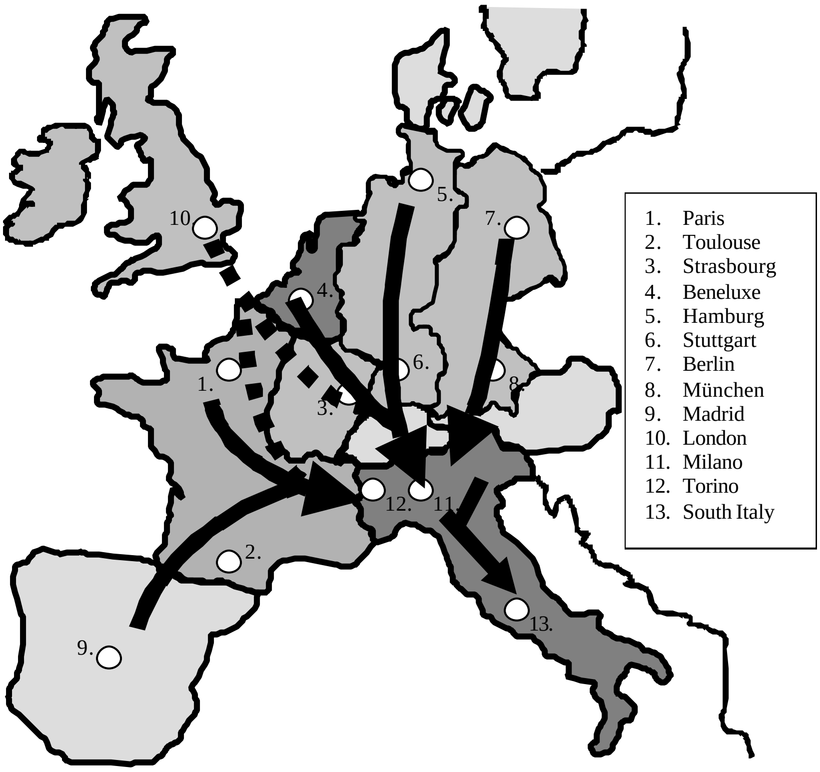

Transalpine Freight Transport System 2005-2020 Scenarios

EPFL: ITEP-LEM

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Conference paper STRC 2001
Session Freight

STRC | 1st Swiss Transport Research Conference
Monte Verità / Ascona, March 1.-3. 2001

Transalpine freight transport system

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Abstract

This paper presents the results of the transalpine freight study undertaken for the EU project "SCENES" for which EPFL-LEM was leader of the transalpine case study.

The contribution explains the structure and results of a new transport model developed for estimating how freight traffic will be allocated amongst all Alpine paths, depending on EU Countries' national transport policies. The model is based on the extensive observations of 1994 SET database, updated with recent -however less aggregated- findings.

A raw database has been designed by selection of the most significant origin-destination pairs in the SET 94database. The pairs have then been allocated to the transalpine paths available in 94. The raw database has then been updated to 1998 figures and matched with economic data, which has enabled a first: "2020 projection scenario".

An important specification of the model is that it has been designed as a set of interdependent modules and it is fully compatible with standard spreadsheets. This enables the possibility of further integration air pollution and other sustainability issues. This shall allow to forecast the effect of new policies or to estimate the impacts of trends.

The first outcome has been a simplified projection scenario –taking no policy changes into account-, which serves as a "landmark" to compare more sophisticated scenarios

An interactive module has then been added to make the model respond to changes in infrastructure capacity, transport regulation (weight, night driving, border crossing time) and transport cost (taxes, fuel, wages) as well as improvements in the logistics chain (load, time savings).

The first results based on 3 scenarios show how road and rail infrastructure will be used along the Alps between now and 2020, depending upon transport policies and economic development in EU Member states and in Switzerland.

Keywords

Transalpine – freight transport – Model – 2020 projection Scenarios – Swiss Transport Research Conference – STRC 2001 – Monte Verità

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1 Objective

- Establish how freight traffic will be allocated amongst the Alpine paths depending on EU countries' national transport policies.

- Define three 2020 projection scenarios

2 Synthesis of the transport policy of the EU countries

2.1 European road transport policy

The transalpine modal share of goods depends directly on the policies of France-Italy-Switzerland and Austria. Germany plays an important role as well, since most of the North-South route is on German territory.

The system of payment for using the road infrastructure is different in each European country. Only France and Italy have the same motorway system of toll payment. In such countries, the roads are managed by motorway companies and the road transport companies have very strong political position. For that reason, no new tax on heavy vehicle is likely to be accepted in a near future. The only way to establish equal conditions of competition between road and rail is to bring significant logistic improvement to the railway network. The reduction of the number of heavy vehicles is then possible only if the quality of service of the rail increases in order to enhance railway supply and increase rail market share. Italy and France will keep their actual toll system. They have signed an agreement for a common integrated system of payment. The Mont-Blanc tunnel will open in 2001.
The average amount of toll calculated from each alpine path to the main Italian destination that are Torino, Milano, Trento and Roma on the web-site http://www.autostrade.it/autonet/automap_ata.html for the CL 3-4-5 vehicle type is about 0.11Euro/km. From 1° January 2000 the rates applied on the network managed by the *Autostrade* Society had an average increase of 1,55%. The average amount of toll calculated from each alpine path to the main French cities on the web-site http://www.autoroutes.fr for the CL 4 vehicle type is about 0.15Euro/km. In 1999, the tariffs of toll increased by 1,2 % on average. The opening of Lyon-Torino project is planned for 2015. This new rail link between will make it possible to multiply by 4 the goods traffic on rail.

Germany is not directly concerned by the transalpine case. The aim of the introduction of a similar heavy vehicle tax as in Switzerland is to finance part of the Federal Transport Infrastructure Plan. Germany will adopt a distance-related charge for heavy goods vehicles with an average of 25 Pfennig/km in 2003.

Switzerland and Austria have the same particular and strategic position regarding the transalpine case. Both have a big transit volume of goods. Both have recently introduced a system of payment for using the motorway with the same declared objective, reduce the number of heavy vehicle and support the rail, but both systems are different. Austria will probably keep the ecopoint system after 2002. There is no news saying if they will change to another system. Austria will set the charge for use of the Kufstein-Brenner route at € 84 as of October 1999, thus providing an integrated solution for all crossings of the Alps. The Trans-European project for high-speed train/combined transport from Berlin to Verona through the Brenner should be achieved in 2010. It is difficult to know what will happen after the ecopoint system ends in 2002. Switzerland will introduce the HVF and will raise gradually the maximum weight limit to 40 tonnes in 2005. The law on switching transport to rail sets the details on the aim of switching from road to rail and firmly establishes it: as soon as possible, but no later than two years after the opening of the Lötschberg tunnel (ca. 2009), no more than a maximum of 650,000 lorries should be crossing the Alps by road. The remainder of transalpine goods transport should be carried by rail. The maximum transit price agreed in the Land Transport Agreement between Switzerland and the EU of CHF 325 for a 40-tonne HGV that covers a distance of 300 km (Basle - Chiasso) approximates to a HVF rate of an average of CHF 0.027 /tkm. After 2005 this charge will rise to € 200 when the first rail tunnel opens, but not later than 1 January 2008.

2.2 Improvement of the rail network

The three following projects are expected to bring significant reductions in traveling time for passengers and freight services:

Lyon-Torino 2015 / NEAT (Lötschberg & Gothard) 2008 / Berlin-Verona 2010

3 TRANSALPINE MODEL

3.1 Method and main O/D taken into account

Our model has been developed for estimating how freight traffic will be allocated amongst all Alpine paths, depending on EU Countries' national transport policies. It expresses the forecasting of the freight demand without analyzing the capacities of the Alpine paths. The model is based on the extensive observations of 1994 SET database, updated with recent -however less aggregated-findings. The analysis of the past trends from 1979/80 to 1994 makes it possible to calculate a global transalpine growth rate that is coupled with a correction by direction and a correction by O/D.

The 94database divides Europe in several regions as shown below. The model is build on the aggregation of the 10 main O/D representing 80% of the total transalpine volume. Centroids are placed in the major center of the aggregated regions. Between each centroid a distance is associated.

The method consists in minimizing the general cost functions that are composed of a component of time and a component of cost and then to simulate a possible modal transfer by comparing them with the complementary mode of transport.

The road costs for each Origin-Destination are composed of three components that are the global road cost (petrol, tolls, vehicle's purchase pay, driver's cost), the road taxes (HVF, …) and a tunnel tax or a cost related to border. The total time is estimated by adding the time resulted from dividing the distance by the average speed to the waiting time lost in borders and traffic jam. We consider one unique average speed for all Europe. The quality of the road is introduced with a parameter penalizing the waiting time lost at border and traffic jam. Once the time and the cost for all the transalpine Origin-Destination are calculated, the proportional distribution of the volume on the transalpine path is split by comparing the general cost functions of the road with the rail.

