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Bundesamt für Raumentwicklung  
Office fédéral du développement territorial  
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Federal Office for Spatial Development

The spatial impact of transport  
infrastructures  
«Learning from the past»

Project summary



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## Background

## Background

Over recent decades, settlements and transport networks have grown enormously and billions have been invested in their expansion.

Planning for major infrastructural projects has always included assessments of the future impact of such investments. These forecasts are known as ex-ante analysis. However, they focus on the analysis of environmental and economical effects, as well as the impact on transport flows. Such assessments have rarely observed the spatial effects of infrastructural planning.

No specific and comparable study results exist at all concerning observations of the actual impact of past investment in the transport infrastructure – known as ex-post analysis.

Only by looking into the actual effects is it possible to understand the relationships between investment in the transport infrastructure and spatial development. This is the only mean of deriving reliable recommendations for future planning and monitoring the success of previous transport infrastructure strategies.

The project «Spatial impact of transport infrastructures», initiated by the ARE in collaboration with the Swiss federal agencies concerned and the Swiss cantons, is intended to close the knowledge gap described above. In the sense of learning lessons from the past, its aim is to draw conclusions about the impact of selected infrastructure projects implemented in the past.

The project therefore concentrates on spatial impact – an area so far given too little attention in transport infrastructure planning processes.

Background



## Objectives

### Objectives

The aim of the project is to show the actual spatial impact of transport infrastructures using a generally applicable approach. This will provide essential feedback and allow reliable hypotheses for the success of current and future transport planning projects at all political levels – from local to national – to be formulated and verified.

As it creates a knowledge base that can be expanded continuously by the incorporation of new case study analysis, the proposed methodology will offer the Federal Government, cantons and municipalities answers to the following policy and planning-related issues.

#### **The interaction between transport infrastructure and spatial planning**

- What spatial impact do particular transport infrastructure programmes have at the local level, along transport corridors and in individual regions?
- What factors and conditions bring about this impact on the spatial structure, and how can the force of these factors be assessed?
- How do the actions of key actors affect the spatial impact of transport infrastructures?
- When do the effects of transport infrastructure projects become evident, in the light of past experience?

#### **More efficient transport planning**

- Are the traffic forecasts – as the main basis of designing and dimensioning transport infrastructure projects – realistic enough? In what way would these assumptions have to be amended or expanded (if at all) to produce a realistic forecast of the impact of programmes?
- What transport infrastructure planning measures will be effective in achieving the objectives set for spatial planning and transport policy?

- How can the efficiency of these measures – i.e. the ratio between cost and effect – be assessed?
- Which actors should be involved in planning, and how can they contribute to the implementation of transport planning objectives?

#### **Optimised spatial planning instruments**

- How can we assess the effectiveness of spatial planning programmes that are implemented in parallel with transport programmes? How can these measures be optimised and steered towards achieving the desired development?
- What indicators are relevant to monitoring transport infrastructure planning and the ongoing controlling of its impact on spatial structure?
- How should such monitoring be carried out in order, for example, to detect (problematic) trends at an early stage – as a sort of «early warning system»?

Objectives

What do we understand by the spatial impact of transport infrastructures?

Transport infrastructures change land use, effect travel behaviour and the distribution of activity locations in the affected area. They therefore influence local, regional and supraregional development.

There is an impact on **local development potential** because building transport infrastructures:

- needs land (urban areas or natural landscape), leads to fragmentation of specific urban and natural areas, causes emissions and harms flora and fauna; this again can impair the development of e.g. residential and recreation zones, as well as urban development;
- on the other hand, transport infrastructures may also provide a stimulus for growth, such as the redevelopment of railway station areas, the expansion of logistics hubs and the linking of service locations and workplaces.

At the **regional level**, there are many potential effects:

- investment in the transport infrastructure often promotes the creation of infrastructure corridors, i.e. the spatial concentration of workplaces;

