</tbody>
</table>

(*) Total does not include AFE personnel restructuring.
FINAL RECOMMENDATIONS

The basic results of the technical assistance provided to the Government of Uruguay, as requested through the MTOP, can be summarized as follows:

1. A Modernization Plan for Uruguay’s Railroad has been proposed, consisting of a series of programs and subprograms designed to respond in a comprehensive and integrated manner to the problem of the railroad in the context of the national transport system. The main recommendation is to have the plan officially approved as an expression of national railway policy and to begin carrying out the activities indicated in the various stages.

2. The proposed modernization plan covers a period of five years, during which time various studies should be conducted and strategic decisions made to enable the formulation of a medium- and long-term plan (20 years).

3. The short-term infrastructure investment projects should be reassessed in light of the recommendations on technical standardization of the railroad.

4. Plans to invest in rolling stock should be put on hold until more information is available concerning potential demand and more is known about the policy on including private investment.

5. As a complement to investment projects aimed at strengthening the capacity of the State-owned enterprise AFE to handle potential increases in the transport of forest products and the initiatives necessary to modernize its management, important decisions concerning the future of the railroad should be tied to opportunities for participation by the private sector.

6. Both international experience and the successive assessments and results obtained concerning the maintenance of AFE’s current monolithic structure clearly recommend the inclusion of private venture capital and management in the railroad, such a decision is part of the process of implementing the proposed plan in the short term and, to a greater or lesser extent, defines much of the future of the railroad and AFE.

7. The Modernization Plan recommends that definitions concerning the role and scope of private sector involvement in the transport of freight and passengers by rail be based on prior studies identifying the relevant investment opportunities as well as the social and financial profitability of those investments and of the services provided. With these results, the State will be able to justify its decisions concerning private participation and the subsidies that will likely be necessary to compensate for any differences between social and private profitability, especially in the transport of passengers by rail.

8. In light of the cost analyses and income projections in a scenario in which transportation of forest products is captured, it was considered very probable that these volumes would ensure the viability of some sectors of the network, and it is recommended that these sectors be considered separately in the studies mentioned in point 7.
ANNEX 1: analysis of afe operating costs and projection of REVENUES and expenses

The DPR prepared by the World Bank in 2007 contains an analysis of AFE’s costs in 2005, which are summarized in the following table. The revenue figures have been amended in line with the figures shown in AFE’s 2005 Annual Report.

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount US$ million</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenues</strong></td>
<td></td>
</tr>
<tr>
<td>Freight</td>
<td>8.55</td>
</tr>
<tr>
<td>Passengers</td>
<td>0.28</td>
</tr>
<tr>
<td>Other</td>
<td>0.56</td>
</tr>
<tr>
<td><strong>Total revenues</strong></td>
<td><strong>9.39</strong></td>
</tr>
<tr>
<td><strong>Operating expenses</strong></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>4.22</td>
</tr>
<tr>
<td>Fuel</td>
<td>3.81</td>
</tr>
<tr>
<td>Materials</td>
<td>1.01</td>
</tr>
<tr>
<td>Other</td>
<td>0.73</td>
</tr>
<tr>
<td><strong>Total operating expenses</strong></td>
<td><strong>9.77</strong></td>
</tr>
<tr>
<td><strong>Administration</strong></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>1.21</td>
</tr>
<tr>
<td>Other</td>
<td>0.58</td>
</tr>
<tr>
<td><strong>Total administration</strong></td>
<td><strong>1.79</strong></td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>2.95</td>
</tr>
<tr>
<td>Other</td>
<td>1.45</td>
</tr>
<tr>
<td><strong>Total infrastructure</strong></td>
<td><strong>4.40</strong></td>
</tr>
<tr>
<td><strong>Traffic</strong></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>2.72</td>
</tr>
<tr>
<td>Other</td>
<td>0.67</td>
</tr>
<tr>
<td><strong>Total traffic</strong></td>
<td><strong>3.39</strong></td>
</tr>
<tr>
<td><strong>Other expenses</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total expenses</strong></td>
<td><strong>19.88</strong></td>
</tr>
<tr>
<td><strong>Net income</strong></td>
<td><strong>(10.49)</strong></td>
</tr>
</tbody>
</table>

Source: Uruguay, Development Policy Review, World Bank

The operating ratio (R/E) is 0.48.
These figures show that direct operating expenses, excluding infrastructure (transportation and maintenance), which are essentially variable, total US$9.77 million and exceed total revenues.

To project AFE’s financial viability in the transportation of freight, this Annex includes an analysis of revenues and expenses in a scenario of increases in the volumes transported. These volumes come from the forest products freight that the railroad could attract, as estimated in the DPR, which looks at a relatively optimistic demand—and therefore revenue—scenario.

The DPR analyzes AFE’s costs on an aggregate basis, which means that it is not possible to draw direct conclusions on the cost of the various services in response to the increases in demand for freight. However, taking the operational information contained in AFE’s Annual Reports and some international standards as a basis, it is possible to project some costs.

The following items will be considered under direct operating costs:

1. Train personnel
2. Fuel and lubricants
3. Locomotive maintenance
4. Train car maintenance
5. Passenger equipment maintenance

The following items will be considered under infrastructure:

6. Traffic operations
7. Track maintenance

And finally, the following will need to be considered:

8. Administration expenses
9. Other expenses

**Train personnel**

No separate data are available on the total number of machinists and auxiliary staff.8 A crew of two persons per train has been assumed, working 2,000 hours annually. Assuming that the staffing levels indicated in the DPR—i.e., 172 for freight and 15 for passengers—apply to the machinists, 344,000 and 30,000 man-hours, respectively, will be available.

---

8 The Annual Report lists 195 staff in 2005 for the entire Transport area.
Freight train-kms in 2005 totaled 936,071. If the 344,000 man-hours are assigned to this traffic, each crew would work an average of 5.4 km/h, slightly more than the amount indicated in the DPR.

If an improvement in commercial velocity to 10 km/h is assumed as a result of the infrastructure improvements, 187,214 man-hours would be sufficient to crew the AFE freight trains and staffing levels could be reduced to a little over 100 persons.

There is no information on unit remuneration for this personnel. The DPR indicates total expenditure of US$4.22 million on operations, with 226 staff dedicated to maintenance of the rolling stock. This amounts to a total staffing level of 421 persons in operations, equivalent to an average gross remuneration of US$10,024 per year. As machinists generally receive a higher wage than maintenance personnel, a cost of US$11,000/year per person has been assumed for the machinists, somewhat lower than in other countries in the region.

Freight train-kms in 2007 totaled 923,509, similar to 2005 levels.

The figures are somewhat different for passenger trains. Passenger train-kms totaled 177,332 in 2005. If the 30,000 hours are assigned to this traffic, each crew would work 11.8 km/h. This figure is low even for two-person crews. The average remuneration of these machinists has also been assumed to be US$11,000/year.

Passenger train-kms totaled 315,201 in 2007, 78 percent higher than in 2005. As it does not appear probable that the average velocity will have increased significantly, it is assumed that the passenger staffing level increased to at least 30 machinists. This supposition is confirmed by data in the Annual Report, which indicates that the staff of 195 persons in the Transport area in 2005 increased to 228 in 2007.

Fuel and lubricants

The DPR indicates expenditure of US$3.81 million in 2005, although it does not indicate physical units.

For the analysis, the following oil prices have been assumed:

<table>
<thead>
<tr>
<th>Year</th>
<th>Price (US$/lt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>0.659</td>
</tr>
<tr>
<td>2006</td>
<td>0.594</td>
</tr>
<tr>
<td>2007</td>
<td>0.757</td>
</tr>
</tbody>
</table>

These prices correspond to corporate prices, before taxes, used in Chile for the same years, which are in turn based on international oil prices. The prices actually paid by AFE are somewhat higher.