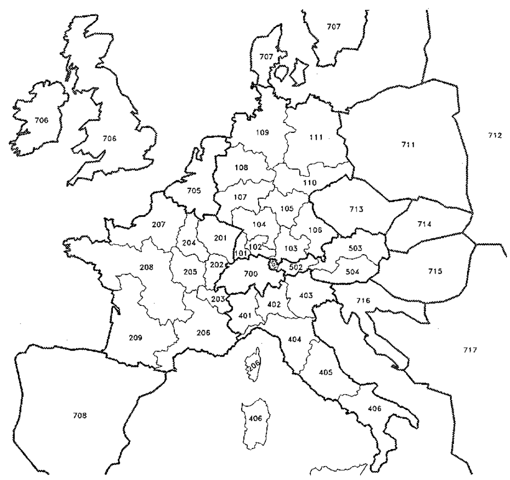
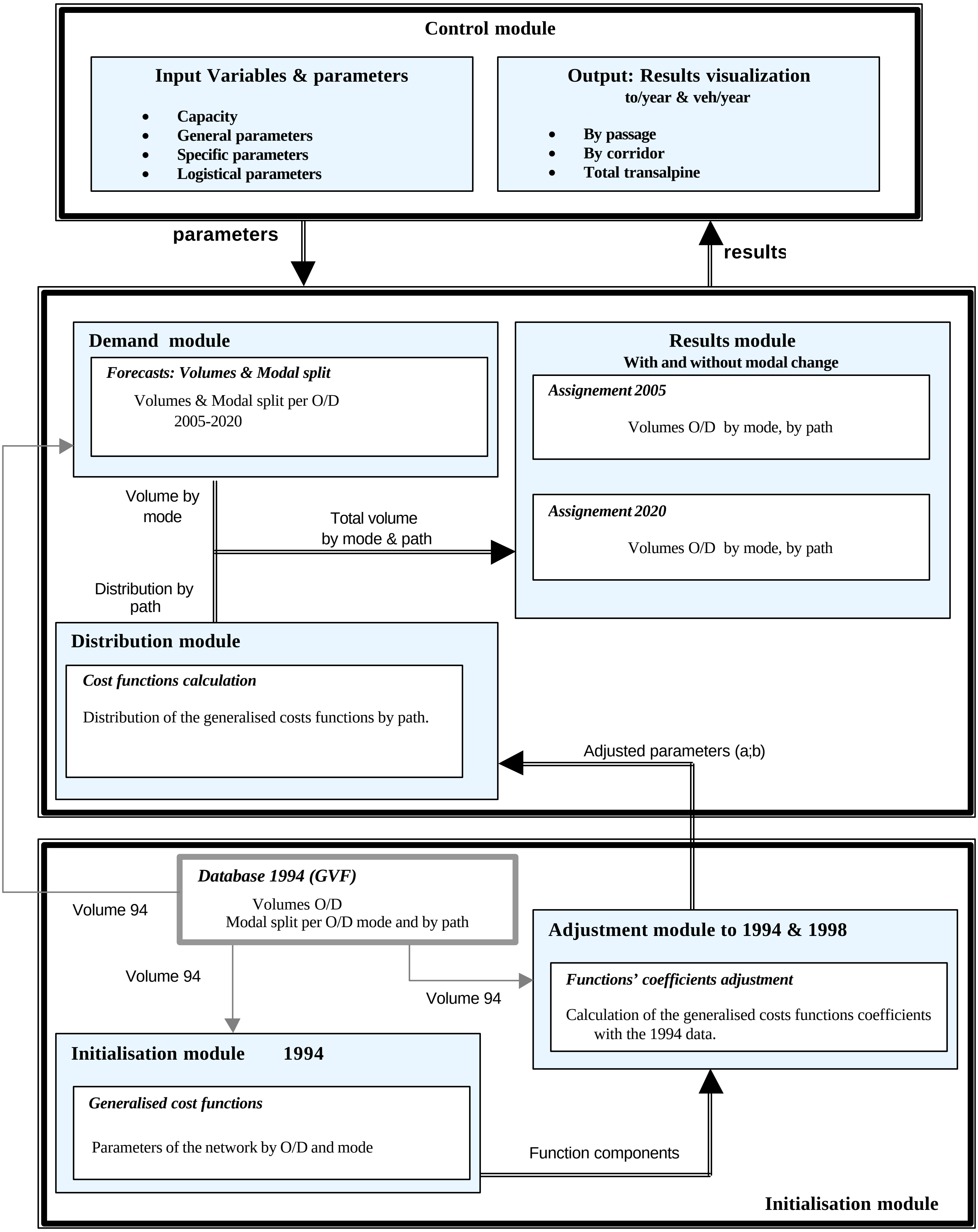


Figure 1: Origin-destination zones in the 94database

3.2 Model architecture



The model is based on the database 1994 worked out by the GVF. The database represents the volume of goods crossing the alpine paths by Origin-Destination, mode and category of goods. The model is composed of several modules having each one a well-defined function and is structured with three groups of module:

1. The first group includes the DB94, the module of initialisation as well as the module of adjustment. The function of this group is to determinate the adjustment parameters a and b that are considered to be fixed when running the exploration scenarios.

Generalised cost function

For each mode :

$$\begin{cases} F_{gi} = a^{*}.(Ti) + b^{*}.(Ci) = \{\%\}pi = V_{OiDipi}/V_{totOiDi} \\ e = a/b \end{cases}$$

T: component of time
C: component of cost
{%}pi distribution on the passage i
e: VOT

The resolution of the system in **a** and **b** then allows to adjust the generalised function cost to the year 1994. The second adjustment step concerns the year 1998. With the parameters a and b found in the previous step, we forecast the volumes 98 and compare it with the real volumes 98. The tolerance we fixed is 3%.

2. The second group is the core of the model. Each module of this group depends on the parameters used during the exploration of the scenarios. This group is composed of three modules:

1. Demand module

This module is the first stage leading to the forecast of the demand for 2020. We carry out here a projection of the total volume 94 by OD and by mode by using simply a global growth rate with two corrections, by direction (North-South & south-north) and by OD group.

The global growth rate and the two corrections are calculated from the analysis of the past evolution of freight transport.

The output of this module is the volume by Origin-Destination and by mode for the years 2005 and 2020. The next step is the distribution of the projected volume on the Alpine paths that is explained in point 2 here below.

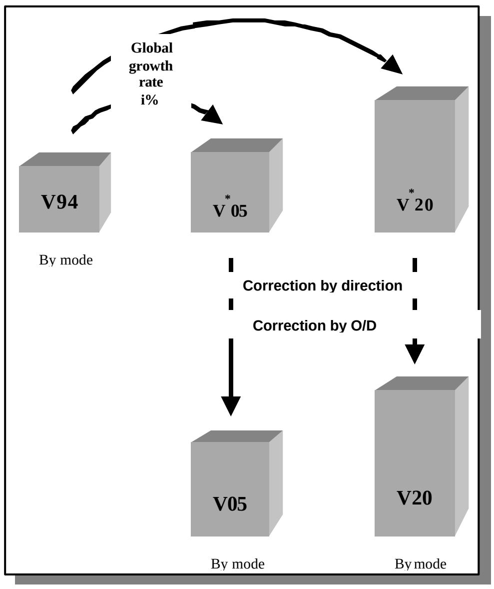


Figure 2: Projection process of the volume 94

2. Distribution module

This module makes it possible to determine the distribution of the volume by mode and by passage. This one is based on the distribution function cost Dfgi. The transfer is considered only in one direction, i.e. from the road to the rail. The assignment of the volume on the transalpine paths is proportional and linear. The assignment on the Alpine paths follows the following step:

a. Determination of Dfgi per mode and OD.
b. Intramodal distribution by comparing Dfgi for each OD
c. Modal transfer from the road to the rail if Dfgi of the rail is higher than that one of the road

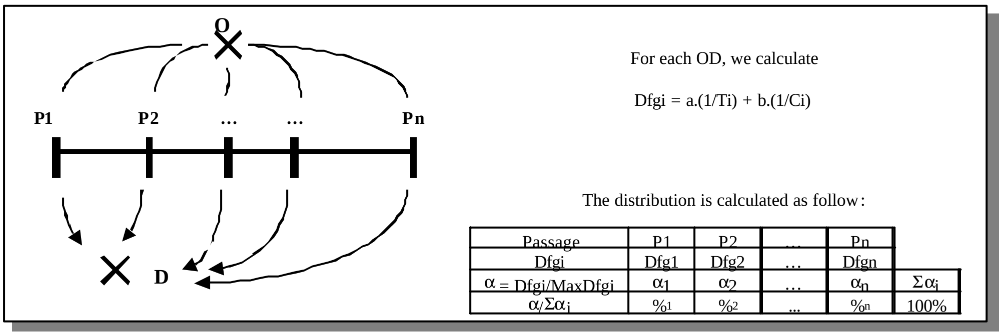


Figure 3: linear process for volume distribution

3. Results module

The results are given in tons per year for the different modes of transport considered and also in vehicles per year (with an hypothesis on the average weight per vehicle) for the road.

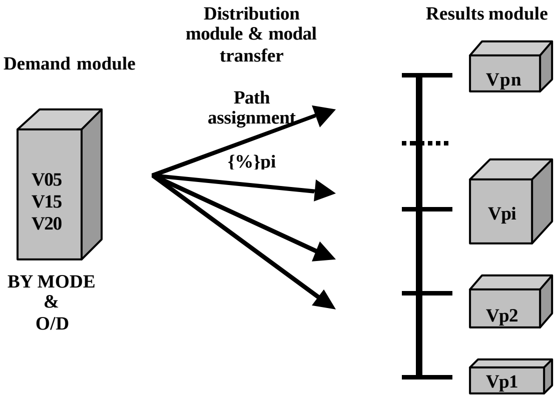


Figure 4: General process of the forecast

The average tonnage by vehicle crossing the Transalpine paths is given on the basis of statistical data provided by organizations such as the GVF for example. This data are admitted to be equal to the current data if in the explored scenarios the authorized Weight limit per vehicle for European countries remains unchanged compared to the current situation. On the other hand, concerning Switzerland, the passage to 40 tons is likely to increase average tonnage by vehicle to a value that is difficult to estimate. Here we make the assumption that transported load is similar to a EU average.