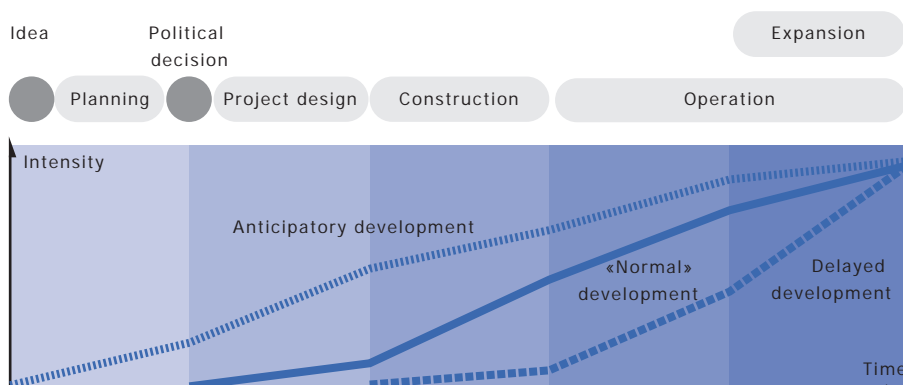
- there may be functional fragmentation or consolidation of land-uses, such as the shift of service locations (e.g. the growth of out-of-town shopping and leisure centres);
- the structure of centres may change – there may be further centralisation or decentralisation of activities;
- regional economic development may be encouraged or may be hindered.

Last but not least, transport infrastructures alter **supraregional** spatial networks: The relation between centres and rural areas, between residential and recreational areas, between the towns themselves and networks with neighbouring countries. Transport infrastructures, thus, do influence travel behaviour.

Each of the effects described here may have its own particular timeframe. Some of them become evident even before the transport infrastructure is built. Others arise when it starts to operate and still more effects appear at later stages. The impact may also differ in intensity over time – increasing, declining or remaining constant. An analysis of the actual effects allows for an understanding of the different types of impact on the two axes of time and intensity of effect. This knowledge can then be used

to improve the (ex-ante) assessments of spatial effects made in transportation and spatial planning.

Effects with differing timeframes





**Approach**

**Approach**

The project as a whole has a medium-term horizon and is broken down into **three sections**:

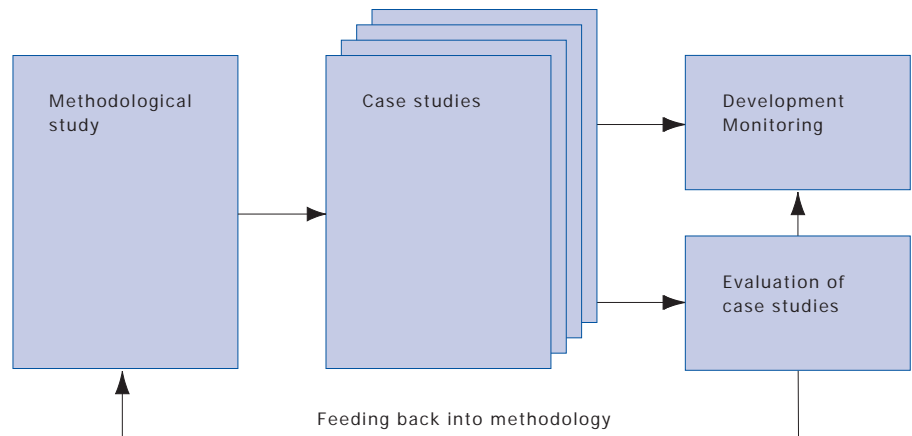
- a. developing a method for analysing the actual impact of transport infrastructures (ex post analysis);
- b. analysing case studies in order to draw conclusions for the future from developments in the past, and to test the methods developed;
- c. developing and implementing a monitoring system, i.e. an approach of a permanent impact assessment of transport infrastructure projects.

**Cooperation of the Federal Government and the cantonal administrations**

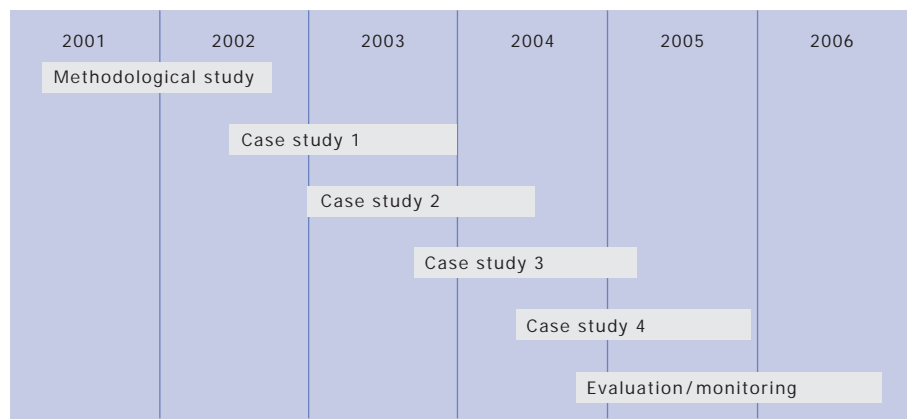
The objectives of this project will be achieved the more effectively the broader the basis of case studies conducted within its framework. Up to 2005, the federal agencies concerned will cooperate with the cantonal administrations to investigate three or four case studies and interpret the findings.