---

9 The DPR indicates 283 persons in 2005. The figure in the AFE Annual Report was adopted.
The Annual Reports show the following consumption in liters:

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumption</th>
<th>Unit</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>5,780,675</td>
<td>Lt</td>
<td>0.0175 (lt/ton-km)</td>
</tr>
<tr>
<td>2006</td>
<td>5,204,490</td>
<td>Lt</td>
<td>0.0171 (lt/ton-km)</td>
</tr>
<tr>
<td>2007</td>
<td>5,030,547</td>
<td>Lt</td>
<td>0.0177 (lt/ton-km)</td>
</tr>
</tbody>
</table>

**Locomotive and train car maintenance**

No disaggregated data are available on locomotive maintenance costs. As indicated above, 226 persons were assigned to rolling stock maintenance in 2005, increasing to 227 in 2006 and 245 in 2007. The average remuneration of this staff in 2005 was US$9,181/year, based on the estimates indicated above. For 2005, information is available only for expenditure on supplies and spare parts.

Estimates of AFE’s real costs have been based on staffing levels and an estimate of expenditure on supplies and spare parts in proportion to traffic. The resulting costs have been compared with standard international costs for maintenance of equipment of this age:

- **Locomotives**: US$2.00/loc-km
- **Train cars**: US$0.05/car-km
- **Passenger cars**: US$2.50/car-km

The following table summarizes these costs.

<table>
<thead>
<tr>
<th>Table 15: Estimate of AFE’s Real Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
</tr>
<tr>
<td>---------------------------------------</td>
</tr>
<tr>
<td><strong>Estimate of real costs</strong></td>
</tr>
<tr>
<td>Staffing level</td>
</tr>
<tr>
<td>No.</td>
</tr>
<tr>
<td>Unit cost</td>
</tr>
<tr>
<td>Annual personnel expense</td>
</tr>
<tr>
<td>Supplies(^{11})</td>
</tr>
<tr>
<td><strong>Total maintenance costs</strong></td>
</tr>
<tr>
<td><strong>Estimate at standard costs</strong></td>
</tr>
<tr>
<td>Locomotive-kms</td>
</tr>
<tr>
<td>Unit cost</td>
</tr>
<tr>
<td>Locomotive maintenance cost</td>
</tr>
<tr>
<td>Train car-kms</td>
</tr>
<tr>
<td>Unit cost</td>
</tr>
<tr>
<td>Train car maintenance cost</td>
</tr>
<tr>
<td>Passenger car-kms</td>
</tr>
<tr>
<td>Unit cost</td>
</tr>
<tr>
<td>Passenger car maintenance cost</td>
</tr>
<tr>
<td><strong>Total maintenance cost</strong></td>
</tr>
</tbody>
</table>

Source: Own elaboration

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\(^{10}\) Estimated amount; data not available.

\(^{11}\) In 2006 and 2007 the only data available, for 2005, were used.
It appears that the real maintenance costs are very similar (slightly lower) to the estimates on the basis of the standards. This appears to indicate that there is no room to reduce these costs.

Traffic operations

Traffic staffing levels in 2005, as indicated by the DPR, totaled 296 persons, 196 of whom were assigned to stations. Expenditure on remuneration totaled US$2,720,000 that year, equivalent to an average unit cost of US$9,190.

The DPR analysis proposes the possibility of eliminating station staff and reducing total staffing levels to 35 persons. Although it is feasible to eliminate the majority of station staff by adopting a track use authorization system for train movements, it is not considered feasible to eliminate the staff in origin and destination stations for freight or passenger trains, which is why a staffing level of 100 persons is considered for this analysis.

The Annual Reports indicate 285 persons in 2006 and 291 in 2007. It is assumed that unit costs have not changed from 2005 levels.

Track maintenance

No breakdown is available for other infrastructure expenses, but it is reasonable to suppose that these expenses involve materials. The 2005 figures show US$2,950,000 for remuneration and US$1,450,000 for other expenses.

The DPR shows that in 2005 there were 315 persons working in infrastructure at AFE. The Annual Report shows 311 for 2006 and 288 for 2007, i.e., comparable figures.

Based on the DPR figures, average annual unit remuneration was US$9,365.

Two additional remarks can be made on these figures. First, expenditure on remuneration is disproportionate to expenditure on materials (2/3 to 1/3). In the maintenance of old tracks that are in poor condition, expenditure on materials is considerably higher. This confirms the DPR’s assessment regarding the apparent surplus staff in this area.

The second remark relates to the unit remuneration. Normally, the remuneration of track maintenance personnel is lower than remuneration in other areas of the railroad because of their limited specialization. In the case of AFE, however, the average remuneration is higher than the estimate for rolling stock maintenance personnel, which requires much more specialization.

Assuming that expenditure on materials remained constant from 2005 to 2006 and 2007, track maintenance expenditure would be as follows:
2005  4,400,000  (US$)  2,731  (US$/km)
2006  4,362,540  (US$)  2,708  (US$/km)
2007  4,147,143  (US$)  2,574  (US$/km)

The resulting unit value is low, even for tracks with little traffic, as is the case with AFE. This is corroborated by the poor condition of the tracks and the high incidence of derailments and other infrastructure accidents.

The total amount allocated for infrastructure maintenance amounts to 22 percent of total expenses (2005). For a railroad with a low level of activity such as AFE, this proportion should be at least 30 percent.

The following equation is proposed to estimate track maintenance expenditures:

\[ C_{v3} = 3,000 + 0.779GTK \text{ [US$/km-year]} \]

in which GTK equals gross ton-kms circulating on the track.\(^{12}\)

Applying this formula, new values are obtained that are more compatible with AFE’s real infrastructure needs.

\[
\begin{array}{ccc}
2005 & 5,422,372  \text{ (US$)} & 3,366  \text{ (US$/km)} \\
2006 & 5,382,929  \text{ (US$)} & 3,341  \text{ (US$/km)} \\
2007 & 5,346,406  \text{ (US$)} & 3,319  \text{ (US$/km)} \\
\end{array}
\]

These figures should be accompanied by staff reductions and an increase in expenditure on materials. With higher levels of activity, the incidence of track maintenance expenses in total expenses will be lower.

Other expenses

These are presumed to be proportional to ton-kms transported, using 2005 values as a basis.

Administration expenses

For 2011 a 50 percent increase over 2005 values is assumed, with these remaining constant for the rest of the period.

\(^{12}\) Adaptation of the formula proposed by SECTRA’s REDEFE Manual, Chile.
Passenger services

The available disaggregation of expenses allows for the allocation of only some costs to passenger services. It has therefore been assumed that this traffic remains constant throughout the period and only those costs that can be allocated are reported.

Projection of revenues and expenses

To assess AFE’s future viability, a projection of revenues and expenses has been made in a scenario in which the railroad captures the tons of forest products freight considered in the DPR. Current transport is considered with no variation.

The following table summarizes transport figures using the time frames in the DPR.

