Coopers
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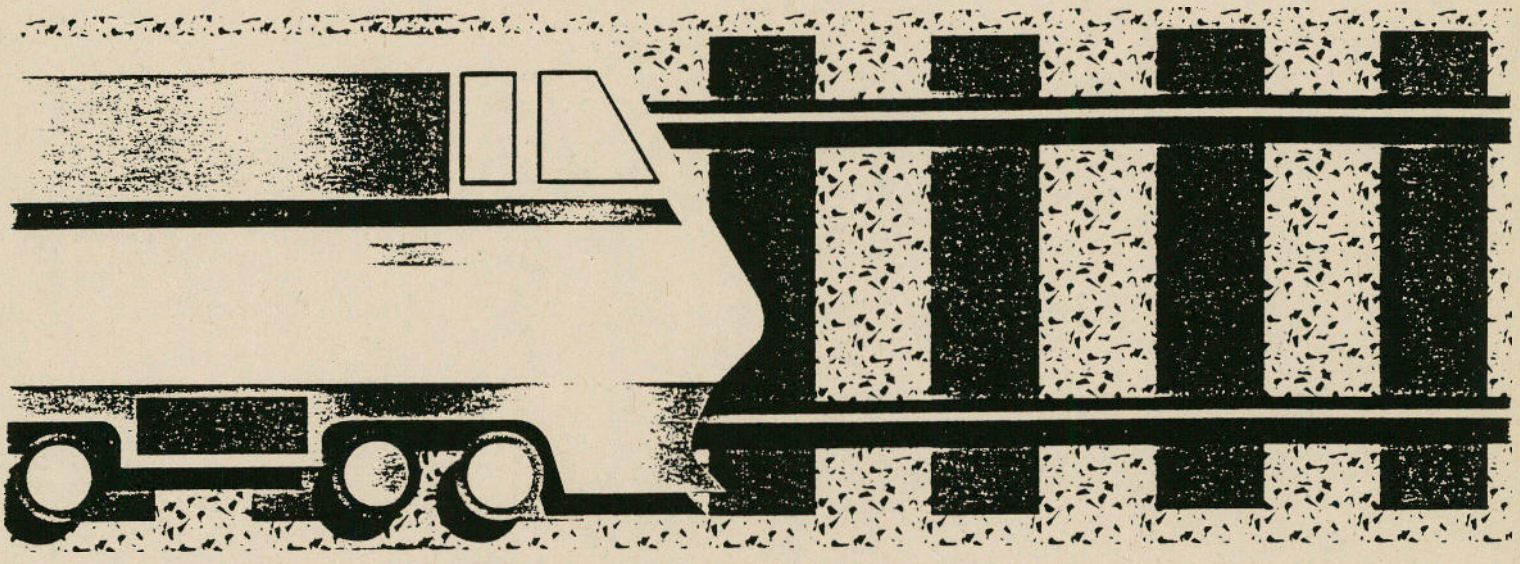
Financial review of the Neue Alpen-Transversale project

Report

February 1995



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Glossary

BAV	**Bundesamt** für Verkehr
BLS	**Berne**-Lötschberg-Simplon railway
GVF	**Dienst** für Gesamtverkehrsfragen
Message	**Botschaft** über den Bau der schweizerischen Essenbahn-Alpentransversale 23 May 1990 90.040
NPV	**Net** present value
NEAT	**Neue** Alpen-Transversale project
SBB	**Schweizerische** Bundesbahnen
SF	**Swiss** francs

1. The NEAT scheme

The need for additional trans-alpine rail capacity in Switzerland

101 The need for additional trans-alpine rail capacity across Switzerland was set out in the "Message sur la construction de la ligne ferroviaire suisse a travers les Alpes" numbered 90.040 of the 23 May 1990 which we have referred to in the rest of this report as Message. Freight tonnage flowing across the Alps, to and from Italy, increased sixfold over the period from 1958 to 1988 to reach a total of 68 million tonnes per annum. In addition, various forecasters were estimating that this would double again at some time between the years 2010 and 2020.

102 The proportion of this traffic passing through Switzerland declined from 44 per cent to 20 per cent between 1965 and 1988. Despite this significant decline in Switzerland's share of trans-alpine freight, total tonnage through Switzerland increased from 8 million to 14 million tonnes in this period.

103 One of the main reasons for the reduction in Switzerland's market share of the traffic crossing the Alps, has been the rapid increase in the proportion of freight traffic by road. In 1965 only 2 million tonnes of goods (12% of the total market) were carried by road. By 1988 it was estimated that 41 million tonnes (60% of the total market) was travelling by road. The environmental impact of this rapid growth in road traffic across the Alps has been a major concern of alpine countries.

104 As a result of this concern restrictions have been placed on the size of lorries which can be used in Switzerland. The legislation governing road transport across the Alps is much more restrictive in Switzerland than in France or Austria. In particular, the maximum laden weight of vehicles is restricted to 28 tonnes as compared with 40 tonnes in France and 38 tonnes in Austria. Switzerland also prevents any heavy vehicle from travelling for seven hours during the night. As a result, considerable volumes of road traffic which, if the legislation were the same in all three alpine countries, would normally travel through Switzerland, finds it more economic to use more circuitous routes via France and Austria. This increases the through costs of moving freight by road between northern Europe and Italy. It also leads to increased concentrations of heavy commercial road vehicles on the alpine passes in Austria and France.

105 Switzerland has therefore faced considerable pressure from neighbouring countries to relax its relatively restrictive laws relating to heavy commercial road vehicles. It has been unwilling to do this because of strong opposition to the environmental impact of heavy lorry traffic across the Swiss Alps.

106 The NEAT project was conceived as a means by which Switzerland could provide equivalent capacity for international freight transport, but by rail rather than by road. By this means it was believed that Switzerland could provide the capacity for the freight transit requirements of its neighbours, whilst maintaining tight control on road transport across the Swiss Alps.

107 After a period of negotiations a transit agreement was concluded in 1992 between the European Community and Switzerland, as well as a more specific agreement between Germany, Switzerland and Italy. In these agreements, which are described in the Message 92.047 of 13 May 1992, Switzerland agreed:

(a) in the short term (by 1994), to increase the dimensions and capacity of the Gotthard and Lötschberg rail routes so that they could handle more ferroutage (accompanied road vehicles "piggybacking" on rail); and

(b) for the longer term, Switzerland agreed to proceed with the NEAT project.

108 The signatories also agreed that "the different modes of transport must cover the costs they create". In particular, Article 12 of the treaty with the European Community describes the procedure which should be used for determining the costs which must be levied on the transport of goods by road. It is pointed out that the procedure will be introduced in stages. In the first stage, the costs of infrastructure must be calculated and imputed. In a second phase, the external costs must also be taken into account, in particular those relating to the environment.

The NEAT scheme

109 The NEAT scheme has been described in detail elsewhere. We therefore confine our description to the main characteristics which will influence its financial viability. The NEAT project will provide increased trans-alpine rail capacity and a shorter rail transit on the Gotthard and Lötschberg routes and it should enable reductions in train operating costs across the Alps compared with the existing mountain routes.

The Gotthard route

110 The basic preliminary project for the NEAT provides a new two track route of 125 kms between Arth-Goldau and Lugano. This route will be nearly 40kms shorter than the present mountain line. The route can be divided into four sections:

(a) the access line from Arth-Goldau to Erstfeld;

(b) the Gotthard base tunnel between Erstfeld and Bodio;

(c) the access line between Bodio and Magadino plain;

(d) the Mont-Ceneri base tunnel between Magadino plain and Lugano.

111 SBB have estimated that the new line would have a capacity for 300 trains per day. In addition, a further 250 trains could use the mountain line. The total capacity of the Gotthard corridor, on the two routes, would, however, be limited to about 400 trains per day because of the limitations of the capacity of the approach lines north of Arth-Goldau and also in the south. The new line would be able to cater for larger and faster trains than the existing mountain line. It therefore provides a significant increase in capacity, as well as a reduction in train operating costs.

112 We have also been asked to look at a variant to the NEAT scheme in which initially only the Gotthard and Mont-Ceneri base tunnels were constructed with the access lines between Arth-Goldau and Erstfeld and Bodio and Magadino being completed at a later date.

113 In this case, the capacity of the route would be restricted to 300 trains per day during the period between the opening of the base tunnels and the completion of the access routes.

The Lötschberg route

114 The NEAT scheme provides a new double track route from a point north of Frutigen station to Steg. In addition, a spur (partly single track) will be provided to Raron Ost on the existing line between Steg and Brig. It would also provide a direct connection from the Lötschberg line to stations in the Valais west of Steg.

