Regional Infrastructure Program, 2001–2005

A USAID Initiative in South East Europe

Rehabilitation of the Vora-Hani Hoti Railway

Albania
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Booz | Allen | Hamilton

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I. Background

On 10 June 1999, more than forty partner countries and organizations signed the Stability Pact for South Eastern Europe in Cologne, Germany with the objective of strengthening the countries of South Eastern Europe "in their efforts to foster peace, democracy, respect for human rights, and economic prosperity in order to achieve stability in the whole region."

The United States Agency for International Development's (USAID's) Regional Infrastructure Program (RIP) for Water and Transport was developed as an important element of the U.S. Government's overall program of support for achieving Stability Pact objectives in the region. Booz Allen Hamilton (BAH) has been retained by USAID to assist in this program by supporting specific efforts to improve the water and transportation infrastructure in the Balkans region. BAH's current project to carry out the pre-feasibility for upgrading the Northern Corridor Railway in Albania constitutes a task under the auspices of the RIP.

I.1 Project Overview

Albania is located in the southern region of the Balkans. It is bordered by Montenegro to the north, Macedonia to the east, Greece to the south and approximately 470km of coastline along the Adriatic and Ionian Seas to the west. It is a country of about 29,000 square kilometers extending 330 km in the north-south direction and approximately 152 km in the east-west direction.

Approximately 75% of the country is mountainous – mostly in the north and east. The majority of the population is located in the cities of Durres, Shkoder, Vlora, and the capitol city of Tirana. According to the 2001 Census, Albania's population stands at 3.1 million. If accurate, this number would be mean a total population 14% lower than the 1996 estimate of 3.6 million.

I.2 Study Purpose and Objectives

The objective of this pre-feasibility study is to evaluate the financial feasibility of upgrading the 119 km Vore-Hani Hoti railway link to standards sufficient to allow movement of international traffic. The scope of the activity involves reviewing existing studies related to the project and cooperating with Albanian Railways officials to determine the need for, or the design of, a complete and detailed feasibility study for renovation of the railway linking Albania to the rest of Europe via Montenegro.

This report addresses the existing situation, presents several scenarios for rehabilitating the railway, recommends the most cost effective way to improve and upgrade the northern link and projects its financial feasibility.

I.3 Rationale and Beneficiaries

This pre-feasibility study focuses on analyzing options for improving the northern corridor rail line between its junction with the Durres-Tirana line at Vora and the Montenegro border. With the opening of an international route to Montenegro, freight and passenger traffic is expected to measurably increase. When constructed, transit time and transport costs will be reduced for the many imports and exports needed to support the Albanian economy. In a mid-2001 preliminary evaluation, undertaken by the American firm Transport Economics Research Associates (TERA), it was suggested that it might be possible to rehabilitate the railway and achieve a Financial Internal Rate of Return (FIRR) of 21.15% and an Economic Internal Rate of Return (EIRR) of more than 30%.

The beneficiaries of this study include the Ministry of Transport, Albania Railways (HSH) and all Albanian railway users.

I.4 Approach and Methodology

Experienced railway and economic/financial personnel primarily through the following activities accomplished this study:

Review of previous studies conducted during the past ten years,
Study of the current situation of the railway by consulting with Albanians railway (HSH) managing and operating staffs,
Field visits to the sites, including riding the rails in an HSH locomotive,
Review of the necessity for infrastructure improvements needed and rolling stock rehabilitation, or replacement, required for providing the level of projected international needs and services,
Calculation of the investments required to capture the projected traffic levels, and
Development of a cost/revenue model to illustrate the level of traffic required ensuring the financial viability of the project.

I.5 Supporting Activities

There are a number of related activities currently taking place that confirms the government's commitment to rehabilitation and improvement of the Northern Corridor. For example:

HSH recently finished construction of a new train station along the studied corridor in the city of Bajze,
HSH is currently tendering for the rebuilding of 12 km of track that was removed (stolen) from the 33 km rail section linking Hani Hoti and Shkoder, and
The Durres-Tirana link, within which the city of Vore lies, has recently been rehabilitated to European standards of 80 km/hr, concrete ties, welded S49 rail, new ballast and rehabilitated switches.

II. Railway System - Existing

II.1 General - System wide

Construction of the HSH rail network began in 1947 with the objective to provide service to the national mining industry and the associated heavy industries. Construction continued until 1989 when all construction was suspended. The current system consists of 447 kilometers (km) of main line and 230 km of secondary lines. The network radiates from its center at Durres Port on the Adriatic Sea, northward to the border of Montenegro at Hani Hoti, southerly to Vlora and Ballishi, easterly to Pogradeci - near the border of Macedonia, and easterly also to the capitol city of Tirana. Although large sections of the country have no service, the majority of the populated and industrial areas are provided with freight and passenger service (See Exhibit II-1).

Being a small country, the Albania Railway length of hauls will always be short. As a result, costs will remain high on a kilometer basis. In addition, the heavy industries (e.g., steel, mining, etc.) that have supported the railway in the past are mostly in decline with little probability of recovery. The investment in highways adjacent to the line also poses significant challenges. On the positive side, the improvements at the Port of Duress provide great opportunity for the HSH to enter the container business. This advantage, however, can disappear in a hurry if the railway is not prepared to move the containers when the container port opens in late 2002-early 2003. It is a virtual certainty that if the container traffic moves to the trucking industry, the railway will never recover the loss. Thus, the railway will need to move quickly and efficiently, or it will soon find the costs to sustain the railway will be beyond what the public can or will bear.

II.1.1 Vora to Hani Hota Link

The 119.6 km Vora to Hani-Hoti rail link is of strategic importance to Albania as it is the nation’s only rail link connecting Albania with the rest of Europe. Current travel by highway is very slow and trucking costs are high. As a result, the majority of Albanian import and export traffic is routed to Italy by boat, and then onward to land connections in Northern Europe.

Construction of the Vora to Hani-Hoti rail link began in 1986 to provide Albania with a seamless rail access to the European rail network. This link was used until the political changes of the early 1990s. The primary traffic consisted of exporting minerals to Eastern European destinations and importing grain and flour to Albania from Hungary and Romania. Immediately following the Yugoslavia embargo of 1997, traffic on the line was reduced significantly. Later in 1997, approximately 12 km of rail was removed (stolen) near the Montenegro border, thus interrupting all cargo traffic to the Balkans. Replacement of this 12 km is scheduled for completion later this year (2002) and direct rail service to the Balkans and the rest of Europe should then be restored.

