



MONITRAF

Summary of work package 5 “Fundamentals”

Road traffic related effects on the alpine space from the sustainable point of view

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SUMMARY WP5 „Fundamentals“

The general aim of the WP5 with responsible Project partner South Tyrol (I) was to give an overview of the interactions of the road traffic and their interactions between environment, economy (especially the tourism) and the social framework in the Alpine Space. The following report tasks were be hold of the External Experts:

- **European Integration and Spatial Differentiation, effects of the political and economical general conditions on mobility, goods production and traffic across the Alps (Manfred Perlik)**
- **The road traffic impact of the public health in the Alpine Space (Anke Huss, Martin Röösl)**
- **Effect of the road traffic of noise and air quality in the Alpine Space (Jürg Thudium)**
- **The effects of the traffic politics and strategies of the road traffic fluxes crossing the Alps (Helmut Köll)**
- **The effect of the road traffic on the social life, space development and economy in the Alpine Space (Basler u. Partner)**
- **The effect of the road traffic on tourism in the Alpine Space (Harald Pechlaner)**

The results and conclusions were shown in the following summarized texts and charts.

The recommendations of the External Expert and of the responsible Project Partner will just be a help for the next WPs and not be a directive for their works.

The summary is made by the responsible Partner South Tyrol. The PPs are invited to read all the reports to their comments to redefine the important concepts of WP5.

The present processes in the European society; economy and spatial development give the basic rules for the Alpine population although they are not always conscious about it. The Alpine Space was and is a geographical barrier for goods and persons transport systems from South to North and vice versa. The Alpine population used in past the natural border for their economical development, but nowadays their negative aspects becomes more and more predominant.

The “**effects of the political and economical general conditions on mobility, goods production and traffic across the Alps**” (MONITRAF report of Manfred Perlik) are caused for an important part by the extra alpine logics of the European community. The generation and growth of cross-alpine transport are influenced by three traffic-relevant thematic fields, so-called logics, were analyzed in their internal causal coherence. Each of the three logics (political, economic logic and logic spatial development) constitutes a certain social compromise or a certain rapport as it is positioned in between a broad range of extreme positions:

- the **political logic** ranges between political integration and isolation;
- the **economic logic** ranges between production efficiency by division of labour and regional redundant diversity;
- the **logic of spatial development** ranges between forced metropolisation and polycentric development.

The described three logics are not mechanical processes but rather man-made relations which are changeable over longer periods of time by the actors/stakeholders.

The political logic in the Alpine Space was not homogenised to a single system of objectives, but current EU-strategy is to achieve a durable cohesion through the connection of political and economic integration (increase of the interactions between the actors

Because the population is increasing in the metropolitan areas and decreasing in the spaces „in between“ (or at best remaining stable), the problems of acceptance of the urban population are more likely to be noticed and solved (most recent example: the effects of the fine particles regulations. This means that the **political logic becomes more homogenous**, however rather in a direction which is not desired by the population of the sparsely inhabited areas.

The economic logic is understood as a logic of goods production and of capital accumulation, where :

- a) **the struggles for resources and their distributions increases**
- b) **the division of labour and technological progress increases (productivity efficiency)**
- c) **types of landscapes (metropolitan areas and wilderness) polarises stronger.**
- d) **personal mobility as well as the flows of goods increases**

The traffic does not cover the costs it produces, so if external costs arise, they must be internalised. In the meantime, based on this, regular calculations are made in order to quantify these costs (**Internalising and externalising**)

The **role of traffic** is defined as the **accessibility** (see also page 30 B&P report): The connection of distant regions to the newest traffic networks always has significant effects on the development of the respective regions. Traffic demand depends on the technical possibilities and the degree of the division of labour. The more specific the products are, the larger the market range becomes and all the **more effective transport systems are necessary**. The expansion of road traffic and mass motorisation are associated with a democratisation of the access to mobility and accessibility. The railway, which was the classic means of transport for bulk articles, was displaced

Role of the railway

In the past distant European regions were connected by railway. The road freight traffic at first remained limited to inner-city traffic between railway-station, but the railway lost its dominant status in long-distance freight traffic in West- and Central Europe and the **transport and logistics became a relevant economic sector** in the Alpine Space. As a consequence of the functional differentiation of Europe traffic-infrastructure and flows of traffic change the importance of the regions and create new strengths and weaknesses, because it became also a **spatial relevance**.

The reconstruction of the logistics companies is occurring in two directions which are drifting apart: On one hand it is attempted to lower the production costs. This happens through personnel costs, sub-contractors, choice of location and route (see study Köll, KÖLL 2005).

The needs of the logistics companies are therewith clear, but partly conflictive:

Those logistics companies in the lower service segment relying heavily on the road, who can hardly relay costs to the customer, are all for a reduction of trade barriers and formalities as well as for an expansion of road infrastructure in order to increase productivity.

Conclusion: We are dealing with two phenomena: On one hand the double-character of traffic, consisting of the possibility to supply the population and a service for the industrial production process, is changing. The second function is now becoming dominant. On the other hand the social opinion over how traffic should be organised is also changing. This different evaluation is probably much more responsible for the dominance of road freight traffic than the technical deficiencies of the railway concerning the needs of the goods-producing economy.

The better adaptability of road traffic to varying social paradigms must however not be permanent.

The dynamics of the market has increased. Work-intensive productions are relocated, presently above all to Eastern Europe or China. Capital-intensive productions stay in Europe. The exchange is occurring over growing distances, cross-alpine traffic is only a small part of it. Through these relocations and through **acquisitions/fusions** corporate groups develop, which then produce within a network, based on division of labour. It is not only the reduction of storage capacities, which **leads to more traffic**, but also the production within the network.

The **Logic of Spatial- and Regional Development** is characterized by the **Centralisation** of functions as an increase of division of labour, because of **urbanisation** (as consequence of a wealthy society) and **industrialisation** (development of technical, artistic and bureaucratic activities against traditional agricultural activities), but also has a **cultural aspect**:

In the age of **change to a society of knowledge** the towns become centres of the stronger value added sectors of culture and rendered services; the periphery is left with the traditional sectors until their decline.

In the course of de-industrialisation towns become touristically and culturally attractive, living experiences an upward revaluation. Hereby it can be seen that spatial segregation between adventure-oriented and tranquillity-oriented inhabitants increases and that more differentiated housing estates develop.

Traditionally in Europe spatial planning as a corrective plays a much stronger role. **Regional development** in the tense environment of balance and sectoral efficiency is therefore dependent on political paradigms, therefore it is **the expression of relations of power and of social negotiations**

Regional development is a generic term for the shifting of importance, wealth and power (correctives by political logic) between towns on one hand and between town and country on the other hand

The processes of regional development therefore ideally reflect the contradiction between political and economic logic.

Summary

The political integration decreases the distance protection between defined markets. The new technologies do not have a traffic-reducing effect. The new business models of flexibilisation and vertical disintegration increase the spatial division of labour and also increase the physical flow of materials. The socio-cultural developments have on one hand led to a worldwide assimilation of certain cultural patterns and on the other hand to new differentiation strategies including politically accepted unequal development. This increases the desired personal mobility just as the undesired mobility (job-related forced mobility, worldwide migration flows). The formation of metropolitan regions changes the spatial relations and generates traffic flows over greater distances.

The **solutions** to reduce the generated traffic caused by processes induced by the European Community can be **technical** (Construction of base tunnels in order to speed up cross-alpine traffic and to enable a relocation of traffic from road to rail, technical changes like particle filters, engine encapsulation, tyre noise, innovations regarding production techniques), **economical** (Toll systems to increase cost transparency, traffic exchanges, increasing energy costs or salaries for drivers)

Other solutions can be

- Reduction of system disadvantages on the railway through innovations in rail traffic
- increase of ecological and social standards in road freight traffic
- reduce deadheads (empty runs) and LTF-loads
- Harmonisation of traffic regulations in all transit countries to the most demanding standard
- Intensification of immission limit values
- implementation by means of temporary driving bans
- Large technical buildings like for instance undertunnelling can have the same importance like transfer payments.

The possibility of a limitation of alpine cross traffic caused by reduction of production and consumption as a result of an economic crisis or the de-industrialisation of Central Europe and Northern Italy) is not acceptable, so as retreat of the population from areas along the traffic corridors or catastrophes (tunnel fire disasters, terrorist attacks).

A few scenarios are shown in Table 02:

Table 02: Dynamics of the individual logics in the short scenarios

		Logic 1 Political integration	Logic 2 Economic growth	Logic 3 Metropolisation
A	Trend-scenario	++	++	++
B	Political disintegration	--	+	++ -
C	Economic decline	+ -	--	+
D	Polycentric development	++	+ -	--
E	General decline	--	--	--

Legend:

L1	Integrating development	Disintegrating development
L2	High functional division of labour	Redundant systems, high diversity
L3	Forced metropolisation	Polycentric development

Suggestion of a paradox regional strategy: Traffic reduction through traffic

Such a strategy indirectly corresponds to the paradox, to 'leave the traffic in the mountains for a longer time' (Gian Paolo Torricelli 2002), i.e. to not further shorten the time needed to drive through these regions, so as to minimise the transit character and to be able to render regional services (tourist accommodation). Such a strategy needs maximum support from higher-ranking institutions (EU, Nation, Associations).

In a certain sense such the strategy rekindles the experiences of the middle-ages. It must therefore be communicated right from the beginning, that these are not isolationist measures or robber-knight methods, but rather the compensation of effective costs which arise because two concurring utilisations exist for a small space in a very difficult topographic location. This path will also only be believable, if it really leads to a so called "greening" of traffic (EU White Paper) and if the quality of life for the population is increased.

The current agreement situation in Europe is such, that both should exist alongside each other (internal market with traffic connections, polycentric regions). From an objective point of view this is expensive.

Aside from the maintenance of pressure against further traffic, other active innovation-suggestions in order to reduce traffic must also be developed, so that the experiences of corruptibility made in times of absolute belief in technology, are not repeated (acceptance of environmentally harmful production, if it was compensated well). As mentioned, it would be wrong to thereof expect self-supporting growth. Furthermore, attention must be paid that differentiation processes which produce metropolisation and traffic are not increased.