115 The basic proposal for the Lötschberg route can be divided into three main sections:

(a) the access line around Frutigen station;

(b) the base tunnel from south of Frutigen station to Steg;

(c) the connection from the base tunnel to Raron Ost;

116 BLS have estimated that the access line around Frutigen and the base tunnel would have a capacity of 300 trains per day. The part single track link to Raron Ost would have a capacity of 110 trains per day. The capacity of the Lötschberg route for through trains from points north of Spiez will be restricted to 172 trains per day by the limitations on the capacity available between Berne and Spiez. It is therefore intended that the extra capacity available on the Lötschberg route would be used to provide a "rolling motorway" service for accompanied road vehicles between Heustrich and Steg. This rolling motorway would be able to accommodate full sized lorries and coaches as well as private cars. It has been planned as a replacement to the abandoned Rawil motorway project and would provide a link between the N6 and N9 motorways.

117 We were also asked to examine an alternative preliminary project which would:-

(a) include additional 4.5km long two single track tunnels flanking the Niessen between Mulenen and Wengi-Ey. The main benefit of this change would be to enable the rolling motorway from Heustrich to Steg to be operated with double deck loading of cars;

(b) include an 14.9 km double track tunnel connecting the base tunnel to Mundbach. This would replace the single track spur to Raron Ost. As a result the capacity available for through trains via the base tunnel to Brig and points beyond would be increased by 24 trains per day.

Construction costs and assumed opening dates

118 We were asked to examine five alternative versions of the NEAT namely:

(a) the initial construction of the full scheme for both routes;

(b) the initial construction of the full Gotthard scheme with subsequent construction of the Lötschberg;

(c) the initial construction of the Lötschberg scheme with subsequent construction of the Gotthard;

(d) the construction of the full Gotthard scheme without the Lötschberg

(e) the initial construction of the Gotthard and Mont Ceneri Base Tunnels, with subsequent construction of the Gotthard access lines, but without the Lötschberg.

119 For each version we were asked to examine two construction cost alternatives. The basic preliminary project and the alternative preliminary project. The latter had higher costs to reflect a number of changes proposed since the basic project was defined. It also assumed that the starting date for construction of the project was delayed by a year and that the opening of the route was delayed by two years.

120 The estimated construction cost (before allowing for interest on capital during construction) and opening date for each version of the NEAT is set out in Table 1.1. The costs of the Lötschberg route include the cost of providing the terminals for the rolling motorway service at Heustrich and Steg.

The impact of NEAT on Swiss trans-alpine rail services

121 The effect of the NEAT project on rail services will be to:-

(a) reduce the trans-alpine rail journey length and, by avoiding the mountain lines, permit the Swiss railways to operate heavier trains. As a result, average train operating cost per freight tonne carried will fall;

(b) increase the capacity of the Swiss railways to cater for through international freight;

(c) enable the Swiss railways to offer an improved and faster service for both domestic and international trans-alpine passengers;

(d) offer an improved internal rolling motorway service between Heustrich and Steg on the Lötschberg axis.

Table 1.1: Estimated construction cost and planned opening date for the main components of the NEAT and variants

SCHEME	Capital Costs(1) (SF millions-1991 prices)			Opening Date (Year)	
	Gotthard	Lötschberg	Total	Gotthard	Lötschberg
NEAT					
• Basic	9,748	4,172	13,920	2006	2004
• Alternative	11,008	4,962	15,970	2008	2006
Gotthard then Lötschberg					
• Basic	9,748	4,172	13,920	2006	2015
• Alternative	11,008	4,962	15,970	2008	2018
Lötschberg then Gotthard					
• Basic	9,748	4,172	13,920	2015	2004
• Alternative	11,008	4,962	15,970	2017	2005
Gotthard only					
• Basic	9,770	250	10,020	2006	
• Alternative	11,030	250	11,280	2008	
Gotthard base tunnels then approach lines					
Base Tunnels:					
• Basic up to 2007	6,350	250	6,600	2006	
• Alternative up to 2008	6,750	250	7,000	2008	
Approach Lines:					
• Basic from 2004	3,420		3,420	2011	
• Alternative from 2005	4,280		4,280	2012	

Source: BAV
Note 1. Excludes interest on capital during construction

122 SBB and BLS have evaluated the capacity which is likely to be available for passengers and freight between Basle/Zurich and the Italian border via the Gotthard and Lötschberg routes with and without NEAT. Their analysis takes account of the capacity available on the access routes to and from the Gotthard and Lötschberg routes, as well as the capacity provided within NEAT. The results of these estimates are summarised in Table 1.2.

Table 1.2: Estimated trans-alpine train capacity

(trains per day)

Scheme	Paths available			Required for passengers		Available for freight	
	Base	Mountain	Total	Base	Mountain	Base	Mountain
Gotthard no NEAT		250	250		82		168
Lötschberg no NEAT		168(3)	168		48		120
Gotthard	300	250	400(1)	62	38	238	62
Gotthard without approach lines	300	250	300(1)	62	38	200	
Lötschberg basic preliminary project	168(2)	224(3)	168(1)	64(4)	30(4)	80	24
Lötschberg alternative preliminary project	168(2)	224(3)	168(1)	64(4)	30(4)	104	

Source: Derived from figures supplied by BLS/SBB

Notes

1. The total paths available is less than the paths available on the base and mountain lines considered independently because of limited capacity on the access lines.
2. The capacity of the Lötschberg base tunnel for through freight transport is reduced by 132 because of the internal rolling motorway trains.
3. The capacity of the Lötschberg mountain line is reduced by 112 because of the rolling motorway service without the NEAT and by 56 with the NEAT
4. It is estimated that, with the NEAT, 20 extra passenger trains per day will use the NEAT. In addition, 30 of the trains will divide at Frutigen with one portion using the base tunnel and the other portion using the mountain line.
5. With the Lötschberg preliminary project the capacity for the through freight is restricted on the single track spur to Raron Est.

123 After allowing for passenger services it is estimated that without NEAT there would be sufficient capacity on the Gotthard and Lötschberg routes combined for up to 288 through trains per day. With the basic NEAT project this would increase to 404 trains per day, of which 238 would be via the Gotthard base tunnel, and 80 via the Lötschberg base tunnel. The remaining 86 trains would use the mountain routes (62 via the Gotthard and 24 via the Lötschberg).

124 In addition, the NEAT, by avoiding the steeply graded mountain sections, will enable both SBB and BLS to run longer trains. Table 1.3 sets out SBB's estimate of the average payload for three types of freight train operating between Basle and Chiasso via the Gotthard route with and without the NEAT. We have assumed that similar payloads, would apply to trains travelling from Basle to Italy via the Lötschberg route. It can be seen that the impact of the NEAT is to increase significantly average payloads. The combined effect of the increased number of paths and the greater payload possible per train will be to increase the potential rail capacity for trans-alpine freight with the full NEAT scheme by about 80 per cent. (The precise increase depends upon the expected future composition of freight trains).

Table 1.3: Average payload by type of train with and without NEAT

(freight tonnes per train)

Type of train	via Base Tunnels	via Mountain Line
combined transport	670	420
rolling motorway	280	240
wagon load	610	530

Source: SBB

The development of a commercial strategy for NEAT

125 The traffic which will use the NEAT will depend upon the growth in the overall market for trans-alpine freight and passengers, and the relative attractiveness of the services provided via Switzerland compared to alternative routes via France and Austria. The relative attractiveness of alternative road and rail routes will depend on a range of commercial, operational and government policy influences both within Switzerland and in other European countries.

126 In order to enhance the financial viability of the NEAT, the Swiss railways will wish to attract additional traffic so as to take advantage of the extra capacity provided by the NEAT. For passengers, the NEAT will enable significant reductions in journey times and this improvement in the quality of service can be expected to generate a considerable increase in rail passenger demand. The majority of this demand will be from domestic passengers where there is no effective competition from routes outside Switzerland. Furthermore, most international passengers using NEAT will start or finish their journey in Switzerland and thus again the issue of competition from other routes is not critical.

127 However for the majority of trans-alpine freight transit traffic there will be an effective choice of routes via France and Austria. Furthermore, the routes via France and Austria will offer the option of using road freight transport without the need to use the rolling motorway option provided in Switzerland.

128 The factors which will determine how much international transit freight will choose to use the Swiss railways are complex. They will be influenced by competition at two levels:

- the choice of road versus rail services; and
- the choice of routes via Switzerland, France or Austria.

129 Most shippers seek to send their goods using the means which offers the lowest total through transport costs; subject to meeting adequate quality of service standards in terms of journey time, reliability and frequency of service.

130 Direct road services offer a simple and flexible means of transport usually carried out in a single operation with only one commercial interface. For road transport there is a relatively straightforward relationship between price paid by the shippers and the haulier's costs of operation. Road freight operating costs are determined mainly by length of journey, although road tolls, road congestion and the directional balance of demand for freight may also effect costs and hence the price of road freight services.

131 International rail transport is considerably more complex and involves a number of different parties in the marketing and operations chain which can include:-

- agents who coordinate the marketing of international rail freight services
- road operators for collection and delivery
- road/rail terminal operators
- national railways who are responsible for rail haulage through their countries; and
- private wagon owning companies

International rail services require complex marketing and operational coordination between a number of different parties including national railways, wagon owners, freight forwarders, road hauliers, terminal operators, shippers and receivers.