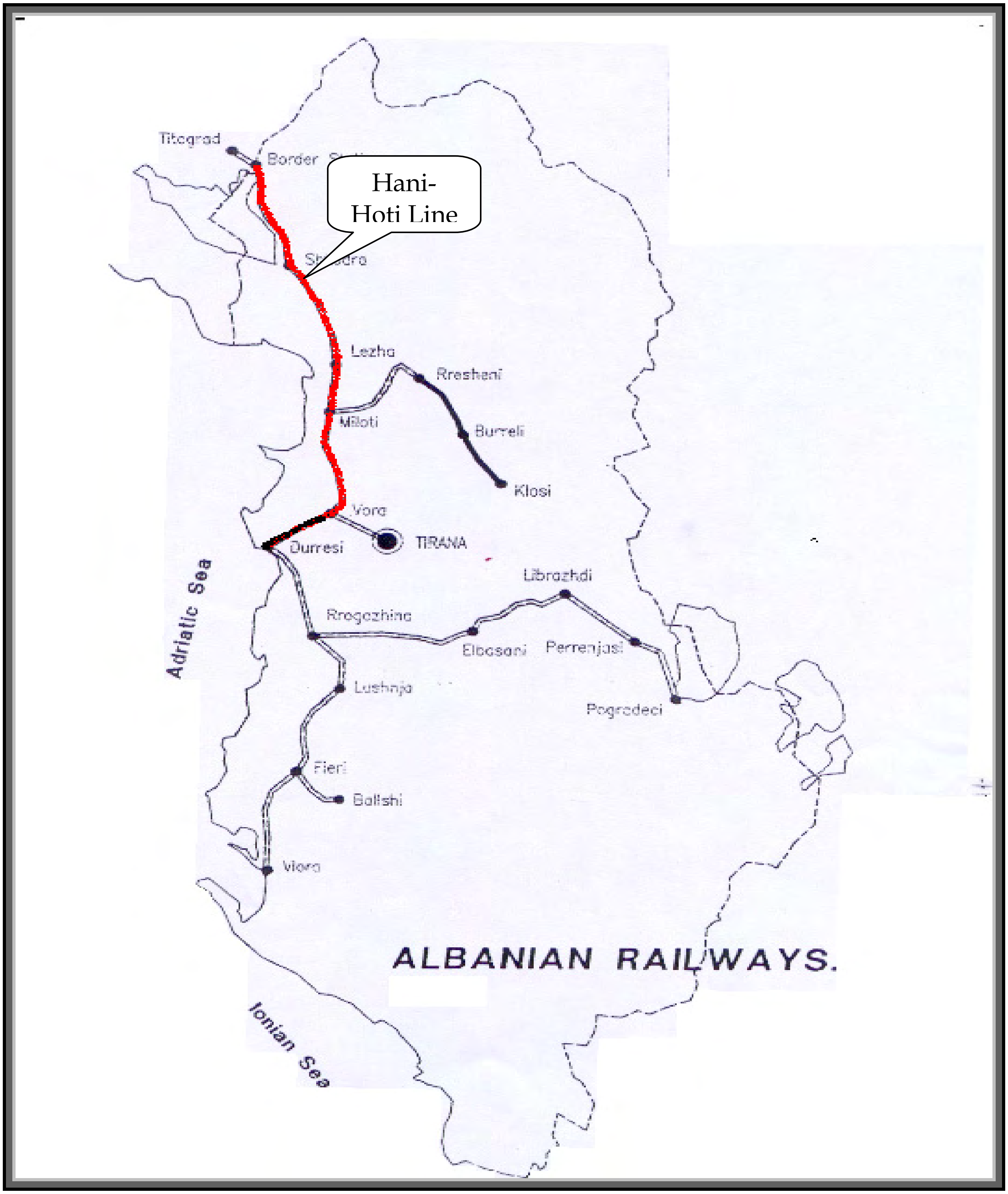

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Exhibit II-1: HSH Railway Network

II.2 Infrastructure – Vora to Hani Hoti

There are conflicting stories related to the quality of construction to which much of the line was built. The initial sections were designed to Soviet Union standards with later construction adhering to Albanian standards. Some reports indicate that the initial construction, although possibly of minimal standard, was still adequate for the services required. Other reports state that sections of the railway were constructed by volunteer youth work teams without specialized equipment and were less than adequate. In the less adequate locations, the weaknesses include:

- Inadequate compaction of the roadway embankments,
- Poor quality of sleepers (crossties) with poor preservative treatment,
- Inadequate drainage – primarily in areas near the mountains,
- Low quality (soft) limestone and/or river gravel ballast, and
- Light (P-43) Rail in certain sections (i.e., 40kg/m rather than 49kg/m).

Although sections of the line were originally signaled, signalization is no longer operational. Communication lines (telephone, telegraph) no longer function.

The railway was originally designed and constructed to support train operations at 80 km/hr although in its current state of repair, freight operations are limited to 25km/hr in most locations and passenger train speeds average approximately 40 km/hr.

During the field visit portion of the study, it was apparent that substandard construction/poor maintenance over the past years has taken a heavy toll on the rail lines ability to function as designed. Much of the railway can no longer efficiently support heavily loaded (2,000 to 4,000 tons) train operations on a high frequency basis. This is especially true in areas where the ballast has eroded and embankments are inadequately protected from flooding or saturation.

To objectively assess the overall condition of the railway, the BAH Team used a Track Structure Condition (TSC) approach developed by the U.S. Corps of Engineers for analyzing track conditions for secondary or infrequently used lines. This TSC approach focuses on the current condition of four railway infrastructure features and their ability to support current and future traffic levels.

The features to be rated are:

1. Rail and Joints, including accessories (connectors),
2. Sleepers (cross ties),
3. Ballast and Sub-grade, including embankments, and
4. Drainage Structures, including bridges.

Once the general conditions of these features are agreed upon, it becomes easier to more consistently estimate costs for improvement to various specific standards.

II.2.1 Rail and Joints Condition

The Vora to Hani-Hoti rail line is standard gauge (1.435 meters) with the main line constructed with rail weight of S-49 (49 kg/m). Sidings are constructed with a mixture of S-49 and a lighter weight P-43 (40 kg/m) material. The existing S-49 rail is of sufficient strength to support the current and projected traffic and visually appears to show little wear. The P-43 material is heavily worn and of little use. There appears to be enough S-49 available in country to replace the P-43 where necessary. None of the line is welded, but rather constructed with 25-meter sections connected with bolted joints. On a scale of 0 to 100, the condition of the S-49 rail would rate an 80.

II.2.2 Sleeper Condition

It is estimated that fewer than 30% of the sleepers are adequate to support existing traffic, much less the expanded traffic envisioned. These sleepers are for the most part of low quality, native materials and have been creosote treated. Many of the existing wooden sleepers have exceeded their expected useable life of 8 to 10 years. Although maintenance crews have replaced some of the more defective sleepers with Albanian manufactured concrete bi-block sleepers on a random basis, any increase in traffic activity will require a major replacement program to assure safe and optimum operations. The inadequate condition of sleepers, combined with the poor ballast and areas of weak roadbed, are the primary reasons behind the reduction in train operating speeds. On a scale of 0 to 100, the condition of the sleepers would rate a 30 to 35.

II.2.3 Ballast and Roadbed Condition

<u>Ballast</u>

The material used for ballast throughout the line varies from sections made of river gravel to sections made of crushed limestone. In several sections, the ballast is mostly worn beyond its ability to support the sleepers.

River gravel is not an acceptable ballast material since it is rounded and provides minimal, if any, lateral support necessary to retain safe rail alignment. Dolemite limestone, while a considerably better material than river gravel, is too soft to provide long life support since the wear rate is high. If the railway moves, as anticipated, to mechanized maintenance, the dolemite limestone will be even less acceptable. In 1995, the CIE study team took several samples of Albanian native rock to Ireland for laboratory testing. The results of those tests confirmed a soft, water-soluble stone that was also less than desirable as a ballast material. Unless a better source of rock can be located near the rail line, ballast costs will continue to be high both for reconstruction and maintenance. On a scale of 0 to 100 the existing ballast condition is rated a 30.