The strategies to reduce traffic and specially the alpine crossing traffic have to be harmonized by **sustainable development** (Brundtland report 1987) in the Alpine Space. According to this definition sustainable development guarantees, „ that the needs of the present generation are met without compromising the ability of future generations to meet their own needs.“¹

The aim of a sustainable development is a harmonic development, in which ecological, economical and social aspects are weighed up against each other. This approach comes closest to the idea of sustainable development.

Thereby

- **environmental pollution** and availability of a given development tend to **set the limits**,
- **economical processes organise the supply of the population** and
- **social processes especially determine over the distribution of resources/environmental burdens and goods** between the regions and the population groups in a region

The expert study of Basler&Partner (**B&P**) examined and presented the connections regarding the effects of road freight traffic (work package 5) on the areas of economy and society.

- The study shows connections of traffic, economy, spatial development and society by means of a simple effect-model. The measurement- and control factors (=indicators) deduced from the effect models show, which data are needed for the Monitoring (time sequences) and for the analyses of measures. For the listed data the data-availability and source is specified.
- Input for WP 6 (Identification of regional commonalities and differences) and WP 8 (Analysis by means of selected indicators)
- The study explains how an adequate objective- and indicator system, based on the principles of sustainable development, can be designed. This procedure and methodology can be incorporated and carried on in work package 7.
- Following assignments in work package 7 are suggested here:
 - Verify the indicators as adequate
 - Reduce the number of indicators (-> key indicators)
 - Propose regional-specific indicators
 - Guarantee the balance of the choice of indicators between the sustainable areas environment, economy and society

¹ English original version: "Sustainable development is a development that meets the needs of the present without.

The **B&P report for MONITRAF** not only describe just the effects of transit traffic, but to also use this pre-study to develop a **possible system of objectives/aims and indicators** concerning the areas *Traffic – Economy/Spatial Planning and Traffic – Society*. This system can then be used by the MONITRAF project partners for the above mentioned procedure steps 1 to 5 (Work package 5 to 9). The use of such a system of objectives and indicators by the MONITRAF project partners at this present stage in the project phase guarantees that following points are observed in the subsequent work packages. The use of such a system of objectives and indicators by the MONITRAF project partners at this present stage in the project phase guarantees that following points are observed in the subsequent work packages.

- By **defining indicators** only the needed and desired data are collected in the following procedures
- The **data are based on the same sources** and therefore the **same survey methods**, which enables a comparison of the developments in the different regions
- Furthermore **objectives** for the aspired developments **of the indicators** can be formulated
- **Measures to reach the objectives** (aspired developments of the indicators) can be formulated by the MONITRAF project partners.

In the Work shop 7-8.03.06 in Bolzano/Bozen the MONITRAF Partner decide to start also with WP10 “Measures” and therefore the other WPs are going on parallel. The B&P report can give a guideline for the MONITRAF partner. The approach of the report to start by the given objectives/measures and develop the indicator system (see fig. 4.2-1 of the report). MONITRAF has to take the strategy to develop first the indicator system to give measures for a sustainable road traffic management in the Alpine Space. So the conclusions in the summary are top down as in the report.

B&P Suggestions of an objectives-system

1) It is expected for every planning process – likewise for MONITRAF - that statements are then made about what should be achieved by the realization of these planned measures. **What should be achieved** is generally referred to as „**objectives, central ideas**“ (in its total and assigned structure) also named “**objectives system**”.

The derivation of a target-system is basically a normative, therefore political process. There is no scientific justification for inclusion of objectives in to an objectives-system.

It is important to be aware that objectives are mostly connected to interests, so that a target-system not to become bound by one-sided interests, it is advisable to include controversial parties.

2) The **behaviour-determining parameters** of the traffic „customers“ are in change. These parameters are summarized as **generalised costs**, which contain the perceived transport expenses (Out-Of-Pocket-costs) and the journey time (monetary); (see page 27 B&P report).

Whether traffic-related effects and potentials lastly lead to economic and social effects, depends moreover on the behaviour of actors

Relevant **spatial effects arise from strategic changes of behaviour**. These changes of behaviour depend on which potentials the individual regions possess and how the actors behave. Due to the improved accessibility the following strategic changes of behaviour can be distinguished:

- „Reorganisation-effects“: Changed accessibilities can entail adaptations in organisation and logistics:
- Market expansion: Because of the lowered transport costs and the improved accessibility the buying- and selling markets can be expanded.
- „Effects at the product market“: Regarding the selling markets the own products can now be offered cheaper on new markets.
- „Effects at factor markets (work, capital, land)“: Goods can possibly also be procured from new markets at cheaper costs or in better quality.
- „Dynamic sectoral interactions“: Changes in one sector can also lead to changes in another sector via the interchangeable relations. Certain learning effects are passed on if necessary (regional cluster).
 - In passenger traffic (non-commercial traffic):

Observations: For the observed MONITRAF-regions, therefore above all the importance of agriculture (export), high-quality services (banks) and tourism should be examined, as these sectors show a high traffic-affinity. Furthermore commuter linkages must be investigated, in order to examine the closeness to job market centres (question of centralism of the regions).

P&P Suggestions for indicator-systems

Indicator systems can in general be used for

- Effect analyses (*Ex-ante-Analyses, comparisons of alternatives*) or
- Effect checks (*Ex-post-Analyses*) of intentions,
- Descriptions of changes of conditions in time sequences (*Monitoring*) or

Comparisons of conditions in similar (political) systems such as states, regions or towns/communities (*Benchmarking*)

Basics on the derivation of indicator-systems (possible identification sheet)

Because indicators concretise objectives, the connection and demarcation of objectives must be explained. The definition exemplified in **Figure 2.2-1 in the Basler & Partner** report:

- the categories environment, society, economy
- top objectives
- subordinated objectives
- indicators and measurement values

Proposed indicators for MONITRAF

In the course of the MONITRAF project the affected alpine regions made it their **objective, to set up a common monitoring of the effects of road traffic in the alpine space** and to **suggest common measures** in order to reduce these negative effects. For this reason we restricted ourselves to the following purposes (see red marking in **Figure 3.1-1**):

- Monitoring in MONITRAF-Regions
- Effect analyses of measures in MONITRAF- und other Regions

Key indicators and specific regional indicators

The indicators should be the same for all the MONITRAF regions, so that these regions can be compared amongst each other (statistical data of **NUTS2- and NUTS3-level**). The **key indicators** are deduced from the top-objectives of the sustainability and define **a indicator hierarchy**.

The indicators must be chosen according to the following criteria:

- As significant as possible for the according top- and subordinate objectives
- easily comprehensible and easily communicable
- influenceable if possible by the relevant administration level

For several years the effects of cross-alpine road traffic are being analysed from various viewpoints in the important alpine valleys. Measures to reduce environmental pollution have however until now only been discussed and put into action very selectively and on a regional level.

The spatial demarcation was hereby defined by the regions of the project partners (Monitraf-regions). The relevant alpine space reaches from Salzburg (Tauern) in western Austria over the Swiss and French Alps as far as the Ligurian coast and the Côte d'Azur respectively

The **Köll report** of Work package 5 should examine **which goods are currently being transported on the road with which vehicles and in which amounts**, and **where the most important traffic sources and destinations are located**. Hence market segments can be compiled, which are especially strongly represented and where applied measures would therefore have a great potential of effect.

The data which provided the basis for these analyses comes from surveys of cross-alpine road freight traffic in the considered corridors from the years 1994, 1999 and 2004. The system limit is hereby defined chronologically with a time period of 10 years as of 1994. So **the aim of the Köll report was not give a traffic prognoses** for the next 10 (20, 30) years but to define the status quo of cross-alpine road traffic in the Alpine Space. The data comprises for instance source and destination of the journey, goods category, transported load, type of vehicle and axle configuration. The changes on the corridors over the years are especially interesting.

As basic data the exchange data set of CAFT (Cross Alpine FreightTransport Survey) from Austria, Switzerland and France from the years 1994 and 1999 were available. In November 2005 data from the 2004 survey are available only for Austria and Switzerland.