132 For rail transport the relationship between price and cost of service is not straightforward. The direct costs of train haulage operations (locomotives, wagons and crew costs) are only a proportion of the relevant railway costs. Railway companies must also recover the costs of their infrastructure from their revenue. These infrastructure costs make up about half the total costs of railways. However, infrastructure costs cannot be directly attributed to particular train services, since they are fixed costs shared between all freight and passenger train operations.

133 In practice, the price which railways receive for carrying freight over particular routes is set by the market; effectively by the price of road haulage which dominates market share on most routes. Railways decide whether or not it is attractive to carry traffic at this price according to the directs costs of handling the traffic and whether this leaves sufficient financial contribution to the costs of infrastructure. The size of this contribution is in practice flexible.

134 Railways have the potential advantage of being able to offer much lower unit line haulage costs than road transport, providing flows are sufficiently large to enable economies of scale to be achieved. For these reasons the competitiveness of rail over direct road services will increase as the volume of traffic on offer increases and the length of the journey increases. High traffic volumes enable the railways to provide regular, trainload services meeting minimum frequency requirements and achieving economies of scale. Long haulage distances reduce the relative proportion of the fixed collection/delivery/terminal costs in the total journey.

135 In addition to the choice of mode of transport, the choice of route is also important in determining future traffic through Switzerland. The choice of route taken will also be largely determined by the relative cost of transport via alternative routes. Shippers themselves have no particular interest in the route taken and it is largely determined by the operators of road or rail services. The main factor affecting the cost of alternative routes is distance, since operational conditions are not significantly different, on average, over alternative routes. However, differential tolls and other charges on road routes or taxation will influence route choice of road hauliers. Similarly, competition between national railways who may offer different prices for rail haulage over their network will influence route choice by rail.

136 The Swiss railways operate just one part of a complex chain in international freight transport and their ability to increase their revenue or influence the shippers' choice of mode or route is limited because:

- the proportion of Swiss railways' charges in international freight costs is small for most transit traffic;

- the level of profitability of rail freight is low and there is little scope to lower charges to attract more freight to railways;

- competition from alternative road and rail routes through France and Austria limits the ability of Swiss railways to increase charges independently since this will result in diversion of traffic.

137 The most effective means of influencing the modal split and routing of traffic across the Alps to achieve policy objectives is by coordinated policy action on a European scale. There is a growing consensus, expressed in the agreement between the Swiss government and the European Community that "the different modes of transport must cover the costs which they create". This user pays principle is applicable to both the external environmental costs imposed primarily by road transport, and also to the cost of providing transport infrastructure. In the case of alpine transport, the costs of infrastructure provision are unusually high and should therefore be reflected in the charges for crossing the Alps. So far much of the policy debate over the principle that transport users should cover the full cost imposed has centred on road transport, implying that road user costs should be increased through taxation or direct toll charges.

138 Given the range of commercial and policy considerations discussed above it is clearly difficult to predict with any certainty the future levels of road and rail tariffs, both within Switzerland and in neighbouring countries, which will be the primary determinant of the traffic and revenue generated by NEAT and hence its financial viability. What can be established is that:

(a) following the institutional article concerning the protection of the Alps, (the so-called Alpine Initiative) the Swiss government is proposing to introduce tighter controls in 2004 designed to restrict the number of commercial vehicles crossing Switzerland to the level observed in 1994;

(b) there are growing pressures within the European Union to increase the taxes levied on commercial vehicles to reflect the environmental costs of road transport;

(c) there is a greater willingness to accept mileage based charges for the use of roads by commercial vehicles registered in another country;

(d) although there are strong pressures from some countries to increase the charges for road haulage, these will be resisted by other countries, particularly those which specialise in the provision of, or are highly dependent upon, international road haulage.

(e) European Union legislation may generate more competition between railways in the provision of international freight services. This might lead to some reductions in rail freight prices. However, any such changes may be offset by a growing unwillingness of many country's governments to continue to pay the high and potentially growing level of subsidies required to maintain the present pattern of rail services.

139 On balance we would expect that both the costs of road and rail transport throughout Europe will increase in real terms[1] as government legislation reflects changes in attitudes to the environmental costs of road transport and government financial support for railways is restricted. There is a strong probability that road costs will increase by more than rail costs due mainly to policy initiatives in European countries which will increase the costs of road freight transport. We have therefore examined the implications for the future profitability of NEAT of a range of alternative assumptions as to the likely level of road and rail charges throughout Europe. We have examined the impact of NEAT based on the following alternative assumptions as to:

(a) changes in the ratio of road to rail prices throughout Europe;

(b) road and rail prices within Switzerland.

140 We have based our forecasts on three alternative assumptions as to the change in relative costs by road and rail **throughout Europe** namely;

(a) no change in relative prices by road and rail;

(b) a 10% increase in road prices relative to rail;

(c) a 20% increase in road prices relative to rail.

In addition we have assumed that, under the Alpine Initiative, a toll on road vehicles crossing the Alps will be introduced within Switzerland set at a level which is designed to prevent road traffic across the Alps from increasing.

141 We have then considered the implications for Swiss railways of three alternative pricing polices which they might adopt **when NEAT becomes operational:**

(a) not changing **Swiss rail** prices;

(b) **reducing Swiss rail** prices by 15% to encourage use of the increased capacity available; and

(c) **increasing Swiss rail prices** by 15% to reflect the improved level of service and to help recover the costs of constructing NEAT.

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[1] Real terms in present day values

2. Traffic Forecasts

Introduction

201 We have prepared estimates of the traffic which would use the Swiss railways both if the NEAT or possible variants to the NEAT were constructed and, for the purposes of comparison, assuming no NEAT were implemented. For this purpose we have prepared separate estimates of:

(a) freight;
(b) international passenger traffic;
(c) domestic passenger traffic; and
(d) traffic using the Lötschberg "rolling motorway"

Freight

Growth in total market

202 Table A1-1 of the Message showed the overall growth in international transit freight traffic across the Alps in the arc bordered by and including the Mont Cenis and Pontebbana passes over the period 1965 to 1988. Selected years from that table are reproduced as Table 2.1. It can be seen that traffic grew very rapidly from 18 million tonnes in 1965 to 53 million tonnes in 1980, an average annual growth of nearly 7.5% per annum. Between 1980 and 1988 the overall growth of traffic slowed, increasing over these eight years from 53 million to 68 million tonnes an annual average growth of 3.2 per cent per annum.

Table 2.1: Trans-alpine transit freight by route[2] used: 1965-1988

(tonnes millions)

Year	Rail				Road				Total
	Swiss	French	Austrian	Total	Swiss	French	Austrian	Total	
1965	8	4	4	16	-	1	1	2	18
1970	10	6	5	21	-	3	3	6	27
1976	9	9	6	24	-	9	10	19	43
1980	11	10	6	27	-	13	13	26	53
1982	9	9	6	24	1	14	14	29	53
1984	10	10	6	26	1	15	16	32	58
1986	10	9	6	25	1	17	17	35	60
1988[1]	12	9	6	27	2	19	19	41	68

Source: Message 90.400

Notes

1. The figures for 1988 were estimated
2. The figures refer to traffic crossing the Alps in the arc bounded by and including the Pontebbana to the east and the Mont Cenis to the west.

203 Since 1988 trans-alpine freight traffic has continued to increase. Table 2.2 shows the estimated increase over the period from 1988 to 1993, although in this table the figures also include Swiss import and export and domestic traffic and refer to a slightly narrower arc as they exclude the Pontebbana Pass. It can be seen that in total traffic has continued to increase rising, using the new definition of routes considered, from 67 million tonnes in 1988 to 78 million tonnes in 1993, an annual average increase of 3.2 per cent per annum.

Table 2.2: Trans-alpine freight by route[1/2] used: 1988-1993

(million tonnes)

Year	Rail				Road				Total
	Swiss	French	Austrian	Total	Swiss	French	Austrian	Total	
1988	16.45	7.23	4.29	27.97	3.67	18.64	16.48	38.79	66.76
1989	17.64	7.98	4.98	30.60	3.96	20.84	15.78	40.58	71.18
1990	17.88	6.96	6.81	31.45	4.33	22.94	13.60	40.87	72.32
1991	17.85	7.20	7.20	32.25	4.60	23.50	14.90	43.00	75.25
1992	17.36	6.80	8.20	32.36	4.92	24.00	16.50	45.42	77.78
1993	15.96	7.00	7.60	30.56	5.28	25.60	16.80	47.68	78.24

Source: GVF

Notes

1. The figures refer to traffic crossing the Alps in the arc bounded by and including the Brenner Pass in the east and the Mont Cenis in the west.
2. Throughout the rest of this report we have defined trans-alpine traffic to include Swiss imports, exports and domestic traffic crossing the Alps.

204 A number of different estimates of the long term potential growth in trans-alpine freight traffic were discussed in Annexe 2 of the Message. It was pointed out that the "volume of traffic across the Alps will depend in the first place on the growth of the Italian economy and of the relationship between Switzerland's southern neighbours and their partners in the European Community". It was concluded that freight traffic was expected to double between 1988 and 2020. This was equivalent to an annual average growth of 2.2 per cent per annum.