3.2.1 Generalized cost function

For clarity reasons, only two functions have been developed: one for road and one for rail. Indeed, rail comprehense rail + combined transport + combined transport not accompanied.

The results of the forecast are obtained in two steps: the first consists in comparing for each OD the generalized function cost of the Rail+CT+CTNA with the road. After aggregation of the volumes of each path, we obtain the road volume as well as Rail+CT+CTNA volume shown in point 1. The second stage consists in applying a growth rate to the volumes of the CT and CTNA in order to determine the respective volumes of the two modes for the year 2005-20. It is then enough to cut off these two volumes with the graph from point 1 to find the volume of the conventional rail to each transalpine passage as shown in point 3 here above.

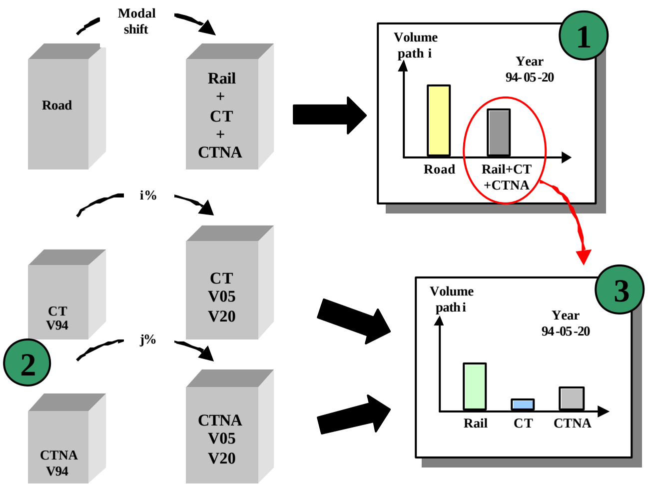


Figure 5: Assignment process of the volume on the 4 modes

Road: $F_{gi} = a.(Kmi/S + qr \cdot T_{wi}) + b.[C_{gi}.Kmi + Tkmi.kmi + C_{ti}]/W_{moy}$

Rail+CT+CTNA: $Fgi = a'.((Kmi/V) + TLi) + b'. [(C_{gi}.Kmi) + Q]$

Parameters	Road	Rail
Distance in km	Km	Km
Average speed between two terminals without waiting time Tw	S	V
Road quality	qr	-
Waiting time (lost in traffic-jam & at custom) or resting time.	T_w	T_L
Transport costs including driver's costs, vehicle purchase cost & petrol cost	C_g	C_g
Road taxes	Tkmi	-
Cost related to custom duties or tunnel taxes (defined on a charged relevant lenght in Km) A-11	C_t	-
average weight per vehicle	W_{moy}	-
Penality for rail (⇒ Hypothesis: Croad = Crail for km = 600)	-	Q
Coefficient		
Coefficient related to the time (distance and speed)	a	a'
Coefficient related to costs	b	b'

3.2.2 Quality of road

The model does not contain an explicit network for road and for rail. European countries are divided in sub-countries. Each sub-country contains a gravity centre point from which all the volume is concentrated. The distance between an Origin and a Destination has been determined with a commercial software entitled "*Autoroute express*". The distances between each Origin and Destination have been displayed in a table. This table is linked to the generalised cost function.

Classification	Ratio of intensification qr
Ventimiglia	1
Fréjus	1
Mt Blanc	1
Gothard	1
Brenner	1
Tarvisio	1
Reschen	30
Grd-St-Bernard	40
San Bernardino	50
Simplon	60

Since no network has been defined, it is necessary to express why a specific path is chosen and not another.

Therefore, a road quality parameter has been introduced in the time component as an intensification ratio for waiting time parameter Tw. This is a way to introduce theoretical constraints into the model.

The values have been given according to the 94database traffic and modal split.

4 Transalpine case: facts and scenarios

4.1 Key elements of transalpine freight

In the railway field, cooperation is based on several European and transalpine infrastructures projects (see TEN-T and PACT Program) in order to increase the supply of rail transport. In the last years the main relative specific provisions to politics of the transports to European level are referred the two essential communitarian principles: the subsidiary and no-discrimination. The subsidiary assumes that the European Union intervenes only if advanced interests prevail to those of the single Countries; the no-discrimination means that the national policy do not damage or support specific enterprises based on their nationality.

All Europe collaborate on several projects with the aim of protecting the environment and promote the rail. For the moment, the transalpine collaboration takes place slowly with specific improvements on the rail network in particular.

Three scenarios will then be defined below: two scenarios will explore the alpine modal split according to possible orientations of the transport policy of each European country and the third one tries simply to make explicit what are the means to set up for a perfect equal competition between road and rail that should reach a 50/50 ratio.

4.2 Three scenarios

4.2.1 National specificities

Switzerland

Switzerland is progressively introducing a mileage-related heavy vehicle tax (HVF). To give an idea, the amount to be paid for driving a 40t from Basel to Chiasso (300 km) is about 200 Euro.

This tax has to be paid even if the lorry is empty. The introduction of 40 tonnes vehicles together with the new HVF, will drastically increase the load factor of vehicles. It is even likely that the factor may overcome European average. For simplification, Scenario1 assumes that the average load per truck is equal all over the Alpine chain. The average value used for computation -based on the GVF data- is 15,5 to/veh. Moreover, in case of HGV "flooding" Switzerland has the possibility to add a border Alpinpath tax, up to 15% of the HVF amount, but no information concerning the evolution of this emergency tax has been found. Therefore, it has not been included in the model. The new tunnels, Lötschberg and Gothard will bring significant reductions of time in 2008-12 and a better quality of service for rail.

Austria

Having no information about what will happen after the end of the ecopoint in Austria in 2002, we assume that they will continue to use it. The new railway project Berlin-Verona is planned to be operational in 2010. This project is expected to bring significant reductions of time. The provision of rail capacity necessary to meet future needs, as well as the increased quality of services resulting from upgraded infrastructure, is expected to improve the share of rail traffic in this corridor. We assume a reduction of time of 1 hour for the Brenner path. The average amount for the Eurovignette is 1250 Euro/veh/year based on the Euro-II vehicle 4 axles.

Germany

Germany will introduce a distance-related charge for heavy goods vehicles on federal motorways, with the charges averaging 25 pfennigs/vehicle-km in 2003. The objective is to finance part of the Federal Transport Infrastructure Plan of Germany. Like the HVF in Switzerland, this tax is not depending on the tonnes carried by the lorries. Even here, we can assume that the german hauliers will try to increase their rate of filling. Anyway, we keep the same average weight per truck as it is in the year 2000. For the Eurovignette, the average amount of 1250 Euro taken into account is based on a Euro-II vehicle with 4 axles.

Italy and France

Italy and France have both a similar system of payment with tolls. The average amount per kilometer for heavy lorry is 0.11 Euro/km for Italy and 0.15 Euro/km for France. Both countries try to improve the logistical chain of all the modes of transport rather than to provoke an artificial modal transfer from the road to the rail using an additional road tax. The new railway Lyon-Torino is expected to bring significant reduction of time for passenger and freight services. The capacity will be more than doubled on the entire axis. The main expected benefit is to enhance the competitive position of the railway supply and increase its market share on this corridor.

4.2.2 Scenario 1 : Trend and implementation of 2000 transport policy

This scenario will explore the effect of the current transport policy of each European country on the transalpine case. All the informations concerning the future evolution of the transport policy of each country, i.e. the new infrastructure investments, development of the networks, introduction of new heavy vehicle tax and collaboration for a better management of the flows of vehicles are taken into account.

Scenario1 assumes 1 hour reduction in transport time over all Swiss transalpine path.

In this scenario, we assume that the project Lyon-Torino will have some delay due to the opening of the Mont-Blanc tunnel and will not be in service before 2020.

4.2.3 Scenario 2: Strong will to improve the rail share of transalpine freight

This scenario explores the effect of a complete European collaboration for the rail in order to provoke a modal transfer from the road to the rail as big as possible with the actual means. We suppose here a strong transalpine cooperation that will favour as much as possible the rail.

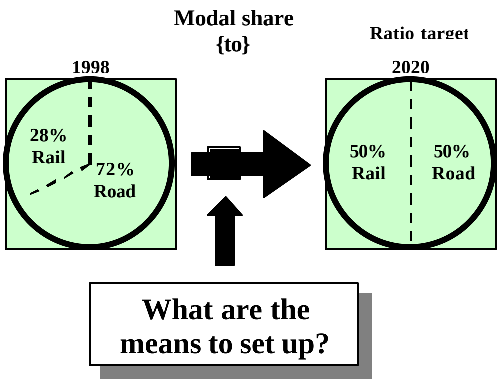
This scenario implies no effort to improve road infrastructure but to shift modal share to the rail through better organisation and logistical improvement.

According to the assumption that all the European countries improve as much as possible all railway logistics, time at custom is reduced by 50%.

Switzerland will introduce the alpine tax with the maximum rate allowed of 15% HVF. Austria, Germany, Italy and France maintain their actual transport policy for the road. The improvement of the rail infrastructure, Lötschberg & Gothard tunnels, Brenner, and Lyon-Torino are functional for the year 2015 for all the scenarios. The Mont-Blanc is open.

4.2.4 Scenario 3: Back casting with a 50/50 rail/road objective

This scenario will explore the necessary conditions for reaching an utopian 50/50 ratio on the overall transalpine case. That mean all European countries will cooperate strongly.



This third scenario is a back-casting exercise: the sharing rail-road has been set at 50%-50%, representing a perfect equal competition between both modes regarding the transported volume in tons.