Roadbed

Considering the proximity of much of the northern section of the line to mountainous locations and the number of stream crossings, the embankment sections are of average height and the poorly compacted sections are less numerous than one might expect. The BAH Team, during the field visit, did identify several locations; two in particular (at kilometers 43 & 73), where poor embankment compaction, combined with water encroachment is resulting in a saturated embankment. This problem will not be easily or inexpensively repaired. As train loading and frequency increase, the situation will worsen unless properly repaired. The problem is that it is difficult to retain alignment of rails in areas of soft and insufficiently compacted roadbed. This in turn, creates a situation that causes wagons to rock and requiring slower speeds to avoid derailments. On a scale of 0 to 100 the roadbed condition is rated a 70 except for the two sections noted.

II.2.4 Drainage Structures

There are fourteen (14) major drainage structures (bridges) along the route (see Table II-1). Each of these structures is of reinforced concrete with piling and/or spread footing foundations. The design standard is 8 tons/meter and the trackage across these bridges is supported by standard ballast and sleeper construction. The railway civil engineers state that the only problems encountered to date have been erosion around the footings in some areas. No major structural weaknesses or deterioration, were observed during the field visit.

On a scale of 0 to 100 the bridges are rated, by visual inspection, an 80. The only deficiencies noted were erosion around footings in several locations, and possible age.

Bridge Name	Location	**Length (meters)**
1. Ura Ishmit	Km 33+500	100
2. Ura Thumane	39+200	50
3. Ura Drojes	42+000	60
4. Ura Milot	55+400	800
5. Ura Hyrje Lezhe	68+500	150
6. Ura Dalje Lezhe	69+500	150
7. Ura Spatharit No. 1	92+000	100
8. Ura Spatharit No. 2	92+500	150
9. Ura Kirit Shkoder	103+500	150
10 Ura Vrakes	112+500	70
11. Ura Rjollit	114+500	120
12. Ura Banushit	124+000	100
13. Ura Prroit Thate	139+000	70
14. Ura Para Kufirit	139+500	40

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Table II-1: List of Bridges Along the Vora-Hani Hoti Railway

II.2.5 Tunnels

There is only one tunnel along this route, and it is located (beginning) at km 69+200 near Lezhes. The tunnel is 320 meters long and classified as GB-2 meaning that it is sufficient for handling planned traffic with little, if any, renovation. The tunnel is lined with concrete and according to HSH engineers; the tunnel is large enough to handle containers on flat cars. On a scale of 0 to 100, the tunnel condition is rated a 75.

II.3 Rolling Stock and Workshops

II.3.1 Locomotives

HSH currently has a fleet of 61 road locomotives of which 25 are considered operational. These are Class T-669 six-axle 1,350 hp, built by CKD of Czechoslovakia. They range in age from 1968 to 1989. HSH personnel estimate that a maximum of 16/17 locomotives are required to provide the current level of service. In addition there are ten 750 hp "shunters" of which none are in service. The railway also has five German built Krupp 2,700 hp locomotives that are not in operation. Most of the inoperable locomotives have been cannibalized. None of the currently operating locomotives is sufficient on a stand-alone basis to economically pull a container block train of 15-20 wagons.

II.3.2 Wagons

The existing fleet of wagons far exceeds demand. Many are in poor condition and should be sold as scrap. None of the existing fleet will meet the long term need for flat cars sufficient to safely carry containers or other goods internationally although it is possible some could be modified. There are sufficient ballast and cement wagons to meet the current demand but the purchase of special container flat bed wagons and special service international wagons will be required to provide service on the Vora-Hani Hoti line.

II.3.3 Carriages

The HSH passenger carriage fleet contains 117 carriages and 18 luggage wagons. Most are in poor condition with many damaged beyond repair. Most of the studies recommend a small program to rehabilitate approximately 10-15 carriages per year for 3-4 years depending on demand.

II.3.4 Workshops

The main facility for repair of all equipment, including locomotives is in Durres. The workshops are equipped sufficiently to provide all type of maintenance services.

II.3.5 Container Yards/Equipment

The HSH currently is ill equipped to handle containers or to move them rapidly into Europe. While there are opportunities to modify existing wagons to handle containers the most likely scenario will require purchase of new equipment.

III. Review of Previous Feasibility Studies

III.1 General

During the past six years, a number of studies for rehabilitation and/or restructuring the HSH have been considered. An Irish Team - CIE Consult, developed the most detailed of these studies in 1995. An Austrian Team followed with another such study in 1999 while the most recent study was carried out in 2001 by the American consulting firm - TERA. While each of these studies focused on the railway as a whole, BAH's review focuses only on the Northern Corridor between Vora and Hani Hoti using these pasts studies as benchmarks for most of the assumptions made in terms of operational costs and investment costs.

Since each of the studies mentioned has its own unique set of objectives and requirements, none of the alternatives or scenarios they present can be directly compared with each other because of the various assumptions made.

III.2 The CIE Consult Study

This professional study, accomplished by a team of railway experts from Ireland in 1994-95 is the most detailed review of the railway that has been carried out during the past ten years. In their attempt to strengthen the HSH and help move it towards a profitable entity, the CIE consultants reviewed four scenarios, with several sub-sets (see Table III-1).

Scenarios	Description
1	1.A Continue operations as present (i.e. 1995). 1.B Continue operations as present with full rehabilitation of railway
2	2 A. Operate as a commercial railway with passenger service between Elbasani, Durresi, Tirana and Shkoder 2. B Operate as a commercial railway with passenger service only between Tirana and Durres.
3	Operate as a mineral railway
4	Abandonment of all rail service

Source: CIE Consulting
Booz Allen Hamilton, 2002

Table III-1: CIE Scenarios

Scenario 1A: Under this Scenario: 1) capital costs were severely restricted, 2) material costs only included costs covering the emergency replacement of sleeper and ballast program, 3) signaling costs were restricted to those necessary to repair the present system, 4) rolling stock refurbishment was limited to 20 coaches per year and purchase of 10 new coaches in early 2000 and, 5) locomotive replacement and refurbishment was not accomplished.

Scenario 1B: Under this Scenario: 1) complete cost for relayment of Tirana-Duress line was include, 2) installation of modern signaling throughout the network was incorporated and, 3) replacement costs of rolling stock with new equipment was assumed. This resulted in total capital costs of at least USD 28 million that far exceeded the financing capabilities means of the government or the railway.

Scenario 2A: In addition to the relaying of 30 km of track between Tirana and Duress, this scenario assumed that a further 166 km would be relayed between 1995 and 2005. The same emergency sleeper program was incorporated as in Scenario 1A with new track maintenance costs provided for. Signaling investment was also provided for the signaling of all passenger services. A higher level of carriage refurbishment was provided for but there less investment was required for locomotives. Total capital costs under this scenario also came to about USD 28 million (1995).

Scenario 2B: Under this scenario track relaying was limited to Tirana/Durres line. The emergency sleeper program was also accounted for. Signaling investment was confined to Tirana/Durres and there was provision for limited carriage and locomotive refurbishment as well as the acquisition of three multiple diesel units. Total capital cost was estimated at USD 17.4 million (1995).