<table>
<thead>
<tr>
<th></th>
<th>2011 D</th>
<th>Ton</th>
<th>Ton-km</th>
<th>Trains</th>
<th>Train-kms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivera Montevideo</td>
<td>563</td>
<td>532,893</td>
<td>300,018,759</td>
<td>545</td>
<td>614,163</td>
</tr>
<tr>
<td>Tacuarembó Montevideo</td>
<td>445</td>
<td>550,124</td>
<td>244,805,180</td>
<td>563</td>
<td>501,136</td>
</tr>
<tr>
<td>Rivera Fray Bentos</td>
<td>445</td>
<td>266,688</td>
<td>118,676,160</td>
<td>273</td>
<td>242,940</td>
</tr>
<tr>
<td>Tacuarembó Fray Bentos</td>
<td>327</td>
<td>838,568</td>
<td>274,211,736</td>
<td>858</td>
<td>561,334</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>2,188,273</td>
<td>937,711,835</td>
<td></td>
<td>1,919,574</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>Ton</th>
<th>Ton-km</th>
<th>Trains</th>
<th>Train-kms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivera Montevideo</td>
<td>563</td>
<td>536,087</td>
<td>301,816,981</td>
<td>549</td>
<td>617,844</td>
</tr>
<tr>
<td>Tacuarembó Montevideo</td>
<td>445</td>
<td>382,965</td>
<td>170,419,425</td>
<td>392</td>
<td>348,863</td>
</tr>
<tr>
<td>Rivera Fray Bentos</td>
<td>445</td>
<td>197,240</td>
<td>87,771,800</td>
<td>202</td>
<td>179,676</td>
</tr>
<tr>
<td>Tacuarembó Fray Bentos</td>
<td>327</td>
<td>537,078</td>
<td>175,624,506</td>
<td>550</td>
<td>359,518</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>1,653,370</td>
<td>735,632,712</td>
<td></td>
<td>1,505,901</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2021</th>
<th>Ton</th>
<th>Ton-km</th>
<th>Trains</th>
<th>Train-kms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivera Montevideo</td>
<td>563</td>
<td>576,440</td>
<td>324,535,720</td>
<td>590</td>
<td>664,352</td>
</tr>
<tr>
<td>Tacuarembó Montevideo</td>
<td>445</td>
<td>381,095</td>
<td>169,587,275</td>
<td>390</td>
<td>347,159</td>
</tr>
<tr>
<td>Rivera Fray Bentos</td>
<td>445</td>
<td>167,001</td>
<td>74,315,445</td>
<td>171</td>
<td>152,130</td>
</tr>
<tr>
<td>Tacuarembó Fray Bentos</td>
<td>327</td>
<td>208,053</td>
<td>68,033,331</td>
<td>213</td>
<td>139,270</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>1,332,589</td>
<td>636,471,771</td>
<td></td>
<td>1,302,910</td>
</tr>
</tbody>
</table>

Source: Uruguay, Development Policy Review

The traffic figures have been applied to the corrected unit costs developed above. The following table shows costs for 2005 thus adjusted, along with costs for 2011, 2016, and 2021. Revenues have been assumed to be based on a tariff of US$0.03/ton-km, the value used in the DPR.

The costs indicated in the following table include the current transport of freight and passengers.
Table 17: Analysis of AFE’s Operating Performance: Adjusted Operating Expenses, Volume of Demand Projected in the DPR

<table>
<thead>
<tr>
<th>Item</th>
<th>2005</th>
<th>2011</th>
<th>2016</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freight train personnel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffing level</td>
<td>180</td>
<td>286</td>
<td>244</td>
<td>224</td>
</tr>
<tr>
<td>Average velocity</td>
<td>5.44</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Annual remuneration</td>
<td>11,000</td>
<td>11,000</td>
<td>11,000</td>
<td>11,000</td>
</tr>
<tr>
<td><strong>Personnel expense</strong></td>
<td>1,980,000</td>
<td>3,141,209</td>
<td>2,686,169</td>
<td>2,462,880</td>
</tr>
<tr>
<td><strong>Fuel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liters/year</td>
<td>5,780,675</td>
<td>22,164,656</td>
<td>18,633,869</td>
<td>16,901,300</td>
</tr>
<tr>
<td>Liters/ton-km</td>
<td>0.0175</td>
<td>0.0175</td>
<td>0.0175</td>
<td>0.0175</td>
</tr>
<tr>
<td>US$/lt</td>
<td>0.659</td>
<td>0.757</td>
<td>0.757</td>
<td>0.757</td>
</tr>
<tr>
<td><strong>Fuel expense</strong></td>
<td>3,810,000</td>
<td>16,785,987</td>
<td>14,112,012</td>
<td>12,799,883</td>
</tr>
<tr>
<td><strong>Locomotive maintenance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locomotive-kms</td>
<td>1,113,403</td>
<td>2,855,645</td>
<td>2,441,972</td>
<td>2,238,981</td>
</tr>
<tr>
<td>Unit cost</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td><strong>Locomotive maintenance expense</strong></td>
<td>2,603,136</td>
<td>5,711,290</td>
<td>4,883,944</td>
<td>4,477,963</td>
</tr>
<tr>
<td><strong>Train car maintenance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Train car-kms</td>
<td>22,056,533</td>
<td>89,241,619</td>
<td>74,763,074</td>
<td>67,658,400</td>
</tr>
<tr>
<td>Unit cost</td>
<td>0.04</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Train car maintenance expense</strong></td>
<td>959,459</td>
<td>4,462,081</td>
<td>3,738,154</td>
<td>3,382,920</td>
</tr>
<tr>
<td><strong>Traffic operations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffing level</td>
<td>296</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Annual remuneration</td>
<td>9,190</td>
<td>9,190</td>
<td>9,190</td>
<td>9,190</td>
</tr>
<tr>
<td>Personnel expense</td>
<td>2,720,240</td>
<td>919,000</td>
<td>919,000</td>
<td>919,000</td>
</tr>
<tr>
<td>Other expenses</td>
<td>670,000</td>
<td>670,000</td>
<td>670,000</td>
<td>670,000</td>
</tr>
<tr>
<td><strong>Total traffic</strong></td>
<td>3,390,240</td>
<td>1,589,000</td>
<td>1,589,000</td>
<td>1,589,000</td>
</tr>
<tr>
<td><strong>Track Maintenance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track length</td>
<td>1,611</td>
<td>1,611</td>
<td>1,611</td>
<td>1,611</td>
</tr>
<tr>
<td><strong>Track maintenance expense</strong></td>
<td>4,400,000</td>
<td>5,828,781</td>
<td>5,668,805</td>
<td>5,589,755</td>
</tr>
<tr>
<td><strong>Other expenses</strong></td>
<td>530,000</td>
<td>2,032,162</td>
<td>1,708,442</td>
<td>1,549,592</td>
</tr>
<tr>
<td><strong>Expenses allocatable to passengers</strong></td>
<td>417,471</td>
<td>417,471</td>
<td>417,471</td>
<td>417,471</td>
</tr>
<tr>
<td><strong>Administration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>1,210,000</td>
<td>1,815,000</td>
<td>1,815,000</td>
<td>1,815,000</td>
</tr>
<tr>
<td>Other</td>
<td>580,000</td>
<td>870,000</td>
<td>870,000</td>
<td>870,000</td>
</tr>
<tr>
<td><strong>Administration expense</strong></td>
<td>1,790,000</td>
<td>2,685,000</td>
<td>2,685,000</td>
<td>2,685,000</td>
</tr>
<tr>
<td><strong>TOTAL EXPENSES</strong></td>
<td>19,880,306</td>
<td>42,645,408</td>
<td>37,483,981</td>
<td>34,951,251</td>
</tr>
<tr>
<td>Freight revenues</td>
<td>8,550,000</td>
<td>36,681,355</td>
<td>30,618,981</td>
<td>27,644,153</td>
</tr>
<tr>
<td>Other revenues incl. passengers</td>
<td>840,000</td>
<td>840,000</td>
<td>840,000</td>
<td>840,000</td>
</tr>
<tr>
<td><strong>Operating margin</strong></td>
<td>(10,490,306)</td>
<td>(5,124,053)</td>
<td>(6,025,000)</td>
<td>(6,467,098)</td>
</tr>
</tbody>
</table>

Source: Own elaboration

The results of this exercise show that, even in an optimistic demand scenario, rail operations produce an operating loss, which indicates that if this scenario were to be produced under the assumed conditions, the State will have to continue to cover AFE’s...
operating deficits as well as all the resources required for investment in the rehabilitation of the tracks and rolling stock needed for the increase in forest products freight.

This transport will require track investments amounting to at least US$88 million (DPR figures), as well as investments in locomotives and train cars.

A conservative estimate, which considers an improvement in the efficiency of the use of the existing GE 2000 locomotives, puts the necessary fleet at 30 line locomotives (20 additional) and 1,000 flat cars (600 additional) based on a rotation cycle of approximately 5 days. These investments total some US$64 million. This brings the total investments to US$152 million.