The objective here is not to demonstrate how could we reach this ratio target but rather to ask the question if it's possible to achieve this objective concretely.

In function of the necessary means to set up, we'll try to answer the question "Is it possible to set them up?"

5 Results and discussion

5.1 Starting point: GVF 1998 data

Note: the data mentioned below are taken from GVF-News 48-1, 1999.

Alpin arc: Ventimiglia-Tarvisio

Freight volumes:

Aplin country	Road [$*10^3$]	Road [$*10^6$ To]	Rail+CT+CTNA [$*10^6$ To]	Road + Rail [$*10^6$ To]
France	2524	39.1	10.1	49.2
Switzerland	1235	7.7	19.3	27.0
Austria	2278	35.9	13.3	49.2
Total	**6037**	**82.7**	**42.7**	**125.4**
France	42%	79%	21%	100%
Switzerland	20%	29%	71%	100%
Austria	38%	73%	27%	100%
Total	**100%**	**66%**	**34%**	**100%**

The following graphs show the modal split of the alpine countries. The heterogeneity of these graphs will not be analyzed. We take these results 98 as a reference for the exploration of the scenarios.

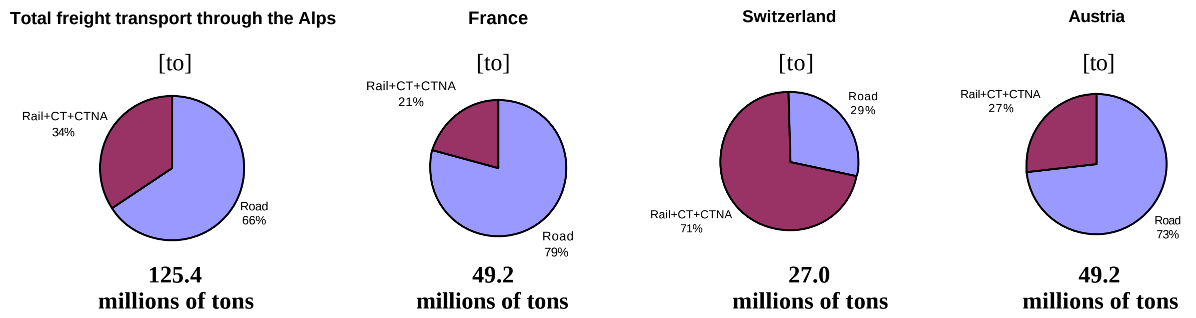


Figure 6: European modal split of the carried volume in net tons

The modal split 1998 between Austria and Switzerland is quite opposite. Switzerland has a big dominance of the transport by rail with 71% of the tons contrary to its neighbors and represents 22% of the total transalpine freight transport that is almost twice less compared to the two others countries that have the roughly same volume equal to 49,2 million of tons.

5.2 Forecasting 98

The results of the forecasting 98 and their difference with GVF 98 data are the following:

Alpine countries	Road	forecast	Rail	forecast	Total	
France	41.9	+ 7.2%	9.0	- 10.9%	50.9	+ 3.4%
Switzerland	7.2	- 6.5%	22.1	+ 14.5 %	29.3	+ 8.5%
Austria	34.5	- 3.9 %	13.7	+ 3.0%	48.2	- 2.0%
Total	**83.6**	**+ 1.1%**	**44.8**	**+ 4.9%**	**128.4**	**+ 2.4%**

5.3 Scenario 1

5.3.1 Forecasting 2005

The aim of the forecasting 2005 is to estimate the effect of the introduction of the HVF in Switzerland on the modal split of the vehicle on the whole transalpine case.

The additional number of lorries that will cross Switzerland is approximately 750'000. This number is 15% bigger than the actual expected number of 650'000 lorries.

More than the rightness of the forecasting number of 750'000 vehicles that will be interested in crossing Switzerland in 2005, if the Federal Council of Switzerland want to stabilize the flow of the lorries to 650'000 vehicles, the European railway network including the combined transport and the combined transport not accompanied has to be more attractive, especially in term of Waiting time at custom and terminals. Since the big projects for railway infrastructure like Lötschberg & Gothard tunnels in Switzerland, the Brenner in Austria and the Lyon-Torino project between France and Italy will not be operational for the year 2005, the railway network will certainly not be attractive enough. The consequence is that even if the logistics and the quality of service will be improved with the actual infrastructures, the growth of volume carried by road will continue to be. Due to this assumption and the result given by our model, the expected potential number of 650'000 lorries crossing Switzerland will certainly be exceeded.

The opening of Switzerland to the 40 tons will attract some vehicles that circled Switzerland by Austria or France before.

This figure show the distribution of the vehicles that crossed Austria and France before 2005 and that will transit Switzerland.

65 % of the 750'000 vehicles come from the French corridor and 35% from the Austrian corridor. The French corridor should be relieved with a bigger proportion than the Austrian one.

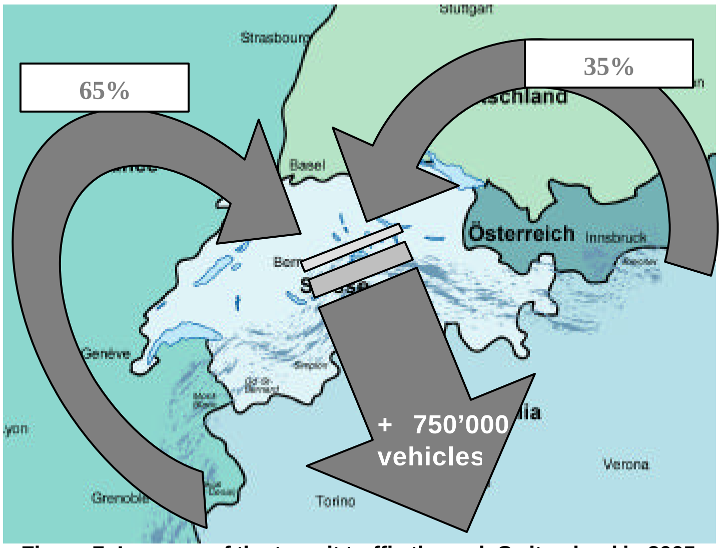


Figure 7: Increase of the transit traffic through Switzerland in 2005

We can find three kinds of reaction to the introduction of the HVF & the opening of Switzerland to the 40 tons:

1. A bypass of Switzerland of some 28 tons that crossed Switzerland before 2005 if the additional cost of 200 Euro is bigger than the additional cost through Austria or Switzerland.
2. A modal transfer on the rail through Switzerland if the additional cost of the rail is smaller than the overcost of the road through Switzerland, Austria or France.
3. A transit through Switzerland for some 40 tons if the additional cost of 200 Euro is smaller than the the additional cost through Austria or France.

The combination of the three undermentioned possible reactions gives the additional number of vehicle of 750'000 shown in figure 15 for 2005.

5.3.2 Preferential transalpine corridors since 2005

This chapter shows the preferential transalpine corridor in term of cost for the 10 main Origin-Destinations in Europe. As an example, the cost of a 40 tons lorry to Milano is presented in the following table. These costs have been calculated in the model.

For Milano destination, the European regions that should be interested by crossing Switzerland are the Benelux, eastern regions of France and western regions of Germany. For these three regions, the overcost of 200 Euros for crossing Switzerland is smaller than the overcost induced for bypassing the country by France or Austria.

40 tons

[Euro]	France	Switzerland	Austria
Stuttgart	1190	1080	1160
Hamburg	2620	2300	2550
Berlin	2420	2260	2015
München	1380	1190	900
Paris	1100	1340	2000
Strasbourg	950	910	1340
Toulouse	1120	1490	-
Madrid	1800	2400	-
Brussel	1380	1320	2250
London	1610	1620	2015

Costs given by the model for Milano destination

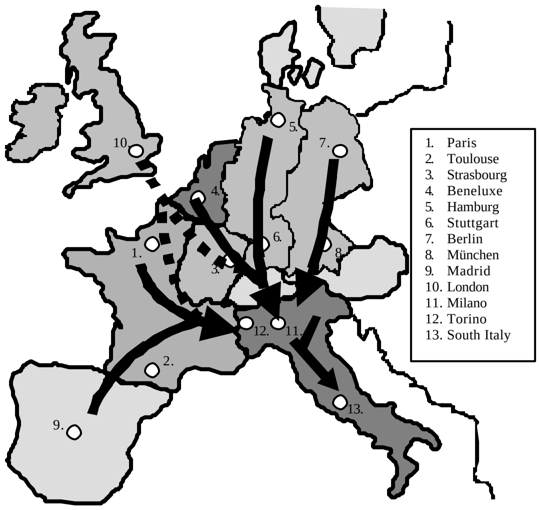


Figure 8: Preferential corridors to Milano, Torino and South Italy

Concerning the international exchanges with Italy, the French corridor is the most attractive for the western and southern regions of France and Spain. From the United Kingdom, French and Swiss corridors are attractive one as much than the other. Finally, the Austrian corridor is the most attractive for the Eastern regions of Germany.

This situation is the same if the destinations of the European regions here above are Milano, Torino or South Italy.

But if the destination is Verona, the Austrian corridor becomes the most attractive for all Germany.

The two maps above showing the preferential transalpine corridors to Italy have to be considered with a very global scale. We have associated a few punctual origins and destinations to large geographical regions.