205 Whilst it is likely that international trade flows will not continue to increase at the high rates observed in the last thirty years we believe, as the evidence for the first five years since the estimate was made has shown, that this assumption may have been somewhat cautious. We have therefore assumed, as a central case assumption that freight traffic will increase by 2.5 per cent per annum between 1993 and 2020 and by 1.5% thereafter. Given the inevitable uncertainty in any such estimate we have however also examined the implications of lower and higher assumed growth rates as set out in Table 2.3. The estimates of growth in total traffic we have used are broadly consistent with the results of the recent study, commissioned by BAV, to develop

forecasts of trans-alpine freight traffic prepared by St Gallen Zentrum fur Zukunftsforschung. The resulting estimated trans-alpine freight traffic over the period from 2004 to 2070 is set out in Table 2.4.

Table 2.3: Estimated growth in trans-alpine freight traffic

(per cent per annum)

Growth assumption	Low	Central	High
1993-2020	2.0	2.5	3.0
after 2020	1.5	1.5	1.5

Source: Coopers & Lybrand estimates

Table 2.4: Estimated growth in total trans-alpine freight

(tonnes millions)

Year	Low growth	Central Growth	High growth
1993	78	78	78
2004	97	103	108
2010	110	119	129
2020	134	152	174
2030	155	177	202
2040	180	205	234
2050	209	238	272
2060	242	276	316
2070	281	321	366

Assessment of the proportion of the total market carried by Swiss rail

Development of a forecasting model:

206 We have outlined in Section 1 some of the complex factors which will influence the amount of transit freight traffic crossing the Swiss Alps. To develop estimates of the share of trans-alpine freight traffic through Switzerland we need to find a means of estimating the influence of these factors within the framework of a model. A statistically-based model cannot be expected to provide an accurate long term forecast of traffic since the range of influences and uncertainty over the relevant time horizon

is too wide. Instead the model is intended to provide a logical and consistent analytical framework for testing the implications of a set of reasonable assumptions as to the way the market may develop.

207 We have suggested that the key factor influencing shippers' choice is the relative total costs to shippers of using either road or rail services. Shippers also require adequate standards of quality of service to be achieved in terms of journey time, reliability and frequency. However, both road and rail are able to provide adequate quality of service standards for a high proportion of the freight market over long distance international routes, providing operational conditions are suitable. For railways these operational considerations relate mainly to the volume and concentration of the flows which enables them to benefit from economies of scale. Small, fragmented and irregular flows are difficult for railways to handle, even over long distances where the competitive advantage of rail transport is greatest.

208 We therefore based our model for estimating the choice of mode and route for international freight flows across the Alps on the relative costs of road and rail transport. To help predict how much of the future freight market will travel by rail, we first examined whether the factors described above could be used to help explain the existing distribution of traffic by road and rail. The most detailed source of information available to us was the survey completed for GVF of trans-alpine traffic in 1989. This gave detailed information on the tonnage by type of commodity, origin, destination, mode and route of all freight traffic crossing the Alps in the arc bounded by the Mont Cenis and the Brenner passes.

209 We analysed this information carefully to see whether we could explain on the basis of predetermined expected relationships the observed choice of route and mode used. We expected to find that the observed modal split between road and rail would be related to the estimated cost by rail as compared with the cost by road. The lower the estimated ratio of the rail to road cost the more likely the goods were to travel by rail. We also expected to find that the choice of route by either mode would reflect the relative cost by that route as compared with the competing alternative routes. For this purpose the costs by road and rail were assumed to be of the form $C_m = A_m + d_m B_m + T_m$

where

C_m = the cost by mode m
A_m = a fixed cost (independent of distance) of using m
B_m = a variable cost per kilometre of using mode m
d_m = the distance by mode m
T_m = the cost of specific Alpine road tolls (eg for use of the Frejus, Mont-Blanc and Brenner motorways).

210 The values of A_m and B_m were initially estimated on the basis of assumptions as to the average cost of carrying goods by road and rail. The distance by mode d_m was based on the cheapest available main route. The observed traffic across the Alps in France, Switzerland and Austria by road and rail given in the 1989 survey was then compared with the "predicted" traffic assuming that the observed total tonnage by mode has been routed according to the formulae set out above. It was found that the predicted traffic corresponded more closely with the observed traffic if the value of B_m was allowed to vary by country. The values finally chosen are set out in Table 2.5. The higher value for Switzerland reflected the fact that vehicles of more than 28 tonnes cannot travel through Switzerland, although they can use the rolling motorway service from Basle to Chiasso.

Table 2.5: Relative cost factors used to explain the choice of route for freight

	Estimated cost[1] SF per tonne	
Cost per tonne	**by rail**	**by road**
Fixed	40.75	20.00
Alpine road tolls (except Switzerland)	-	11.88
Cost per kilometre		
Switzerland	0.0325	0.1313
Austria	0.0325	0.0563
France	0.0300	0.0563
Germany	0.0375	0.0575
Italy	0.0325	0.0563

Source: Coopers & Lybrand
Note 1. These are notional cost figures designed to estimate relative costs not actual observed costs.

211 Table 2.6 compares the results of applying the formulae set out in Table 2.5 to the matrix of flows by mode in 1989 given in the GVF survey of trans-alpine traffic with the observed traffic by mode and pass. It can be seen that the predicted flows match the observed flows quite closely.

212 It was found that whilst the relative cost formulae given in Table 2.5 could explain reasonably well the choice of route for goods by a prespecified mode, the choice of mode was more difficult to explain at the aggregate level for all commodities considered together. This did not surprise us. The cost per tonne of carrying traffic

between a pre-specified origin and destination by rail varies appreciably according to the nature of the commodity carried and the size of the potential flow. The greater the flow the more likely the traffic can be economically handled by rail in full train-loads which obviate the need for expensive remarshalling during the course of the rail journey. A partial analysis of selected commodities in more detail showed that for these individual commodities there was, as expected, a clear relationship between the modal split by rail and the relative costs by road and rail as estimated by the formulae set out in Table 2.5. However, the observed modal split, for a given ratio of rail to road costs, and the sensitivity of that ratio to changes in the relative costs by road and rail varied significantly.

Table 2.6: Comparison of observed freight traffic by mode and country in 1988 with the predicted freight traffic using the freight forecasting model

(percent of total market)

		Switzerland	France	Austria	Total
Through Rail:	observed	15.1	6.7	3.6	25.4
	predicted	14.2	7.6	3.5	25.3
Rolling Motorway:	observed	2.5			2.5
	predicted	2.5			2.5
Road:	observed	4.0	16.2	18.6	38.8
	predicted	4.5	15.3	19.2	39.0

Source: Coopers & Lybrand

213 The future traffic using rail can be expected to reflect these underlying relationships. We concluded that the best way to forecast the potential demand for NEAT was to assume that the proportion of the total demand between any origin and destination which would travel by rail was related to the estimated cost by road and rail by a formula of the form.

$$\text{Rail share} = \frac{\exp(-\lambda \text{ Rail cost})}{\exp(-\lambda \text{ Rail cost}) + \exp(-\lambda \text{ Road cost})}$$

214 It can be seen that with this formula if the relative costs of road and rail remain constant then the modal split will remain constant. If rail costs fall relative to road costs the rail proportion will increase. The sensitivity to this change depends upon the value of λ chosen. After examining closely the interrelationship for selected commodities between the observed modal split between different origins and destinations and the estimated cost by rail and road, we concluded that the value of

λ which would in aggregate best explain the interrelationship between modal split and relative costs by mode would fall within the range 0.05 to 0.1.

215 We have therefore prepared our future forecasts of the interrelationship between relative costs by road and rail and the proportion of traffic travelling by rail assuming a central value for λ of 0.075. The sensitivity of selected forecasts to alternative values of λ has, however, also been examined.

Application of the forecasting model

216 Table 2.2 showed that between 1989 and 1993 rail freight traffic through Switzerland fell by 1.68 million tonnes. The Swiss railways share of the total market fell from 24.8% to 20.4%. There are various possible explanations for the decline in the Swiss railways' market share. One is a continuation in the long term trend in the overall market modal split in favour of road. During the four years, taking the flows through all three countries together, road traffic increased by 17.5%. Rail traffic grew by 5.4% between 1989 and 1991, remained constant in 1992 and then fell by 5.6% in 1993 so that over the four year period rail traffic remained constant. This change in modal split may reflect the increased competition in the European road haulage industry brought about by the deregulation of the road haulage markets, particularly in France and Germany. A second factor which explains part of the reduced modal share by Swiss rail is stronger competition from the Austrian railways or a shift in the pattern of trade towards routes to the east. Between 1989 and 1993 Austrian rail traffic increased by 52.6% whilst Swiss rail traffic fell by 9.5% and French rail traffic by 12.3%.