Scenario 3: The capital cost for this scenario was limited to the emergency reballasting program on the 203 km of railway line to be retained in service. Rolling stock acquisitions was limited to three (3) locomotives in the early part of 2000. Total capital cost was estimated at USD 1.5 million (1995) since maintenance costs were accounted for as a non-capital cost.

Scenario 4: Self-explanatory (i.e., total abandonment of rail service translated into zero capital cost).

III.2.1 The CIE Preferred Option

The CIE Team immediately discarded scenarios 3 and 4 as being unrealistic. The public reaction would have been extremely negative and the costs would have been greater than the benefits, both in monetary and social costs. Similarly Scenarios 1A and 1B were deemed unrealistic since they did nothing, or little, to improve the situation.

Therefore, the choice rested between scenarios 2A (commercial railway with significant passenger service) and 2B (commercial railway with significantly reduced passenger service). In financial terms, 2B was deemed the best (fewer subsidies required) recognizing that withdrawal of much passenger service could give rise to serious problems.

Scenario 2A, while not as financially attractive as 2B, had many advantages. It provided for the rehabilitation of the core of the railway and the improvement of the services. Under this scenario productivity would have been raised and the railway re-oriented toward becoming a market driven organization with high standards of efficiency. It was projected that by the year 2005, HHS would recover 87% of its costs from revenue in the optimistic case and 50% in the base case.

At the end, CIE recommended Scenario 2A (modified slightly) as the best option because of the following advantages:

It provided for basic retention of the basic network,
It resulted in considerable productivity gains,
It maintained potential for future interconnection with other Balkan railway systems,
It supplied a necessary social service,
It readily coped for the likely development in the mining industry,
It maintained a reasonable transport service for those passengers who lived in areas where the roads was inadequate or non-existent, and
It provided an alternative to passenger and freight traffic as roads became more and more congested with increasing vehicle numbers.

III.2.2 BAH's Comments

With only light traffic on the line since the CIE study, there has not been significant change in the railways condition. Maintenance for the most part, has been able to keep an already depleted roadbed operational, but no major rehabilitation has been accomplished. Although the CIE report did not address the Vora-Hani Hoti line directly, the assessments of the railways general conditions and remedies for repairing are in general agreement with BAH's findings.

Primary changes since 1995 include a much lower probability of increased mining related traffic, a higher cost for network rehabilitation and the probability today of a higher level of container traffic. Otherwise, CIE's views for the future appear to have been quite accurate.

III.3 The Austrian Study

The Sector Study of the Railway Sector in Albania was conducted in 1998-1999 by the Austria Rail Engineering group from Wien, Austria. The objective of this study was to determine the railways structural, financial, and economic condition and present recommendation for how best to assure the future viability of the railway. In accomplishing their review, the Austrian Team, in cooperation with the HSH, developed a needs list and three programs to address those needs over a ten (10) year period:

1. Emergency Program: emergency maintenance to basically keep the railway operating until rehabilitation could begin – a survival effort to begin immediately (1999) and be completed in two years.

2. Medium Term Program: sufficient rehabilitation to return the railway to its original design standard and capacity and assuring a low cost maintenance effort – a three-year effort to be accomplished between years 3 and 5.

3. Long Term Program: a major rehabilitation effort designed to rehabilitate the railway to meet international standards and long term objectives – a five year effort to be accomplished between years 6 and 10.

The approximate cost for accomplishing each of these efforts was estimated (based on the entire system) on a kilometer basis as follows:

1. **Emergency Program:** USD 16.2 million system wide, including USD 6.7 million for emergency rehabilitation on the Shkoder to Hani Hoti (36 kms) segment. This number translated in USD 186,000 per km and would include replacing the sleepers, (some wooden-some concrete), using existing rail, no welding except across bridges and replacing the ballast.

2. **Medium Term Program:** USD 292 million that would include mechanized maintenance, some concrete sleeper and ballast work on the northern corridor as well as some signalization work. Purchase of diesel rail cars was also envisioned for passenger traffic. The majority of these funds (USD 256 million) were for new lines in other parts of the country.

3. **Long Term Program:** USD 503.7 million that included additional concrete sleeper and ballast replacement as well as installation of European telecom standards. The majority of these funds (USD 235 million) were for new lines in other parts

of the country and for track rehabilitation with concrete sleepers (USD 250 million).

This list was later revised into an investment program at somewhat lower costs. Unfortunately, funds were never provided to meet this level of rehabilitation and few of the improvements were accomplished.

III.3.1 BAH's Comments

The findings of the Austrians appear to have been accurate. The proposal of initiating an emergency maintenance program immediately and following up with a rehabilitation program still has merit today. Although the Government of Albania embraced the Austrian Study, the level of funding was not provided, so the expected results were not achieved.

III.4 TERA Study

The May 2001 TERA study, much like those conducted earlier by other consulting groups, identified that:

- The rail network had suffered rapid deterioration over the past 10-20 years,
- Current railway revenues from operations cover approximately 50% of the operating expenses while the rest is subsidized by the Government,
- Given the present level of needed investment, and recent decline in revenue, it is only a matter of time before the railway will be unable to operate unless it is subjected to a major restructuring,
- There is a need to mechanize the renovation and future maintenance of the railway,
- There is a need for larger locomotives to pull longer and heavier trains, and
- There is a need for a Management Information System, and also for signalization and communication equipment.

The TERA study highlighted that the passenger service, while heavily used, is also heavily subsidized and that the arterial highway network, much of which parallels the railway, will be completed in two to three years. As a result, the challenge to compete for revenue traffic (freight) will become significantly greater then it is now.

III.4.1 TERA's Recommendations

The TERA team developed a list of nine (9) recommendations to assist the HSH to meet its current and future needs. These are:

- HSH should review its operations in light of the major road rehabilitation, population movements, and future industrial development.
- It should develop a plan for modernizing its standards, regulations and methods of operations and maintenance.
- It should develop a restructuring plan based on future role, investment plan and improved labor efficiency.
- It should discuss with potential freight shippers opportunity for possible investment in track, rolling stock, etc.
- Given Albania's desire to join the EU, consideration should be given to separation of infrastructure from operation so that the railway can meet EU requirements for third party operations over its tracks.
- An analysis should be undertaken to determine under the new plan the viability of each line and service.
- A review should be made for coopering with at least the Montenegro Railways for possible operating and maintenance.
- It should discuss with the government to determine the required standard of service. The government's agreement for a Public Service Operation (PSO) agreement, whereby the government agrees to pay for the provision of certain services (for example: passenger services) needs to be obtained, should the likely revenues not support the service.
- Based on the analysis, the railway should develop an investment plan that is in itself capable of being financed either commercially, or through a development agency such as the World Bank.

III.4.2 TERA's Recommendations for the Vora-Hani Hoti Line

In addition to focusing on the railway system in total, TERA focused specifically on the international routes proposed, including the Vora-Hani Hoti link. In so doing, its specialists estimated the repair/replacement needs for restoring this rail connection to Montenegro. Their cost estimates are shown in Table III-2.

TERA also noted the need for several large locomotives, new wagons, and radio signalization. To obtain larger locomotives, it suggested that it might be possible to rehabilitate some of the eight (8) General Motors units currently in Montenegro for train movements from Albania to Montenegro.