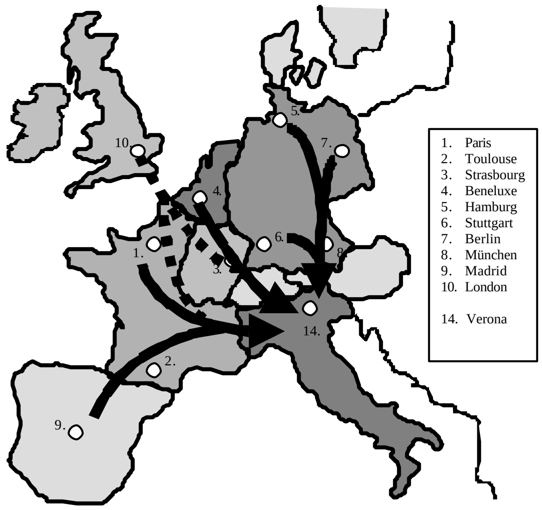


Figure 9: Preferential corridors to Verona

5.3.3 Transalpine modal split of the lorries in 2020

As shown in the figures thereafter, the introduction of the 40 tons and the HVF coupled with the development of the new railway infrastructures in Switzerland and in Austria has evidently an effect on the transalpine modal split of the vehicles. A first look at these figures show that Austria has an increase of 2% of the transalpine modal split of the vehicles. Switzerland has a reduction of the same amount and France keep the same modal split as 1998.

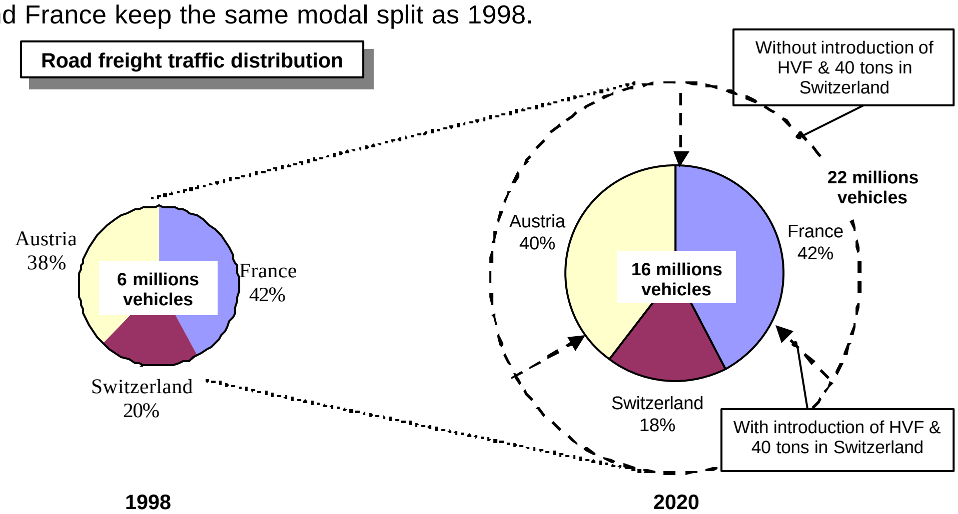
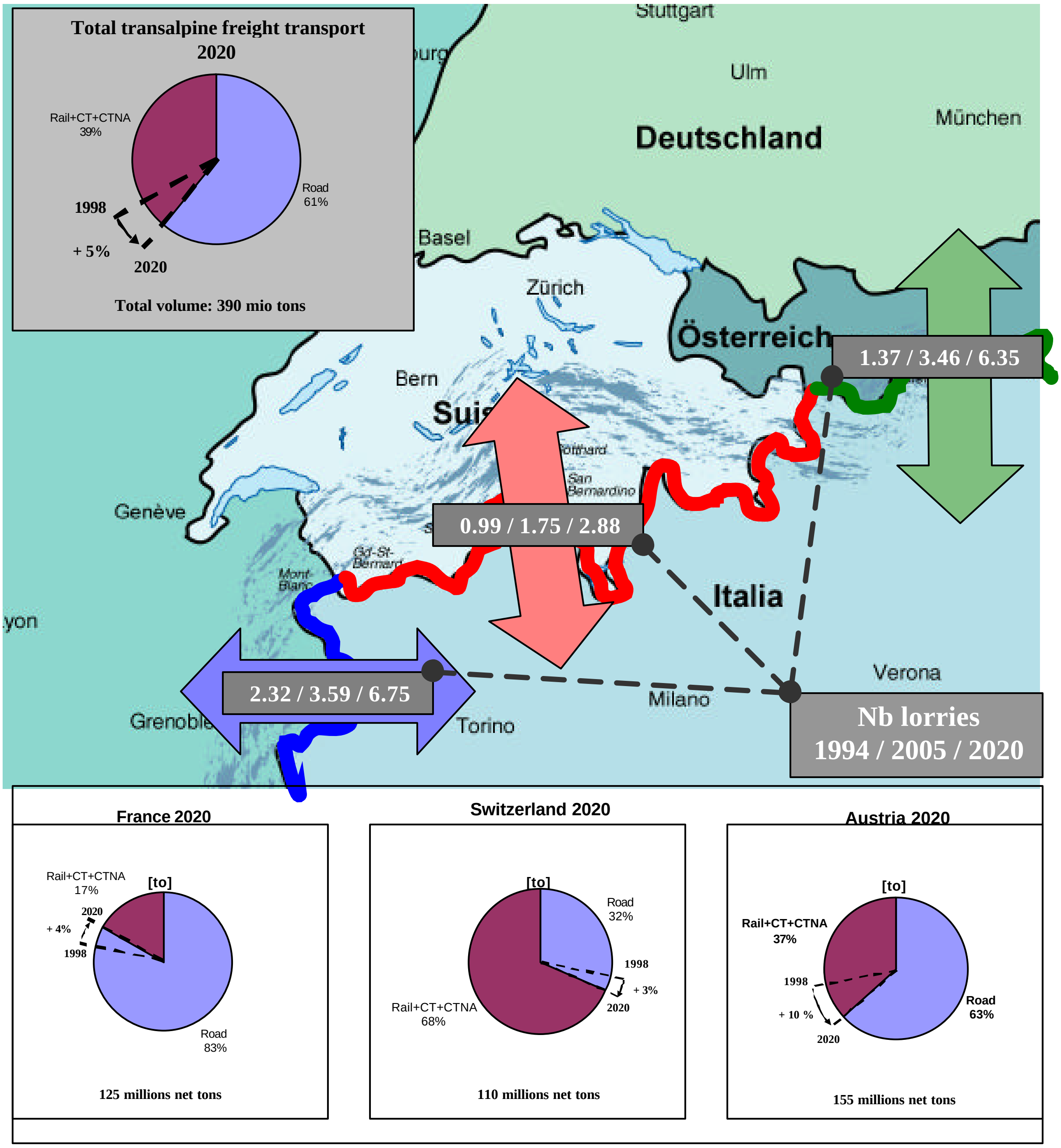


Figure 10: Lorry distribution along Transalpine paths

The reduction of 2% in Switzerland and the increasing of the same amount in Austria doesn't mean at all that Austria will have proportionally more vehicles in 2020 than in 1998. We saw in the previous chapter the increasing of the rail modal share in Austria. The analysis and the explanation of these results must take into account two aspects: the first one is the continuous growth of the freight transport that will induce a "natural" growth of the number of vehicles in all Europe. The second is the introduction of the 40 tons and the HVF coupled with the development of the new railway infrastructures in Switzerland and in Austria. The effect of this second aspect is to change the behaviour of some road transporters. Some will go through Swiss paths instead of Austrian or French paths. Due to the calculation of the HVF that don't depend on the tons carried but to the kilometers, the authorized total weight and the polluting values of the towing vehicle, the transporters should maximise their rate of filing in order to have a cost per tons as small as possible. The combined effect of the HVF with the development of the new railway infrastructures in Switzerland and Austria will be a reduction of 2% of the vehicle modal split in Switzerland, a growth of the same amount for Austria and a stable modal split in France. It would be also interesting to study the growth rate of the vehicles that are potentially interested by crossing Switzerland compared to the global growth rate of road in whole Europe.

5.3.4 Synthesis map Scenario 1



5.4 Scenario 2

Let us remind that what distinguish scenario 1 from scenario 2 is the strong will to improve the transalpine railway network. That is to say an improvement of the average speed between the terminals of 20%, a reduction of wasting time at border and terminals of 50% and a decrease of the global costs of 1% per year due to better management.

5.4.1 Forecasting 2005

The improvement of the rail infrastructure, Lötchberg & Gothard tunnels, Brenner, and Lyon-Torino are functional for the year 2015 and the Mont-Blanc is open. The situation is exactly the same as the scenario 1. We have no real improvement of the transalpine rail network in 2005. The model gives the same additional number of lorries that will cross Switzerland. This number is 750'000 vehicles (see chapter 7.2.1).

5.4.2 Transalpine modal split of the lorries in 2020

As shown in the figures thereafter, the introduction of the 40 tons and the HVF coupled with the development of the new railway infrastructures in Switzerland and in Austria has evidently an effect on the transalpine modal split of the vehicles. The results show that Austria has the same proportion of vehicles in 2020 compared with 1998. Switzerland has a reduction of 1% and France has in increase of the same amount.