217 We have applied the freight forecasting model to estimate potential changes in the Swiss railways' share of the market after 1993 both with and without NEAT. In each case we have considered the three alternative assumptions as to relative road and rail prices throughout Europe set out in paragraph 141. We have further assumed that in 2004 a tax of SF 150 per vehicle will be imposed on all commercial vehicles cross the Swiss Alps.

218 We indicated in Section 1 that we considered the prime factor influencing freight shippers' choice of mode was the throughout price, providing a reasonably reliable service was provided. On this basis, so long as sufficient capacity was available without NEAT, the direct impact of introducing the NEAT on the traffic routed via Switzerland may be small unless the prices charged by the Swiss railways are adjusted. However, even if prices are not adjusted the NEAT is nevertheless likely to lead to some increase in the reliability and operational convenience of providing rail services across Switzerland. This improvement in operational efficiency will make it more attractive to the railways to offer competitively priced services to a wider portion of the market. We have reflected this in our future traffic forecasts by assuming that the effect of NEAT is equivalent in the cost formulae used in the forecasting model to a 20km reduction in journey distance through Switzerland.

219 We have considered whether specific transport improvements in other countries will alter the relative cost of travel by different routes. In particular we have considered the potential impact of the proposed improvements to the Brenner route and to the route between Lyons and Turin. The current status of these routes is uncertain. Whilst there is a clear desire to implement these schemes which are considered to be high priority projects within the trans-European transport networks, they are expensive projects and there is no certainty as to how and when they will be financed. It is probable that if they are constructed specific tolls will be required to finance them. For this reason we do not believe that their construction would, if implemented, radically influence shippers' preferred choice of route.

220 We have examined the impact of three alternative pricing policies which Swiss rail might adopt after NEAT. These are a 15% reduction in prices, no change in prices and a 15% increase in prices (see paragraph 141). In all cases we have assumed that these price changes are reflected in the price charged to the shipper in such a way that they influence the choice of mode and route used according to the formulae set out in paragraph 213. The price changes are assumed to be applied when the first components of the NEAT, or its variants, become operational. They do not apply to the without NEAT situation.

221 Table 2.7 shows, for each of these alternative assumptions, the proportion of the total demand which would on the basis of our freight model wish to use Swiss rail services with and without the NEAT. The ability of the Swiss railways to cater for its estimated proportion of the total demand will depend upon the capacity provided by the different variants of NEAT.

Table 2.7: Impact of alternative assumptions on the proportion of total trans-alpine freight expected to use Swiss railways

(per cent of total market)

	Without NEAT			With NEAT		
Price changes (per cent)	**Through Train**	**Accompanied Road Vehicles**	**Total Rail**	**Through Train**	**Accompanied Road Vehicles**	**Total Rail**
0 / 0	20.0	1.5	21.5	25.3	5.5	30.8
0 / +10	24.2	1.3	25.5	30.2	4.6	34.8
0 / +20	28.5	1.1	29.6	35.1	3.7	38.8
-15 / +10	Not applicable			32.9	7.0	39.9
+15 / +10	Not applicable			23.5	0.9	24.3

Source Coopers & Lybrand

Note: Throughout this report we have used the notation shown in this table (eg. 0/0) to indicate the assumed change in rail costs in Switzerland compared with relative road over rail cost in Europe as a whole (see paras 140 and 141).Therefore +15/+10 denotes the scenario of a 15% increase in Swiss rail prices in the with NEAT situation and a 10% increase in the relative costs of road over rail throughout Europe in both the with and without NEAT situation.

222 It can be seen from Table 2.7 that the model indicates a substantial increase in the use of the rolling motorway through Switzerland following the opening of NEAT. This reflects the sensitivity of the assignment of some particularly large north-south flows to the assumed 20km reduction in the route distance through Switzerland to take account of the improved quality of service and operational capacity of the new Lötschberg service. Whilst it is not possible to forecast with any degree of certainty traffic at the level of particular flows over such a long time period, there will in practice be a significant improvement in the capacity and frequency of the new rolling motorway which can be expected to attract considerably more traffic. The impact on the financial viability of NEAT of these projected increases in traffic is, however, negative because this traffic does not cover its operating costs.

223 The ability of Swiss railways to cater for the estimated proportion of the total demand will depend upon the capacity provided by the different variants of NEAT. In Tables 1.2 we set out the number of freight train paths available without the NEAT and with each variant of the NEAT. Table 1.3 gave SBB's estimate of the average net tonnage that could be carried by different types of freight train through the base tunnels and via the mountain routes. We have used this information to estimate the maximum annual tonnage which could be carried without NEAT and with each version of NEAT before reaching a capacity limitation. To do this we have further assumed:

(a) that the present imbalanced pattern of trade whereby 62% of all freight tonnage flows from north to south across the Alps will continue;

(b) that the demand for freight trains is spread over 310 days per year;

(c) that the proportion of through rail freight which is carried as combined transport currently 39%, will increase to 50% by 2007, and 60% by 2020.

224 On this basis, the estimated capacity in one direction and the date by which each scheme reaches capacity is as set out in Table 2.8. We have assumed that the tonnage using any scheme cannot exceed its estimated capacity as defined above.

Table 2.8: Estimated rail freight capacity through Switzerland for each variant and date capacity reached[1]

Scheme	Capacity (tonnes millions)	Year capacity reached
No NEAT	39.7	2022
Full NEAT	68.5	2038
Gotthard only	67.5	2037

Note 1. Based on the 0/+10 assumption relative road and rail costs, and no change in Swiss rail prices with NEAT.

225 The resultant tonnage using the Swiss railways in different years for different assumed tariff policies with and without NEAT is set out in Table 2.9.

Table 2.9: Estimated freight traffic using Swiss rail services in selected years with and without NEAT

(tonnes millions)

Rail/road price charge (per cent)	2006		2015		2030	
	Through Train	Rolling M'way	Through Train	Rolling M'way	Through Train	Rolling M'way
No NEAT						
0/0	21.7	1.5	26.9	2.0	35.3	2.7
0/+10	26.1	1.5	32.5	1.8	37.6	2.0
0/+20	30.4	1.5	38.3	1.6	39.5	1.5
With NEAT						
0/0	29.4	3.8	35.0	6.5	44.8	9.7
0/10+	34.0	3.5	41.4	5.5	53.4	8.1
0/+20	36.9	2.9	47.6	4.7	62.0	6.6
-15/+10	38.2	4.9	45.4	8.3	53.9	11.6
+15/+10	25.1	1.3	31.5	1.4	41.6	1.6

Source: Coopers & Lybrand

International passengers

226 In 1993 a total of 2.25 million passengers travelled to and from Switzerland by train. A further 0.70 million international rail passengers travelled across Switzerland in transit. Table 2.7 shows the current and expected future journey times between Zurich or Basle and Milan. Currently the journey from Basle to Milan takes about 5hrs 15 mins and from Zurich to Milan about 4hrs 20 mins. In future these journey times are expected to fall substantially, especially after the NEAT. These changes are likely to lead to a significant increase in demand as shown in Table 2.11.

Table 2.10: International rail passenger journey times

Route	1993	Future	
		Without NEAT	With NEAT
Zurich-Milan	4 hr 20 mins	3 hr 30 mins	2 hr 10 mins
Basle-Milan	5 hr 15 mins	3 hr 50 mins	2 hr 45 mins

Source: SBB

Table 2.11: Estimated international rail passengers

(millions)

Year	Without NEAT	With NEAT
2010	4.4	6.9
2020	4.9	7.6

Source: Coopers & Lybrand

Domestic passengers

227 In 1993 a total of 3.5 million trans-alpine domestic rail passengers used the Gotthard route. A further 1.0 million domestic passenger used the Lötschberg route. Table 2.9 shows the current and expected journey time between Bern and Brig. It will be seen that with NEAT there will be a very substantial reduction in journey times. These reductions in the journey time are likely to lead to a significant increase in passenger traffic as set out in Table 2.13.

Table 2.12: Domestic rail passenger journey times

Route	1993	Future	
		Without NEAT	With NEAT
Zurich-Bellinzona	2 hr 30 mins	2 hr 15 mins	1 hr 10 mins
Bern-Brig[1]	1 hr 37 mins	1 hr 37 mins	55 mins

Source: SBB

Note 1. In addition, a number of fast "pendelino" train services will operate non-stop between Berne to Brig which will offer improved journey times.

Table 2.13: Estimated Domestic Rail Passengers

(millions)

Year	Gotthard		Lötschberg	
	Without NEAT	With NEAT	Without NEAT	With NEAT
2010	4.6	8.9	1.2	2.1
2020	5.1	9.8	1.3	2.3

Source: Coopers & Lybrand

The Lötschberg rolling motorway

228 The BLS currently provides a rolling motorway service for cars and commercial vehicles up to 2.5 metres wide and 3.4 metres between Kandersteg and Goppenstein which caters primarily for domestic Swiss traffic. A service with capacity for about 75 cars and 15 commercial vehicles is provided every 30 minutes in both directions on weekdays. The service is doubled at peak periods. The tariff charged for private cars was SF 23 until the 16 December 1994 when it was raised to SF 25.