The project as a whole will be overseen by a steering group comprising the federal agencies concerned and the cantons.

**Project procedure**



**Work schedule**



Approach



**Notes on the proposed methodology**

**Notes on the proposed methodology**

**Key elements**

The analytical method used is intended to facilitate the recording of the spatial impact of transport infrastructure projects and to explain it as an interplay of different factors. As such, it should also make it possible to assess the implications of future transport planning programmes more effectively.

In collaboration with experts from Switzerland and abroad, a corresponding analytical model was developed as part of a methodological study. The model can be used to detect the spatial impact of transport infrastructures at local, regional and supraregional level.<sup>1</sup>

The methodology derived from this model forms the foundation for specific case studies and the comparative evaluation of case study findings. Over the next few years, it will be expanded and refined using the experience gathered from a range of case studies looking particularly at Switzerland. The methodology will evolve into a basis for the evaluation (ex-post analysis) of the actual spatial impact of transport infrastructures that is unique both in Switzerland and internationally.

The key elements of this method are its reference to different territorial levels, the comparative analysis of several cases, the evaluation of three types of major influencing factors on the spatial impact of transport infrastructures, and the observation of effects over a number of years.

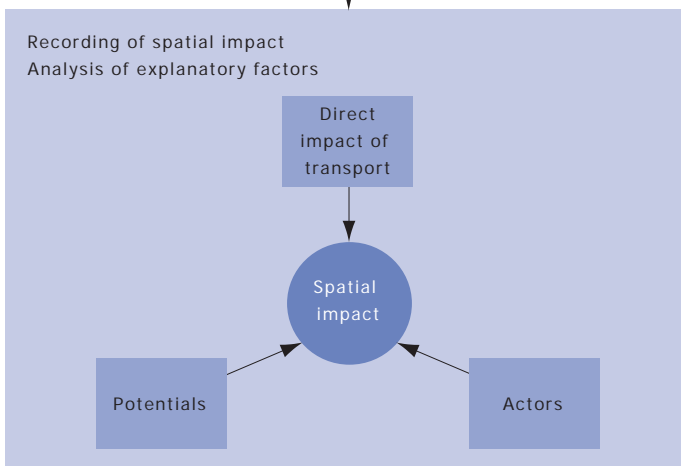
<sup>1</sup> The methodological principles for identifying the spatial impact of transport infrastructures were developed by the team of Güller Güller – Synergo – Ecorys – Inregia – P.H.A.B. – DREIF and then described in a guideline document: the methodological report.

**Analysis procedure**

*Design of case study/project description*

1. Political issues
2. Areas of study
3. Timeframe
4. General assumptions on interactions

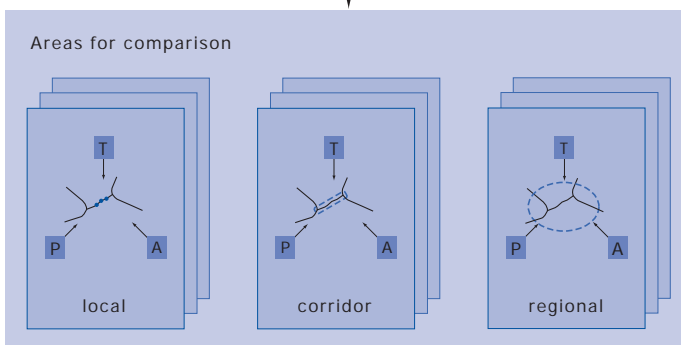
*General assessment of spatial trends*



*Specific hypotheses*

- Spatial impact of the project
- Interactions

*Detailed study/ Selection of areas for comparison*



*Synthesis*

- General/specific conclusions for each area studied
- Evaluation of relevance of results

*Assessment of spatial impact*

- in terms of the objectives of spatial planning policy
- in terms of project-related objectives



**Notes on the proposed methodology**

**Three types of major influencing factors**

There is no compelling direct statistical relationship between transport infrastructure and space, nor is any impact automatic. Spatial structures may change even where the level of infrastructure remains the same. There may be a time lag, or there may be no change at all, despite an expanding infrastructure. The instrument used to record and depict these relationships must thus be equally complex. The «Tripod» was developed for this purpose as part of the methodology report. It is used to show the determining factors within a particular region or local environment that have influenced, promoted or hampered the development of that area.<sup>2</sup>