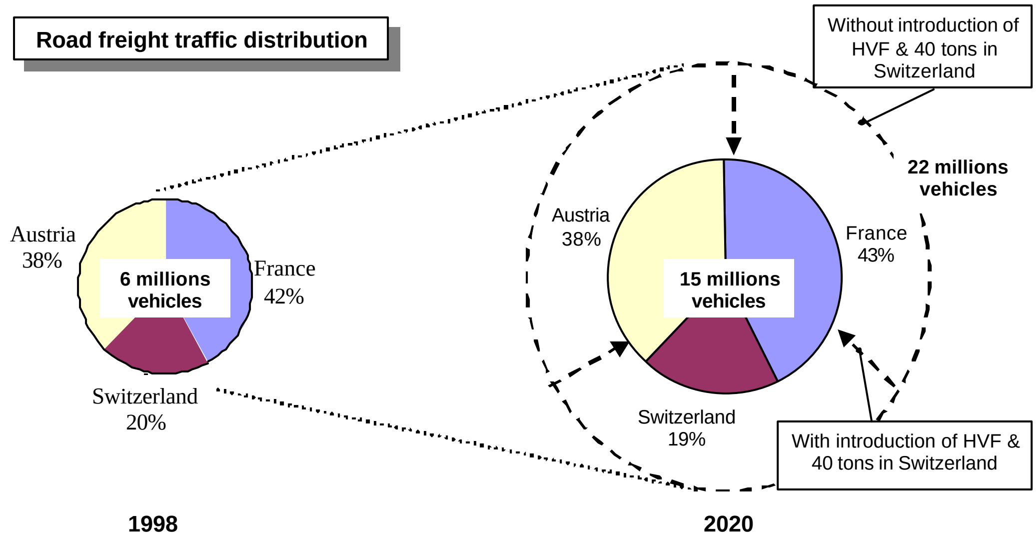


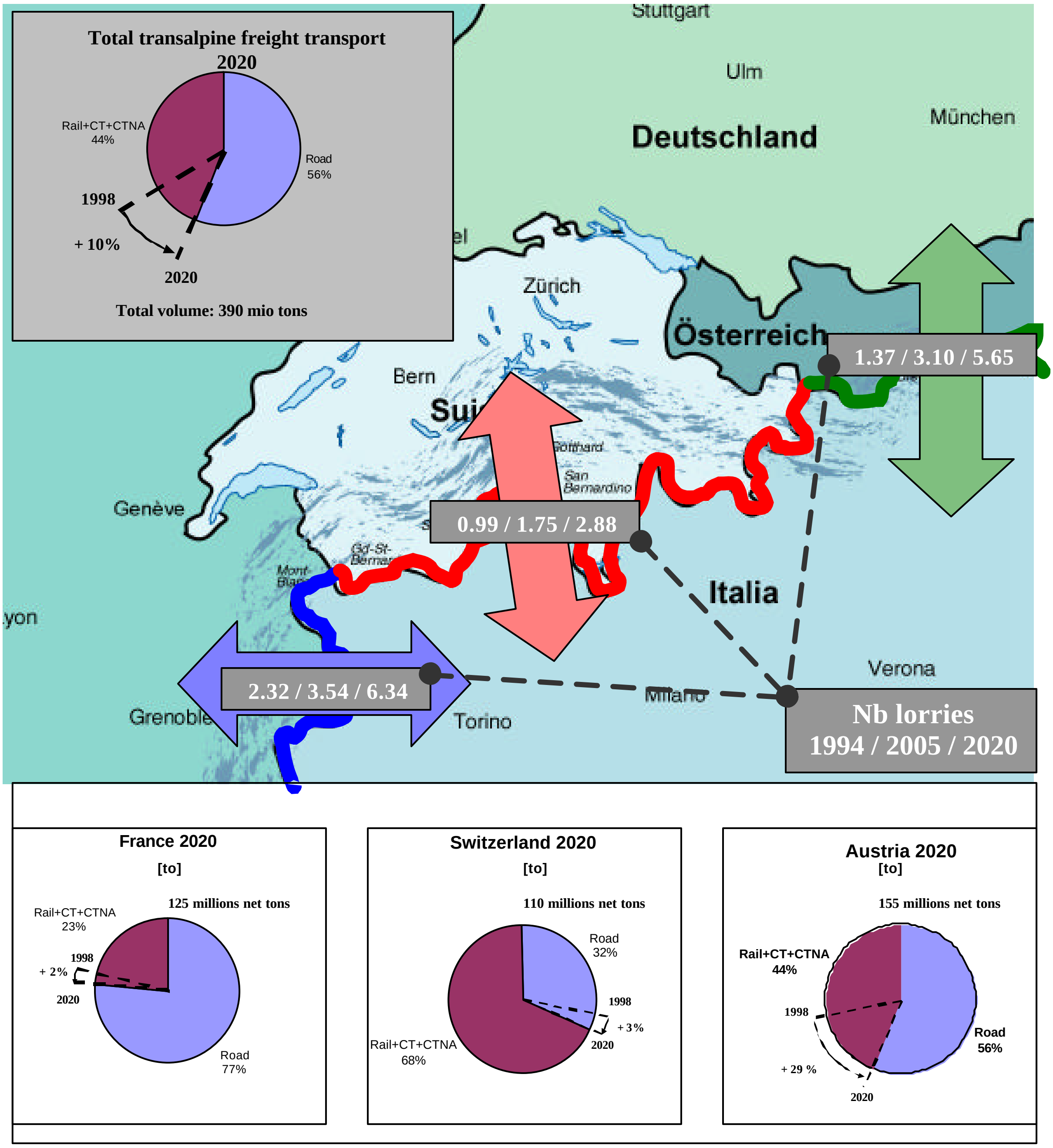
Figure 11: Lorry distribution along Transalpine paths

The reduction of 2% in Switzerland and the increasing of the same amount in Austria don't mean at all that Austria will have proportionally more vehicles in 2020 than in 1998. We saw in the previous chapter the increasing of the rail modal share in Austria.

The analysis and the explanation of these results must take into account two aspects: the first one is the continuous growth of the freight transport that will induce a "natural" growth of the number of vehicles in all Europe. The second is the introduction of the 40 tons and the HVF coupled with the development of the new railway infrastructures in Switzerland and in Austria. The effect of this second aspect is to change the behaviour of some road transporters. Some will go through Swiss paths instead of Austrian or French paths. Due to the calculation of the HVF that don't depend on the tons carried but to the kilometers, the authorized total weight and the polluting values of the towing vehicle, the transporters should maximise their rate of filing in order to have a cost per tons as small as possible.

The combined effect of the HVF with the development of the new railway infrastructures in Switzerland and in Austria will be a reduction of 2% of the vehicle modal split in Switzerland, a growth of the same amount for Austria and a stable modal split in France. It would be also interesting to study the growth rate of the vehicles that are potentially interested by crossing Switzerland compared to the global growth rate of road in Europe.

5.4.3 Synthesis map Scenario 2

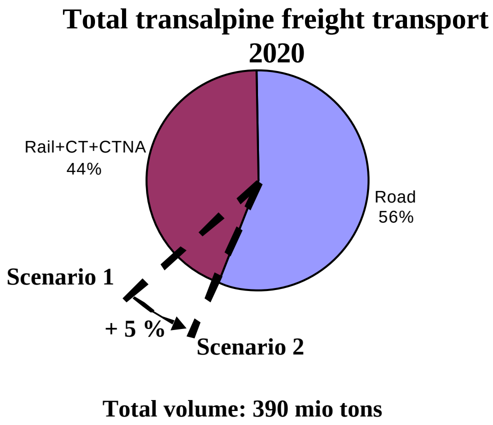


5.5 Invariants and differences: Scenario 1 vs Scenario 2

5.5.1 Forecasting 2005

The improvement of the rail infrastructure, Lötchberg & Gothard tunnels, Brenner, and Lyon-Torino are functional for the year 2015 and the Mont-Blanc is open. The situation is exactly the same as the scenario 1. There is no real improvement of the transalpine rail network in 2005. The model gives the same additional number of lorries across Switzerland: 750'000 vehicles.

5.5.2 Forecasting 2020



This chapter will express the relative difference between scenario 1 and scenario 2 for the year 2020.

The combination of the increase of the quality of service in term of average speed (+ 20%) with the reduction of the costs of 1% per year for rail has a relevant effect on the transalpine modal share.

Compared to the year 98, scenario 2 doubles the progress of the rail modal share of scenario 1. The difference between both scenarios is 5%, which represents about 20 millions tons.

Switzerland has the same modal share for both scenarios. The strong dominance for the use of the rail transport in that country should not progress. The modal share of Austria for scenario 2 is equal to the transalpine one. The difference with scenario 1 is about 7% in favor of the rail. The volume of goods carried through the French corridor by rail increases of 6% with scenario 2 compared to scenario 1.