229 Table 2.14 shows the traffic using the rolling motorway for selected years over the period 1980-1995. The fall in traffic from 1980 to 1984 was mainly due to the opening of the toll-free Gotthard motorway. The rise in 1986 reflected the implementation of Article 36 of the federal constitution and the subsequent reduction in the tariffs charged from SF 28 to SF 15 per car. It can be seen that since 1990 the traffic has remained broadly constant. The majority (95%) of the traffic is private car.

Table 2.14: Traffic using the Lötschberg rolling motorway

(thousands)

Year	Cars	Lorries	Coaches	Motorbikes	Total
1980	714.7	17.2	6.7	11.7	750.1
1984	567.8	14.2	4.7	10.3	597.0
1986	842.6	21.7	2.9	14.8	882.0
1988	988.3	30.2	3.6	16.4	1038.3
1990	1171.5	37.5	3.8	18.7	1231.6
1993	1178.1	43.3	2.1	17.6	1241.1

230 The NEAT scheme will involve the provision of a new rolling motorway service over a considerably longer distance, from Heustrich to Steg in the Rhone valley. The journey time from the north end of the Lötschberg valley to the north eastern end of the Rhone valley will be reduced appreciably compared with the existing rolling motorway service. The new rolling motorway will be able to take full sized commercial vehicles. A service will also continue to be provided between Kandersteg and Goppenstein.

231 As a result, there is likely to be an increase in the traffic using the rolling motorway. The size of this increase will depend partly upon the tariffs charged for the new motorway. The higher the tariff the greater the percentage of the traffic, particularly from Bern and points further north to towns in the Rhone Valley west of Sierre which will elect to use the longer, but toll free, motorway route via Fribourg.

232 The tariffs to use the new rolling motorway services have not yet been fixed. We have based our estimates on the lower of two tariffs suggested by BLS namely a tariff per private car from Heustrich to Steg of SF35 and of SF30 between Kandersteg and Goppenstein. On this basis, we estimate that the overall impact of the NEAT will be to increase the volume of rolling motorway traffic by about 30%. BLS have assumed that in addition to the direct effect of the NEAT the demand to use the rolling motorway will increase by 1.5% per annum. The resultant forecast demand to use the Lötschberg rolling motorway system (including both the base tunnel and the mountain route rolling motorways) with and without the NEAT is set out in Table 2.15.

Table 2.15: Forecast demand for the Lötschberg rolling motorway system with and without NEAT

(vehicles thousands)

Year	Without NEAT	With NEAT
2004	1,462	1,901
2010	1,599	2,078
2015	1,722	2,239
2020	1,855	2,412

Source: Coopers & Lybrand

3. Assessment of the Financial Profitability of NEAT

Introduction

301 We were asked to assess the financial viability of the full NEAT scheme and of a number of variations to the NEAT. In particular, we were requested to examine whether the NEAT could pay for itself over a sixty year period from opening, assuming that the finances required to fund the construction of the scheme were made available at a real rate of interest of 2%. To do this it is necessary to compare the overall costs of constructing and operating the NEAT with the extra net revenue received by the Swiss railways as a result of constructing the NEAT or its variants. These costs and revenues have been assessed on a year by year basis throughout the assumed life of the project. The method used to determine these costs and benefits is discussed in this section. We then describe the financial criteria which we have used to assess the financial profitability of the schemes and present the results.

Construction Costs

302 The cost of constructing the NEAT and the variants which we have examined were supplied to us by BAV and are summarised in Table 1.1. We have not attempted to carry out a detailed engineering review or audit of these costs. Inevitably the costs of such major engineering contracts involving very long tunnels below high mountains within uncertain geological conditions must be subject to a wide margin of error. We understand, however, that a comparison carried out with the costs of recently completed, but smaller, tunnels in Germany suggested that the estimated costs per kilometre for the NEAT were broadly comparable with observed costs in Germany.

Maintenance and operating costs

303 After discussion with BAV we have made an allowance of 0.25% of the capital cost of each scheme to cover the extra annual costs of operating and maintaining the specialised equipment and facilities required with the base tunnels.

Net railway revenue from NEAT

Increased contribution from rail freight traffic which will use Swiss railways without NEAT

304 The NEAT, by reducing the through journey distance and by increasing the maximum payload per train, will reduce the cost of carrying freight and passenger traffic across Switzerland. Table 1.3 set out SBB's estimate of the average payload for three types of train operating between Basle and Chiasso via the Gotthard route, with and without the NEAT. It can be seen that the impact of the NEAT is to significantly

increase average payloads. The combined effect of the shorter distance and higher payload per train, using the NEAT compared with existing mountain lines, will be to reduce the cost per tonne to Swiss railways of carrying traffic across Switzerland by between 17 and 29% according to the type of train. This is shown in Table 3.1. The costs estimates provided by SBB have been examined by independent railway operating specialists and are considered to be realistic. We have assumed that these cost improvements would also apply to the smaller numbers of through international freight trains routed via the Lötschberg route.

Table 3.1: Cost to Swiss railways of operating different types of through international freight train

(SF per tonne carried)

	via base tunnels	via mountain routes	Savings on existing traffic
Combined transport	12.1	17.0	4.9
Rolling motorway	23.3	29.4	6.1
Wagon load	19.9	24.0	4.1

Source: Derived from figures supplied by SBB

Contribution from additional freight traffic using Swiss railways as a result of NEAT

305 The estimated future trans-alpine freight demand using Swiss railways with and without NEAT was summarised in Table 2.9. The extent to which the Swiss railways can cater for this demand will depend upon the capacity available. This will vary depending upon which version of the NEAT is chosen.

306 The financial benefit derived by the Swiss railways from this additional traffic will depend upon the revenue received per tonne carried less the direct operating costs incurred in carrying this traffic. The average revenue achieved per tonne will vary according to the type of service. Table 3.2 shows the estimated average revenue by type of train at the time of the Message. More recent figures prepared by SBB, also shown in Table 3.2, indicate that by 1993 the average revenue per tonne had fallen. It is possible that one reason for this fall was the difficult competitive position faced by the railways in 1993 as a result both of the Europe-wide recession and the impact on competing road haulage tariffs of the earlier deregulation of the road haulage industry.

Table 3.2: Estimated average revenue to Swiss rail of trans-alpine freight

(SF per tonne)

Type of train	Message	1993 average
Combined transport	17.7	13.2
Rolling motorway	20.2	8.2
Wagon load	28.4	28.0

Source: Prepared by Coopers & Lybrand from figures given in Message 90.040 assuming an average journey of 316 kms

307 The future financial return from NEAT is crucially dependent on the revenue that can be charged for the extra traffic carried with NEAT. Table 3.3 shows the financial contribution (extra revenue minus extra cost) from each extra freight tonne:

(a) assuming a continuation of the 1993 average revenues; and
(b) assuming the average revenues used in the Message.

It can be seen that rolling motorway traffic will fail to cover direct operating costs in all cases and, at 1993 tariffs, revenue would cover only 35 per cent of the operating costs even using the new base tunnels. At 1993 tariffs, combined traffic would also fail to cover direct operating costs via the mountain routes and the surplus contribution to fund the new NEAT infrastructure from combined transport would also be very small at these tariff levels. Table 3.3 demonstrates how sensitive the future profitability of NEAT is to the tariffs charged by Swiss railways.

Table 3.3: Net financial contribution from each extra freight tonne carried by Swiss Railways as a result of NEAT

(SF per tonne)

Type of freight	via Base tunnels		via Mountain Lines	
	Message	1993 average	Message	1993 average
Combined transport	5.6	1.1	0.7	-3.8
Rolling motorway	-3.1	-15.1	-9.2	-21.2
Wagons	8.5	8.1	4.4	4.0

Source: Coopers & Lybrand

308 A key consideration is therefore the level of tariffs which the Swiss railways will be able to charge in ten or more years time, when after the NEAT has been opened. We discussed in Section 1 the factors which will influence the tariffs Switzerland can charge for freight transit by rail across Switzerland. In essence, they depend upon the charges levied by both other national railways and more generally by the competing road hauliers. The prices the Swiss railways can charge for trans-alpine freight will, in particular, be very sensitive to the prices levied in France, Austria and Switzerland for both rail and road freight across the Alps.

309 We know that Switzerland intends to introduce tolls to restrict the level of road freight across the Alps. This may of itself enable the charges for the rolling motorway to be increased compared with 1993, without loss of traffic. It is also possible that Austria and France may increase the charges for, and/or impose greater restrictions on, road freight across the Alps. We have therefore assumed, as a central case, that tariffs for use of the rolling motorway across Switzerland will revert to the levels set out in the Message, by the year 2004.