III.4.3 BAH's Comments

TERA's general recommendations are consistent with those contained in the studies conducted during the previous 10 years as well as consistent with BAH's observations. If the recommended changes were implemented, the results would be significant and positive. The converse is also true (i.e., the non implementation of the majority of the TERA recommendations, will likely result in a railway that will find it very difficult to continue to financially exist without major infusions of government funds).

Description	Cost/Unit (in USD)	Shkoder to Vora	Shkoder to Border		Total
			Replace	**Upgrade**	
Track:					
Length – km		84.6	11.2	24.3	
Total Sleepers required		27,601	17,360	37,665	
Ballast m³/m		1	0.6	0.6	
Total Ballast m³		84,600	6,720	14,580	
Costs:					
Sleepers	35	USD 966,035	USD 607,600	USD 1,318,275	
Plates	12				
Rail	-	-			
Ballast	10	USD 846,000			
Material Transport	1	USD112,201			
Value Added Tax (20%)		USD 384,847			
Total		**USD 2,309,683**	**USD 1,088,640**	**USD 1,819,584**	**USD 5,217,907**
Other:					
Radio Token Block					USD 500,000
Container wagons	40,000				USD 1,000,000
Other wagons	10,000				USD 1,000,000
Value Added Tax (20 %)					USD 500,000
Total					**USD 3,000,000**

Source: TERA Report – June 2001
Booz Allen Hamilton, 2002

Table III-2: Cost Estimates - Rehabilitation of the Vora-Hani Hoti Line

While BAH agrees with TERA's general recommendations, it does not agree that the suggested rehabilitation of Vora-Hani Hoti to an acceptable standard can be accomplished for the estimated costs. More specifically, BAH believes that TERA's estimated costs for rehabilitating the Vora-Hani Hota link are significantly:

- Lower than costs for similar work recently tendered in Albania,
- Less than HSH estimates,

- Less than cost estimates of other previous studies, and
- Less than the costs known to BAH for similar projects in similar countries.

The difference in cost expectations is probably linked to the standard to which the improvements are expected to be made, thus in the level of effort and the quality of material required to achieve that standard. In its report, TERA refers to the improvements as those necessary to achieve "commercial standards". Commercial standards do not appear to be a recognized measurable railway standard approved by the European Union or any other recognized International Railway Group. Civil/Railway engineers at HSH are not aware of such a standard. It appears that TERA experts were attempting to develop an investment alternative that would minimize costs and maximize benefits with little regard to the project's ability to sustain those benefits over the long run or assist the HSH in its efforts to meet EU Standards. While BAH agrees with the principle of minimizing costs, it finds TERA estimated costs unreasonably low and, therefore, insufficient to generate the estimated benefits without additional investments.

For example, TERA's cost estimates per kilometer translate into:

- USD 27,300 for the Vora to Shkoder link of 84.6 km;
- USD 97,200 for replacing the missing link near Shkoder, and
- USD 74,880 to upgrade the remaining 24.3 km from Shkoder to border.

These figures translate to an estimated total cost to reconstruct the 120.1 km line (TERA's length) of USD 5.2 million, or an average of USD 43,450/km. This number is much lower that the CIE 1995 estimate cost of USD 206,000/km for relaying existing rail on existing ballast and an average of USD 220,000/km for much of the actual 1998 work on the Durres-Tirana link.

While not all comparisons are "like to like" or "apples to apples", this cost differential is too great to be acceptable and the proposed TERA investment should probably more properly be classified as temporary, emergency maintenance. This perception is reinforced by TERA's approach to costing some of the rehabilitation work. For instance, TERA costs appear to be based on using HSH crews (force-account) with use of minimal quantities of low cost material installed. For example the TERA estimate for sleepers (installed) is USD 47 each. This compares unfavorably with current actual cost for sleepers of USD 66 each (uninstalled). Additionally, TERA's estimates of 0.6 m^3/m and 1.0 m^3/m of rock ballast is insufficient to ensure stabilization of the trackage for any length of time. Finally, TERA's estimate of replacing only 20% of the sleepers in sections of the line is much fewer than the number identified in the track foreman's actual condition survey. BAH's visual survey indicates that this percentage should actually be closer to 70 % (See Photo III-1 and Photo III-2).

Although an investment of USD 5.2 million would likely improve the trackage to the point that safe travel between 40 and 50 km/hr can be assured, it does little, if anything, to improve the trackage to European Standards or to improve the trackage to the point that mechanical maintenance could be accomplished. Mechanical equipment requires equal spacing of uniform quality sleepers and large quantities of uniform, high quality ballast, neither of which are considered in the TERA's study.

Photo III-1: Hani Hoti Line – Track Section Section

Photo III-2: Hanit Hoti Line - Track

BAH has reviewed the "actual costs" for rehabilitating the 11.2/12.0 km of the line since the HSH has received a tender for this work with an average cost of USD 115,000/km. This tender is based on the use of lower quality sleepers (used wooden) than those proposed in TERA's proposal which further confirm that TERA estimated costs were too low (See Appendix A – Tender Summary Vora to Hani-Hoti).

IV. Proposed Rehabilitations Scenarios

IV.1 BAH Conclusions – Technical

Following its review of the previously noted studies, visual inspection of the line and discussions with HHS personnel, BAH concluded the following:

The railway infrastructure, in its current condition, will neither support international operations, nor a level of operations sufficient to adequately finance HSH's continued operations.
The alignment of the entire rail line is above average and sufficient to meet an 80 km/hr and 22.5-ton axle load railway. However the cost of reconstruction to meet an international standard, or to make the railway safe and useable for an extended period of time (10-20 years) is considerable.
The condition and quantity of the S49 rail along the line appears sufficient to assure a useable track life of 30 years if properly rehabilitated, and properly reinstalled, on concrete sleepers in a bed of sound ballast.
The major structures, (i.e., the tunnel and the bridges) appear visually to be in satisfactory conditions to meet a 30-year life rating with minimal upgrading.
The non-uniform, random spacing of sleepers currently being conducted in emergency repair sections will not permit the use of mechanized maintenance gangs – a stated HSH goal.
The continued emergency maintenance efforts, while sufficient to keep the railway in operation, does very little to assist the railway with its objective of improving the trackage to European standards, or to provide a long-term solution.

IV.2 Rehabilitation Scenarios

The stated goal of the HSH since at least 1995 has been to rehabilitate its railway system to meet international standards of at least 80 km/hr and 20 ton/axle loading. More recently, these goals have been upgraded to improving the trackage to the point that mechanized maintenance crews could more cost effectively maintain the system, and increasing the axle loading to 22.5 tons which would be similar to that of the Montenegrin Railway.

In order to meet these goals on the Northern Corridor, BAH developed preliminary cost estimates for four different scenarios assuming various unit costs, material quantity, type of tendering and level of work. The unit costs developed for each scenario are based on the following base costs modified for each situation:

- New S49 rail costs of USD 750/ton (material only) with an operational life of 50 years,
- Welding rail costs of USD 15,000/km,
- Tensioning welded rail costs of USD 8,000 km,
- Concrete sleepers cost of USD 66 at plant including connectors life of 50 years,
- Ballast cost of USD 10/ton at plant with an operational life of 15/20 years,
- Cost of preparing (cleaning and cropping) used S49 rail of USD 5,000 km,
- Used wooden sleepers with an expected operational life of 7-10 years at a cost of USD 10 each,
- Cost of lifting rail, relaying, rectifying and machine realigning of USD 20,000/km, and
- Cost of laying rail with sleepers and new ballast of USD 50,000/km.

