Case study : Baku's tank wagon workshop

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1. Introduction

Following the economic disruption caused by the break-up of the former Soviet Union (military conflicts, constraints on trade and economic restructuring), rail freight traffic on Azerbaijan Railways (in tonne km) has fallen to only 5% of its peak 1988 level. Traffic has fallen by similar amounts in neighbouring countries. Production of refined oil in Azerbaijan has fallen drastically.

The tank wagon workshop in Baku had established itself as a high quality workshop able to carry out capital repairs of tank wagons. Even now it carries out some capital repairs for neighbouring countries, including Russia. However the condition of the workshop is deteriorating: it is over 100 years old and not designed for its present function. Provision of a redesigned and improved workshop would enable improvements to be made in the quality of capital repair work which could reduce overall maintenance costs of wagons.

Azerbaijan Railways are currently considering a proposal to build a new tank wagon workshop described in "Business-Plan for Construction of Baku Tank Wagon Repair Works", Giprozavodtrans, 1996. This report included a financial evaluation based on former Soviet Union evaluation practices which indicated that a new workshop could be regarded as self-financing if the workshop received appropriate remuneration from the railway for the services it rendered, especially if a reduced scale or "minimum model" project (proposed by the current TRACECA study) was implemented.

During the analysis of rolling stock maintenance at the Azerbaijan railway, it was decided to perform a case study of the tank wagon repair shop at Baku with a view to produce material which would allow immediate consideration of funding of rebuilding or refurbishment.

This case study was selected as one of a total of four to be carried out as part of the rolling stock study.

2. Background

During the field work in Baku in July 1996, several options for improving the possibilities of capital repair of wagons were discussed.

The facility presently available for this purpose is an old locomotive repair shop, located in the city of Baku. The railway expressed a wish to tear down the existing facility and to built a complete new facility. In order to be able to present an alternative solution, the consultant suggested an investigation of the option of rehabilitating the existing facility.

The railway had already commissioned the Ukranian firm, Giprozavodtrans Institute, to carry out a preliminary design of a new tank wagon repair plant. This design can form the basis for further work on renovation of the plant, should this solution be chosen.

The consultant urged the railway to establish an inter-railway group to work with the alternative of a rehabilitation of the existing facility. This group was formed during the visit of the consultant to Baku in November 1996, and a first meeting was held. When the consultant returned in February 1997 to discuss the findings of the group, it appeared that a result had not been reached, and that no user's requirements for a renovation had been prepared.

The consultant chose to prepare their own version of a rehabilitation, based on the findings of the field visits. They furthermore, in cooperation with the railway and Giprozavodtrans, defined the first phase of constructing a completely new facility in order to allow the step by step development of a new workshop. This would secure a wider range of technical options for inclusion in the evaluation.

3. Demand for Capital Repairs

3.1 Traffic Forecasts

Two scenarios for future traffic development have been considered when evaluating the proposed improvement of the workshop. These cover the likely range of alternative traffic levels that could be expected.

Past railway traffic forecasts in the region look rather optimistic. For example even in the pessimistic scenario of the TRACECA Infrastructure Maintenance project, traffic growth of 100% between 1995 and 2000 is expected. This is rather unlikely, taking into consideration that in 1996 no real changes were reported.

Those forecasts are based on high growth of oil products, which would require upgrading of refinery plants. However there are no firm financing plans for this. Several oil companies are planning to move crude oil out of the Azerbaijan and Kazakkstan oil fields to the Black Sea, especially to the port of Novorossisk in Russia. In all cases pipeline is the mode of first choice. Nevertheless there is considerable potential crude oil traffic which could be carried by rail from east to west, through Azerbaijan and Georgia, as a temporary measure until alternative pipelines are constructed. It is understood that Chevron has such plans in the short term. Unfortunately the Ajerbaijan International Operating Company (AIOC), which has members from a number of major oil companies and is investing heavily in the region, has informed us that they have no plans to use the railway. Instead they will develop the pipeline alternative. It is therefore concluded that any possible crude oil rail traffic would be strictly a short term affair, and not a suitable basis for evaluating long term investments in workshops.

In view of the limited prospects for sustained growth in rail traffic, high traffic growth is very unlikely.

The Regional Traffic Forecasting Model gives the following results for the year 1995 :

- 764 000t were import by rail, 931 000t were exported by rail,
- 786 000t of mineral products (assuming that there are oil products in Azerbaijan) were exported by rail, 1 500 000t exported by sea.

This means that 30% of oil products are exported by rail, and oil traffic represents a maximum of 8,000,000 t of the goods transported by rail

3.1.1 Pessimistic assumptions

The pessimistic traffic forecast is based on the projections made in the main study.

As in the case of other TRACECA countries, traffic is assumed to remain constant until 2000, and then increase by 10% between 2000 and 2005. Continued growth is assumed at a similar rate up to 2010. Such growth would be feasible if the refinery in Azerbaijan is rehabilitated for supplying the domestic market and if the railway is used to a significant degree for local distribution (over distances of about 250 km).

With such short hauls the turn around time of wagons should not be higher than 5 days.

In 1995 the turn over was 2.25 billion ton.km and the quantity of freight transported was 8.98 million tons. Based on the estimates in the main study, the total required fleet of wagons in Azerbaijan is 2,600 in 2000 and 2,860 in 2005 according to the recommended development alternative (with management improvements which improve utilisation and efficiency). By 2005 the required number of wagons could reach 3,146.

Overhauls are carried out every 8 years for tank wagons (which constitute the majority of wagons) and 12 years for other types. Assuming 8 years, the total number of overhauls to be carried out every year is 320 in 2000, 360 in 2005 and 390 in 2010.

3.1.2 Optimistic assumptions

The optimistic traffic scenario is similar to the optimistic forecast made by another TRACECA study, ("Infrastructure 1 - Railways" carried out by the TEWET consultants). It implies re-establishing the north-south corridor linking Russia, Iran and Turkey, despite recent political conflicts. It assumes that production of refined oil gradually recovers to historic levels and that rail transport is used for carrying most Azerbaijan refined oil consumed domestically and exported. Oil transport therefore becomes about 90% of all rail traffic in Azerbaijan. Such forecasts are valid only if the oil refinery recovers output (which is far from certain) and if the railway manages to secure most of this traffic. In fact much of the current traffic is carried over short distances and the railway does not get paid for most of its oil traffic, so there is the possibility that much traffic diversion to road could eventually take place if the customers are forced to pay for rail transport.