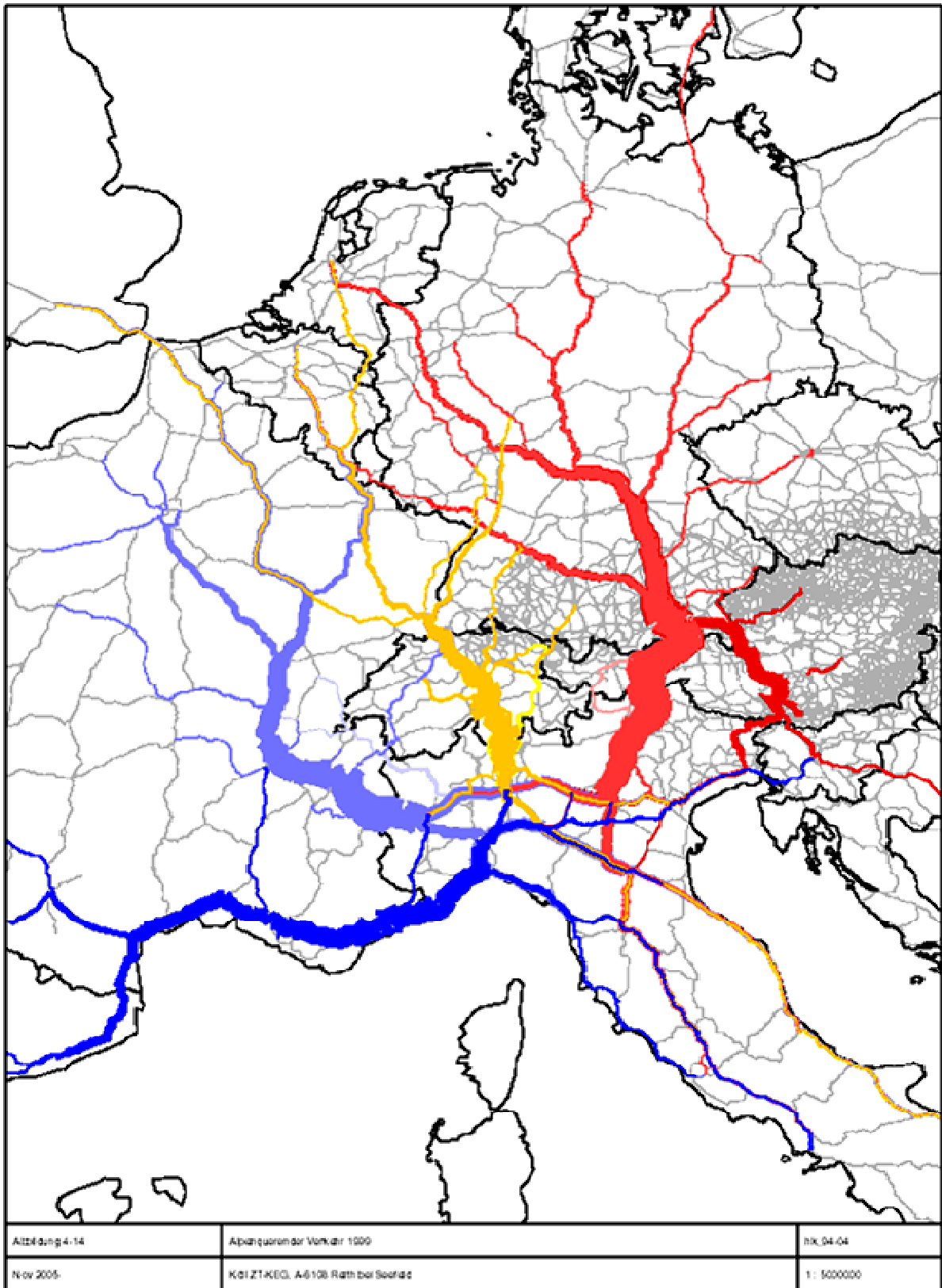
These must then be compared to the most important general conditions (regarding traffic-politics): the development of toll and restrictions regarding road freight traffic, but also the economic development of the alpine countries in the past ten years must therefore be investigated.

In the years 1994, 1999 and 2004 extensive interviews with lorry-drivers engaged in freight road-transport were carried out at all important alpine crossings in Austria, Switzerland and France. During this time period the transport policies and the general economical conditions have also significantly changed. Important milestones in **Austria** included the entry of Austria to the EU, the discontinuation of the Ökopoint-system at the end of 2003 and the introduction of Road pricing for lorries on motorways on the 1st of January 2004. In **Switzerland** the year 2001, which saw the implementation of the "Landverkehrsabkommen" (country-traffic-regulation), the "leistungsabhängige Schwerverkehrsabgabe" LSWA (output-related freight traffic contribution) and the barricade and proportioning system at the Gotthard, is of special importance. In **France**, due to the fire disaster in the Mt. Blanc tunnel in 1999, various measurements such as spacing-regulations, portioning and alternating one-way system for lorries were implemented in the Fréjus and Mt. Blanc tunnel. In **Germany** the Euro-vignette was discontinued on the 31st of August 2003. The distance related toll on motorways was introduced on the 1st of January 2005. In the survey year 2004 the use of German motorways for lorries was therefore free of charge.

Regarding economical surroundings, the different development of countries within the EU15 - Germany, France, Italy and Austria - and of the new EU countries - Poland, Slovakia, Hungary and Slovenia - is remarkable. In the observed ten-year-period the gross domestic product (GDP) grew on an EU15-average by about 20%, while the latter mentioned countries showed an increase of their GDP by around 50%. However the (monetarily valued) goods import and export grew significantly faster: The countries of the EU15 could partly double this value, the new EU members, starting however at a considerably lower level, exhibited growth rates of up to 600%.

The development of freight transport in the last ten years has to be seen against this background. The spatial demarcation was hereby defined by the regions of the project partners (Monitraf-regions). The relevant alpine space reaches from Salzburg (Tauern) in western Austria over the Swiss and French Alps as far as the Ligurian coast and the Côte d'Azur respectively. **Because the French data from the year 2004 was not yet available the main focus of this study lies therefore on the Austrian and Swiss alpine crossings, but the mentioned data must be intergraded.**

This also applies to the topic of **detours in road freight traffic**. In the course of the MONITRAF project a differentiated analysis of the data from the year 2004 should contribute to more clarity on this subject.



Development of the road freight traffic

In total the amount of cross-alpine freight traffic on rail and road in Austria and Switzerland increased between 1994 and 2004 from 60,7 mill t. to 98,9 mill. t. (+62,9%). The tons transported on the road have approximately doubled. Aside from this the unaccompanied combined traffic grew the most. During the last 5 years in Switzerland the unaccompanied combined traffic clearly overtook the rail freight transport ("waggonload

traffic”) and amounts to now 12,22 million tons per year. The amount of goods transported per year by unaccompanied combined traffic is similar to the amount transported by freight traffic on the road (12,50 million tons per year).

Concerning the relation between the two modes of transport - road and rail - a clear **dominance can be seen for road traffic in Austria and France: 71,3% in Austria and 79,8% in France in the year 2004.** The tendency towards the road could apparently be stopped in Austria between 1999 and 2004. **In Switzerland on the other hand, the road market gained shares, albeit starting from a very low level of 25,7% up to 35,3% in the year 2004.**

The highest tonnage, namely 31,14 million tons (2004) was transported over the Brenner. At the Brenner-in contrast to the Gotthard- the increase of road freight traffic slowed down in the second 5-year time period. **Although if the amount of lorries is compared an increase of +29% on the Brenner and a decrease of -12% on the Gotthard can be seen.** The reason for this can be found in the average tonnage, which has increased from 8,2 tons/loaded lorry to 11,7 tons/loaded lorry following the raise of the maximum weight limit in Switzerland from 28 tons to 34 tons. Furthermore a decrease of deadheads (“empty runs”) from 21% in the year 1999 to 13% in the year 2004 was registered.

Concerning the types of traffic the inland traffic only plays a larger role at Tauern, Gotthard and San Bernadino. At all the other alpine crossings the share of inland traffic is very low due to the location of the measuring points close to the borders. The tendency is generally decreasing, for instance on the Tauern from 39% of all journeys in 1994 to 19% in 2004. The transit rate is the highest on the Brenner with 86%, followed by 59% at the Gotthard, 58% at the Reschen and 54% at the Tauern pass.

In general the extension of local transport infrastructure which goes parallel or semi-parallel to the main transit routes might be change the logic of the freight transportation to choose other routes incrementing the local traffic (for example Laives near Bolzano). Here we find a approach to the Perlik report shifting the local traffic to the main transit routes to give pressure for new solutions.

In Austria the number of transit journeys climbed to a total of 2,308 mill. lorries in the year 2004, this constitutes a plus of 109,9% compared to the year 1994. In Switzerland the number of transit journeys increased only by half as much (+50,3%) to a total of around 704.000 lorries in the year 2004.

Examining the **most important source-destination-relation** in the year 2004 across the Austrian and Swiss alps, as is to be expected the **Germany – Italy** relation, with 1,65 mill. journeys takes first place ahead of Netherlands – Italy with about 226.00 journeys (without source-, destination and inland relations of Austria and Switzerland). In the year 1999 the relation **France – Italy** with 1,7 mill. journeys was still ahead of Germany – Italy. Furthermore it can be seen that from 1,5 mill. journeys between Germany and Italy only 3% led across the French alps. The French transit relation Spain – Italy takes third place with 430.000 lorries in the year 1999. **The strongest relations on NUTS1-level run between Southern Germany and Northern Italy.** Solely between Bayern (Bavaria) or Baden-Württemberg respectively and Italy Northeast or Italy Northwest respectively 715.000 journeys across the alps were carried out in 2004, **this constitutes already 43% of all the Italy - Germany journeys.** This relation is followed by the relations Austria West– Italy Northeast and inner-Austrian journeys.

Concerning the routes, over 92% of all journeys on each of the 10 most important transit relations lead over the Tauern, the Brenner and the Gotthard. On the Brenner practically continuous increases can be observed, where as at Gotthard a reduction can be seen.

Everywhere where the decreases at Gotthard were not fully compensated by Brenner, increases can be seen at the Tauern (Fig. 4-8). This applies especially for the relation Germany – Italy, where the Tauern share increased from 3,6% to 8,9% or also for Belgium – Italy with an increase from 1,4% to 7,2%. In 2004 traffic between Germany, Czech Republic, Poland, Denmark on one hand and Italy on the other hand exhibits high Brenner shares, namely 77% to 94% of all journeys. Virtually 100% of all journeys between Germany and Slovenia lead over the Tauern. In 2004 the Gotthard shows the highest share of transit traffic from the relation France – Italy (77%) and Belgium – Italy (61%).

The development of the route split on NUTS1-level is especially recognizable for journeys from Germany to Northwest Italy and back. The catchment area of the Brenner is clearly expanding towards North- and West Germany. The increase mainly took place in the time period between 1994 and 1999, even though the LSV was introduced in Switzerland in the year 2004. In addition in the year 2004 in the course of the “Landesverkehrsabkommen” 400.000 lorries with 40 tons overall weight were allowed to pass through Switzerland. Apparently almost no margin was left by Austrians entry to the EU and the Schengen-agreement further through the drop out of the border controls in 1999. Whereas the more southern and eastern provinces show an increase at the Brenner divvies between 1999 and 2004 (partially limited). Apparently the margin was already fully exhausted by 1999 following the Austrian EU- and Schengen membership and the subsequent stopping of border controls. On the other hand a further (if partly slowed down) increase of the Brenner share could be seen for the southern and eastern German states.