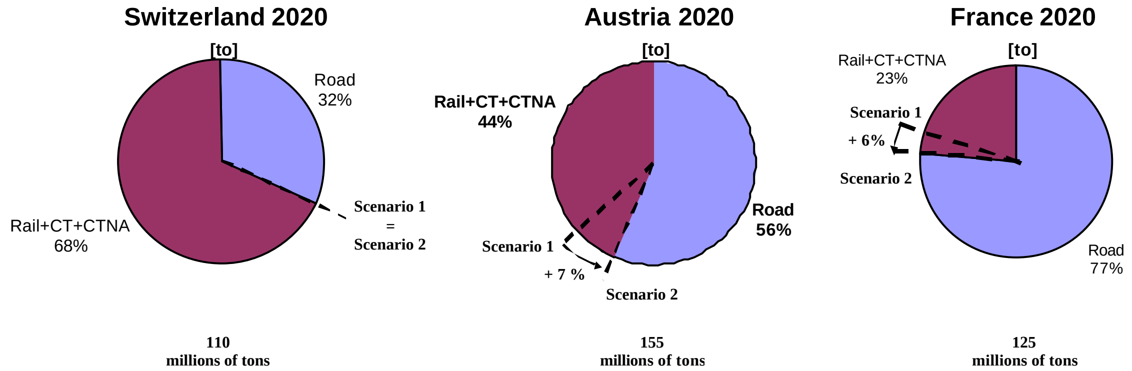
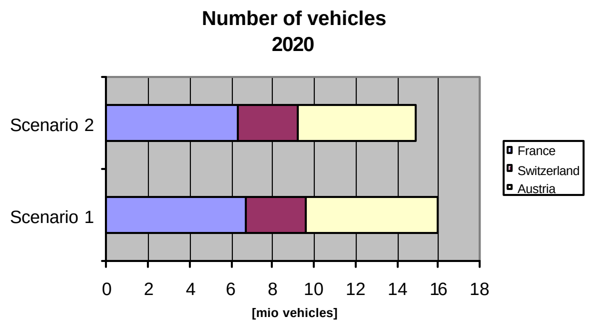


Figure 12: Scenario 1 vs scenario 2

5.5.3 Transalpine modal split of the lorries in 2020



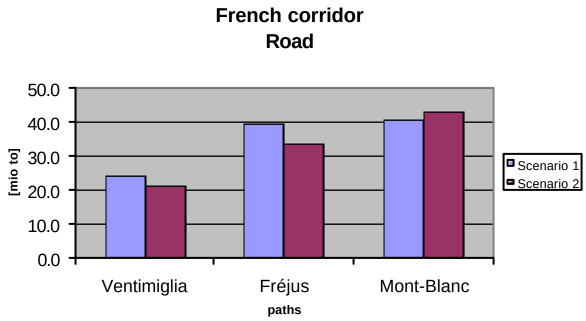
The difference of the number of vehicles between scenario 1 and scenario 2 is 1.1 million for the whole transalpine case.

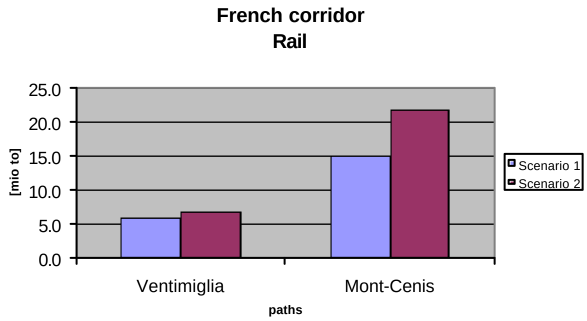
For Switzerland, the number of vehicles stays equal to 2.9 millions for both scenarios. For Austria and France, the difference is respectively about 0.7 and 0.4 millions.

5.5.4 Evolution of the Transalpine volume by path

France

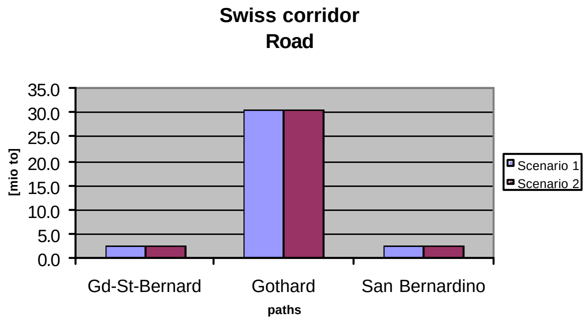
The decrease of road traffic is effective only on the Ventimiglia and Fréjus paths. Even if the global modal share of road transport decreases on the French corridor, Mont-Blanc has a small increase of the volume of 3 millions of tons. Concerning the rail, most of the difference of the volume between the scenarios is supported by the Mont-Cenis and the Lyon-Torino project. This difference represent 8 millions of tons.

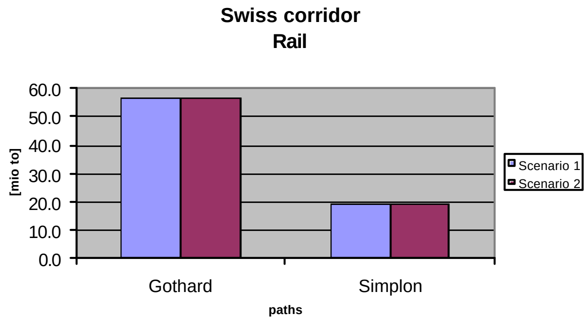




Switzerland

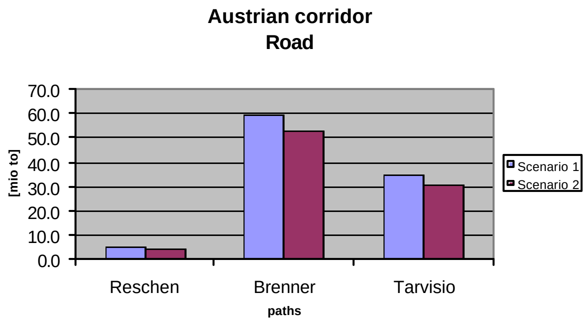
Both scenarios have the same effects in Switzerland. For each swiss path, we have the same volume of goods for both modes, rail and road. We see here the dominance and the importance of Gothard path for road and rail transport.

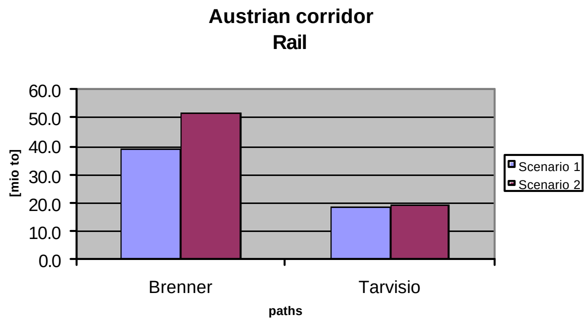




Austria

The Brenner path supports almost all the difference of volume transferred on the rail between scenario 1 and 2. This volume represents 13 millions of tons. For road transport, the difference between both scenarios is 7 millions of tons for the Brenner and 4 millions for Tarvisio.





<u>Note</u>: in this model, Lyon-Torino new rail infrastructure effect is globally included in the forecasting of Ventimiglia and Mont-Cenis

Scenario 3: Images of the future

The ratio target of 50/50 between road and rail in tons can be reached with several configurations of the parameters. The next figure illustrates the relation between the decrease of the rail costs per year Cost_Global and the average speed between two terminals Speed* for the year 2020. In our model, the components of time and the component of speed are separated. The speed Speed we have defined in the model is the average between two terminals without the waiting time at custom. Speed* is not equal to Speed: Speed* includes the waiting time at custom T_wait_Cust.