Under this scenario, oil traffic doubles by 2000 and doubles again by 2005, which means that 17 million tonnes are to be transported in 2000 and 33 million tonnes in 2005. Traffic growth of 10% is assumed between 2005 and 2010. Taking into consideration that 90% of the freight is transported over even shorter distances than assumed for the pessimistic scenario, the turn around of wagons should decrease to a maximum of 3.5 days over a distance of about 200 km.

According to those very optimistic assumptions, the total fleet requirement is 2750 wagons in 2000, 5300 in 2005 and 5,830 in 2010.

Accordingly, the total number of overhauls would be 340 in 2000, 660 in 2005 and 730 in 2010.

3.2 Capacity of the workshop

3.2.1 Railway's Assumptions

The railway has reported the following production figures for the Baku tank wagon workshop:

	1994	1995	1996
Capital repair 4 axle tank wagons	223	350	434
Capital repair 8 axle tank wagons	-	11	-
Capital repair 4 axle special TW	205	4	22
TOTAL CAPITAL REPAIR	428	365	479

In addition

Depot repair	-	18	-
Running repairs	-	249	-

Furthermore, the railway has the following planned work in the shop for 1997:

Capital repairs:

Azerbaijan	600
Russia	150
Kazakstan	40
Private wagons	90
TOTAL	880

Depot repair

Azerbaijan 150

Additionally, 3,600 wheelsets are to be produced.

The above figures may not be achieved in practice. Almost no foreign railway has been sending wagons to Baku in recent years, so the number of foreign wagons is particularly uncertain.

The railway plans the following production in the workshop for the following years:

	1998	1999	2000
Azerbaijan	600	600	600
Contracts	364	473	615
TOTAL	964	1073	1215

Again the figures are subject to considerable doubt because of uncertainties about traffic and the use of the Baku workshop by foreign railways.

3.2.2 Consultants Assumptions

According to our assumptions, tank wagons from Georgia would be maintained in Baku. The main study estimates that there is a requirement for 720 tank wagons in Georgia in the short term (2000), rising to 790 in 2005. It is projected that the requirement becomes 940 in 2010. This would represent an additional 90-120 overhauls per year.

It is assumed that the production of the workshop is one wagon in 5 days, which is higher than the time imposed by the procedures, but it is a realistic time applied in many other places. This production can be achieved with one shift 5 days a week, and could be increased considerably by week end shifts, and working two rather than one shift per day.

The number of bays (room required for the maintenance of one wagon) is given in the following table for the target years 2000, 2005 and 2010. Note that overhauling foreign wagons could increase the work load considerably. Based on the railway's plans, 280 non Azerbaijan wagon overhauls could be carried out in 1997, rising to 615 in 2000. This represents about 30-70% of the Azerbaijan wagon work. Allowing for the assumed overhauls of Georgian wagons, this would imply rather less than 50% additional overhauls than estimated in the table. Such additional work could comfortably be carried out without increasing the number of bays, if multiple shifts are worked.

	2000		2005		2010	
	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic
Wagon Fleet Required						
- Azerbaijan	2,600	2,750	2,860	5,300	3,146	5,830
- Georgia	720	720	790	790	940	940
Wagon Overhauls						
- Azerbaijan	320	340	360	660	390	730
- Georgia	90	90	100	100	120	120
Total Overhauls	410	430	460	760	510	850
Number of Bays	8	8	9	15	10	17

4. Description of the Existing Plant

4.1 Background

The Tank Wagon Repair Plant was erected in 1893 at the time when the Azerbaijan Railways were built.

The total site is 300 ha.

The plant was originally built for the maintenance of steam locomotives, but was in 1920 converted to capital repair of tank wagons, which was to take place every eight years.
In general all the buildings need a thorough rehabilitation as proposed by the Consultant later in this report.

The staff was very proud of an international reward (Estrella de Diamante Internacional a la Calidad) for outstanding performance.

4.2 Capacity

At present approximately 250 are employed repairing around 120 wagons per month.

When spare parts were available in sufficient numbers the capacity of the plant was 230 tankers per month and 600 were employed.

4.3 Description of Workshops

4.3.1 Machine Shop

In the machine shop ten lathes and other tool machines are installed. Average age of the machines is approximately 20 years.

Some of the machines are out of order mainly because of age and lack of spare parts.

4.3.2 Blacksmith

At the Blacksmith shop rivets and bolts are dropforged.

The presses seem to be in good working order.

4.3.3 Undercarriage Repair Shop

At the shop 15 tankers (4-axles) can be placed for undercarriage repair, and the bogies are reconditioned at two tracks.

A washing unit was seen in operation cleaning bogies and components.

All lifting gear has to be renewed, and the traverser, marshalling the tankers between the tracks is most probably beyond repair.

4.3.4 Tank Repair Shop

At the tank repair shop 9 wagons can be repaired on three tracks.

4.3.5 Wheel Shop

Dismantling of bearings is done in a very dirty environment and the procedures should be changed to ensure the bearings are not harmed at the process.

Two wheel lathes are installed - a very old Polish one and a Russian wheel lathe from 1980.
The crack detection of bearings is excellent and the entire bearing repair shop is very clean and tidy.

4.3.6 Balajari Washing Station

The Washing Plant for tank wagons is situated in the Baku suburb Balajari, and was built in 1937.

The steaming out of the interior of the tankers can be done at three tracks each containing 15 tank wagons. After the steaming, diesel oil and hot water with caustic soda is used to clean the residues within the tanks.

After the cleaning, the mix of oil and water is emptied directly down on the tracks leaving a huge pool of contaminated waste.

The plant for outside washing of the tank wagons is virtually a ruin, but as it is necessary to have the wagons cleaned before entering the Wagon Plant, it was decided the project should look into the possibilities of rehabilitating the exterior washing facilities.

At present 115 persons are employed at the Washing Plant and the planned capacity is 200 to 250 wagons per day.

5. Technical Solutions

5.1 Overview

Three different solution have been considered in order to present a reasonable range of alternatives.

The three solutions are:

a) Maintain the facility as it is, but repair as need arises,

b) Rehabilitation of the existing facility

c) Construction of a new facility

The railway does not support solutions a) and b). Solution a) will require close attention from the shop management in order to secure that no building parts are left in a condition where their collapse may endanger people or equipment.

5.2 Maintain the Facility as it is but Repair as Need Arises

In this solution, all holes in roof and wall are to closed. Structural members, mainly in the roof, which are worn out, must be replaced.

The wagon traverser must be rehabilitated, and the track in front of it adjusted so that derailment of wagons is avoided.

Machinery, presently not operational, should be made operational, when a business plan shows that they are needed for the further work of the plant.

A higher than usual, annual cost of maintenance of the building must be foreseen. This is partly due to the age of the building, partly due to lack of funds over the last few years and the resulting lack of maintenance.