Of a total of 45,3 million tons, which were transported over the west Austrian alpine crossings the category “Other Products” makes up the main share followed by 9,0 million tons „Food Products and Animal Feed“ and 7,4 million tons “Agricultural- and Forestry-Products”. In fourth place are the „Iron, Steel and Non-Iron Metals“ with 4,2 million tons. This category grew by +910% in the last 10 years and shows the biggest increases. Heavy increases can also be observed for the category “Agricultural- and Forestry-Products” (+238%) and “Chemical Products” (+208%). All three categories grew especially strongly in the first 5-year period. Altogether the transported tonnage over the Austrian alpine crossings has doubled in the last 10 years.

In Switzerland similar tendencies are seen as in Austria: The highest relative increases can be found in the “strong” goods categories like „Iron, Steel and Non-Iron Metals“ and “Chemical Products”. Of the total 12,5 million transported tons of goods in the year 2004 approximately 6,5 million tons belong to the category “Other Products”, 1,6 million tons were classified as „Food Products and Animal Feed“ and 1,2 million tons as “Chemical Products”.

The effects of road traffic on the environment regarding air and noise pollution in the transit valleys were analysed and compared for the year 2004 **by the Thudium report**. It was been made a distinction between the central parts of the valley and the upper parts close to the alpine crossing (table T1) because aside from the cross-alpine traffic the inland traffic is of varying importance. Only those components could be analysed for which sufficient data could be obtained for this year:

Region	Central Valley	Upper Part	Temperature profile
Piemonte			Bardonecchia
Valle d'Aosta	Châtillon	Courmayeur (Capoluogo)	Aosta
Zentralschweiz		Erstfeld	Erstfeld
Ticino	Camignolo	Moleno	Moleno
Tirol	Vomp	Mutters	Schwaz
Südtirol	Schrambach		Bozen

Table T1

Volume of traffic

The volume of traffic was measured in the six MONITRAF-regions and divided into 2-7 different categories. A comparable description of the volume of traffic which applies to all regions could only be made for two categories:

1. Light vehicles ('Cars'), primarily private cars and motorbikes; private cars dominate this category in all regions.
2. Heavy vehicles, primarily buses and vehicles transporting heavy goods, the latter comprising delivery vans (DV), lorries (LO), heavy lorries (HLO) and articulated lorries (ALO). The amount of heavy lorries and articulated lorries amongst all heavy vehicles varies greatly for each metering point; the category 'Heavy vehicles' may therefore by no means be equated with heavy lorries/articulated lorries.

It should be mentioned that while at swiss metering points any type of lorry is recorded as a heavy vehicle, at austrian metering-points only two thirds of all lorries are in this category, and at Italian metering points this ratio is unknown. The valleys of Valle d'Aosta and Valle di Susa (Piemonte) show consistently lower volumes of traffic.

The results are shown in table T2, where table T3 shows the proportion of heavy duty vehicles

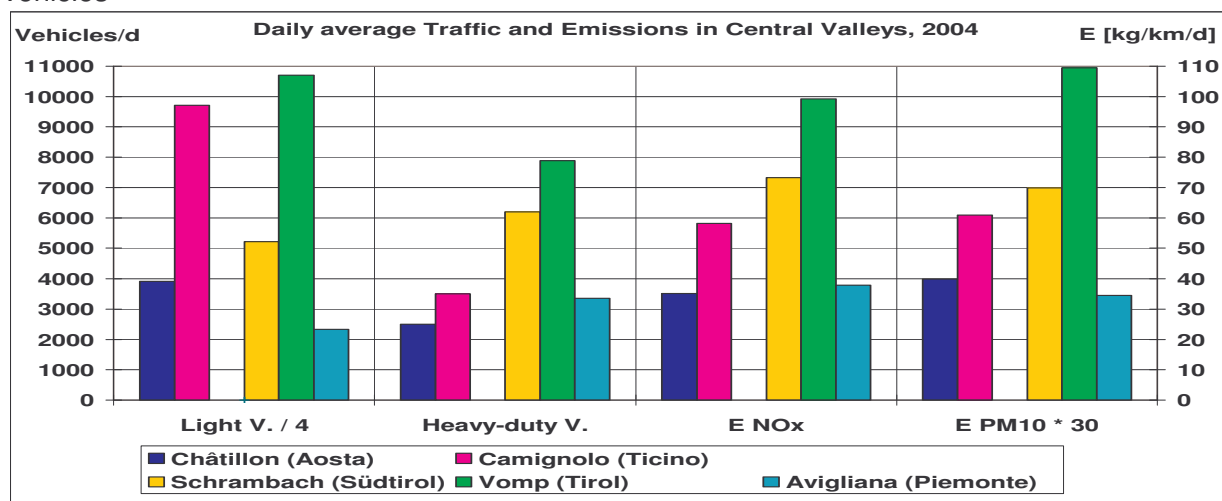


Table T2

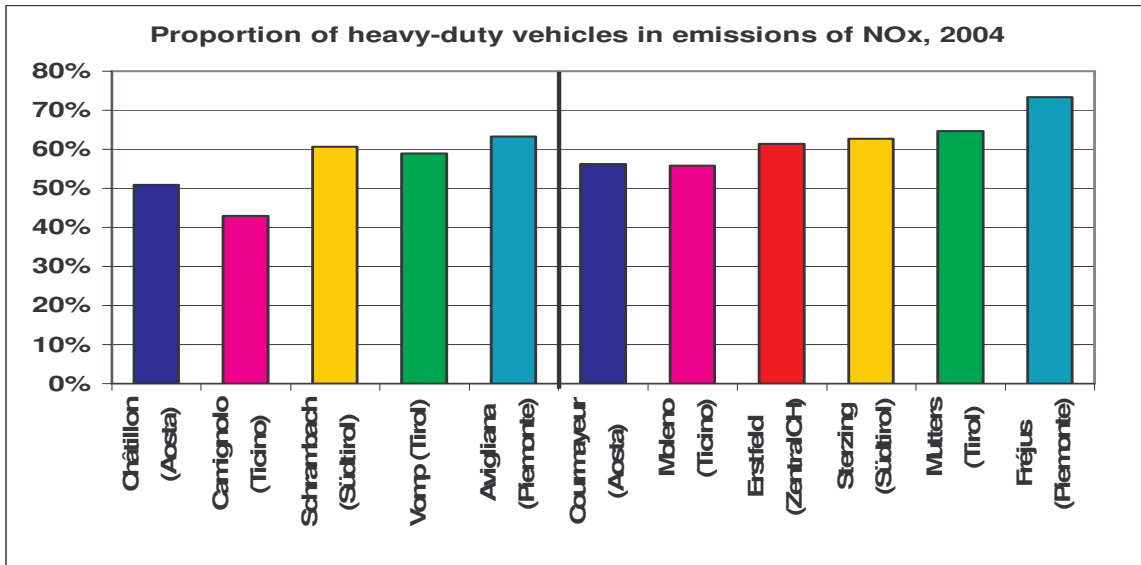
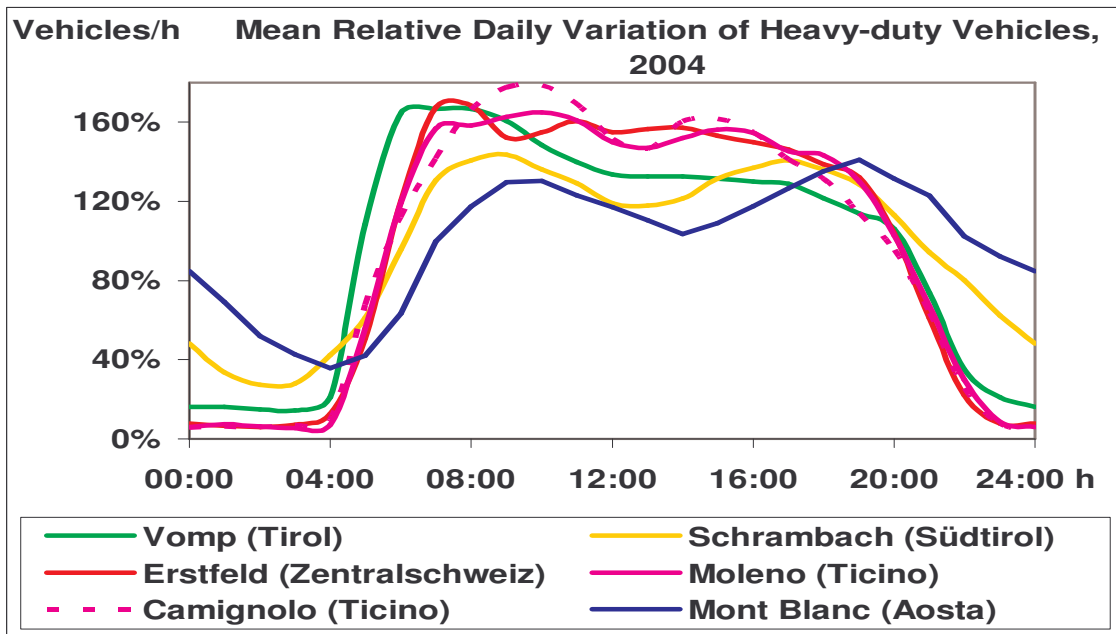


Table T3



The effects of the nocturnal traffic ban for heavy goods transport are clearly visible (Figure T4): At the metering points Erstfeld, Moleno and Camignolo a nocturnal traffic ban prevails, at Montblanc, where there is no such ban, the number of heavy vehicles circulating by night is clearly higher. Although on the Südtirol side of the Brenner pass there is no nocturnal traffic ban, a traffic ban is in place on the Nordtirol side of the pass. This leads to a nocturnal reduction at Schrambach although the reduction is not as pronounced as in the Swiss regions. Vomp in Tirol shows a nocturnal reduction just like the Swiss regions, but a rapid increase in the early morning, due to the geographically only relatively small area which is covered by the nocturnal traffic ban.