The following scenarios assume that the HSH wishes to reconstruct the railway trackage to a standard consistent with its stated goals (i.e., (1) preparing the railway for international traffic and EU standards, and (2) reconstructing the trackage to permit mechanized maintenance in the near future (3 to 5 years)).

IV.2.1 Scenario I

This scenario would cover the rehabilitation of the entire line so as to permit safe operations at 80 km/hr, 22.5-ton/axle load for a duration of 30 years.

Estimated Cost:

Rehabilitation of Roadbed:	USD 10,000/km
Sleepers: New Concrete (1700/km)	USD 110,000/km
Ballast: New (2100 ton/km)	USD 50,000/km
Rail: Existing (Labor & Transport only)	USD 50,000/km

Estimated cost for Scenario I is USD 26.1 million or USD 220,000/ km. Under this alternative, the line would have an estimated 30-year life for the railway trackage but would require a minor rehabilitation of the ballast at the 15th year.
This scenario would meet minimum International (European) Standards for the trackage but not for signalization and operations. It would permit the minimum use of mechanized maintenance equipment and personnel.

IV.2.2 Scenario II

This scenario would defer from Scenario I as follows:

- Rail welding would be used for the entire 118.6 km of the line,
- Added cost of USD 30,000/km for welding and cropping,
- An additional 10% new rail on curves & tensioning, and
- Renewal of all switches (35 year life) and improvement of sidings.
- The estimated Cost for this Scenario would be USD 30.9 million, or approximately USD 260,000/km.

This scenario would meet minimum international standards and permit the use of minimum mechanized maintenance. The ride would be improved and operations would be more efficient and safer due to the welded rail and renovated switches.

IV.2.3 Scenario III

Same as Scenario II except BAH considered the installation of new rail instead of reusing the existing S49 rail. In addition to which, BAH included the installation of crossing gates at all major highway crossings.

The estimated Cost for this Scenario would be USD 34.0 million, or approximately USD 283,000/km.

This scenario would meet international standards and permit maximum use of mechanized maintenance.

IV.2.4 Scenario IV

This scenario is based on improving the railway by implementation of an accelerated emergency maintenance program and would provide a ten (10) year life for the trackage. It would involve upgrading the line to the same standard as the recent (May 2002) tender for the 12 km North of Shkoder. Simply stated it would involve installing used sleepers more rapidly than the current program financed by the Government.

The estimated Cost for this Scenario would be USD 15.4 million, or USD 140,000/km for 106.6 km and USD 40,000 km for the 12 km currently being rehabilitated. It would possibly meet international standards but would not permit efficient use of significant mechanized maintenance equipment or methods.

IV.2.5 Other Costs

In addition to the track costs, BAH estimated that the HSH would need the following equipment to begin container operations for international service:

- Radio Link Signalization System - USD 500,000

- Container Flat Cars (25 each) - USD 1.0 million
- New Wagons for International Service – USD 1.0 million

Additionally, BAH would also add three locomotive overhauls at a cost of USD 0.5 million each for a total of USD 1.5 million. Thus for each scenario, an extra USD 4.0 million should be contemplated.

V. Project Financial Feasibility

In order to establish the project financial feasibility, BAH developed an Excel based financial model to project the rail line future revenues and costs depending on:

- Domestic container traffic levels;
- Container transport tariffs;
- Passenger traffic and revenues;
- Rehabilitation scenarios costs,
- Rehabilitation scenarios financing terms, and
- Operating costs per ton/kilometer for cargo and passengers transported.

Exhibit V-1 presents the detailed structure of the financial model.

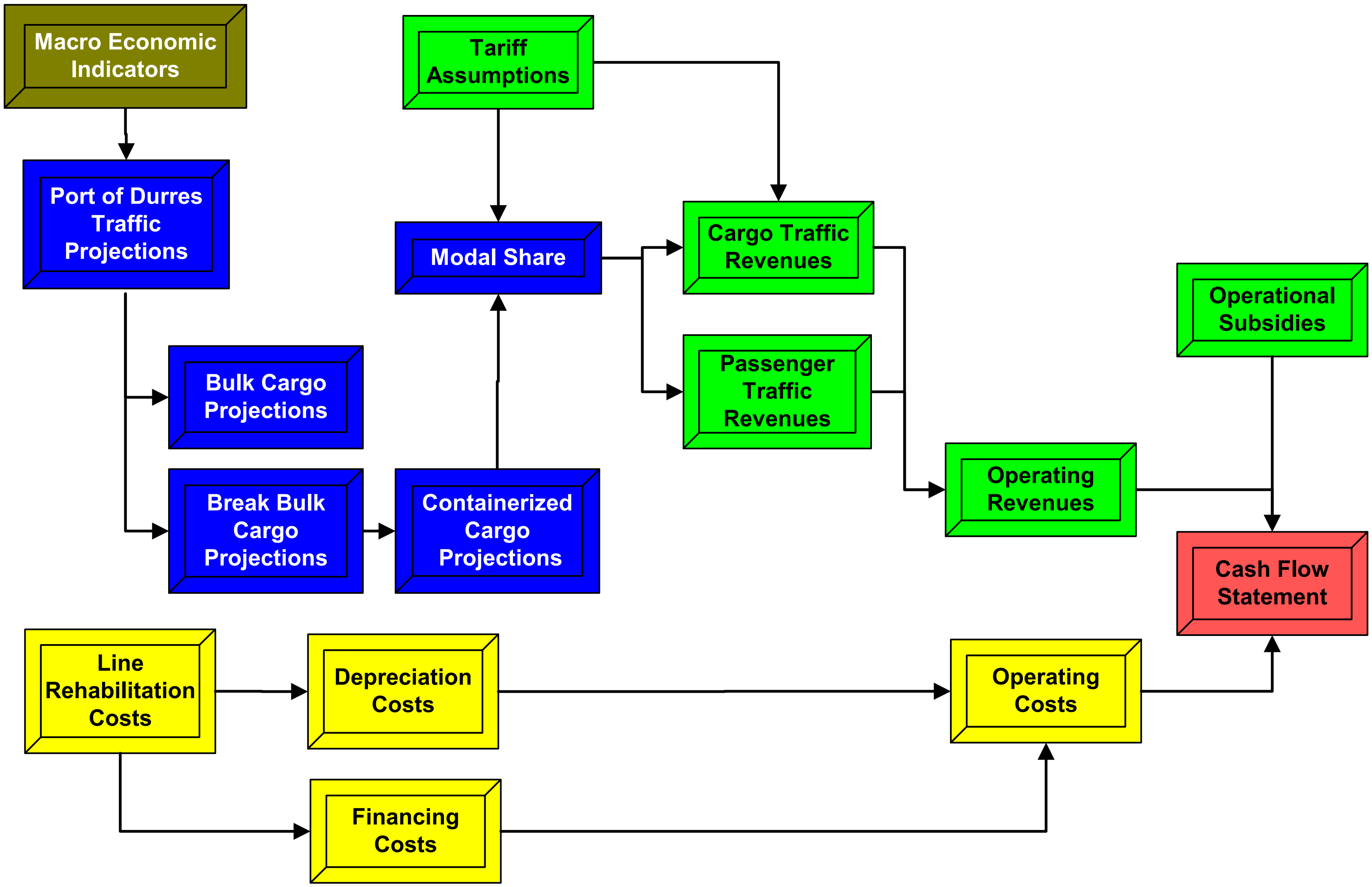
V.1 Financial Model Assumptions

The following key assumptions were used when developing this model:

Cargo container demand projections: the Port of Durres is the primary port of entry for international goods arriving and leaving Albania. The primacy of the port reflects not only the decrepit state of international roadways connecting Albania to neighboring countries, but also the key economic influence of nearby Tirana. Within the context of this project, BAH considered that the future level of cargo traffic at the port of Durres would dictate the potential demand level for railborne container traffic on the Vora Hani-Hoti line. This linkage was solely studied from the standpoint of domestic container traffic due to budget constraints (i.e., projecting potential international traffic on the rail line would have required extensive Origin/Destination (O/D) survey work in neighboring countries). The model, nevertheless, answers the critical question of how much international container traffic would be needed so as to allow HSH to operate the line without any public subsidies (i.e., the model translates automatically projected subsidies into international containers traffic equivalent).

In developing its forecast of domestic container cargo demand for the line, BAH took the following steps:

1. It projected total cargo traffic at the port of Durres;
2. It identified the portion of that cargo that would be containerized by differentiating between bulk and break-bulk cargo (see Exhibit V-1); and



Booz Allen Hamilton, 2002

Exhibit V-1: Financial Model Structure

3. It then assigned a modal share to total container traffic (i.e., which portion of the container will be carried by road versus rail). It considered both the current stranglehold of truck companies on the transport market for break bulk cargo (i.e., they have a market share in excess of 95%) as well as acknowledged the impact that the upgrading of the existing roadways which parallels the Vora Hani-Hoti line would have on truck transport competitiveness.

Passenger traffic projections: passenger traffic on the line was projected using actual passenger traffic's share of HSH revenues (i.e., currently around 55%). Since over the projected period, it is expected that car ownership would continue to increase rapidly and the completion of a parallel highway would further weaken rail's competitiveness, BAH assumed that rail passengers revenues would decrease over time as a percentage of total HSH's revenues.

Tariff assumptions: these assumptions were developed based on prevailing truck tariffs between Durres and the northern Albanian border (i.e., one way USD 150/container if the container is full and USD 75/container if the container is empty).

Line rehabilitation costs: the assumptions used reflect the four rehabilitation scenarios shown in Chapter IV.

Investment financing costs: BAH assumed that the entire cost of the proposed rehabilitation program would be financed using lending terms similar to those provided by international lending institutions such as the World Bank or the European Bank for Reconstruction and Development (i.e., extended grace period, low interest rates and long repayment periods – in excess of 20 years).

Depreciation costs: these costs were computed using straight-line depreciation methodology with similar timeline for both rolling stocks and tracks.

Operating Costs: these costs include all others operating costs besides interest and depreciation costs. In order to project them, assumptions were made in terms of personnel productivity improvement using international benchmarks for labor productivity.

V.2 Financial Model Results

The results of these assumptions were tested using three scenarios: an Optimistic Scenario, a Likely Scenario and a Pessimistic Scenario. Table V-1 presents the values utilized and the results obtained under each scenario. The Likely Scenario represents

BAH's view of the rail line market potential when it comes to domestic container traffic. As shown, under this scenario, the level of subsidies that will have to be provided to operate the line would cumulatively amount through the year 2025 to USD 31 to USD 39 million. Conversely, the rail line could achieve financial equilibrium if an additional 18,000 to 21,000 TEUs could be secured annually through 2025. Since this number represent 35 to 40 times the actual level of TEUs traffic at the Port of Durres, it is quite obvious that the financial feasibility of this project is extremely low by all accounts.

Model Input Parameters	Scenarios		
	Optimistic	**Likely**	**Pessimistic**
Port of Durres Traffic Growth – 2001/2025	7.8%	5.8%	4.7%
Port of Durres Traffic by 2025 – Millions of Tons	10.9	7.0	5.4
Port of Durres Projected TEUs Traffic by 2025	182,000	106,000	58,800
Projected Domestic TEUs Traffic on the Hani Hoti Line by 2025	4,400	1,300	180
Projected Tariff For Domestic Container – Full/One Way – In USD	225	150	100
Projected Cumulative Revenues through 2025 (USD millions)	21.2	2.9	0.2
Financing Terms:			
Duration	40 Years	30 Years	20 Years
Grace Period	10 Years	5 Years	2 Years
Real Interest Rate	1%	3%	5%
Required Subsidies through 2025 (USD millions):			
Rehabilitation Scenario I	1.8	33.3	50.1
Rehabilitation Scenario II	1.9	36.3	55.6
Rehabilitation Scenario III	3.1	39.5	60.6
Rehabilitation Scenario IV	1.0	31.5	48.5
Additional Yearly TEU Traffic through 2025 Required to Eliminate Subsidies:			
Rehabilitation Scenario I	2,700	17,600	42,600
Rehabilitation Scenario II	3,100	19,200	46,800
Rehabilitation Scenario III	3,700	20,800	50,900
Rehabilitation Scenario IV	2,600	17,600	43,600

Booz Allen Hamilton, 2002

Table V-1: Financial Scenarios Key Results

VI. Conclusions/Recommendations

Based on its analysis of the project, BAH believes the following to be true:

- There is no need for a feasibility study as all relevant facts and data on the railways condition have been thoroughly documented.

- Since HSH is currently operating at a loss and there is no possibility of it producing a profit or a return of investment, commercialization should be considered as the only realistic economic/financial future for the railway (i.e., leasing lines to private operator, or renting lines, or a full partner with Montenegro or something else.). For this alternative to work there needs to be a seamless haul from Durres to Belgrade (550-600 km).

- The most likely source of revenue sufficient to pay for major improvements of the railway is container traffic. However, at this time, existing domestic container traffic is extremely low (i.e., less than 1,000 TEUs/year at the Port of Durres). It will take a significant number of years for this traffic to grow to a size sufficient to sustain viable rail based container transport operations that is unless HSH can secure container traffic to/from neighboring countries.

- Time for action is short, containers will arrive in 6-9 months, and highways parallel to the trackage will open in 2-3 years. HSH must act swiftly and efficiently, or container traffic will go to trucks and never return.

- Albania's short haul is a major challenge (distance from Durres to Border is 138 km + or -.). Therefore, HSH should consider non-stop service from Durres to Belgrade. The recent Memorandum of Understanding (MOU) signed between Serbia and Croatia under which Serbia would start using the Port of Rijeka as its primary international maritime gateway highlights the challenges facing the HSH.

- Under current conditions, if the project were to go ahead, the Albanian Government would face subsidy liabilities that could reach under the worst case scenario anywhere from USD 2 to 3 million annually.