Close attention must be paid by management to the state of building and equipment in order to prevent serious break-downs

At the washing station at Balajari, an impermeable floor shall be arranged, gathering the spills from the washing process. The run off shall be collected and treated in an oil separator. The oil shall be collected and taken to the refinery for reprocessing. This can be done either by truck or by tank wagon.

A cost estimate for the most needed repairs and renovations are:

US$, Cost level Mid 1995

Item	Unit	Cost (US$)
Building	jug.	1,300,000
Equipment	jug.	700,000
Washing plant	jug	1,500,000
Subtotal		3,500,000
Contingencies	20%	700,000
TOTAL		4,200,000

5.3 Rehabilitation of the Existing Facility

The reason for selecting this alternative is that the existing building, even in its dilapidated state, represents a value. A value which in the present, pressed economic situation, can be utilised to secure useful repair facilities The building is, therefore, repaired to an extend where it will be safe to work in and adequately protect equipment and wagons, taken in for repair. This will mainly consist of proofing the walls and roof against the elements in order to secure a dry, calm working area.

The floors need to be renovated as well. In order to save capital and to concentrate the work, it is proposed to renovate only the southern half of the floor, which will give sufficient capacity for the expected number of repairs. Should the optimistic prognosis necessitate a larger capacity than provided by working one shift in the renovated half of the plant, it will be possible to work two shifts to cover peak periods.

Furthermore, the washing plant at Balajari is repaired to ensure, over the long term, that serious environmental damage does not occur.

As a first measure, a general clean up of the area must be performed.

The structural members are left as they are with the exception of those, which are worn out and in need of replacement. Replacement is especially required of some of the roof members.

Roof and wall claddings are removed and new cladding installed. Electrical and mechanical installations are repaired to the extent necessary. Only the southern half will be fully equipped, while the northern half will be repaired only to a level of acceptable safety. All main lines, distribution switch gear etc. will be laid out so as to allow a later expansion to include the full facility.

The floor in the southern half of the facility is renovated. In the northern part, which should not be required for the time being, the floor is repaired to allow safe movement.

Equipment in need of repair and/or renovation will be classified and repaired in the order of priority, established through a survey.

A detailed survey must decide if the traverse should be repaired or if new tracks are to be laid in front of the shop in order to allow access to the repair bays. As long as only a limited number of bays are required, only those bays are to be provided with new track, if this is the solution chosen after further study.

At the washing station at Balajari, an impermeable floor shall be arranged, gathering the spills from the washing process. The run off shall be collected and treated in an oil separator. The oil shall be collected and taken to the refinery for reprocessing. This can be done either by truck or by tank wagon.

The cost is estimated at:

US$, Cost level Mid 1995

Item	Unit	Cost (US$)
Building	jug.	5,000,000
Equipment	jug.	3,500,000
Washing plant	jug	1,500,000
Subtotal		10,000,000
Contingencies	20%	2,000,000
TOTAL		12,000,000

5.4 Construction of a New Facility

5.4.1 Introduction

The railway commissioned the Ukrainian firm Giprozavodtrans Institute to carry out a preliminary design of a new tank wagon repair plant.

The cost of the plant was estimated by the Ukrainian firm at US$ 62 million. The consultant did a rough order of magnitude evaluation of this estimate. It is probably a little on the high side, but the order of magnitude is correct.

A translation of the programme for this complete rebuild is presented in Annex 1.

This complete rebuild is considered economically non-feasible at the present time, and a reduced first phase has been worked out in cooperation between the railway and the present consultant. In the following, the proposed first phase is described.

It shall be noted that the first phase does not exclude a later extension to the full project, if and when need so indicates and the funds can be made available.

5.4.2 Phase 1 of a Completely New Repair Shop

As previously indicated, the present consultant is of the opinion that the programme for a complete rebuild is too extensive to be feasible at the present time. But as a future target it is worth considering (especially on a new site outside the city).

It was therefore decided to prepare the programme for a first phase of this design in order to be able to evaluate the feasibility of constructing new facilities against the cost of repairing the old ones. This was done by the consultant in cooperation with the railway and with the assistance of Giprozavodtrans Institute.

The following is the minimum found necessary if one is to achieve the technological lift and the improvement in working conditions which must be the reason for selecting a new construction solution.

It was agreed to plan a first phase, comprising the following elements:

Demolishing of the existing main tank wagon workshop

Levelling of the ground

Change of track location

Reconstruction of a new main tank wagon workshop, model "long spans"

Demolishing of existing crane system on outside ware house

Reconstruction of the blacksmith on that area

Improvement of existing boiler-/compressor systems

Demolishing and reconstruction of washing plant for outside cleaning of tank wagons in Balajari

Improvement of welfare facilities

The floor areas involved are:

Tank wagon workshop 5600 sqm

Blacksmith 1358 sqm

Washing plant (outside) 1080 sqm

Cost Estimate
Giprozavodtrans Institute has prepared a budget estimate for as well the complete renovation project as for phase one.

The method seems to be standard in several CIS countries. A set of unit prices in Roubles 1984 cost level are indexed to 1991. They are then converted to the national currency (Manat) and indexed to 1996 cost level. At this stage they are converted into US$ at a rate of
1 US$ = 4,300 Manat. The method secures that estimates have the same basis, but the consultant consider it imprecise to cover a tender situation.

The estimate for the complete facility is, as previously mentioned, US$ 62 million.

The budget estimate of Giprozavodtrans Institute for the 1st phase, described above, is:

(Cost in US$)

Item	Building and civil works	Installation works	Equipment	Other expenses	TOTAL
Tank wagon workshop and blacksmith	11.632.900	3.407.000	7.785.900	2.960.000	25.786.200
Washing plant	1.626.700	257.200	661.000	277.400	2.822.300
TOTAL	13.259.600	3.664.200	8.446.900	3.237.400	28.608.500

The consultants estimate is as follows:

US$, Cost level Mid 1995

Item	Floor area (Sqm)	Cost (US$)
Tank wagon repair plant	5600	9,500,000
Blacksmith	1358	2,500,000
Machinery	N/A	4,500,000
Washing plant	1080	3,000,000
Subtotal		19,500,000
Contingencies	20%	4,000,000
TOTAL		23,500,000

This estimate has reduced the standard of the building proposed and assumed a wider reuse of equipment than the one prepared by Giprozavodtrans Institute.

6. Economic Evaluation

6.1 General Approach

This evaluation, which considers alternative ways to develop the workshop, is carried out in economic terms in which costs and benefits for the TRACECA Region as a whole are estimated (in mid 1995 prices), in terms of actual resources consumed rather than in terms of what particular railways pay. Therefore adjustments are made to recorded financial costs paid by the railways to remove transfer payments such as taxes and subsidies.