The Modernization Plan for the Railroad (see Chapter [7]) proposes a program to modernize AFE (Program 3). Its objective is to fully modernize AFE, not only from a technical point of view but also from an organizational, management, and investment project analysis capacity standpoint, with a view to improving its efficiency, its management capacity, and its technical and economic performance. This program must be implemented before AFE can operate freight services at a level of efficiency that is consistent with the cost estimates.

A very preliminary analysis shows that these adjustments, including the studies needed for their implementation, could require an estimated investment of around US$14 million. These resources would need to be included in the investment amounts necessary for the reorganization of the rail sector in any scenario.

The following table shows AFE’s performance with the same demand scenario, but with some more favorable revenue and expense assumptions:

1. The average tariff for the transportation of forest products is US$0.04/ton-km.
2. The average train velocity is 15 km/h.
3. Administration expenditures are only 1.4 times higher than they are at present.
4. A subsidy of US$300,000/year is established for passenger trains.
Table 18: Analysis of AFE’s Operating Performance -- Volume of Demand Projected in the DPR – Favorable Revenue and Expense Assumptions

<table>
<thead>
<tr>
<th>Item</th>
<th>2005</th>
<th>2011</th>
<th>2016</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight train personnel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffing level</td>
<td>180</td>
<td>190</td>
<td>163</td>
<td>149</td>
</tr>
<tr>
<td>Average velocity</td>
<td>5.44</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Annual remuneration</td>
<td>11,000</td>
<td>11,000</td>
<td>11,000</td>
<td>11,000</td>
</tr>
<tr>
<td>Personnel expense</td>
<td>1,980,000</td>
<td>2,094,140</td>
<td>1,790,780</td>
<td>1,641,920</td>
</tr>
<tr>
<td>Fuel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liters/year</td>
<td>5,780,675</td>
<td>22,164,656</td>
<td>18,633,869</td>
<td>16,901,300</td>
</tr>
<tr>
<td>Liters/ton-km</td>
<td>0.0175</td>
<td>0.0175</td>
<td>0.0175</td>
<td>0.0175</td>
</tr>
<tr>
<td>US$/lt</td>
<td>0.659</td>
<td>0.757</td>
<td>0.757</td>
<td>0.757</td>
</tr>
<tr>
<td>Fuel expense</td>
<td>3,810,000</td>
<td>16,785,987</td>
<td>14,112,012</td>
<td>12,799,883</td>
</tr>
<tr>
<td>Locomotive maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locomotive-kms</td>
<td>1,113,403</td>
<td>2,855,645</td>
<td>2,441,972</td>
<td>2,238,981</td>
</tr>
<tr>
<td>Unit cost</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Locomotive maintenance expense</td>
<td>2,603,136</td>
<td>5,711,290</td>
<td>4,883,944</td>
<td>4,477,963</td>
</tr>
<tr>
<td>Train car maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Train car-kms</td>
<td>22,056,533</td>
<td>89,241,619</td>
<td>74,763,074</td>
<td>67,658,400</td>
</tr>
<tr>
<td>Unit cost</td>
<td>0.04</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Train car maintenance expense</td>
<td>959,459</td>
<td>4,462,081</td>
<td>3,738,154</td>
<td>3,382,920</td>
</tr>
<tr>
<td>Traffic operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffing level</td>
<td>296</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Annual remuneration</td>
<td>9,190</td>
<td>9,190</td>
<td>9,190</td>
<td>9,190</td>
</tr>
<tr>
<td>Personnel expenses</td>
<td>2,720,240</td>
<td>919,000</td>
<td>919,000</td>
<td>919,000</td>
</tr>
<tr>
<td>Other expenses</td>
<td>670,000</td>
<td>670,000</td>
<td>670,000</td>
<td>670,000</td>
</tr>
<tr>
<td>Traffic expense</td>
<td>3,390,240</td>
<td>1,589,000</td>
<td>1,589,000</td>
<td>1,589,000</td>
</tr>
<tr>
<td>Track maintenance</td>
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<td></td>
</tr>
<tr>
<td>Track length</td>
<td>1,611</td>
<td>1,611</td>
<td>1,611</td>
<td>1,611</td>
</tr>
<tr>
<td>Track maintenance expense</td>
<td>4,400,000</td>
<td>5,828,781</td>
<td>5,668,805</td>
<td>5,589,755</td>
</tr>
<tr>
<td>Other expenses</td>
<td>530,000</td>
<td>2,032,162</td>
<td>1,708,442</td>
<td>1,549,592</td>
</tr>
<tr>
<td>Expenses allocatable to passengers</td>
<td>417,471</td>
<td>417,471</td>
<td>417,471</td>
<td>417,471</td>
</tr>
<tr>
<td>Administration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>1,210,000</td>
<td>1,694,000</td>
<td>1,694,000</td>
<td>1,694,000</td>
</tr>
<tr>
<td>Other</td>
<td>580,000</td>
<td>812,000</td>
<td>812,000</td>
<td>812,000</td>
</tr>
<tr>
<td>Administration expense</td>
<td>1,790,000</td>
<td>2,506,000</td>
<td>2,506,000</td>
<td>2,506,000</td>
</tr>
<tr>
<td>TOTAL EXPENSES</td>
<td>19,880,306</td>
<td>41,419,339</td>
<td>36,409,591</td>
<td>33,951,291</td>
</tr>
<tr>
<td>Freight revenues</td>
<td>8,550,000</td>
<td>46,058,473</td>
<td>37,975,308</td>
<td>34,008,871</td>
</tr>
<tr>
<td>Other revenues incl. passengers</td>
<td>840,000</td>
<td>1,140,000</td>
<td>1,140,000</td>
<td>1,140,000</td>
</tr>
<tr>
<td>Operating margin</td>
<td>(10,490,306)</td>
<td>5,779,135</td>
<td>2,705,717</td>
<td>1,197,580</td>
</tr>
</tbody>
</table>

Note: The table above provides a detailed analysis of AFE’s operating performance, including staffing levels, expenses, and revenue projections for various operational divisions such as freight train personnel, fuel costs, locomotive maintenance, train car maintenance, traffic operations, track maintenance, administration expenses, and total expenses. The data is presented for the years 2005, 2011, 2016, and 2021 under favorable revenue and expense assumptions.
The operating margin shows a great deal of sensitivity to rail transport prices and, naturally, to demand levels. In the analysis of an increase in transportation tariffs to US$0.04/ton-km, the operating margin is positive, although in no case does it cover investment costs.

These figures simply confirm the importance of carrying out more in-depth technical and economic feasibility studies that estimate both levels of demand for freight and realistic tariffs based on the market. In addition to this analysis of private operating profitability, a social assessment should be prepared to show the potential benefits from the positive externalities generated by the railroad in terms of less congestion on the roads and less expenditure on road infrastructure, fewer accidents, and other positive impacts.

Considering the combined results of the social assessment and the private evaluation, the government should support the decision to invest in the railroad and identify the best business model to adopt, considering the possible private participation options.

In addition, the results of the analysis confirm the outcome of the assessment of AFE, namely that a sizable portion of the network does not have sufficient traffic for viable operation. In practice, the transportation of forest products uses only 836 km of the existing network (51 percent), all of which was included in the previous exercise. If the AFE network were to be reduced to only those sectors with significant volumes of traffic, it would probably show a profit.

The following table shows the results projected in the scenario in which the network is reduced to the portion needed for the transportation of forest products (the Rivera-Montevideo corridor and the Piedra Sola-Fray Bentos branch line), plus the current limestone and clinker traffic.

With this reduction in the network, the cost of train personnel, rolling track maintenance, train movement and fuel and general expenses all decline, leading to a profit in all years with a tariff of US$0.03/ton-km.

The above exercises are merely indicative, since they are based on international standards and include some suppositions that could vary in a detailed study, but in all cases they show that the rehabilitation of the railroad in Uruguay will require far-reaching measures.