Pollution

The basic data for the pollution with nitrogen oxides (total nitrogen oxides NOx and nitrogen dioxide NO2) and fine particles (PM10: particles with an equivalent diameter up to 10µm) are comparable for all the regions. These components are described in the following chapter. Hereby only the measuring points which lie close to the road were taken into account; they all are at a similar distance to the road (5-6m) and are therefore ideal for comparisons. The

background measuring points are described in the last sub-chapter. The limit values for NO₂ and PM₁₀ differ for the various regions according to the respective national laws:

Country	Annual average NO ₂ [$\mu\text{g}/\text{m}^3$]	Annual average PM ₁₀ [$\mu\text{g}/\text{m}^3$]	Number of days where PM ₁₀ mean daily value > 50 $\mu\text{g}/\text{m}^3$
Austria	45	40	35
Italy	52	40	35
Switzerland	30	20	1

There are additional limit values for NO₂. In Austria and Italy the limit values are being lowered continuously until 2010.

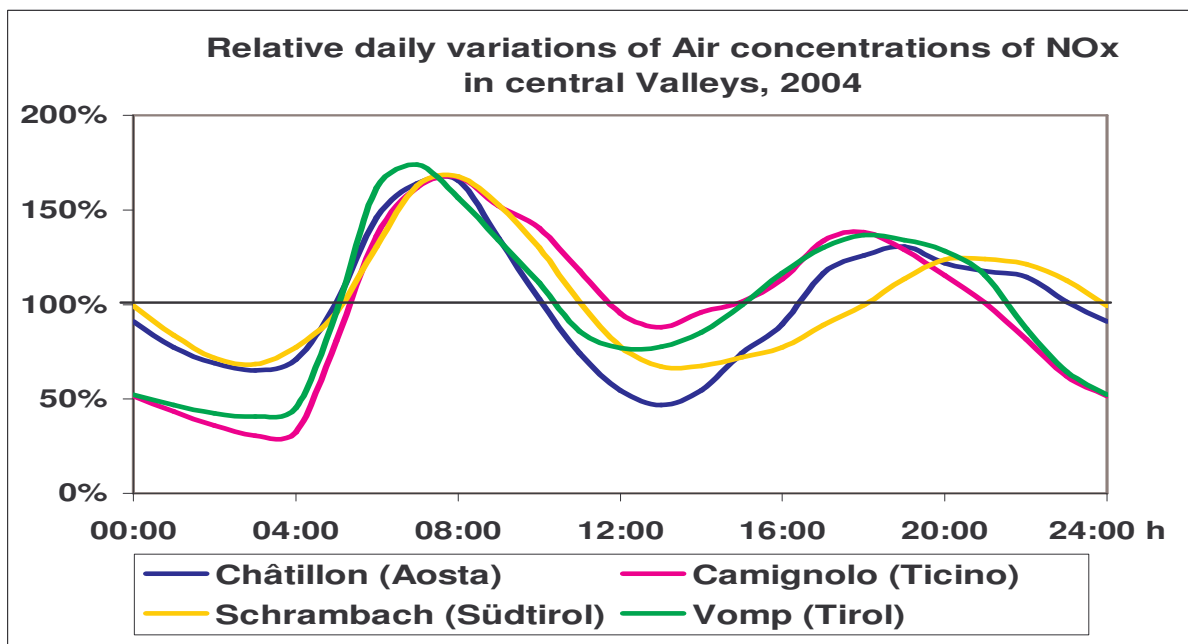


Figure T5

In all cases there are two maxima, at 8 am and between 5 and 8 pm. In all cases the morning peak is more pronounced than the evening peak. The effect of the nocturnal traffic ban is superimposed by the different valley-specific diffusion-conditions. Nevertheless the nocturnal traffic ban shifts part of the air pollution from night- to daytime.

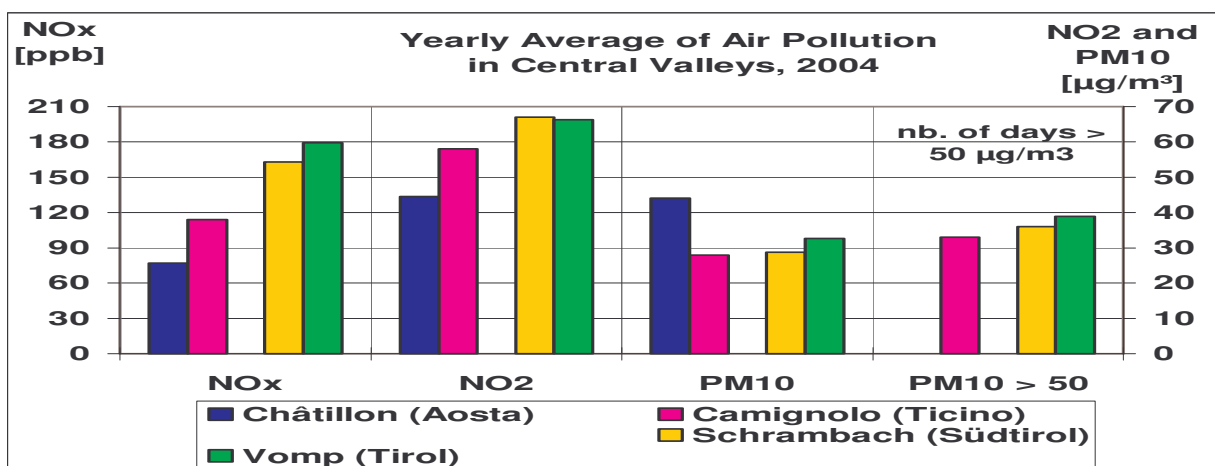


Table T6 Concentration nitrogen oxides and particles (PM₁₀), Monthly annual average

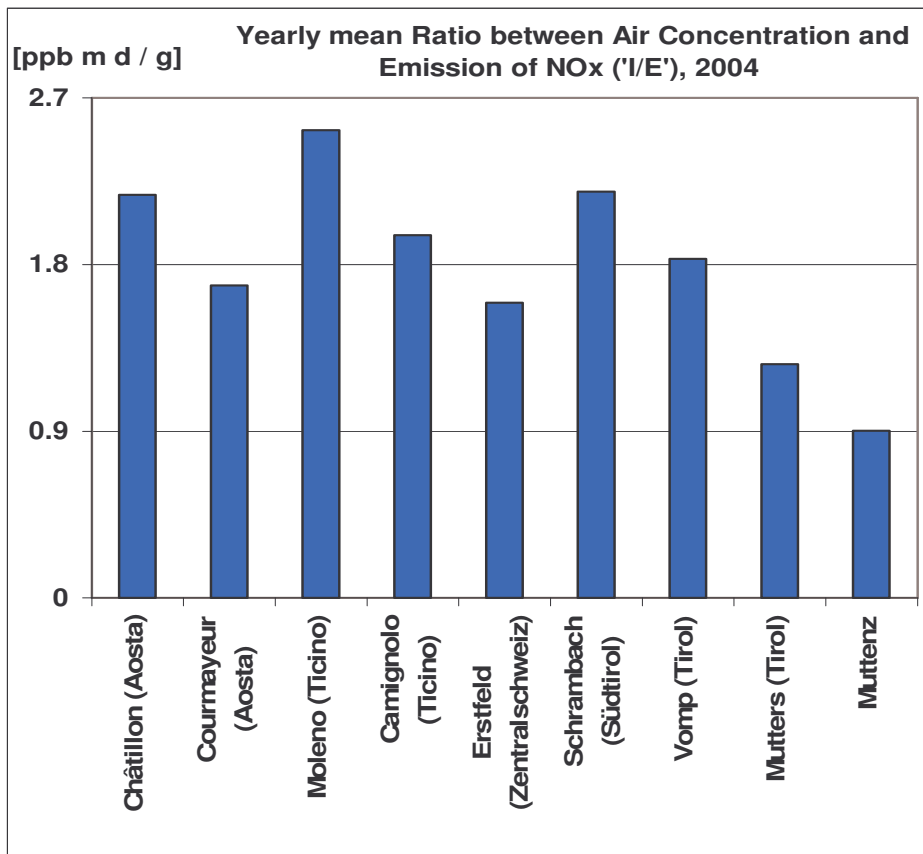


Table T8

The relation between air pollution levels and the emission of a specific responsible source (here road traffic) is an empirical measure for the existing diffusion conditions, which are quite different in the valleys from those on the flat country. The higher the ratio between immission / emission is the worse are the diffusion conditions. In the alpine valleys of the MONITRAF regions one emission unit creates a 2-3 fold higher air pollution than in the flatter country.

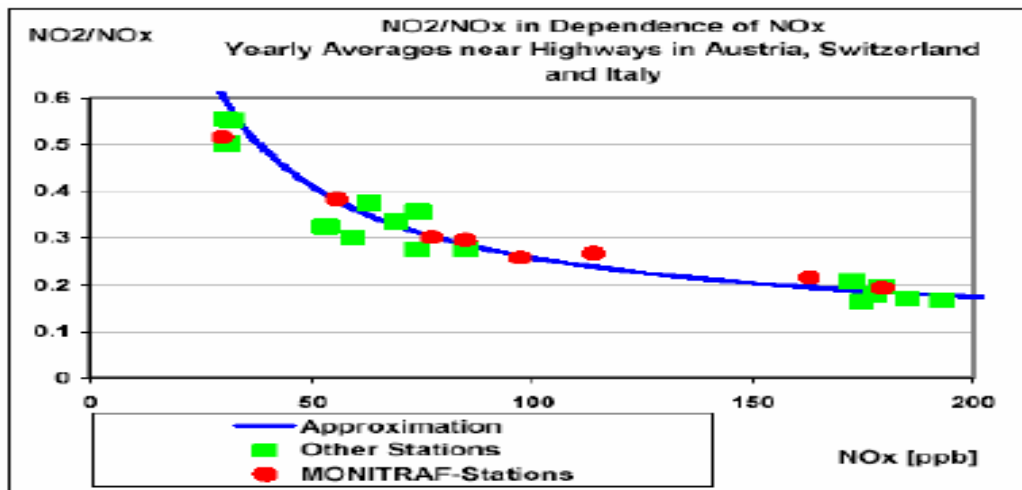


Figure T9

The figure depicts T9 an approximation curve which was generated from earlier measurements obtained in Switzerland, Italy and Austria. The current measurements of 2004 lie astoundingly well on this curve. This shows that, in general, NO₂-formation processes are the same everywhere and it is indirectly also a quality affirmation. A general approximation curve may not be used however for models where daily- or seasonal irregular changes of emissions should be simulated

Climatic aspects

The fundamental climatic elements which determine the diffusion of noxious emissions are the layers of different temperatures and the wind conditions. These two elements are described in the following

In general there are more inversions in winter than in summer but apart from that, the regional differences are considerable.