Following the economic evaluation, the financial implications of the project for Azerbaijan Railways are considered, to assess if the project would increase profitability or not.

The general approach assumes that a tank wagon workshop is essential in the Caucasus Region to provide capital repair services for tank wagons. It was one of only three such workshops in the railways of the former Soviet Union and the only such workshop in this part of the TRACECA Region. It established a good reputation and is well located for the maintenance of the tank wagon fleet required by the growing oil industry in Azerbaijan. It further assumes that the tank wagon workshop would be used for capital repair of other types of Azerbaijan wagons and for capital repair of tank wagons from other railways.

In accordance with this approach the evaluation seeks to identify the least cost option for developing the workshop, taking both capital and running costs of the workshops and wagon fleets of Azerbaijan and Georgia into consideration. Costs are considered over the long term, from 1997 to 2025, similar to the lifetime of the assets involved, and the current Net Present Value (NPV) of total costs is estimated by discounting the annual costs from mid 1996 at a rate of 12% per year (representing the economic opportunity cost of capital). Costs incurred over the first ten years or so, to 2008, are estimated separately for each year. Since only very approximate projections of costs can be made beyond that date, constant annual costs are assumed thereafter. This simplifying assumption is unlikely to affect the evaluation results strongly because of discounting.

Any potential benefits arising from increased profits from overhauling foreign wagons are also approximately estimated.

6.2 Options

The following three options are considered, as described in Section 5.1:

a) Continue as present - repairs to existing buildings from time to time on an ad-hoc basis leaving the present poor working conditions unchanged,

b) Rehabilitate the present tank wagon workshop and other related central wagon workshops to provide better and sustainable buildings and working conditions (described earlier in this report),

c) Construct new workshops to provide even better buildings and working conditions (the revised cost estimate proposal mentioned earlier).

6.3 Main Assumptions

6.3.1 Traffic Scenarios

The main traffic scenario used in the evaluation is based on the traffic forecasts of the main study: referred to as the pessimistic assumption in Section 3.1. An alternative optimistic forecast is also considered as described in the same section.

6.3.2 Railway Development

The following assumptions are made regarding railway development:

- productivity improvements in maintenance, greater under options (b) and (c) due to the better workshop conditions, (leading to staff reductions but increases in salary as assumed in the main study),
- continuation of same type of rolling stock for 10-15 years and then gradual replacement with modern technology (there is considerable potential for conversion of general wagons to tank wagons over the next 15 years to meet any growth in demand, but eventually more efficient wagons using modern technology could be justified),
- the tank wagon workshop is used for capital repairs of all Azerbaijan wagons and tank wagons from Georgia and other countries such as Russia and Armenia, and
- improvements in equipment utilisation are achieved as the surplus equipment is reduced and the improved workshop allows more efficient operating methods to be introduced.

6.3.3 Definition of Project Costs

The following capital and running costs are considered in the evaluation:

- capital cost of building construction work for the tank wagon works and for related workshops (only for the provision of essential environmental improvements to minimise contamination of ground water under option (a); for replacing the floor and roof and installing services under option (b); and for new construction under option (c)),
- capital cost of workshop equipment for replacing, at minimum cost in the short term, machinery which is inadequate for meeting current needs under option (a); and for a general upgrading of equipment under options (b) and (c),
- building and equipment maintenance costs (this is highest for option (a) because of the poor continued condition of the buildings and lowest for option (c)),
- wagon repair costs which are lower under options (b) and (c) because of lower maintenance staff numbers required in the workshop with a more efficiently designed layout (which in turn reduces costs of salaries, employment costs and overheads),
- repair costs of wagons in the TRACECA Region which are lower under options (b) and (c) due to better quality of capital repairs which reduces breakdowns, accidents and costs of lower level maintenance.

Possible additional benefits which could offset the costs of improving the workshop include improvement in worker health and safety (which in this simple evaluation cannot be quantified). It should be noted that possible savings in repair costs of wagons outside the TRACECA Region which are maintained in the workshop are not included in the benefits because these do not necessarily benefit the TRACECA countries. However if the workshop was able to attract more revenue from overhauling wagons from other countries then this would represent additional benefits to the TRACECA Region.

Note that possible wagon acquisition/rehabilitation costs could also be incurred after about 2005 and that improvements in the workshop, by minimising such costs, could achieve further benefits. However such benefits canot be reliably estimated so far into the future. They are unlikely to affect the evaluation because of discounting.

6.4 Estimation of Costs (at mid 1995 prices)

Project costs are described in Section 5. The capital cost of option (c) for both construction and equipment has been estimated in "Business-Plan for Construction of Baku Tank Wagon Repair Works", Giprozavodtrans, 1996, using 1984 Rouble prices converted to current Azerbaijan Manats by means of various indices and expressed in 1996 US$. Because the structure of prices would have changed considerably since 1984 and there would be doubt about the values of the conversion indices under high inflation conditions, this estimate must be considered as rather questionable. The cost, excluding equipment and taxes, is US$ 20.2 million. The equipment cost is estimated as US$ 8.4 million. Allowing for, say, 3% annual inflation this corresponds to US$ 19.6 million and US$ 8.2 million at 1995 price levels. Because much of the existing equipment would be replaced under this option, no further equipment purchases are assumed to be necessary for the next ten years. Then an annual allowance of US$ 0.3 million is assumed to be required to replace existing equipment.

The consultant has revised this estimate in view of the need for using prices which are likely to appear in international competitive bidding. This gives a building cost of US$ 12 million, a cost for renovating the washing plant at Balajari of US$ 3 million and an estimated cost of new equipment of US$ 4.5 million. To these figures are added 20% to allow for contingencies, adding up to a total of US$ 23.5 million.

The capital cost of option (b) is based on our estimate of replacing the roof and floor of the existing main building plus other similar improvements in other related buildings used for tank wagon maintenance, amounting to US$ 12 million, including building costs of US$ 5.0 million, equipment US$ 3.5 million, washing station US$ 1.5 million and contingencies US$ 2.0 million. Because less replacement of equipment takes place initially, annual equipment replacement costs of US$ 0.3 million are assumed for all future years.

The capital cost of option (a) includes minor building costs, assumed to be around US$ 1.3 million, equipment costs of US$ 0.7 million and US$1.5 million for renovation of the Balajari washing plant. An allowance for contingencies of 20 % is added. All amounts exclude taxes. Increased annual equipment replacement costs, of US$ 0.7 million, are assumed compared to option (b) due to the increased deterioration of equipment that would be expected under the poor conditions appertaining in the workshop, and the lower level of equipment replacement in the short term.