- In the next ten years, it is expected that once the Southern Europe railways are connected and their overall infrastructure is improved, the mode of cargo transport that will prove to be best suited for the region will be container on flat car (COFC) movements by unit trains that will shuttle across the Southern Balkan countries without stopping at political borders. The units will move in bond and clear customs at destination terminals electronically.

Appendix A - HSH Tender for Rehabilitation of 12.0 km North of Shkoder

Item #	Tender Summary	Unit	**Quantity**	**Unit Cost (Lek)**	**Total Cost (Lek)**
I. Ballast & Sleepers					
1	Topo Engr & Supervison	Job	1		1,700,000
2	Reshape embankment & roadbed	m³	4,200	550	2,310,000
3	Sleepers (Used Wooden)	each	25,000	1,885	47,125,000
4	Install Sleeper	km	12	122,813	1,473,756
5	Align & Profile	km	12	866,250	10,395,000
6	Ballast	m³	14,400	562	8,100,000
7	Transport by wagon – at site 15% of ballast	m³	2,160	280	60,480
8	Transport by worker – at site	ton	1,640	1,426	2,338,640
9	Transport by hand – at site	m³	1,728	633	1,093,824
10	Transport Rail by truck – at site (0.5 km 50%)	ton	600	193	115,800
11	Loading/Unloading Rail	ton	1,200	186	223,200
Subtotal:					75,480,020
Overhead-Benefits @) 19%:					14,341,204
Total for Items I:					**89,821,224**
II. Rail & Accessories					
1	Install-supply with rail furnished	km	12	330,000	3,960,000
2	Install - supply with Accessories	ton	602	75600	45,533,880
3	Supply & connect Rail S49	km	12	491,250	5,895000
Subtotal:					55,388,880
Overhead-Benefits @ 11%:					6,092,777
Total for Items II:					**61,481,657**
III. Transport					
1	Transport of Rail & Accessories to Site (12km)	ton	1,640	240	393,600
2	Transport of Sleepers)	m³	1,720	168	288,960
3	Transport of Marking Stones	each	120	60	7,200
Sub-total:					689,760
Overhed-Benefits @ 19%:					131,054
Total for Items III:					820,814

Item #	Tender Summary	Unit	Quantity	Unit Cost (Lek)	Total Cost (Lek)
IV Miscellaneous					
1	Supply and install stones	each	120	690	82,800
2	Drill bolt holes – Rail Length	each	50	105	5,250
3	Cut Rail	each	25	225	5,625
4	Electric Generator	hour	900	375	337,500
5	Small Crane	hour	320	312	100,000
Subtotal:					531,175
Overhead – Benefits @ 19%:					100,923
Total for Items IV:					632,098
Total Sum of Items I – IV:					**152,755,793**
Add 1.8% for Office & Bldg.					2,749,604
Sub Total					155,505,397
Reserve Fund - Contingency 5%					7,775,270
Sub Total					163,280,667
Custom Taxes for Treated Sleepers & Accessories					1,853,178
Sub Total					165,133,845
VAT (20%)					33,026,769
Sub Total					198,160,614
Round off tender					198,000,000
Accountant					280,000
Construction Supervision					1,720,000
Grand Total **USD 114,943 per km on 5/22/02 @ 145 lek/USD**					200 million or USD 1,379,310

In the Government's budget the Railway had approval for 4 separate operations in 2002 for a total of 316 million Lek:

1 6,000,000 Lek for operations protecting small drainage, bridges, etc.
2. 44,000,000 Lek for general railway maintence/improvement.
3. 200,000,000 Lek for the railway rehab work by contractor 12 km
4. 66,000,000 Lek for ballast for the rest of Skhoder – Hani Hoti

Appendix B: Life Cycle Cost (Construction) - USD 000's

(PRESENT WORTH METHOD)

Project Albania Rail **Location** Vora-Hani Hoti				**Alternative # 1**		**ALT. 2**		**ALT.3**	
PROJECT LIFE CYCLE (YEARS)			30						
DISCOUNT RATE (% in decimals)			10%						
Construction Costs				Est.	PW	Est.	PW	Est.	PW
A)	Rehab Railway 118.5 km - Cost in $1(			26,100	26,100	30,900	30,900	34000	34000
B)	Radio Controls			500	500	500	500	500	500
C)									
D)									
E)									
F)									
Other Initial Costs									
A)	Locomotives			1,500	1,500	1,500	1,500	1500	1500
B)	Wagons			2,000	2,000	2,000	2,000	2000	2000
Total Initial Cost Impact (IC)					30,100		34,900		38000
Initial Cost PW Savings							(4,800)		-7900
Replacement/Salvage Costs		Year	Factor						
A)	Rehab Ballast & Align	15	0.2394	2,962	709				
B)	Rehab Ballast& Align	20	0.1486			2,962	440	2962	440
C)	Salvage Rail, Ballast, Sleepers	30	0.0573	(9,361)	(536)	(15,405)	(882)	-17775	-1018
D)	Locomotives, Radios	15	0.2394	1,500	359	1,500	359	1500	359
E)									
F)									
G)									
H)									
Total Replacement/Salvage PW Costs					532		(83)		-219
Operation/Maintenance Cost		Escl..00'	PWA						
A)	Maintenace (3000x118.5/yr)		9.427	355	3,347				
B)	Maintenance(1500/118.5km/yr}		9.427			178	1,678	178	1678
C)									
D)									
E)									
F)									
G)									
Total Operation/Maintenance (PW) Costs					3,347		1,678		1678
Total Present Worth Life Cycle Costs					**33,979**		**36,495**		**39459**
Life Cycle (PW) Savings							**(2,516)**		**-5480**

PW - Present Worth PWA - Present Worth of Annuity

Appendix C - Life Cycle Cost (Emergency Maintenance vs. Min. Reconstruction) - USD 000's

(PRESENT WORTH METHOD)

Project Albania Rail **Location** Vora-Hani Hoti 118.5 km PROJECT LIFE CYCLE (YEARS) **30** DISCOUNT RATE (% in decimals) **10%**			**Alt #1** Reconstruction Minimun		**ALT. 4** Emergency Mtnc			
Construction Costs			Est.	PW	Est.	PW	Est.	PW
A)			26,100	26,100	15,400	15,400		
B)			500	500	500	500		
C)								
D)								
E)								
F)								
Other Initial Costs								
A)			1,500	1,500	1,500	1,500		
B)			2,000	2,000	2,000	2,000		
Total Initial Cost Impact (IC)				30,100		19,400		
Initial Cost PW Savings						10,700		
Replacement/Salvage Costs	Year	Factor						
A)	15	0.2394	2,962	709				
B)	10	0.3855			2,962	1,141		
C)	20	0.1486			2,962	440		
D)	30	0.0573	(9,361)	(536)	(3,436)	(196)		
E)	15	0.2394	1,500	359	1,500	359		
F)								
G)								
H)								
Total Replacement/Salvage PW Costs				532		1,744		
Operation/Maintenance Cost	Escl..00'	PWA						
A)		9.427	355	3,347				
B)		9.427			533	5,025		
C)								
D)								
E)								
F)								
G)								
Total Operation/Maintenance (PW) Costs				3,347		5,025		
Total Present Worth Life Cycle Costs				**33,979**		**26,169**		
Life Cycle (PW) Savings						**7,810**		

PW - Present Worth PWA - Present Worth of Annuity