310 The rate which Swiss railways can charge for the other types of traffic is dependent upon the pricing policy adopted by the Austrian and French railways. Again there may be a pressure to raise prices both to enhance the financial performance of railways and possibly to finance the proposed new base tunnels in France and Austria. In addition, the tariff levels for rail freight in 1993 may have been artificially depressed by the effects of recession and could therefore return to higher levels in more normal economic conditions. We have therefore assumed as a central case that, by 2004, tariffs for the other types of freight traffic through Switzerland will have reverted to the level set out in the Message. We have, however tested the sensitivity of these results to assumed variations in the average tariff charged as set out in Section 1. However, we would stress that there is no certainty that the improvements assumed in relative rail and road tariffs will be achieved without concerted policy action. We return to this point in the next section.

Financial contribution from passenger services

311 The impact of the NEAT on the volume of international and domestic passengers was considered in the previous chapter and was summarised in Tables 2.11 and 2.13. These changes will lead to a substantial increase in rail passenger traffic thus generating significant extra revenue. Information supplied by SBB indicated that the average revenue was SF 0.21 per passenger km for international passengers and SF 0.13 per passenger km for domestic passengers. We have estimated future revenue assuming that, on average, trans-alpine domestic passengers using the Gotthard are currently charged SF 20.8 based on an assumed journey length of 160 kms and that the domestic tariff will be maintained constant in real terms after NEAT. The comparable revenue for the Lötschberg route is estimated to be SF 13 per passenger, based on an assumed journey length of 100 kms. The average revenue from international passengers is assumed to be SF 42 per passenger, based on an assumed journey length of 200 kms.

312 The potential impact of NEAT on the costs of carrying these extra rail passengers is difficult to determine. It will depend upon the precise pattern of service offered. The Swiss railways have indicated that since the current average load factor on passenger trains is approximately 30-35% they could carry some increase in passengers at very low marginal cost, without running any extra trains and allowing load factors to increase. We believe that this is reasonable and have assumed that traffic could increase by up to 50% as a result of NEAT without an increase in train operating costs. Thereafter it would be necessary to provide more trains.

313 The NEAT will also influence train operating costs by reducing average journey distances and gradients. As a result, the cost of providing a through train via the NEAT from Arth-Goldau to Lugano or via the Lötschberg base tunnel will fall. However, this will be at least partially compensated by the need to continue to provide a service to the stations on the mountain lines. As a result some existing train services will have to be duplicated or split into two sections, one travelling via the base tunnels and the other via the mountain line. We have assumed that the impact of these two effects will cancel each other out.

314 Table 3.4 indicates the impact of the assumptions we have made on the financial contribution received from each extra passenger carried as a result of NEAT.

Table 3.4: Estimated contribution per additional passenger as a result of NEAT
(SF per passenger)

	up to 50% increase in[(1)] passengers	more than 50% increase[(1)]
International	42.0	14.7
Domestic Gotthard	20.8	7.3
Lötschberg	13.0	4.6

Source: Coopers & Lybrand
Note 1. Compared with 1993 passengers.

The financial contribution from the Lötschberg "Rolling Motorway"

315 BLS have prepared a range of detailed estimates of the potential financial impact of the Lötschberg rolling motorway. These vary depending upon assumptions as to the assumed level of demand, the tariffs charged, the scheme adopted, and the frequency of service provided both on the new service from Heustrich to Steg and on the existing service from Kandersteg to Goppenstein which is assumed to remain in operation. For our analysis we have used forecasts based on an assumed tariff of SF 35 francs per car between Heustrich and Steg and SF 30 francs between Kandersteg and Goppenstein. The operating costs for the basic preliminary scheme assume that

the service from Heustrich to Steg is provided in one level trailers. This is made necessary by the exclusion of the Niesenflanken tunnel from the NEAT.

316 Table 3.5 shows that, at the assumed tariffs, the Lötschberg "Rolling Motorway" is unable to cover its operating costs. It therefore has a negative financial impact on the NEAT scheme. (It is assumed that without NEAT the existing "rolling motorway" service between Kandersteg and Goppenstein would just cover its operating costs).

Table 3.5: Estimated operating loss for the Lötschberg "Rolling Motorway" (with the Basic Preliminary Project)

(SF millions)

Year	Revenue	Operating Cost	Operating Loss
2004	63.9	101.9	38.0
2010	69.9	101.9	32.0
2020	81.2	101.9	20.7

Source: Coopers & Lybrand

Financial Criteria

317 We have been requested to assume that the NEAT will be financed by loans funded at a 2% real rate of interest. We were asked to examine whether on this basis the loans required to finance the NEAT or its variants could be repaid within a 60 year period from opening. Since the opening of the main components of the NEAT and its variants differ according to the scheme considered we have chosen to examine all variants of the NEAT over the period from 1993 up to the year 2070. This is 66 years from the earliest assumed opening date for a component of the NEAT scheme.

318 It was found that many of the schemes examined could not pay for themselves by the year 2070. In Table 3.6 we have therefore shown, for each of the pricing options examined the loan that would be outstanding in the year 2070 for the basic preliminary project (measured at 1993 prices). The loan has been calculated on two alternative basis concerning the attribution of the costs of financing the Lötschberg Rolling Motorway namely either:

(a) assuming that the whole cost of building the Lötschberg Rolling Motorway and the operating loss are financed through the NEAT loan; or

(b) assuming that half the construction cost of the Lötschberg Rolling Motorway and the operating loss are funded separately.

319 Table 3.6 also shows the cumulated loans outstanding over the evaluation period at the year 2070 for the full basic preliminary version of the NEAT scheme and for each of the four variants to the basic preliminary version of NEAT, assuming no increase in Swiss rail prices and a 10% increase in road costs relative to rail costs. It can be seen that with these prices the loan outstanding in 2070 is lowest for the variant in which the Gotthard base tunnels are built before the Gotthard approach lines, without any improvement to the Lötschberg route. It can also be seen that the best financial results are obtained under the pricing policy scenario which assumes a 15% increase in Swiss rail prices with NEAT. Under this scenario the full NEAT scheme would be able to repay all the loans by 2070, providing the Lötschberg Rolling motorway was financed separately.

Table 3.6: Estimated loan outstanding in 2070[1]

(SF billions at 1993 prices)

Pricing policy	Scheme (Basic preliminary version)	Including Lötschberg Rolling Motorway	Excluding Lötschberg Rolling Motorway
0	NEAT	-32.4	-20.8
0/+10	NEAT	-27.4	-15.9
0/+20	NEAT	-22.6	-11.0
-15/+10	NEAT	-56.7	-45.1
+15/+10	NEAT	-6.7	+4.9
0/+10	Gotthard then Lötschberg	-23.7	-14.9
0/+10	Lötschberg then Gotthard	-27.7	-16.2
0/+10	Gotthard only	-12.2	-12.2
0/+10	Gotthard base tunnels then approach lines	-10.2	-10.2

Note 1. The negative figures indicate the loan outstanding at 2070. The positive figure indicates that the loan would have been repaid before 2070 and that the surplus thereafter would have reached the figure stated.

320 We have also presented the results of the financial appraisal in the form of the net present value (NPV) of the stream of financial costs and benefits in the year 2006. To do this we have applied an assumed discount rate of 2% per annum to the estimated annual stream of costs and net revenue from construction and operation of the NEAT. The costs and net revenue over the period from 1993 to 2006 have been discounted forward to the year 2006, whilst the costs and benefits after 2006 have been discounted back to the year 2006. This enables us to compare the financial performance on a common basis of schemes with different patterns of revenue and expenditure. The year 2006 was chosen as the base for the calculation as the expected opening date of the most expensive component of the full NEAT scheme. (The choice of a different base year would alter the calculated net present value but would not influence the comparison between different schemes, as the net present value of all schemes will change by the same proportion if a new base year is chosen.)

321 Table 3.7 shows the NPV in 2006 for a range of variants and pricing policy assumptions for the basic preliminary version of the project. Table 3.8 shows the components of the total project NPV for each of the basic preliminary project variants for one particular pricing policy (0/+10). This shows the breakdown of the NPV between construction and operating costs of NEAT and net revenue benefits from freight and passenger traffic. Finally the sensitivity of the NPV to the alternative growth rates in trans-alpine traffic shown in Table 1.3 is set out in Table 3.9 for one selected pricing policy assumption.

322 We have also added in Table 3.9 the effect on the net present value of the NEAT, with the central traffic growth assumptions, of the effect of a 15% real increase in **all** rail and road freight tariffs by the year of opening of NEAT. This might be achieved through a general policy in Europe to raise the real costs of transport in order to meet environmental policy objectives and to finance the costs of providing transport infrastructure more directly from user charges.