Annual average building maintenance costs are assumed to be 2% of the initial cost (excluding equipment costs) by 2008 for revised option (c) (that is US$ 0.36 million), increasing from zero in 1997 because of the reduced maintenance needs for a new building. The same maintenance cost is assumed in the long term for option (b), but the same amount is assumed even in the short term because the building is not new. Under option (a) there is a high risk (say 20% each year) of serious collapse of parts of the existing buildings which could require major repairs equal to 10% or more of the total reconstruction cost of the workshops (assumed conservatively to be equal to the initial cost of option (c)). It is assumed that such major repairs require on average 2% of the value of the reconstruction cost which, together with the cost of minor repairs, would require expenditure each year of about 4% of the reconstruction cost. Under these assumptions the average annual total building repair costs would be US$ 0.72 million.

Workshop equipment maintenance costs for options (b) and (c) are estimated at 5% of the initial value, taken to be US$ 8.5 million). Because of the inferior conditions expected under option (a), especially the continued leaking roof, equipment maintenance costs are assumed to be higher, at 7.5% of the initial value.

Maintenance staff costs have been estimated assuming that current staffing levels remain under option (a) but reduce to 90% and 80% of these under options (b) and (c) because of the increased productivity allowed by the redesigned workshops. It seems reasonable to expect less improvement under option (b) because there would be restricted space and the layout would be constrained due to the characteristics of the present building. Overheads are assumed to remain at 10% of staff costs for all options.

It is assumed that the increased quality of maintenance achievable with the improved workshop would reduce direct wagon repair costs, for spare parts and staff at all wagon workshops on the railways of Azerbaijan and Georgia. No reduction in overheads are assumed because of the time lag between reducing maintenance needs and the adjustments required by the railway to rationalise other facilities. Based on cost analyses performed as part of this study for railways in the TRACECA Region, it has been estimated that annual maintenance costs per wagon are US$ 1,100 and 600 for materials and staff respectively (based on a material cost of US$ 0.016 per wagon km and 70,000 km per year, and 0.1-0.25 staff per wagon costing an average of US$ 235-350 per month). Most of this would be incurred through planned maintenance activities

and it is assumed that only 30% of this is due to breakdown repairs which could be reduced through better quality capital repair: US$ 510 per wagon per year. It is assumed that this figure can be achieved only under option (c), while under options (a) and (b) breakdown repair costs would be increased by 5% and 10% respectively due to reduced quality of capital repairs.

The benefits to the TRACECA Region of increased profits arising from carrying out wagon overhauls for foreign railways in the workshop have been estimated based on the possible number of overhauled wagons and the possible increase in profits per overhaul. As described earlier, the number of foreign wagons (mainly from non-TRACECA countries) is expected to be about 50% of those from Azerbaijan and Georgia. Increased profits would mainly be derived from the higher quality of repairs in the improved workshops, which could allow higher charges to be levied. Depending on the competitive conditions in the region, the maximum increase in charge that foreign wagon owners would be prepared to pay could be equal to the expected reductions in direct wagon repair costs that they would enjoy as a result of the improved quality of overhauls. However it is assumed that in practice the scope for increasing charges would be only half this; that is the benefits are equally shared between the workshop and the wagon owner.

6.5 Comparison of Costs

The total NPV of each option (in US$ million) is shown in Table 1 below. The annual costs for each option are shown in additional tables in Annex 2.

Under the pessimistic scenario, Option (b) has the lowest total cost. Compared to Option (a), the NPV of running costs are significantly reduced by about US$ 7 million, which more than compensates for the higher capital costs of about US$ 4 million. In addition potential increased profits of about US$ 0.2 could be achieved.

Option (c) has the highest costs. Although running costs are reduced even further than Option (b), to about US$ 10 million, and potential profits are as high as US$ 0.4 million, this is outweighed by the additional capital cost of US$ 14 million.

The result is not sensitive to traffic level. Under the optimistic scenario, Option (b) is still clearly the least cost option and Option (c) the most expensive. The result is also not sensitive to the assumed discount rate of 12% - the same pattern of costs is found with a discount rate of 10% as shown in Annex 2.

Table 1 Summary of Net Present Value of Costs and Benefits for Each Option (US$ million)

Scenario	Option (a)				Option (b)				Option (c)			
	Continuing as at Present				Reconstructing Existing Workshop				Constructing New Workshop			
	Capital Costs	Running Costs	Total Costs		Capital Costs	Running Costs	Total Costs	Potential Additional Profits	Capital Costs	Running Costs	Total Costs	Potential Additional Profits
Optimistic	8.7	42.1	50.9		12.9	35.0	47.8	0.2	22.9	32.1	55.0	0.5
Pessimistic	8.7	36.2	44.9		12.9	29.3	42.2	0.2	22.9	26.7	49.6	0.4

NOTE (1) Estimated at mid 1995 prices, discounted from mid 1996 at 12%.

7. Conclusion

Since Option (b) appears to be the least cost option, this project should be further considered as the basis for the development of the wagon workshop over the medium term. A major investment in a new workshop is not justifiable at the present time, even if costs are minimised as suggested in this study. In any case it is questionable whether such a new workshop should be sited near the middle of town: there would be environmental and cost advantages in siting a new workshop outside the city area, such as using land of lower value, allowing the washing plant to be located closer to the workshop, and reducing environmental hazards to the community.

According to the financial evaluation in "Business-Plan for Construction of Baku Tank Wagon Repair Works", Giprozavodtrans, 1996, a new workshop could be regarded as self-financing if the workshop received appropriate remuneration from the railway for the services it rendered, especially if a reduced scale or revised project, as proposed under Option (c), was implemented. However the annual profits were projected to increase from only US$ 1.0 in 1997 to US$ 9.8 million in 2001, representing, for a projected cost of US$ 28.6 million, a financial return on investment which increases sharply from only 3.5% at present to an attractive 34.3% after four years.

The financial return for Option (b) is likely to be much higher, because it should be able to produce similar production levels for a capital investment of less than half that of Option (c). However even this Option may be difficult to finance unless traffic grows significantly. This implies that consideration should be given by the railway to securing finance from customers in the oil industry, who could reduce the risk of investment by guaranteeing minimum traffic levels.