This scenario is completely compatible with the partial privatization of the AFE network and should be analyzed in the studies on the cost of the railroad proposed in this report. The idea of conducting studies that assess and compare the many alternatives that could contribute to developing rail transportation of freight in Uruguay is stressed. Success will depend on the comprehensive application of the Modernization Plan for the Railroad.

The operating profit shown for this last option would appear to indicate that a project such as this could even help finance a significant part of the necessary investment in the infrastructure (close to 40 percent), although these figures must be validated with a broader study than this analysis of very preliminary figures.
Table 19: Analysis of AFE’s Operating Performance – Volume of Demand Projected in the DPR; Operating Expenses Applied to Restricted Sections of the Network

<table>
<thead>
<tr>
<th>Item</th>
<th>2005</th>
<th>2011</th>
<th>2016</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight train personnel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffing level</td>
<td>180</td>
<td>128</td>
<td>100</td>
<td>87</td>
</tr>
<tr>
<td>Average velocity</td>
<td>5.44</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Annual remuneration</td>
<td>11,000</td>
<td>11,000</td>
<td>11,000</td>
<td>11,000</td>
</tr>
<tr>
<td>Personnel expense</td>
<td>1,980,000</td>
<td>1,407,688</td>
<td>1,104,328</td>
<td>955,468</td>
</tr>
<tr>
<td>Fuel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liters/year</td>
<td>5,780,675</td>
<td>16,383,981</td>
<td>12,853,194</td>
<td>11,120,625</td>
</tr>
<tr>
<td>Liters/ton-km</td>
<td>0.0175</td>
<td>0.0175</td>
<td>0.0175</td>
<td>0.0175</td>
</tr>
<tr>
<td>US$/lt</td>
<td>0.659</td>
<td>0.757</td>
<td>0.757</td>
<td>0.757</td>
</tr>
<tr>
<td>Fuel expense</td>
<td>3,810,000</td>
<td>12,408,101</td>
<td>9,734,126</td>
<td>8,421,997</td>
</tr>
<tr>
<td>Locomotive maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locomotive-kms</td>
<td>1,113,403</td>
<td>1,919,574</td>
<td>1,505,901</td>
<td>1,302,910</td>
</tr>
<tr>
<td>Unit cost</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Locomotive maintenance expense</td>
<td>2,603,136</td>
<td>3,839,148</td>
<td>3,011,802</td>
<td>2,605,821</td>
</tr>
<tr>
<td>Train car maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Train car-kms</td>
<td>22,056,533</td>
<td>67,185,085</td>
<td>52,706,540</td>
<td>45,601,867</td>
</tr>
<tr>
<td>Unit cost</td>
<td>0.04</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Train car maintenance expense</td>
<td>959,459</td>
<td>3,359,254</td>
<td>2,635,327</td>
<td>2,280,093</td>
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<tr>
<td>Traffic operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Staffing level</td>
<td>296</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Annual remuneration</td>
<td>9,190</td>
<td>9,190</td>
<td>9,190</td>
<td>9,190</td>
</tr>
<tr>
<td>Personnel expense</td>
<td>2,720,240</td>
<td>919,000</td>
<td>919,000</td>
<td>919,000</td>
</tr>
<tr>
<td>Other expenses</td>
<td>670,000</td>
<td>670,000</td>
<td>670,000</td>
<td>670,000</td>
</tr>
<tr>
<td>Traffic total</td>
<td>3,390,240</td>
<td>1,405,200</td>
<td>1,405,200</td>
<td>1,405,200</td>
</tr>
<tr>
<td>Track maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track length</td>
<td>1,611</td>
<td>968</td>
<td>968</td>
<td>968</td>
</tr>
<tr>
<td>Track maintenance expense</td>
<td>4,400,000</td>
<td>3,634,478</td>
<td>3,477,058</td>
<td>3,399,812</td>
</tr>
<tr>
<td>Other expenses</td>
<td>530,000</td>
<td>1,502,162</td>
<td>1,178,442</td>
<td>1,019,592</td>
</tr>
<tr>
<td>Expenses allocatable to passengers</td>
<td>417,471</td>
<td>417,471</td>
<td>417,471</td>
<td>417,471</td>
</tr>
<tr>
<td>Administration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>1,210,000</td>
<td>1,694,000</td>
<td>1,694,000</td>
<td>1,694,000</td>
</tr>
<tr>
<td>Other</td>
<td>580,000</td>
<td>812,000</td>
<td>812,000</td>
<td>812,000</td>
</tr>
<tr>
<td>Administration expense</td>
<td>1,790,000</td>
<td>2,148,000</td>
<td>2,148,000</td>
<td>2,148,000</td>
</tr>
<tr>
<td>TOTAL EXPENSES</td>
<td>19,880,306</td>
<td>30,121,501</td>
<td>25,111,754</td>
<td>22,653,454</td>
</tr>
<tr>
<td>Freight revenues</td>
<td>8,550,000</td>
<td>36,681,355</td>
<td>30,618,981</td>
<td>27,644,153</td>
</tr>
<tr>
<td>Other revenues incl. passengers</td>
<td>840,000</td>
<td>1,140,000</td>
<td>1,140,000</td>
<td>1,140,000</td>
</tr>
<tr>
<td>Operating margin</td>
<td>(10,490,306)</td>
<td>7,699,854</td>
<td>6,647,227</td>
<td>6,130,700</td>
</tr>
</tbody>
</table>

Source: Own elaboration
ANnex 2: detailed description of the afe modernization program

1. Subprogram 3.1: Development of a technology policy for AFE

The purpose of this subprogram is to develop a technical standardization policy for Uruguay’s Railroad, applicable to the fundamental components of the infrastructure and the rolling stock.

Technical standardization is considered an element of major importance in the rehabilitation of railroads, and the relevant standards should apply not only to AFE, but to all railway systems in Uruguay, both present and future.

The initial phase should consist of adopting definitions related to the most relevant technological elements of the infrastructure and the rolling stock, which are discussed below. In the second phase, these definitions should be developed into technical standards that will govern the technical management of AFE and any other railway companies operating in Uruguay, whether on AFE’s lines or on their own.

1.1 Tracks

For historical reasons, Uruguay’s railway system comprises at least ten kinds of track with different technical specifications, which were either inherited from the British companies that built the various lines or were acquired later on.

The AFE lines include rails conforming to the British standard (BR), the European standard (UIC), the North American standard (AREA) and, owing to a recent acquisition, the Russian standard (R). All these rails have different shapes, dimensions and toughnesses, which require a wide variety of accessories such as fishplates, seats, anchors, bolts and other mutually incompatible parts. This requires the keeping of larger inventories than necessary, with the attendant maintenance difficulties and costs.

Moreover, these differing profiles, especially as concerns the shape and toughness of the rail head, cause abnormal wear to both wheels and rails, which decreases their useful life and drives up operating costs.

The most widely used rail standards in the western world are: AREA, which is used in North America (Mexico, U.S. and Canada) and UIC, used in Europe. Brazil and Chile have opted for the AREA standard (now known as AREMA); Argentina applies the UIC standard.

In adopting a standard, Uruguay should choose between these two, which are the most common.

The choice should be based on an internal AFE study assessing the characteristics of both standards, including a survey of the quantity of existing rails of these and similar types in
the system. However, the assessment should not include the existing light rails in the system, which should be replaced in the medium term by other, heavier rails.

The tendency throughout the world has always been to increase the cross section of rails. North America abandoned the ASCE standard, which went up to 90 lb/yd (45 kg/m) and the ARA standard, with rails of 90 and 100 lb/yd (50 kg/m). All these profiles are now considered obsolete.

The AREA standard begins with type 100 RE (50 kg/m) but is rarely used. The lightest rail included in the AREA standard is 115 RE (57 kg/m), which is the smallest profile purchased for railroads in Brazil and Chile. In North America, where the trains are much heavier, the largest profile is 142 RE (71 kg/m).

Similarly, the minimum profile in Europe is UIC 54 (54 kg/m) and the largest at present is UIC 70.