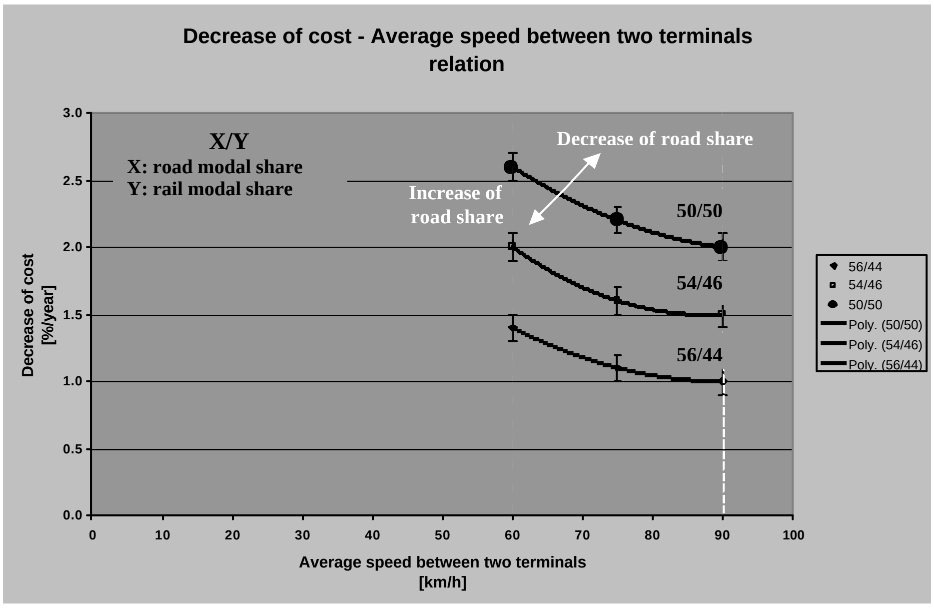


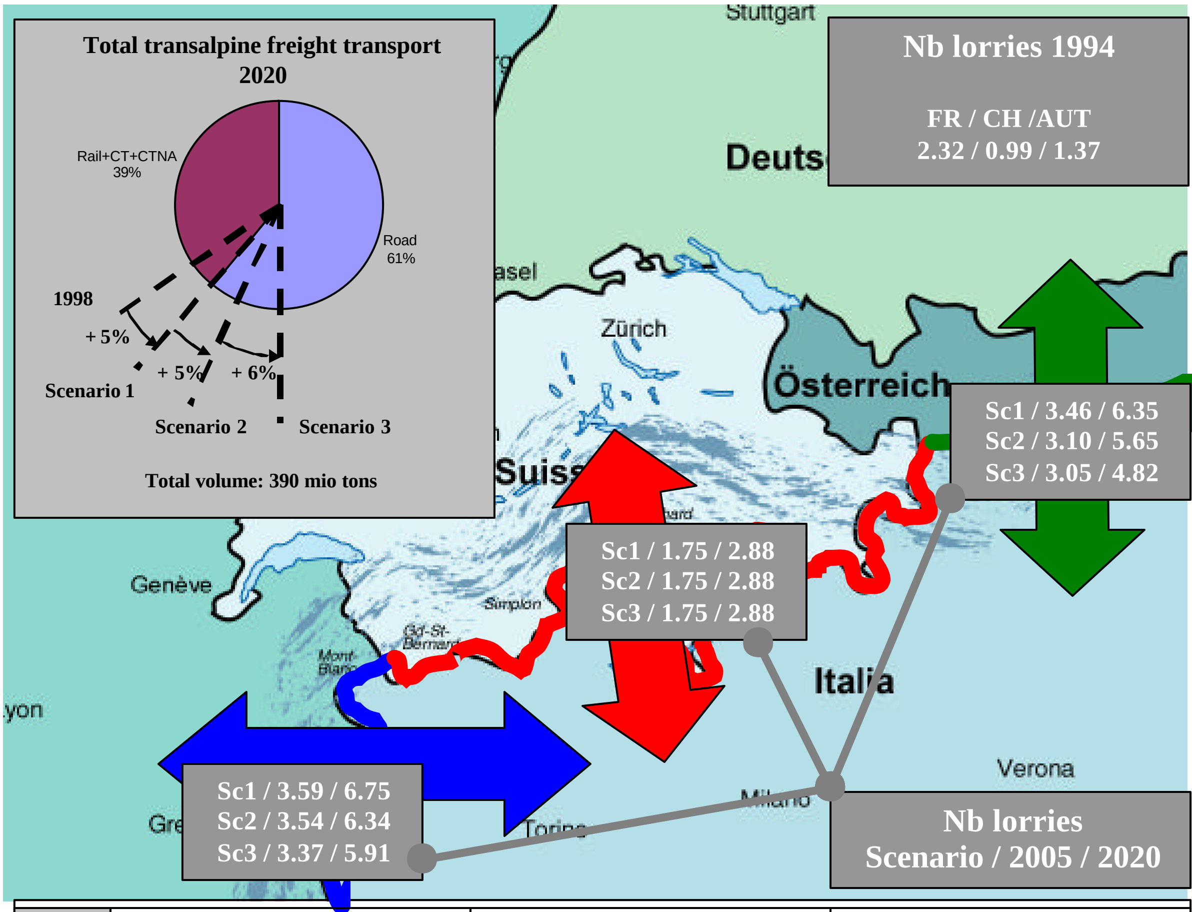
Figure 13: 50/50 road-rail ratio

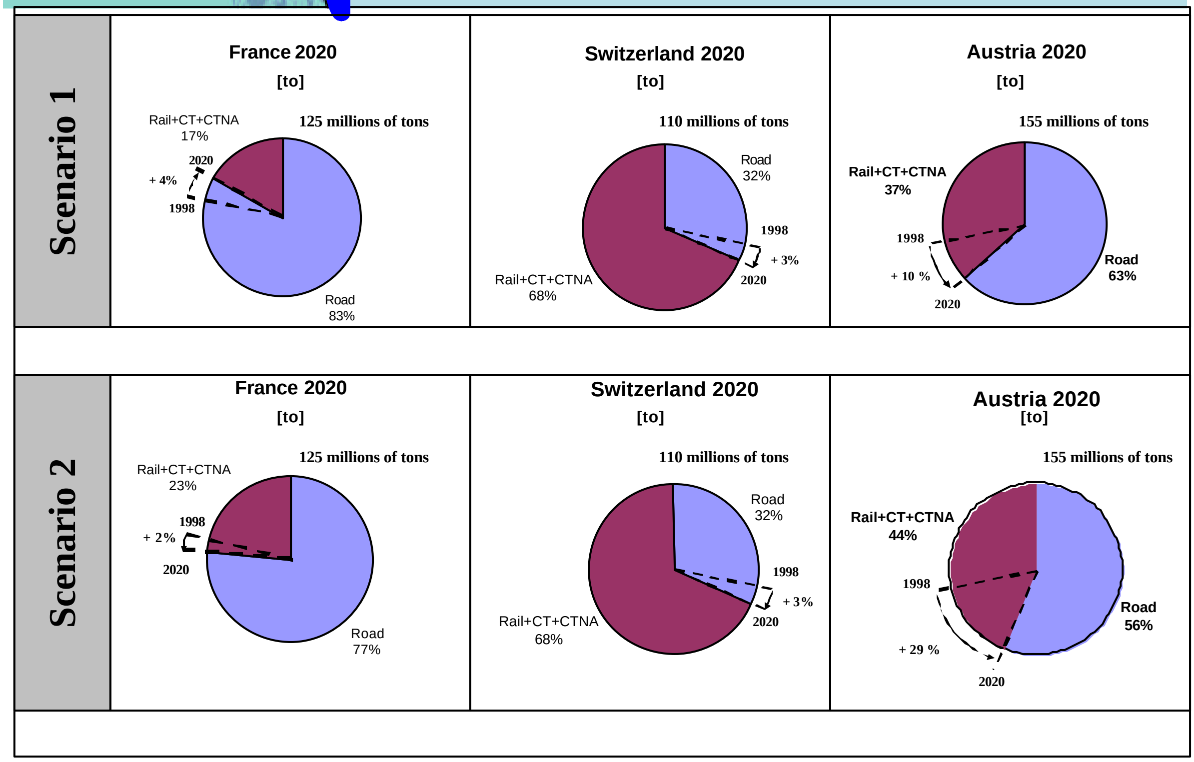
According to the range of variation of the parameters fixed previously in chapter 6.2, the results show that the ratio target of 50-50 cannot be reached without an improvement of both parameters. The reduction of the number of vehicles is about 18% compared to the scenario 1 and 10% compared to scenario 2 for the whole transalpine case. A decrease of the cost of 2,0 % per year represent a reduction of 33% in 20 years. In addition to that, if the actual average speed is almost doubled, both modes will be in equal competition. The improvement of the average speed depends essentially on the management of the traffic including the problems of capacity and logistical aspects like reduction of wasting time at border and terminals. The reduction of the costs is possible with a better management of the resources and a high level of maintenance and economy management.

Alpine corridor	Alpine paths	Road [$*10^6$] veh	Road [$*10^6$] tons	Rail [$*10^6$] tons
France	Ventimiglia	1.4	21.7	(8.7*)
	Fréjus	1.8	27.8	-
	Mont-Cenis	-	-	(27.7*)
	Mont-Blanc	2.7	42.2	-
	S-TOTAL	**5.9**	**91.7**	**36.4**
Switzerland	Gd St Bernard	0.2	2.4	-
	Simplon	-	-	19.5
	Gothard	2.5	30.4	56.6
	San Bernardino	0.2	2.6	-
	S-TOTAL	**2.9**	**35.4**	**76.1**
Austria	Reschen	0.3	4.8	-
	Brenner	2.5	38.9	65.4
	Tarvisio	2.0	31.0	20.3
	S-TOTAL	**4.8**	**74.7**	**85.7**
TOTAL		**13.6**	**201.8**	**198.2**

(…*) cf note page 16

5.5.5 Synthesis map Scenario 1, 2 & 3





6 Conclusion

6.1 Transalpine case study

The study shows that the transalpine rail developments considered in all scenarios have a strong importance to meet future needs and increase rail share on the transalpine market.
The study confirms that a 50% rail share is conceivable. This is of particular importance in the ecologically sensitive Alpine regions where road traffic is likely to cause significant environmental impact.
It is important to note that the present work (2001) has been undertaken before the French decision to build a fast link between Lyon and Torino. Even though the link is not going to be operational much before 2020, the resolution, will strengthen the tendency to enhance the quality of rail transport supply for the next 50 years.

6.2 Results

Three scenarios have been developed with different level of logistical improvement of the railway network in term of speed and costs.
The first scenario investigates the effects of continuing present EU transport policy. All political and economic measures applied or about to be implemented in 2000 are taken into account. (i.e. the new infrastructure investments, development of the networks, introduction of new heavy vehicle tax and collaboration for a better management of the flows of vehicles). The effect of this continuation scenario would be to increase rail share from 34% in 1998 to 39% in 2020.
The second scenario supposes a strong cooperation on Transalpine transport in order to encourage rail as much as 2000 policy makes it seem possible (Lyon-Torino built). It boils down that a 1% yearly reduction or rail costs, together with a 20% faster transport between European Origin and Destination terminals, should **increase the rail share** over the entire transalpine bow **by 10% in 2020**, compared to 1998.
The third scenario examines the ways to reach a set objective of equal ratio between rail and road. Investigation is based upon the relationship between productivity and the average speed between two terminals. Simulation confirms that a 50% global share for both rail and road over the Alpine bow can be reached. This can be done within a certain range of speed-productivity combinations, for instance by increasing rail productivity (= decreasing costs) by 2,0-2,5% per year and increasing the EU average speed between North and South to 60-90 km/h. Compared to both other scenarios, such improvements would reduce by 10% - 18%[1] the number of lorries crossing the Alpine paths. Nevertheless, this scenario suggests that a 50% rail policy would still let 15 million trucks cross the Alps in 2020 which is 2.5 times more than in 1998.

6.3 Method

The parameters selected for modelling do not include specific modes' flexibility, restrictions on driving time or constraints on return freight. Indeed, some of these parameters will be taken into account in further developments since they are likely to play a role in the choice of routes or in the captivity of some goods. Nevertheless, for clarity in the assumptions, it has been decided that most of them depend upon policy agreements and may well undergo deep changes during the 20-year period considered.

6.4 Model

The model used to estimate freight transport in this study is based on a generalized cost function, which, basically, converts time into monetary cost, allowing thereby to add monetary expenditures and time costs. Values were taken in the literature whereas distance has been computed for all relevant Origin-destination pairs. Another simplifying hypothesis is made by estimating freight transport without considering path capacities.

[1] 10% compared to Scenario2 (foster rail), 18% compared to scenario 1 (continue 2000 transport policy).

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