From the financial point of view of Azerbaijan Railways, only if traffic increases greatly would a major investment in the Baku workshop be attractive and increase profitability. Under these conditions Option (b) is likely to be financially feasible at an earlier date than Option (c) because similar levels of maintenance and wagon cost savings would be achieved with much less capital investment. This suggests that a step by step development strategy, in which improvements are made as and when they can be justified by higher traffic levels, makes economic and financial sense. This conclusion is strengthened still further if consideration is given to the present difficulties of the railway in securing revenue for the traffic it carries. It seems unlikely that any investment in the workshop would be considered until such fundamental difficulties are resolved.

When the traffic prospects are clearer, the costs of Option (c) should be reviewed to establish the extent of possible cost savings. The possibility, in the long term, of relocating the workshop outside Baku could also be considered as a way of securing additional benefits from construction on less expensive land. This could offset at least some of the additional costs of this option.

Annex 1 : Programme for a Completely New Plant

Introduction

The railway commissioned the Ukranian firm Giprozavodtrans Institute to carry out a preliminary design of a new tank wagon repair plant.

The Consultant considered the complete programme to be non-feasible. In cooperation with the railway and Giprozavodtrans, a first phase programme was developed. This 1 phase is described in chapter 5 of this study, and its economic prospects in chapter 6.

In order to maintain all information on plans for the tank wagon repair shop in one document, a translation from Russian of the programme for the completely new plant follows.

Programme for the Future Plant

The railway expects a requirement to repair 2000 tank wagons annually. The consultant feels this is an optimistic forecast. There is, however, a need for repair of all other types of freight wagons. Since the renovated workshop can be used for repair of several types of wagons, it will be possible to utilise the capacity of the renovated plant.

The design material provided by Giprozavodtrans Institute contains the following main features:

- Keep the current specialisation of the works on the capital repair of the tank wagons.
- Conduct the reconstruction of the works within the current maintenance areas with technical re-equipment of the production;
- Remove the current building of the wagons workshop and blacksmith's and construct the new workshop, where to arrange the tank wagons repair department, the bogie department and assembling department;
- Arrange the washing, steaming and inside cleaning of the tank wagons in Balajari washing and steaming station. This business-plan considers the installation of new washing machinery;
- Reconstruct and enlarge the current frame workshop and arrange the blacksmith's within it;
- Move the thermic department from the current wagons workshop to the wheel department;
- During the reconstruction period, arrange temporary facilities in the pressure department for the repair of the tanks and bogies. After reconstruction, transfer the parts and details to the proper departments;
- Construct new painting department with the gasification facilities;
- Arrange the loco axles repair on the free areas of the axle department;
- Arrange the repair of the coupling heads in the areas of the current boiler department;
- Move the electric department to the breaking system department;
- Carry-out the capital repair of the small garage and arrange the electrocar garage;
- Build-up new electric control board for 6 kV;
- Build-up new communication system.;
- Replace the old boilers in the boiler department, model dkvr-6.5/13 by more economic one- de-10-14 gm.;
- Install two new compressors in the compressor department;
- Build-up the cleaning facilities and the fire pump station,
- Make the technical re-equipment of the rest of the workshops;
- Provide the energy saving facilities running on Swedish technology;
- Make the capital repair of equipment and electric engines in special enterprises of the city and in the works to make only the light repair;

- Make lifting and transport operations in the workshops by electric cars and bridge cranes.
- Arrange modern gas cleaning facilities:
- To detect the aerosols and gazes during welding, use the technology of the Swedish company - Plumex.
- To detect the solvents steams during the painting and drying process, use the technology of the Japanese company - Toyo Boseki.
- To detect the aerosols of the paints, use the technology of Ukraine institutes
- (use of the mono-threads) and Russian company-Vortex technologies (use of the Vortex reactive).

As previously indicated, the present consultant is of the opinion that this programme is too extensive to be feasible at the present time. But as a future target it is all right.

It was therefore decided to prepare the programme for a first phase of this design in order to, be able to evaluate the feasibility of constructing new facilities against the cost of repairing the old ones. This was done by the consultant in cooperation with the railway and with the assistance of Giprozavodtrans Institute.

Annex 2 : Estimated annual costs for each option

COSTS FOR DEVELOPING BAKU TANK WAGON WORKSHOP - OPTION A, PESSIMISTIC SCENARIO (US$ Million)

	Capital Costs		Recurrent Costs						
Year	Workshop Construction	Workshop Equipment	Building Maintenance	Equipment Maintenance	Staff	Overheads	Direct Wagon Repairs		
1997	3.36	0.84	0.72	0.41	0.99	0.10	1.86		
1998		0.70	0.72	0.41	1.02	0.10	1.89		
1999		0.70	0.72	0.41	1.06	0.11	1.92		
2000		0.70	0.72	0.41	1.10	0.11	1.94		
2001		0.70	0.72	0.41	1.14	0.11	1.97		
2002		0.70	0.72	0.41	1.18	0.12	2.00		
2003		0.70	0.72	0.41	1.23	0.12	2.03		
2004		0.70	0.72	0.41	1.27	0.13	2.06		
2005		0.70	0.72	0.41	1.32	0.13	2.09		
2006		0.70	0.72	0.41	1.37	0.14	2.12		
2007		0.70	0.72	0.41	1.42	0.14	2.16		
2008		0.70	0.72	0.41	1.47	0.15	2.19		
2009		0.70	0.72	0.41	1.47	0.15	2.19		
2010		0.70	0.72	0.41	1.47	0.15	2.19		
2011		0.70	0.72	0.41	1.47	0.15	2.19		
2012		0.70	0.72	0.41	1.47	0.15	2.19		
2013		0.70	0.72	0.41	1.47	0.15	2.19		
2014		0.70	0.72	0.41	1.47	0.15	2.19		
2015		0.70	0.72	0.41	1.47	0.15	2.19		
2016		0.70	0.72	0.41	1.47	0.15	2.19		
2017		0.70	0.72	0.41	1.47	0.15	2.19		
2018		0.70	0.72	0.41	1.47	0.15	2.19		
2019		0.70	0.72	0.41	1.47	0.15	2.19		
2020		0.70	0.72	0.41	1.47	0.15	2.19		
2021		0.70	0.72	0.41	1.47	0.15	2.19		
2022		0.70	0.72	0.41	1.47	0.15	2.19		
2023		0.70	0.72	0.41	1.47	0.15	2.19		
2024		0.70	0.72	0.41	1.47	0.15	2.19		
2025		0.70	0.72	0.41	1.47	0.15	2.19		
TOTAL	3.36	20.44	20.88	11.96	39.56	3.96	61.42	161.58	
NPV @ 12%	3.00	5.74	5.78	3.31	9.85	0.99	16.26	44.93	
NPV @ 10%	3.05	6.69	6.75	3.86	11.70	1.17	19.12	52.35	