The basic differences between the two standards lie in rail shape and toughness. Concerning shape, the differences are such that accessories such as fishplates, bolts, anchors and other parts are different and can be used only on the corresponding rails.

As for toughness, there are major problems involving premature wear, as the North American standard for both rails and wheels specifies a greater toughness than the European standard. Consequently, European cars traveling on North American rails will experience premature wheel wear, and North American cars traveling on European rails will cause premature rail wear, especially on curves.

Concerning railroad ties, there is no major technological difference between the European and North American standards. Both rail systems use timber ties and, increasingly, concrete ties. Considering the growing scarcity of hardwoods, the use of concrete ties on AFE lines should be studied.

The usual types of concrete ties are: monoblock and duoblock. Duoblock ties are used less frequently on standard gauge tracks (1,435 mm) and are scarcely used on wide gauge tracks (1,676 mm) because the flexibility of the bar joining the two blocks results in less rigidity and stability on the track, in addition to being vulnerable in the event of derailments.

Monoblock ties, on the other hand, are more stable and less vulnerable, but they cost more. These ties may be pre-stressed or post-stressed. The former have been used for decades without any major problems; the latter are the product of more recent technology, although there are no reports of systematic failures.

The rails can be attached to the ties in many different ways. With timber ties, the spikes used since the nineteenth century have been gradually replaced by screw spikes, which work better in softer woods. These screw spikes can even be used on concrete ties, with heavy-duty plastic inserts.
The growing use of welded bar rails (36, 48 or 60 m) or continuously welded rails has given rise to the development of elastic fasteners. These fasteners consist essentially of an elastic component (spring), attached to the tie by bolts or inserted into a housing which is in turn rigidly attached or fitted to the tie. The first types of fastener are known as adjustable elastic fasteners; those of the second type are called fit and forget fasteners. Either may be used with any kind of tie, but both types, and especially the fit and forget type, are considerably more expensive to use with timber ties because of the accessories required.

The welding of rails results in a better quality track and lower maintenance costs. On high traffic sections, the benefits of continuously welded rails are significant. On moderately traveled sections, bars of 36 or 48 meters are used with good results.

In summary, the following steps are recommended:

- Adopt a rail standard, either AREA or UIC, which should be applied to all future rail purchases.
- Adopt a minimum weight profile for rail purchases. As a long-term policy, AREA 115 or UIC 54 is recommended (depending on the standard adopted). Lower weight profiles (AREA 100 or UIC 50) are only manufactured upon request, although they can be found in the secondary market.
- Adopt a standard concrete tie. Pre-stressed monoblock ties are recommended, although post-stressed ties are acceptable.
- Adopt a standard elastic fastener for use on concrete ties. The fit & forget type is recommended because of its lower maintenance costs.
- For rigid fastening only screw spikes should be used.

1.2 Bridges and concrete structures

The ALAF standard used by AFE (18 tons/axle) is quite old and has been rendered obsolete by current trends in the field of freight transport. In practice, 18 tons/axle represents a gross car weight of 72 tons, or the equivalent of a maximum net carrying capacity of 50 tons, which is insufficient for current freight transport requirements. Moreover, this per-axle weight corresponds to a total locomotive weight of 108 tons, which seriously limits the power and adhesive weight of the equipment, as well as the real possibilities of the market.

Although raising the limit for cars and locomotives to a minimum of 25 tons/axle seems sufficient in the medium term, the design and construction of new bridges and concrete structures makes the adoption of a higher standard of 30 tons/axle advisable, as the useful life of these structures is more than 50 years and the additional cost of going from 25 to 30 tons/axle is minimal.

The cost of reinforcing existing metal bridges to handle 25 and 30 tons/axle and reinforcing them for 30 tons/axle only should be assessed if the cost difference is
minimal. If it is not, it seems more advisable to reinforce them for 25 tons/axle only, leaving additional reinforcement for a later date.

1.3 Vertical clearances

According to the policy statements of government spokespersons, the authorities want to make Uruguay a service center for international trade, which includes maximizing the use of rail connections with Brazil and Argentina. This presupposes a major increase in container traffic, as the connection with Brazil is of a different gauge and the connection with Argentina, despite being of the same gauge, is with Mesopotamic Railway, which in turn is of a different gauge than the rest of the Argentine system.

Modern container traffic features the use of so-called double stackers, which are specialized, minimal tare cars that carry stacked 40-foot containers. It is therefore important that any new construction that imposes vertical railway clearance limits have at least seven clear meters.

1.4 Brakes

AFE’s rolling stock has both vacuum brakes, which have been abandoned by every railroad in the world, and compressed air brakes, which is the current technology. Compressed air brakes conform to one of two different standards: the North American AAR standard and the European UIC standard. The two standards are different and specify different pressures, with the result that a single train can simultaneously have three types of brakes: vacuum, AAR and UIC.

It is vitally important for the operating efficiency of the railroad to standardize freight car braking systems by completely eliminating vacuum breaks and adopting a single compressed air brake standard. This change should be made shortly on all cars in use on the railroad, as the current situation of mismatched standards results not only in higher operating costs but also tenuous safety conditions.

1.5 Couplings

AFE cars have European couplings with two buffers and coupling hooks. The use of these couplings is complicated and risky, in addition to limiting the length of trains because of their inferior capacity.

For the efficient operation of freight cars it is more appropriate to use AAR type automatic coupling, although replacing the current couplings would require a very large investment—the structure of the cars would have to be modified—that is probably not economically feasible at this time.

In the future, however, this type of inadequate coupling could become a major obstacle to railroad development, as is currently the case in Argentina. It is recommended that any
new equipment allocated to specific projects be outfitted with AAR couplings, so as to gradually institute a change that will in fact prove necessary in the long run.

1.6 Friction bearings

The axles of many AFE cars are equipped with friction bearings, an obsolete system that has been abandoned by almost all railroads because it entails higher operating costs and is less reliable.

A plan should be formulated to replace the friction bearings on all rail cars to be kept in operation with the roller bearings that are now standard in rail systems.

1.7 Signaling and traffic control

Signaling and traffic control systems are key to the safety of railroad operations. Two technologies are involved, the North American and the European. Although the basic concepts of the two groups are the same—safe train traffic—the technologies are different.

North American systems are governed by the specifications of the Advanced Train Control System, ATCS, and are classified in accordance with five levels of increasing safety. These specifications are designed to facilitate compatibility and standardization, without limiting the internal design criteria of the various suppliers.

LEVEL 1: Movement orders sent by radio, in the form of voice messages.
LEVEL 2: Movement orders sent by radio, in the form of data messages.
LEVEL 3: Movement orders sent by radio, in the form of voice and/or data messages plus block safety control by discreet counting equipment and/or intrinsic or vital safety systems.
LEVEL 4: Movement orders sent by radio, in the form of data messages plus track circuit control, remote control of switching equipment and movement orders via remote-controlled signals confirmed by radio messages.

Block safety control and control of signaling and switching equipment by intrinsic or vital safety systems.
LEVEL 5: Same as level 4, plus automatic on-board control.

European systems are governed by the concepts of the European Train Control System, ETCS, and are classified in accordance with four levels of increasing safety. The ETCS was developed as part of the ERTMS (European Rail Traffic Management System) initiative, the objective of which is to standardize European railway systems.
LEVEL 0: When an ETCS vehicle is used on a non-ETCS route, the operation is usually referred to as Level 0. On-board equipment monitors the train for the maximum allowable speed. The engineer must obey trackside signals.

LEVEL 1: Level 1 is a cab signaling system that can be superimposed on the existing signaling system, i.e., leaving the fixed signaling system (national signaling and track-release system) in place.

The system is based on radio beacons (known as “Eurobalise” beacons) that transmit trackside signal information and route data at fixed points to the cab. The information transmitted by the radio beacon depends on the trackside signal aspect and comes from signal adapters and telegram coders (LEU).