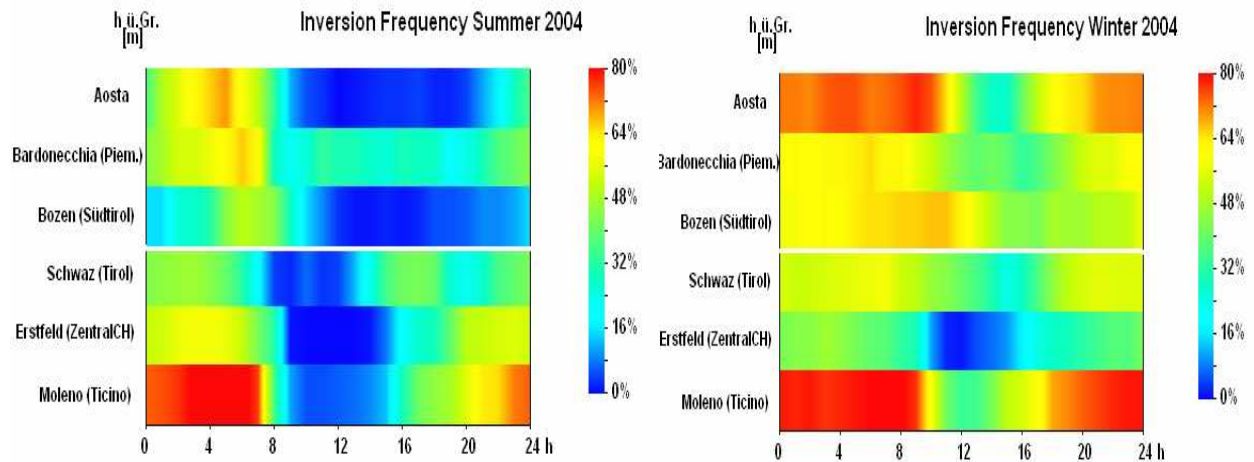


Figure T10 and T11: Inversion Frequency Summer and Winter

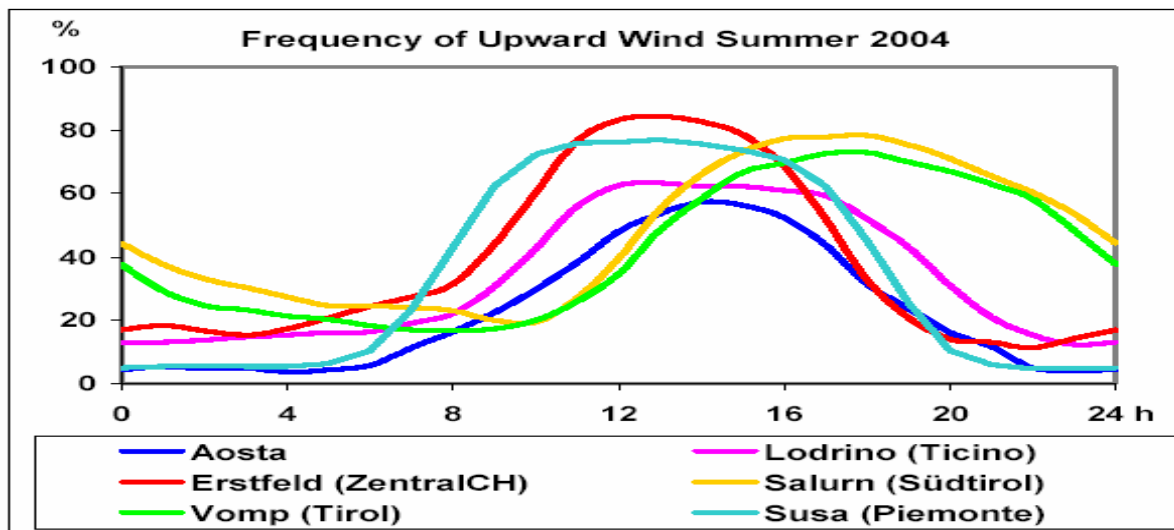


Figure T12

Daily frequencies of upward wind (sector of 60°) reach 60-80% everywhere, even though the valleys are completely differently aligned. The local element therefore plays a big role concerning the wind regime. It can currently not be explained why the frequency maximum in the Etschtal (Südtirol) and the Inntal (Vomp) is reached a couple of hours later than in the other valleys.

Noise

Only the two Swiss regions provided a total of three measuring points located close to the highways where continuous measurements were carried out. In the Valle d'Aosta 3-6 measuring campaigns each lasting a week were carried out every year at three measuring points close to the highway. These noise measurements can be compared amongst each other.

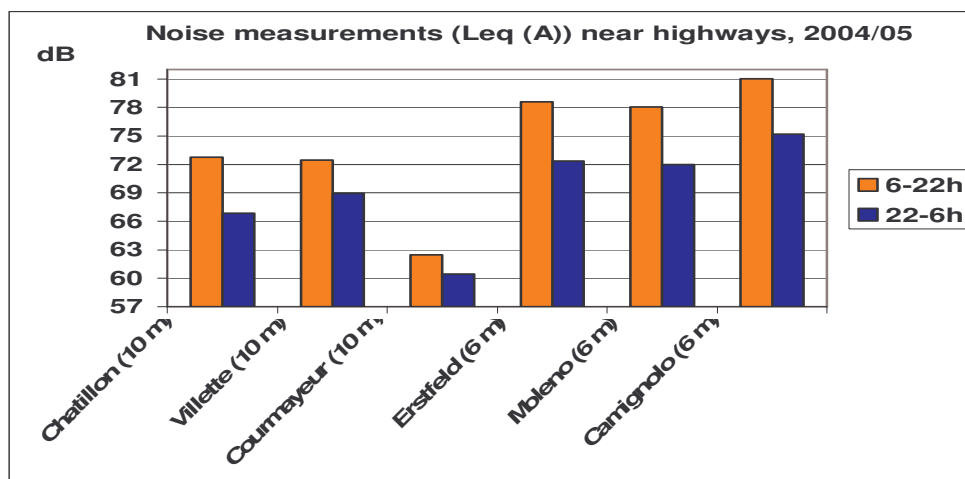


Table T12

From the Valle di Susa there exist a couple of one-weekly measurements done at different times and different places, with different volumes of traffic and at different distances to the highway. These are documented merely as information, but can not be compared with the other data. From Tirol there existed only few measurements, from Südtirol none.

Results:

Following statements can be made for all examined valleys:

- In the alpine valley one emission unit generates a 2-3 fold higher concentration of pollutants than in the flat country.
- The reasons for this are the topography (hindrance of lateral diffusion of emissions and channeling of wind) and the climate (frequent development of inversions); and this although the valleys are topographically very different (different alignment of valley axes, different topographical structures).
- Road traffic dominates as cause for the pollution with nitrogen oxides, for PM 10 this is not so clear.
- Local wind conditions comprising thermic upward winds during the day (especially in summer) and gravity-generated downward winds in winter, prevail.
- The frequency of inversions shows an annual average of 30-40%, in one case even 50% and is therefore significant.

Furthermore following central statements can be made:

- The share of inland traffic in the total traffic volume varies greatly within the valleys and also amongst the valleys.
- At a great number of measuring points the pollution limit values were exceeded.
- The seasonal and daily distributions of inversion frequencies varied greatly amongst the valleys.
- The situation of the valleys also shows a negative impact regarding noise pollution: The “amphitheatre effect” carries sound to locations higher up, which at the same distance from the noise source in flat country would be much less affected; also in inversion layers the resulting sound absorption is less than without inversion.

As a whole all the examined transit valleys have turned out to be sensitive regions; yet in a scientific study each region should be seen individually.

Air pollution and noise have adverse effects on human health and traffic is one of the main contributors. **The Huss-Rössli (H-R) report figure out one of the MONITRAF objectives to give a quantitative evaluation of the impact on human health due to air pollution and noise in the area of the Alpine Space** and to discuss methodological problems in dealing with a **health impact assessment (HIA)** on a detailed spatial scale for a defined pollution source.

HIA have been performed for assessing the impact of general air pollution (PM10).

PM10 is a good surrogate pollutant for general air pollution because it has a spatially more homogeneous distribution, but is not very specific with regard to transport-related air pollution. Traffic (especially transit transport) is rather on a detailed spatial scale and source specific. Idem PM2,5 is considered not to be a good surrogate to assess health impact for the same reasons. So for evaluating the impact on human health in the Alpine transit corridors, there are two main problems: a **suitable surrogate** (direct and indirect) must be chosen that adequately represents transit transport related air pollution and considers the **spatial distribution** on a large (i.e. detailed) scale.

1) Air quality and pollution

A first suggestion of the H-R report is to consider NO₂/NO_x as a possible and reasonable marker of exposure to traffic related emissions (see also WHO report 2003 and 2005, Lewnè et al 2004), secondary PAH can be also a specific indicator (see page 7). CO, BC (Black carbon), PNC (particle number concentration) were highly correlated in a study estimating the spatial correlation between these pollutants near a high way (Zhu et al. 2002)

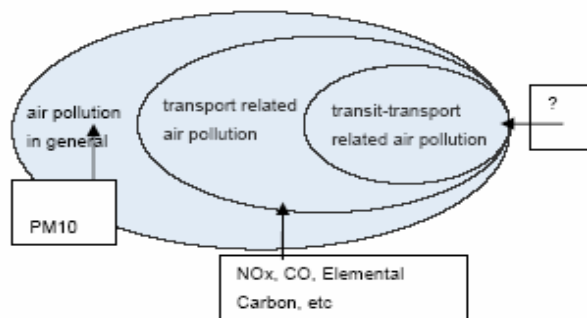


Figure 4: Air pollution from different sources and examples for used surrogates for exposure

The considered PH-studies (see WHO Europe 2005) show the complexity of approach to decide which HIA to consider for the MONITRAF regions:

- Transport related surrogates – influence of mortality
- Long term change (reduction) in air pollution levels
- High versus low exposure areas
- Multi pollutants model
- Distinguishing between large scale and small scale effects
- Traffic counts

The exposure - response relationship for traffic related pollutants was summarised in the WHO Europe 2005 report where 2 most important points for the RP are:

Non allergic respiratory morbidity

Cardio vascular morbidity

Birth outcomes and mortality data are difficult to be correlated by transit traffic or cancer data are difficult to achieve. The available publication are represented in Table 1 (page 14)

Noise

The selection of the adverse effects of noise must be made from the WHO report 1999 where the traffic related surrogate can be:

- **Sleep disorder (WHO Europe 2003)**
- **Cardiovascular diseases (Babisch 2006)**
- **Annoyance**

The other negative health effects of noise of the WHO report 1999 must be considered in the next steps of MONITRAF.