COSTS FOR DEVELOPING BAKU TANK WAGON WORKSHOP - OPTION B, PESSIMISTIC SCENARIO (US$ Million)

	Capital Costs		Recurrent Costs						
Year	Workshop Construction	Workshop Equipment	Building Maintenance	Equipment Maintenance	Staff	Overheads	Direct Wagon Repairs		
1997	7.80	4.20	0.11	0.28	0.89	0.09	1.78		
1998		0.30	0.12	0.28	0.92	0.09	1.80		
1999		0.30	0.13	0.28	0.96	0.10	1.83		
2000		0.30	0.15	0.28	0.99	0.10	1.86		
2001		0.30	0.17	0.28	1.03	0.10	1.88		
2002		0.30	0.19	0.28	1.06	0.11	1.91		
2003		0.30	0.21	0.28	1.10	0.11	1.94		
2004		0.30	0.23	0.28	1.14	0.11	1.97		
2005		0.30	0.26	0.28	1.19	0.12	2.00		
2006		0.30	0.29	0.28	1.23	0.12	2.03		
2007		0.30	0.32	0.28	1.28	0.13	2.06		
2008		0.30	0.36	0.28	1.32	0.13	2.09		
2009		0.30	0.36	0.28	1.32	0.13	2.09		
2010		0.30	0.36	0.28	1.32	0.13	2.09		
2011		0.30	0.36	0.28	1.32	0.13	2.09		
2012		0.30	0.36	0.28	1.32	0.13	2.09		
2013		0.30	0.36	0.28	1.32	0.13	2.09		
2014		0.30	0.36	0.28	1.32	0.13	2.09		
2015		0.30	0.36	0.28	1.32	0.13	2.09		
2016		0.30	0.36	0.28	1.32	0.13	2.09		
2017		0.30	0.36	0.28	1.32	0.13	2.09		
2018		0.30	0.36	0.28	1.32	0.13	2.09		
2019		0.30	0.36	0.28	1.32	0.13	2.09		
2020		0.30	0.36	0.28	1.32	0.13	2.09		
2021		0.30	0.36	0.28	1.32	0.13	2.09		
2022		0.30	0.36	0.28	1.32	0.13	2.09		
2023		0.30	0.36	0.28	1.32	0.13	2.09		
2024		0.30	0.36	0.28	1.32	0.13	2.09		
2025		0.30	0.36	0.28	1.32	0.13	2.09		
TOTAL	7.80	12.60	8.66	7.98	35.60	3.56	58.68	134.88	
NPV @ 12%	6.96	5.89	1.79	2.21	8.87	0.89	15.54	42.15	
NPV @ 10%	7.09	6.36	2.20	2.58	10.53	1.05	18.27	48.07	

COSTS FOR DEVELOPING BAKU TANK WAGON WORKSHOP - OPTION C, PESSIMISTIC SCENARIO (US$ Million)

	Capital Costs		Recurrent Costs						
Year	Workshop Construction	Workshop Equipment	Building Maintenance	Equipment Maintenance	Staff	Overheads	Direct Wagon Repairs		
1997	18.00	5.50	0.00	0.28	0.79	0.08	1.69		
1998			0.01	0.28	0.82	0.08	1.72		
1999			0.01	0.28	0.85	0.08	1.74		
2000			0.01	0.28	0.88	0.09	1.77		
2001			0.02	0.28	0.91	0.09	1.80		
2002			0.03	0.28	0.95	0.09	1.82		
2003			0.05	0.28	0.98	0.10	1.85		
2004			0.07	0.28	1.02	0.10	1.88		
2005			0.11	0.28	1.06	0.11	1.91		
2006			0.16	0.28	1.09	0.11	1.93		
2007			0.24	0.28	1.13	0.11	1.96		
2008			0.36	0.28	1.18	0.12	1.99		
2009		0.30	0.36	0.28	1.18	0.12	1.99		
2010		0.30	0.36	0.28	1.18	0.12	1.99		
2011		0.30	0.36	0.28	1.18	0.12	1.99		
2012		0.30	0.36	0.28	1.18	0.12	1.99		
2013		0.30	0.36	0.28	1.18	0.12	1.99		
2014		0.30	0.36	0.28	1.18	0.12	1.99		
2015		0.30	0.36	0.28	1.18	0.12	1.99		
2016		0.30	0.36	0.28	1.18	0.12	1.99		
2017		0.30	0.36	0.28	1.18	0.12	1.99		
2018		0.30	0.36	0.28	1.18	0.12	1.99		
2019		0.30	0.36	0.28	1.18	0.12	1.99		
2020		0.30	0.36	0.28	1.18	0.12	1.99		
2021		0.30	0.36	0.28	1.18	0.12	1.99		
2022		0.30	0.36	0.28	1.18	0.12	1.99		
2023		0.30	0.36	0.28	1.18	0.12	1.99		
2024		0.30	0.36	0.28	1.18	0.12	1.99		
2025		0.30	0.36	0.28	1.18	0.12	1.99		
TOTAL	18.00	10.60	7.19	7.98	31.65	3.16	55.93	134.51	
NPV @ 12%	16.07	6.82	1.01	2.21	7.88	0.79	14.81	49.59	
NPV @ 10%	16.36	7.19	1.34	2.58	9.36	0.94	17.42	55.18	

COSTS FOR DEVELOPING BAKU TANK WAGON WORKSHOP - OPTION A, OPTIMISTIC SCENARIO (US$ Million)