LEVEL 2: Level 2 is a digital radio-based signal and train protection system. Movement authority and other signal aspects are displayed in the cab for the driver. Apart from a few indicator panels it is therefore possible to dispense with trackside signaling. However, track-release signaling and hence train integrity supervision remain in place at the trackside.

LEVEL 3: In ETCS level 3, the exact position and integrity of each train on a route is known. This allows for increasing the traffic on a line because it is always possible to determine exactly when a track has been cleared in order to move the next train onto the same track.

The European systems are geared toward passenger train traffic and have stricter safety and routing compliance standards. The North American systems, on the other hand, were developed for freight trains, which are larger and can travel more flexibly.

In Uruguay, AFE has automatic signaling and traffic control systems only on a small section of the network around Montevideo, where passenger trains travel. On the rest of the network, trains are moved from station to station by telephone communication. This system is slow, labor-intensive and subject to human error.

Both systems—ATCS and ETCS—should be analyzed with a view to adopting the standard most appropriate for the AFE network.

Currently, the AUV (Track Use Authorization) system, which is based on radio communication and is equivalent to ATCS Level 1, is used on lines with low traffic density. When this system is based on computer control, it is quite safe, although the movement of trains is less fluid than in automated systems.

This system, which represents the most basic level of safety, should be part of the generally applicable basic standards.
The signals at level crossings are included in the signaling systems, although in many cases they constitute a separate subsystem. These signals are part of the traffic signaling system when the crossings are located within the signaling area of stations and shunting zones. In all other cases they operate independently and may or may not be coordinated with road traffic signals.

1.8 Electrification

No part of the AFE network is electrified. Freight railroads generally do not use electric traction because of the operational rigidity of the system, which negates the advantages of electrification.

In urban and suburban passenger transport systems, however, electric traction is widely used. Although the feasibility of establishing a suburban electric traction system in Montevideo is doubtful because of its low traffic density, a policy should be formulated for future electrification.

Alternating current power supply has clear economic advantages, as it does not require rectifying substations and the sections of transmission lines needed are considerably smaller. However, the high voltage poses safety risks in populated areas, which requires strict segregation of the rail line.

The international standard for electric traction used in long-distance passenger services is ACV 25000. There are no plans to implement it in Uruguay.

DCV 1500 and 3000 are used for suburban systems, although some lines in Europe are powered at ACF 25000 (RER in France, RENFE in Spain).

Lower voltage direct current is more costly but easier to manage in populated areas. Rolling stock technology has progressed substantially in recent years. The controls are completely electronic and the traction engines are powered by variable frequency alternating current, resulting in greater energy efficiency, simpler maintenance and lower weight.

1.9 Locomotives

Given the small size of the AFE railroad, acquiring locomotives from different places and different manufacturers should be avoided. Uniformity in this regard will result in lower maintenance costs and greater equipment availability.

At present, AFE operates with a fleet of 43 diesel locomotives, only 19 of which are large enough to tow freight trains: GE 2000s (10) and GE 1500s (9).

However, the GE 1500s are more than 50 years old and their technology is obsolete, which means that they are often unavailable (24 percent availability in 2008). As a result, AFE currently has only ten GE 2000 locomotives for freight service use.
On the AFE lines, locomotive size is limited by the capacity of the infrastructure: tracks and bridges. The current standard for the most heavily traveled lines is 18 tons per axle, limiting the total gross weight of 6-axle locomotives to 108 tons, which is equivalent to 1,500-2,000 horsepower.

The per-axle load of 18 tons requires a 40 kg/m rail (ASCE 80 or similar). However, the program to rehabilitate AFE’s lines calls for the replacement of light rails with 50 kg/m rails. These rails can handle a per-axle load of 25 tons and, therefore, would allow for locomotives having a total gross weight of 150 tons.

Railroads in North America (USA, Canada and Mexico) use considerably larger locomotives with horsepower ranging from 4,000 to 6,000. The policy to replace less powerful locomotives will allow for the acquisition of relatively recent 2,000-3,000 HP equipment, like AFE’s GE 2000s or more modern models, which can be refurbished at advantageous prices and kept in service for 20 or 30 more years.

The option of purchasing used, recent model locomotives and rebuilding them seems far more advantageous than buying new locomotives. Tendering for new locomotives with soft loans from nontraditional suppliers may have financial advantages, but the advantages are often outweighed by significant operational disadvantages: low efficiency and availability, high maintenance costs, and technical disparities.

1.10 Freight cars

Replacing AFE’s light rails would allow for travel by freight cars having a maximum gross weight of 100 (t) and a net capacity of approximately 70 (t). The recommended specifications for the cars are as follows:

- Minimum 1:3 tare/load ratio
- Compressed air brakes with loaded/empty mechanism
- Roller bearings
- Monoblock wheels
- Automatic AAR type couplings

The toughness and configuration of the wheels will depend on the technology of the rails.

1.11 Communications

For reasons of safety and self-sufficiency, railroads usually have autonomous communications systems and use their own infrastructure, although back-ups and communications with remote areas may be based on third-party infrastructure.

In modern practice, the communications infrastructure consists essentially of two subsystems:
(a) The so-called Multiservice Network, consisting of a trackside fiber optic network. The railroad right-of-way is especially suited for these purposes and in many countries the railroads allow the installation of third-party networks on their right-of-way.

(b) A radio communications network, supplemented by the fiber optic network or established independently.

Both subsystems may also be supported and/or backed up by third-party networks.

Communications subsystems based on the two above subsystems generally comprise:

(c) Traffic management
(d) Train telephony or train-to-land communication
(e) Direct telephony
(f) Automatic telephony (administration)
(g) Station tolls (suburban passengers)
(h) Management IT
(i) Special systems
  ① Rail car identification
  ② Recorders
  ③ Timekeeping
  ④ Station public address system (passengers)
  ⑤ CCTV
  ⑥ Others

A communications plan can be implemented in stages, although the investments involved are generally not large compared to other needs of the railroad.

It is important that the technology adopted be compatible with the communications technology most widely used in the country, especially in terms of standards and protocols.

1.12 Summary

For Subprogram 1, the following actions are recommended:

- Adopt exclusive standards for rails, ties and fasteners
- Raise the design standards for new concrete structures to 30 tons per axle and for existing bridges to 25 tons per axle
- Raise the vertical clearance for new structures to 7 meters
- Eliminate all vacuum brakes and adopt an exclusive standard for the compressed air brakes system
- Equip rail cars allocated to specific projects with AAR type automatic couplers; in the future, analyze the advisability of adopting this as an exclusive standard
- Develop a systematic plan to replace all friction bearings with bearings that are standard for railway use
• Analyze and adopt a standard for traffic signaling and control
• Adopt a policy for standardization of the tractive fleet
• Set standards for the procurement of freight cars
• Adopt a communications standard that is compatible with the prevailing standard in Uruguay

2. Subprogram 3.2: Development of information systems for AFE management and cost accounting

The purpose of this subprogram is to develop an information system for AFE, to provide it with timely and appropriate information for decision-making concerning the operation and management of the railroad.

This system should be based on modern computational technology that provides staff at all levels of management with effective and efficient tools.

2.1 General approach

Railroad information systems should be based on a communications system that encompasses all points that generate relevant information, with information storage in a homogeneous, Open Source type database to allow for processing—in real time, whenever possible—by all functional units of the railroad.

In the case of AFE, whose communications system should be developed as part of the modernization plan for the railroad, the information system should be developed in stages compatible with the communication facilities available.

2.2 IT plan

The basic purpose of the IT plan is to organize information flows between the various units of the company and to standardize data processing for management purposes.

The development of a customized IT system for the company can be achieved in various ways. One way is to subcontract development of the system to a specialized consultant. A second option is to purchase an existing product and adapt it to the company’s needs with the help of a specialized consultant. Both options require the availability of internal counterpart capacity and include training for staff who will operate the system.