So the **next steps for MONITRAF** should be:

- Evaluation of the noise cadastral data
- Evaluation of conversion factors of NO₂ to BS/EC/soot
- Assessment of population exposure of NO₂/BS
- Assessment of population exposure of noise/ noise cadastral data
- Meta analyses of dose-response-effects of NO₂ and BS
- Meta analyses of dose-response-effects of noise

In order to quantify health impact of air pollution and noise on health eight steps are necessary:

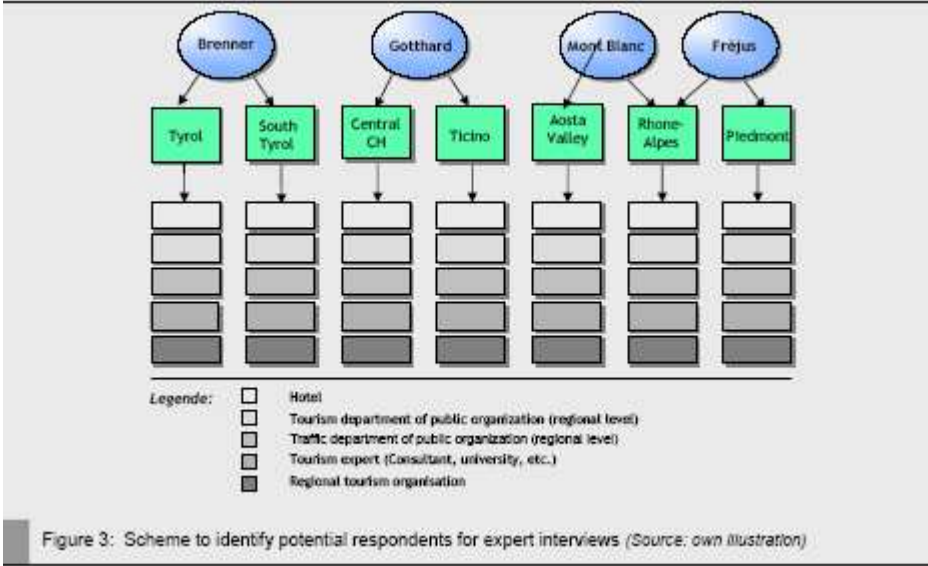
- **Select the primary surrogate (suggestion: NO₂ (and for noise ?))**
- **Evaluate the conversion factors of other pollutants into NO₂**
- **Assess population exposure of NO₂/noise**
- **Select the health outcomes**
- **Perform meta-analysis to assess effect estimate**
- **Assess base prevalence/incidence of health effect**
- **Evaluate reference concentration/value**
- **Quantify health impact**

In general we don't can aspect to start a PH study as a MONITRAF spin off in the first moment, but to start a meta analysis with the data of the selected PH studies and standard health statistic of the MONITRAF regions.

While traffic for a long time had positive effects on Alpine regions, especially from an economic perspective, Alpine transit is recently seen more negatively as traffic increases and pollution or noise become major issues in the regions along transit routes. Besides the negative effects mentioned here, there might also be negative effects of (heavy load) traffic on tourism. Therefore, two fundamental questions were raised: Is there a way to design tourism so that it is reconcilable with traffic and vice versa? This issue was then broken down into more specific research questions which are:

- Is there a relationship between tourism and traffic according to the respondents?
- Are there ways to cope with the problems of (heavy load) traffic in the regions North and South of the Alpine transit routes, and particularly those affected by the Brenner?
- What factors influence tourists' perception of costs and benefits of their vacation?
- Do tourists and local people notice (heavy load) traffic when commuting in and traveling to Alpine destinations? To what extent?
- What are the main effects of traffic on tourism?
- What influences tourists' satisfaction with a destination?

The **Pechlaner study and report** for MONITRAF focuses out the mentioned effects in a first step in a “qualitatively” approach. That means experts in tourism in the MONITRAF regions were interviewed about the interaction between traffic in general (and also heavy duty transport traffic) and the tourism evolution in their region.



In the second step the report describes the quantitative study (with focus on the Brenner axis) based on the results of the qualitative study to confirm the tendencies

The tourism can be seen as a system (P1) and apart from the economic aspect tourism is an important cultural and social factor.

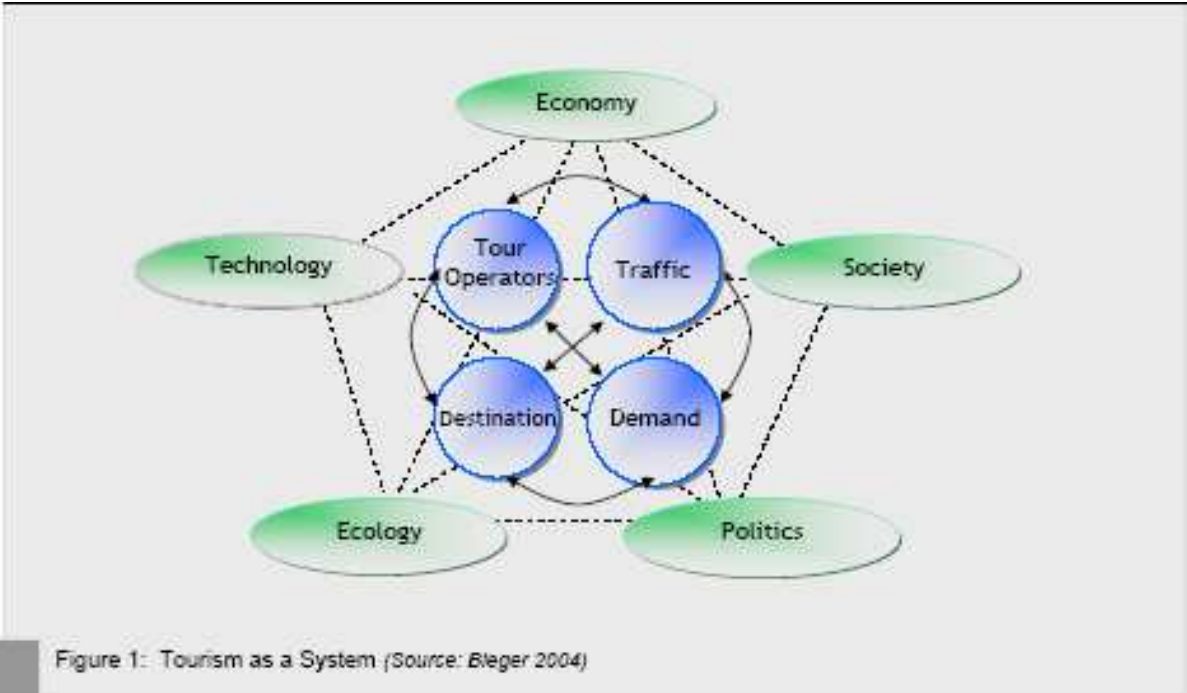


Figure 1: Tourism as a System (Source: Bieger 2004)

Figure P1

For tourism perspective there is a distinction between traffic from or to a destination and traffic within a destination (Bieger 2004)

Tourism causes directly and indirectly a substantial amount of traffic which leads to negative effects. The possibilities to regulate traffic might lead to decrease of demand (like road pricing). The positive aspects of taxes or regulation are the decreasing of the volume of traffic and we see the tense relationship between traffic and tourism.

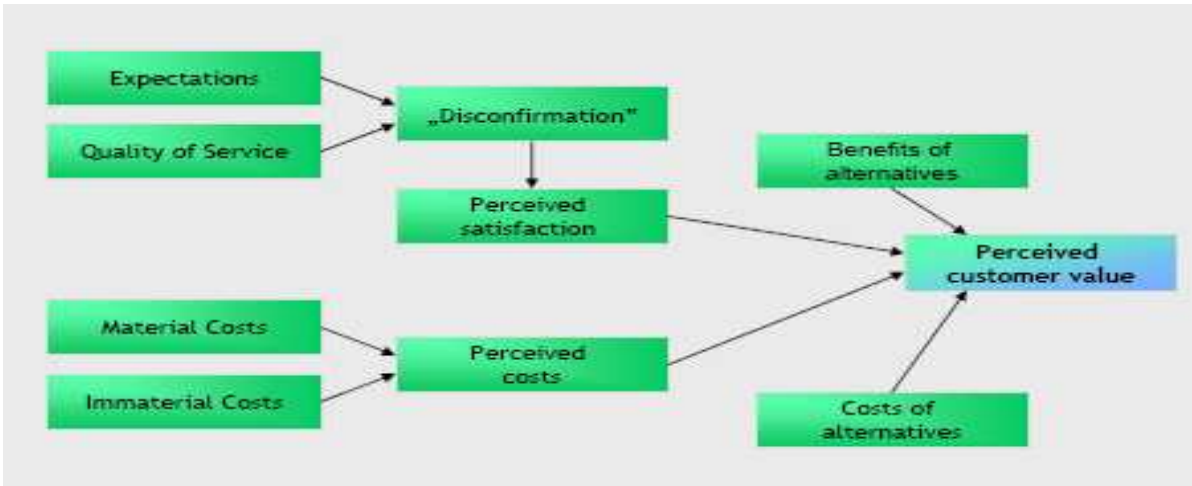
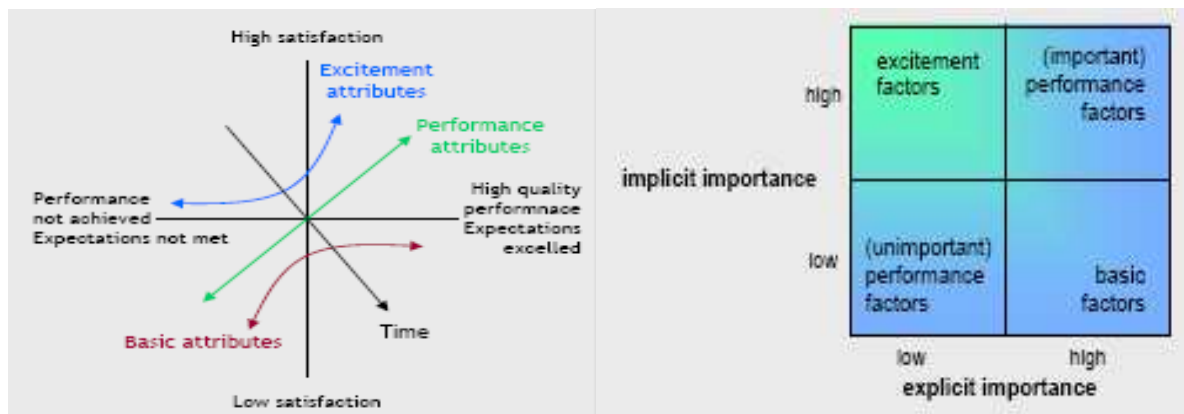