	Capital Costs		Recurrent Costs						
Year	Workshop Construction	Workshop Equipment	Building Maintenance	Equipment Maintenance	Staff	Overheads	Direct Wagon Repairs		
1997	3.36	0.84	0.72	0.41	0.99	0.10	1.94		
1998		0.70	0.72	0.41	1.02	0.10	2.06		
1999		0.70	0.72	0.41	1.06	0.11	2.18		
2000		0.70	0.72	0.41	1.10	0.11	2.31		
2001		0.70	0.72	0.41	1.14	0.11	2.44		
2002		0.70	0.72	0.41	1.18	0.12	2.58		
2003		0.70	0.72	0.41	1.23	0.12	2.74		
2004		0.70	0.72	0.41	1.27	0.13	2.90		
2005		0.70	0.72	0.41	1.32	0.13	3.07		
2006		0.70	0.72	0.41	1.37	0.14	3.25		
2007		0.70	0.72	0.41	1.42	0.14	3.44		
2008		0.70	0.72	0.41	1.47	0.15	3.63		
2009		0.70	0.72	0.41	1.47	0.15	3.63		
2010		0.70	0.72	0.41	1.47	0.15	3.63		
2011		0.70	0.72	0.41	1.47	0.15	3.63		
2012		0.70	0.72	0.41	1.47	0.15	3.63		
2013		0.70	0.72	0.41	1.47	0.15	3.63		
2014		0.70	0.72	0.41	1.47	0.15	3.63		
2015		0.70	0.72	0.41	1.47	0.15	3.63		
2016		0.70	0.72	0.41	1.47	0.15	3.63		
2017		0.70	0.72	0.41	1.47	0.15	3.63		
2018		0.70	0.72	0.41	1.47	0.15	3.63		
2019		0.70	0.72	0.41	1.47	0.15	3.63		
2020		0.70	0.72	0.41	1.47	0.15	3.63		
2021		0.70	0.72	0.41	1.47	0.15	3.63		
2022		0.70	0.72	0.41	1.47	0.15	3.63		
2023		0.70	0.72	0.41	1.47	0.15	3.63		
2024		0.70	0.72	0.41	1.47	0.15	3.63		
2025		0.70	0.72	0.41	1.47	0.15	3.63		
TOTAL	3.36	20.44	20.88	11.96	39.56	3.96	94.30	194.46	
NPV @ 12%	3.00	5.74	5.78	3.31	9.85	0.99	22.20	50.87	
NPV @ 10%	3.05	6.69	6.75	3.86	11.70	1.17	26.61	59.83	

COSTS FOR DEVELOPING BAKU TANK WAGON WORKSHOP - OPTION B, OPTIMISTIC SCENARIO (US$ Million)

	Capital Costs		Recurrent Costs						
Year	Workshop Construction	Workshop Equipment	Building Maintenance	Equipment Maintenance	Staff	Overheads	Direct Wagon Repairs		
1997	7.80	4.20	0.11	0.28	0.89	0.09	1.86		
1998		0.30	0.12	0.28	0.92	0.09	1.97		
1999		0.30	0.13	0.28	0.96	0.10	2.08		
2000		0.30	0.15	0.28	0.99	0.10	2.20		
2001		0.30	0.17	0.28	1.03	0.10	2.33		
2002		0.30	0.19	0.28	1.06	0.11	2.47		
2003		0.30	0.21	0.28	1.10	0.11	2.61		
2004		0.30	0.23	0.28	1.14	0.11	2.77		
2005		0.30	0.26	0.28	1.19	0.12	2.93		
2006		0.30	0.29	0.28	1.23	0.12	3.10		
2007		0.30	0.32	0.28	1.28	0.13	3.28		
2008		0.30	0.36	0.28	1.32	0.13	3.47		
2009		0.30	0.36	0.28	1.32	0.13	3.47		
2010		0.30	0.36	0.28	1.32	0.13	3.47		
2011		0.30	0.36	0.28	1.32	0.13	3.47		
2012		0.30	0.36	0.28	1.32	0.13	3.47		
2013		0.30	0.36	0.28	1.32	0.13	3.47		
2014		0.30	0.36	0.28	1.32	0.13	3.47		
2015		0.30	0.36	0.28	1.32	0.13	3.47		
2016		0.30	0.36	0.28	1.32	0.13	3.47		
2017		0.30	0.36	0.28	1.32	0.13	3.47		
2018		0.30	0.36	0.28	1.32	0.13	3.47		
2019		0.30	0.36	0.28	1.32	0.13	3.47		
2020		0.30	0.36	0.28	1.32	0.13	3.47		
2021		0.30	0.36	0.28	1.32	0.13	3.47		
2022		0.30	0.36	0.28	1.32	0.13	3.47		
2023		0.30	0.36	0.28	1.32	0.13	3.47		
2024		0.30	0.36	0.28	1.32	0.13	3.47		
2025		0.30	0.36	0.28	1.32	0.13	3.47		
TOTAL	7.80	12.60	8.66	7.98	35.60	3.56	90.09	166.29	
NPV @ 12%	6.96	5.89	1.79	2.21	8.87	0.89	21.21	47.82	
NPV @ 10%	7.09	6.36	2.20	2.58	10.53	1.05	25.42	55.22	

COSTS FOR DEVELOPING BAKU TANK WAGON WORKSHOP - OPTION C, OPTIMISTIC SCENARIO (US$ Million)

	Capital Costs		Recurrent Costs						
Year	Workshop Construction	Workshop Equipment	Building Maintenance	Equipment Maintenance	Staff	Overheads	Direct Wagon Repairs		
1997	18.00	5.50	0.00	0.28	0.79	0.08	1.77		
1998			0.01	0.28	0.82	0.08	1.87		
1999			0.01	0.28	0.85	0.08	1.98		
2000			0.01	0.28	0.88	0.09	2.10		
2001			0.02	0.28	0.91	0.09	2.22		
2002			0.03	0.28	0.95	0.09	2.35		
2003			0.05	0.28	0.98	0.10	2.49		
2004			0.07	0.28	1.02	0.10	2.64		
2005			0.11	0.28	1.06	0.11	2.79		
2006			0.16	0.28	1.09	0.11	2.96		
2007			0.24	0.28	1.13	0.11	3.13		
2008			0.36	0.28	1.18	0.12	3.31		
2009		0.30	0.36	0.28	1.18	0.12	3.31		
2010		0.30	0.36	0.28	1.18	0.12	3.31		
2011		0.30	0.36	0.28	1.18	0.12	3.31		
2012		0.30	0.36	0.28	1.18	0.12	3.31		
2013		0.30	0.36	0.28	1.18	0.12	3.31		
2014		0.30	0.36	0.28	1.18	0.12	3.31		
2015		0.30	0.36	0.28	1.18	0.12	3.31		
2016		0.30	0.36	0.28	1.18	0.12	3.31		
2017		0.30	0.36	0.28	1.18	0.12	3.31		
2018		0.30	0.36	0.28	1.18	0.12	3.31		
2019		0.30	0.36	0.28	1.18	0.12	3.31		
2020		0.30	0.36	0.28	1.18	0.12	3.31		
2021		0.30	0.36	0.28	1.18	0.12	3.31		
2022		0.30	0.36	0.28	1.18	0.12	3.31		
2023		0.30	0.36	0.28	1.18	0.12	3.31		
2024		0.30	0.36	0.28	1.18	0.12	3.31		
2025		0.30	0.36	0.28	1.18	0.12	3.31		
TOTAL	18.00	10.60	7.19	7.98	31.65	3.16	85.88	164.46	
NPV @ 12%	16.07	6.82	1.01	2.21	7.88	0.79	20.22	55.00	
NPV @ 10%	16.36	7.19	1.34	2.58	9.36	0.94	24.23	61.99	