The functions of the system are themselves the subject of a survey to be carried out by IT experts and business analysts within the company. Some of the services that the system should necessarily incorporate are:

• **ERP**: The system should be based on the ERP (Enterprise Resource Planning) function. Its purpose is to program and monitor aspects such as the use of rolling stock (locomotives and rail cars); operating time and down time; fuel consumption, maintenance schedule and substitution of equipment, inventories, operating and
maintenance costs, etc.

- **Routing and Fleet Control**: In industries with distribution or supply chains, ERPs can include systems for online monitoring, fleet control, logistical optimization and route programming. The specific characteristics of the system used in railway operations require specialized construction or adaptation projects on each network, which may include outfitting trains with GPS equipment.

- **Accounting**: Many enterprises separate their accounting and management systems, but if investments are to be made in the construction or adaptation of a customized system, it is recommended that the latter incorporate the accounting, tax and compensation applications in a single modular package that can retrieve data from the ERP, by reading from the same database.

- **Front Office**: The system can be expanded to support the front office as well, through a subsystem designed to handle customers with commercial and segmentation and promotional objectives, based on a transactional and interactive platform that allows customers to contract freight services, determine the location of their freight, receive and pay invoices, and access other services electronically.

2.3 Hardware

The IT system of the project as a whole is physically structured as a star network, in which a central office houses most of the workstations and possibly the servers, and there are numerous remote stations located along the various sections of track.

If a system less expensive than a line of point-to-point connections based on fiber optic technology is wanted, it is always possible to use the Internet for communications between the remote stations and the central office when a sufficient volume of data is exchanged between the central office and the stations. This solution could be adopted in the early stages of implementing the system, or when the level of activity is low.

The topology of the project network could be supplemented with mobile stations, consisting of the rolling stock itself. These stations will be limited to batched data transmission on a periodic basis, using the train-to-land subsystem or even cellular telephony. Each train should be able to connect and independently transmit data on consumption, travel time and position, the latter through use of the GPS.

2.4 Recommendations

- Study and define the policy on the provision of an IT system: development of an in-house system or adaptation of products available on the market.
- Organize an IT section, responsible for designing and implementing the system.
- Formulate an IT plan, including its development stages, based on AFE requirements.
3. Subprogram 3.3: Participation in the analysis and implementation of passenger transport projects

3.1 Evaluation of passenger transport projects

For AFE, passenger transport services represent a heavy financial and management burden that is not justified from a private perspective.

However, some of these services may be socially profitable and the State may assign responsibility for providing them to AFE.

To determine the profitability of these services a proposal needs to be developed, including the following basic elements:

1. Analysis of current and potential demand
2. Study of alternative modes
3. Estimate of the demand to be captured by the project
4. Determination of service standards
5. Formulation of an operational project
6. Estimate of investments at private and social prices
7. Estimate of operating costs at private and social prices
8. Assessment of social benefits
9. Private economic assessment
10. Socioeconomic assessment
11. Identification of indicators
12. Sensitivity analysis
13. Results and recommendations

As indicated above, these feasibility studies should be conducted by the MTOP’s Railroad Regulation Office and carried out by a specialized external consultant, to ensure the objectivity of the results.

AFE participation would be important in the following respects:

(a) As a member of the counterpart commission for the studies.
(b) In the determination of service standards. AFE technical staff should collaborate with the consultant to ensure due consideration of AFE’s prior experience in providing services of this type and in assessing available resources, such as infrastructure.
(c) In the formulation of the operational project. The design of the operational project includes elements such as movement systems, staff shifts, maintenance facilities and other operational aspects in which AFE’s prior experience should be considered.
(d) In the estimation of operating costs, knowledge of the current circumstances regarding staff, supplies, collection systems, infrastructure and equipment maintenance and other cost factors are essential for determining project costs, without prejudice to the streamlining efforts called for in the project.
3.2 Project implementation

The results of the above-described studies will enable the government to make the implementation decisions it considers appropriate. If a decision is made to implement a project, a contract between AFE and the State should be signed, spelling out the obligations of both parties.

AFE’s primary obligations will be to:

- Create the internal institutional framework (subsidiaries, business units, cost centers, etc.) necessary for implementation of the project.
- Establish operational and accounting information systems.
- Purchase the rolling stock called for in the project.
- Fit out or rehabilitate the necessary facilities (stations, workshops, tracks, signaling, offices, etc.).
- Provide the service on the previously agreed terms.
- Periodically report on the operating revenues and costs of the project.

The State’s obligations will be to:

- Allocate the investment resources needed to implement the project.
- Grant necessary operating subsidies.
- Monitor the basic indicators of the service provided by AFE: service standards, transport volumes, changes in demand, and other contractual obligations.

4. Subprogram 3.4: Participation in the analysis and implementation of freight transport investment projects.

4.1 Evaluation of freight transport projects

According to the policy outlined by the Government of Uruguay, the development of the rail sector will be based on freight transport. One of the aims of this policy is to include the private sector in these activities, although not in the short term, which will be devoted to rehabilitating the railroad through major infrastructure investments.

The investments should be supported by economic feasibility studies that quantify their social benefits, in accordance with internationally accepted criteria and methodologies. The studies should be conducted by the MTOP’s Railroad Regulation Office and carried out by a specialized external consultant, to ensure the objectivity of the results.

Two types of investment studies are envisaged:

- Infrastructure investments
- Investments in rolling stock, during the time that freight transport services will be provided by AFE
AFE participation would be important in the following respects:

(a) As a member of the counterpart commission for the studies.
(b) In the quantification of the infrastructure investments. AFE has (or should have) detailed records on the various railway sections and the corresponding concrete structures. This information is crucial for infrastructure rehabilitation or improvement projects.
(c) In the determination of service standards. AFE technical staff should collaborate with the consultant to ensure due consideration of AFE’s prior experience in providing services of this type and in assessing available resources.
(d) In the formulation of the operational project. The design of the operational project includes elements such as movement systems, staff shifts, maintenance facilities and other operational aspects in which AFE’s prior experience should be considered.
(e) In the estimation of operating costs, knowledge of the current circumstances regarding staff, supplies, collection systems, infrastructure and equipment maintenance and other cost factors are essential for determining project costs, without prejudice to the streamlining efforts called for in the project.

4.2 Project implementation

The results of the above-described studies will enable the government to make the implementation decisions it considers appropriate. If a decision is made to implement a project, AFE’s role will differ according to whether the project is an infrastructure project or a freight transport project.

In the case of infrastructure projects, the State’s contributions to financing the project will be made through CFU. In this case, AFE’s primary obligations will be to:

- Assist CFU with the bidding process, from preparing the bidding documents to drafting the works contract.
- In the case of works to be managed by AFE itself, establish the information and control systems called for in the contract.
- For contracts performed by third parties, supervise the purchases of supplies called for in the project to ensure that they conform to AFE’s technical standards.
- Collaborate with CFU in the inspection of the works.
- Ensure the availability of facilities necessary for performance of the works contract (station yards, workshops, offices, etc.).
- Serve as a member of the committee responsible for acceptance of the works.

For its part, the State, through CFU, will have the following obligations:

③ Allocate the investment resources necessary to implement the project.
② Conduct the bidding and works contracting process(es).
③ Administer contracts and perform technical inspections. In the case of contracts to be administered by AFE, it will be important to have an external inspection.
In the case of projects that include the purchase of rolling stock for freight transport, although the State’s contributions will also be made through CFU, the contracts are different, since the equipment will normally be manufactured or refurbished abroad.

AFE’s role in these projects should be somewhat more limited:

- Participate in the committee responsible for inspecting and accepting the equipment.
- Verify that the equipment components conform to AFE’s technical standards.
- Provide the staff and facilities necessary for acceptance and commissioning.

For its part, the State, through CFU, will have the following obligations:

- Allocate the investment resources necessary to implement the project.
- Conduct the bidding process with the help of an external consultant, from the bidding documents to the supply contract.
- Administer contracts and perform technical inspections. For contracts of this type, it is important to have an external inspection.