Figure P2: customer satisfaction algorithm (perceived customer value. Matzler 2000)



Figures P3 and P4

The objective of tourism management is the **tourists' satisfaction**. And the satisfaction of costumers evolves over 3 phases:

- Comparing different alternative and choose one out based on the previous experiences
- Observing the quality of he services
- Comparing the perceived quality of the service with the **expectations**

The costumer **satisfaction** has various **attributes** (figure P3) and perceived quality indicated as the indicator for tourists' satisfaction gives the out comes of the effects on tourism. So the aim is to find the perceived costumer value which is determinate by various components such as perceived materials and immaterial benefits and costs.

Conclusions:

The qualitative and quantitative empirical studies that had been conducted in the Alpine regions show that this subject is of great interest to various political and social interest groups.

More specifically, the findings of both studies illustrate that there is **a correlation between tourism and traffic** and that **heavy load traffic has mainly negative effects from a point of view of local people, but traffic is seen as being necessary**.

When it comes to the perception of traffic by tourists, respondents stated that there might be national differences concerning the **tolerance towards traffic**.

As the most important indicators for the negative tourists' satisfaction is

1. the lacking hospitality
2. equal : price/performance ratio and **noise**
3. bad accessibility of destinations

to confirm the previous results we see the the ranking of the benefits:

- 1) hospitality
- 2) quality of the tourist companies
- 3) good air quality
- 4) quietude and peace
- 5) beautiful landscape and nature

Finally, respondents proposed some alternatives for road traffic, such as a more efficient management of transportation, the shift of traffic on the road towards rail transportation as well as a stronger promotion of regional products in the respective Alpine regions to reduce traffic to tourist destinations at least a little bit.

But in the evaluation it can be deduced a resignation about traffic and transport traffic as a negative effect to bear/endure but also the fear about the negative effect of traffic reduction measures on the tourism economy.

External Expert	Aim , goals & outlines	Suggestions, strategies recommendations	Possible data or “indicators”
Helmuth Köll	<p>examine which goods are currently being transported on the road with which vehicles and in which amounts, and where the most important traffic sources and destinations are located</p> <p>“transitshare” between Frejus/Mont Blanc and Gotthard/Brenner</p>	<p>Integration of the French Caft data</p> <p>Better specification of the duty entities as CAFT</p> <p>MONITRAF-Harmonization of the definitions :</p> <p>heavy duty traffic detours in road freight traffic</p> <p>Pay attention on “alternative” surreptitiously routes</p>	<p>Choose indicator of CAFT data define which take (WP6):</p> <p>For freight volumes and types</p> <p>For number of truck</p> <p>For different destinations/ source</p>
Jürg Thudium	<p>Effects of road traffic on the environment regarding air and noise pollution in the MONITRAF regions valleys were analysed and compared for the year 2004</p> <p>Because of the topography and alpine climate one emission unit generates higher concentration of pollutant as in the flat areas (this although the valleys are topographically very different)</p> <p>Road traffic dominates as cause for the pollution with nitrogen oxides, for PM 10 this is not so clear.</p> <p>The share of inland traffic in the total traffic volume varies greatly within the valleys and also amongst the valleys.</p> <p>At a great number of measuring points the pollution limit values were exceeded</p> <p>Noise. The situation of the valleys also shows a negative impact regarding noise pollution: 'amphitheatre effect' Increased spreading of noise in inversion layers Larger difference between low ground level and actual level Worse possibilities of protection (no 'quiet side')</p>	<p>MONITRAF partners have to continue their collaboration</p> <p>Data must be available in digital form and per hour</p> <p>Harmonisation of the traffic data</p> <p>Measurement like EC1999/30/22/04/99 VI §1</p> <p>Quantitative comparative evaluation of the ratio between immission / emission (Tau-value)</p> <p>Quality management of the data</p> <p>Setting up of a technical MONITRAF network</p>	<p>mg/m³ NOx /hour</p> <p>mg/m³ PM10 /hour</p> <p>traffic flux/ hour</p> <p>“Tau”-value</p> <p>if possible number of Particles and COV</p> <p>noise Lequ (at which distance?)</p> <p>vertical distribution of the temperature near the measurement station (MS)</p> <p>wind measurements near the MS</p>
Manfred Perlik	<p>Review of present social, economic and space-relevant processes in Europe regarding their impact on the generation of mobility, traffic and traffic growth</p>	<p>Find the so called “silent knowledge” accumulated in these regions, which is hard to copy at other locations</p> <p>Development of the paradox strategy : reduce traffic by traffic</p> <p>Reduction of system disadvantages on the railway through innovations in rail traffic</p> <p>increase of ecological and social standards in road freight traffic reduce deadheads (empty runs) and LTF-loads in order to lower journey numbers, prohibition of dangerous goods</p> <p>Harmonisation of traffic regulations in all transit countries to the most demanding standard</p> <p>Intensification of immission limit values implementation by means of temporary driving bans</p>	<p>Demographic development (population, age- and education structure, labour-force participation rate)</p> <ul style="list-style-type: none"> • Immigration and migration, commuting • Change of industry sectors, jobs • Land prices and land utilisation • Public institutions (Service Public, rendered services, see BfS-Brochure) • Population activity (behaviour of the actors) according to the indicators for “social” sustainability, the cultural activity, the entrepreneurial innovative

External Expert	Aim , goals & outlines	Suggestions, strategies recommendations	Possible data or “indicators”
<p>Anke Huss Martin Rössli</p>	<p>give a quantitative evaluation of the impact on human health due to air pollution and noise in the area of the Alpine Space</p> <p>Discuss methodological problems in dealing with a health impact assessment (HIA) on a detailed spatial scale for a defined pollution source.</p>	<p>Evaluation of the noise cadastral data</p> <p>Evaluation of conversion factors of NO2 to BS/EC/soot Assessment of population exposure of NO2/BS</p> <p>Assessment of population exposure of noise/ noise cadastral data Meta analyses of dose-response-effects of NO2 and BS Meta analyses of dose-response-effects of noise Evaluate the conversion factors of other pollutants into NO2 Perform meta-analysis to assess effect estimate Assess base prevalence/incidence of health effect Evaluate reference concentration/value Quantify health impact</p>	<p>NO2 exposure / Non allergic respiratory morbidity NO2 exposure / cardio vascular morbidity Noise exposure / annoyance (Noise exposure / cardio vascular morbidity) birth out comes mortality</p>
<p>Basler&Partner</p>	<p>Find the strategies to reduce traffic and specially the alpine crossing traffic have to be harmonized by sustainable development in the Alpine Space.</p> <p>Find key indicators were developed which should be the same for all the MONITRAF regions, so that these regions can be compared amongst each other</p>	<p>Passenger traffic must be insofar considered as eventual measures in freight traffic might also have effects on passenger traffic.</p> <p>WP6: the same data are available for all the regions (e.g. statistical data of NUTS2- and NUTS3-level). The key indicators are deduced from the top-objectives of the sustainability. Propose to WP6: start a questionnaire to the MONITRAF partner which of the proposed data which determine the indicators are available to define: The hierarchy of the indicator system Verify the indicators as adequate. Reduce the number of indicators (key indicators) to propose regional-specific indicators(WP7) Once single measures are selected they can then be reviewed and evaluated by means of the indicators described in this study. (WP 10)</p>	<p>EUROSTAT guideline for regional statistics the following data exist on various differentiation levels. According to EUSTAT the dataset may be incomplete (not all regions or not all time periods). In such a case it must be examined, how far regional statistics can be used. WP6</p> <p>Evaluation of the example Indicator Sheet (WP9)</p> <p>In work package 6 of MONITRAF regional commonalities and differences should be determined</p>
<p>Harald Pechlaner</p>	<p>Qualitative and quantitative research of the relationship between tourism and traffic in the MONITRAF regions</p>	<p>objective of tourism management is the tourists’ satisfaction ranking of the negative tourists’ satisfaction: 1) the lacking hospitality 2) price / performance ratio 2) noise 4) bad accessibility of destinations ranking of the touristic benefits: hospitality quality of the tourist companies good air quality quietude and peace beautiful landscape and nature</p>	<p>Start a quantitative study on the Gotthart, Mont Blanc and Frejus passage</p> <p>Research of other tourism studies for a meta-research</p> <p>Number of over night stays (NUTS3-Level) Development of over night stays (NUTS 3 – Level)</p>

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