The Tripod covers the following factors associated with spatial impact:

- **Direct transport effects:** e.g. changes in an area’s accessibility and the direct load on the environment caused by the transport infrastructure. The actual direct impact of transport results in turn from the specific infrastructure and transport offers that are available, the framework conditions for transport in terms of price and regulative policy and actual levels of demand for passenger and goods transport.
- **Potentials:** i.e. the local, regional and economic context, including specific locational factors, economic structures, reserved land and building zones, etc.
- **Actors:** i.e. the activities of key persons in spatial planning and project work who exercise significant influence

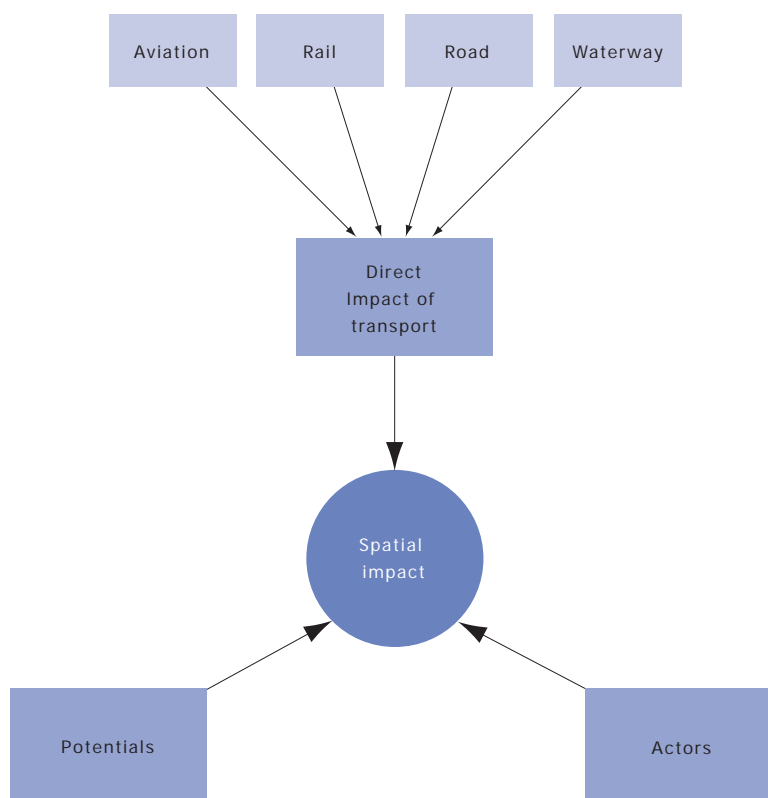
on how and whether or not a potential spatial impact will occur.

**Comparative analysis of several examples**

Looking as part of an ex-post analysis at the spatial impact that has already occurred, we find that the spatial effects of different projects and different factors overlap. It is both time-consuming and difficult to attribute or trace back a specific spatial effect to a single project or factor. To isolate the specific contribution of an infrastructure project, the method demands that

- the project is compared with a similar infrastructure in a different environment (e.g. a stretch of motorway through countryside with a stretch of motorway through an urban area);
- the project and its environment are compared with a similar environment which does not have the same sort of infrastructure (e.g. a rural area with a railway station and a rural area with no railway station but with, say, a bus station).

**Spatial impact factors – the «Tripod» analysis framework**



<sup>2</sup> The analytical structure has already been adopted and successfully tested by the European TranSEcon project (ex post analysis of the impact of urban railway branch lines in 13 cities).



**Notes on the proposed methodology**

**Different levels of study**

The method covers a broad spectrum of spatial effects and studies them at different territorial levels – first in general terms and then in detail for specific areas.

**Observation over a number of years**

Spatial effects appear at different moments in time. For example, the response of spatial structures to changes in transport conditions is generally slow.