Table 3.7: NPV in 2006 at 1993 prices of options examined

(SF billions)

Pricing policy	0/0	0/+10	0/+20	-15/+10	+15/+10
Including Lötschberg Rolling Motorway					
NEAT	-8.90	-7.52	-6.14	-15.74	-1.68
Gotthard then Lötschberg	-7.86	-6.53	-5.22	-14.74	-0.78
Lötschberg then Gotthard	-8.58	-7.33	-6.09	-15.47	-0.91
Excluding Lötschberg Rolling Motorway					
NEAT	-5.86	-4.48	-3.10	-12.70	+1.37
Gotthard then Lötschberg	-5.52	-4.19	-2.88	-12.40	+1.53
Lötschberg then Gotthard	-5.53	-4.28	-3.04	-12.70	+2.14
Gotthard only	-5.21	-4.03	-2.84	-12.57	+2.77
Gotthard base tunnels then approach lines	-4.67	-3.55	-2.41	-12.00	+3.32

Source: Coopers & Lybrand
Note 1. For the basic preliminary version of the project

Table 3.8: NPV in 2006 at 1993 prices of options examined, broken down by main components: excluding Lötschberg rolling way; 0/+10 price changes

	Net present value Swiss Francs billions (in 2006)				
	Full NEAT	**Gotthard priority**	**Lötschberg priority**	**Gotthard only**	**Gotthard only delay access**
Construction costs[1]	16.78	15.81	15.13	12.00	11.38
Maintenance costs	1.25	1.16	1.05	0.88	0.74
Total	18.03	16.97	16.18	12.88	12.12
Net revenue					
Freight	8.12	7.92	7.03	6.15	5.87
Passengers	3.12	2.99	2.56	2.70	2.70
Total net revenue	11.24	10.91	9.32	8.85	8.74
Net present value	-6.79	-6.06	-6.86	-4.14	-3.58
Add half Lötschberg	2.31	1.88	2.31	-	-
Net project results	-4.48	-4.18	-4.28	-4.03	-3.55

Source: Coopers & Lybrand
Note 1. For the basic preliminary version of the project

Table 3.9: NPV in 2006 at 1993 prices. Sensitivity to changes in selected assumptions - full NEAT scheme, 10% increase in ratio of European road to rail costs

(SF billions)

Assumption/Pricing Policy	Including Lötschberg Rolling Motorway	Excluding Lötschberg Rolling Motorway
Central traffic growth	-7.52	-4.48
Low traffic growth	-8.36	-5.32
High traffic growth	-7.28	-4.24
15% increase in freight tariffs(1)	-5.19	-2.15

Source: Coopers & Lybrand

Note 1. Assumes 15% trend increase in all freight tariffs both with and without NEAT at the central traffic growth rates and a 10% further increase in European road prices relative to rail.

Note 2. For the basic preliminary version of the project.

4. Implications of the Financial Analysis

Sensitivity of the results to alternative assumptions

401 The analysis in the previous section showed that the results of the financial analysis of the NEAT and its variants are sensitive to the assumptions on which they are based. Depending upon which particular assumptions are adopted, Table 3.7 shows that it is possible to have either a negative or positive NPV in 2006. A positive NPV implies that the loan could be repaid by 2070, a negative NPV that it could not.

402 The results are particularly sensitive to the assumptions made about prices; both the prices that Swiss railways charge and more generally the movement in relative road and rail prices throughout Europe. We discussed in Section 1 the factors which may influence the future relative level of road and rail prices throughout Europe and thus change the share of rail and road in trans-alpine traffic. Table 3.7 shows the importance of these factors for the NEAT project. For example, the effect of a 20% increase in European road relative to rail costs would have the effect of almost halving the size of the negative NPV of the full NEAT scheme, excluding the Lötschberg rolling motorway. The deficit falls from a NPV in 2006 of SF -5.86 billion with no change in relative European road and rail costs, to SF -3.10 billion assuming a 20% increase in European road costs relative to rail costs.

403 The results are even more sensitive to the level of Swiss rail tariffs. For example, although a 15% increase in Swiss rail tariffs, would lead to a significant reduction in the demand to use the NEAT, the resultant increase in the profitability of the remaining traffic is more than sufficient to compensate. Table 3.7 showed a negative NPV in 2006, excluding the Lötschberg rolling motorway of SF -4.48 billion for the NEAT, assuming a 10% increase in the relative cost of road as compared with rail transport throughout Europe. The impact of a 15% increase in Swiss rail tariffs is, however, sufficient to convert this negative NPV into a positive NPV of SF +1.37 billion.

404 By contrast, Table 3.8 shows that the financial viability is relatively insensitive to the assumptions as to growth in the total level of trans-alpine freight traffic. The difference in NPV in 2006 between the appraisal based on the low and that based on the high traffic growth assumptions is relatively small.

The analysis of the alternative variants

405 Table 3.7 shows that for the various pricing assumptions considered the highest NPV (or lowest deficit in the NPV) is achieved with the variant in which the Gotthard base tunnels are built first, with the Gotthard approach lines being constructed later, and without any investment in the Lötschberg route.

Implications of the analysis for Switzerland

406 The NEAT scheme will require a massive investment of public sector funds in Switzerland to provide a substantial increase in freight and passenger transport capacity across the Alps by rail. Whilst Swiss passengers will benefit from the improved level of service offered with NEAT, the main potential beneficiaries of this expenditure will be non-Swiss producers and consumers who will gain from the resultant improvement in the trans-alpine transport network.

407 Our analysis has shown that at the levels of prices recently charged for road and rail transport throughout Europe (assuming that Swiss rail prices can be restored to the levels assumed in the Message) the scheme is unlikely to be able to pay for itself within the time period of 70 years which has been set by the Swiss government. If the NEAT scheme is to meet the financial criteria it will therefore be necessary to adjust the prices charged for NEAT so that the revenue generated from users of the tunnels is sufficient to pay for the unusual levels of investment required to provide capacity for trans-alpine traffic.

408 This will not happen if the present policies towards the pricing of road and rail transport in Europe are maintained. At present, there are no specific tolls for the use of alpine rail tunnels. The costs of these tunnels have to be effectively recovered from the average revenue share which SBB earns from freight and passengers over the whole international journey. This is partly because many of these tunnels were constructed a long time ago and they are fully depreciated; but also because there is a limit to how much tariffs can be raised by any of the alpine countries operating independently to recover the additional costs of mountain transport without deterring traffic unreasonably.

409 It is, however, questionable whether the same policies should apply to new infrastructure requiring large scale commitment of scarce investment funds. Certainly the Channel Tunnel, another major trans-european link, would never have been built on this basis. There are strong economic arguments for levying specific tolls for the use of the trans-alpine tunnels to recover their costs. This charge should be separately identified and accounted for within SBB's infrastructure unit and should not be subsumed within the overall share of international through tariffs which SBB receives. The shares of revenue received by each railway for international journeys tends to be determined on the basis of distance travelled on each network and do not fully recognise the abnormally high costs of transport through mountains.

410 Our analysis has demonstrated that the effect of increasing the tariffs for use of the Swiss railways would be to make the NEAT scheme financially viable, even after allowing for the resultant loss of traffic to competing railways. We consider that it would, however, be risky for the Swiss railways to adopt such a policy independently of the other railways. Our analysis of the impact of an independent rise in Swiss rail prices is inevitably sensitive to the assumptions in our traffic forecasting model as to the impact of changed prices on shippers' choice of route. If we have under-estimated

the sensitivity of their response, we will have over estimated the ability of the NEAT to be fully financed in this way. There would also be practical difficulties in Switzerland independently levying additional charges for trans-alpine transit. In so far as the tariffs would divert traffic back from NEAT to alternative rail or road routes through France and Austria, this would defeat the prime purpose of the NEAT; that is to provide capacity to carry trans-alpine traffic.

411 A much better solution would be if an agreement could be reached amongst alpine countries on a rational pricing structure for all alpine transit routes aimed at ensuring efficient use of available infrastructure and financing the lumpy increments of investment needs to provide the capacity for growing demand. Our analysis has shown that if, as a result of the proposed improvements in trans-alpine capacity in all three countries, the tariffs for trans-alpine rail and road freight were simultaneously increased by 10% to 15% in all three trans-alpine countries, this would, if coupled with a 10% increase in the relative ratio of road to rail costs throughout Europe, be sufficient to generate a positive NPV in 2006 for the full NEAT when compared with a without NEAT scheme in which tariffs were not raised. In this case there would be no diversion of traffic from the NEAT to other countries.

412 Our analysis has also shown that, independent of the prices charged by the trans-alpine railways, the return from NEAT is sensitive to the relative rates of road to rail prices in Europe. There has in recent years been a growing appreciation throughout Europe that road users often do not pay the full economic and environmental costs which they impose. As such the European Union is concerned to develop policies which may encourage more traffic to use the railways in preference to road. There are, however, a number of other factors, described earlier in this report, which have made major shifts in traffic from road to rail difficult to achieve without significant incentives. Such incentives are most efficiently achieved by a combination of direct pricing and well designed tax measures aimed at increasing the relative costs of using road compared to rail transport. More inefficient means include capacity constraints on road routes and consequent high congestion costs which would be shared by all road users, or rationing measures such as licence restrictions or prohibitions on certain categories of road user.

413 We mentioned in Section 1 that the transit agreement concluded in 1992 between the European Community and Switzerland includes an agreement that "the different modes of transport must cover the costs they create." Article 12 of the treaty describes the procedure which should be used for determining the costs which must be levied on the transport of goods by road. Our analysis in this report has demonstrated that the financial viability of the NEAT would be greatly improved by the effective implementation of this procedure.