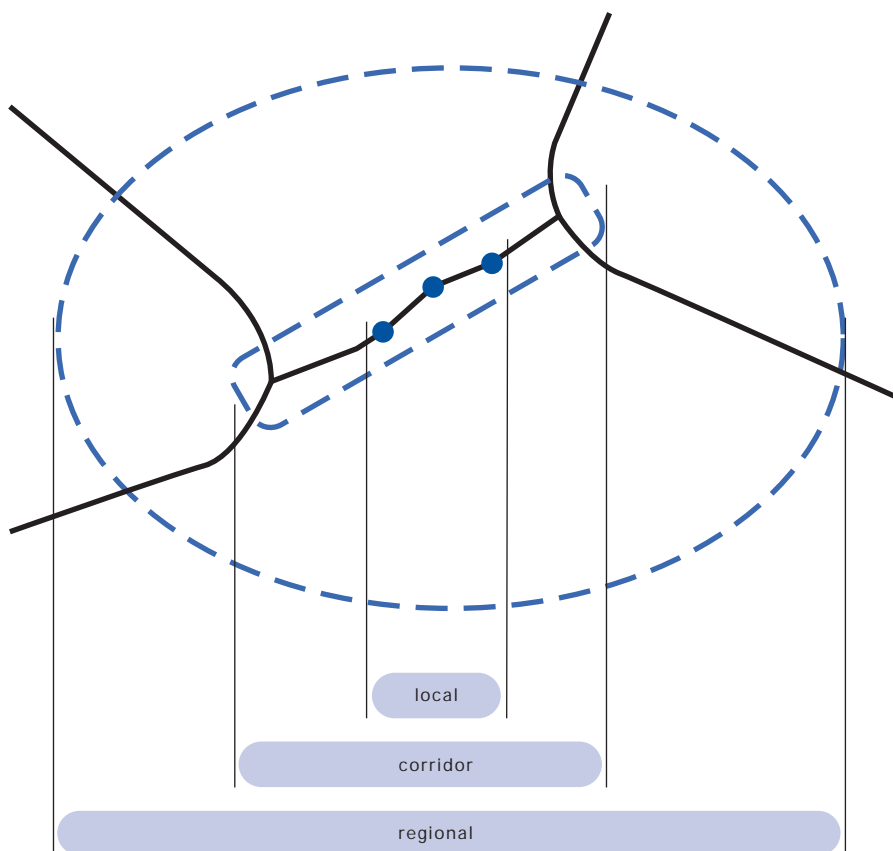
The method therefore demands that spatial impact be analysed over a longer period. This period should begin at least ten years before the infrastructure is built. The infrastructure in question should have been operative for at least 10 years.

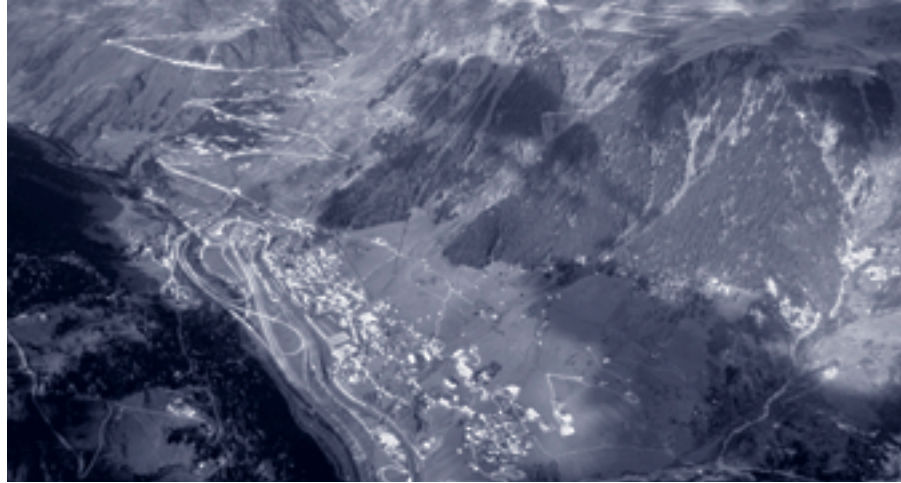
**Status and improvement of methodology**

The first product of this stage of the project is the present methodological report. It provides the framework for the ex-post analysis of the spatial impact of transport infrastructures.

The case studies given below will be developed according to this methodology. Their findings will then be used to review and, if necessary, modify the methods used. The results of these tests will be written up in a methodology evaluation report.

**Analysis of spatial impact on three levels**







## Notes on possible case studies

### Object

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The case studies should not be a purely academic exercise. The project is intended to produce conclusions which can then be implemented directly and incorporated into the evaluation of the Swiss cantonal transport planning. They will also serve as a basis for cantonal transport planning in the future. In addition, the case studies will supply inputs to an expanding spatial monitoring programme for Switzerland.

### Elaboration

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The various case studies should be formulated using the methodology that has been developed so that the results can be compared with each other in the subsequent synthesis report.

Two case studies are currently in preparation:

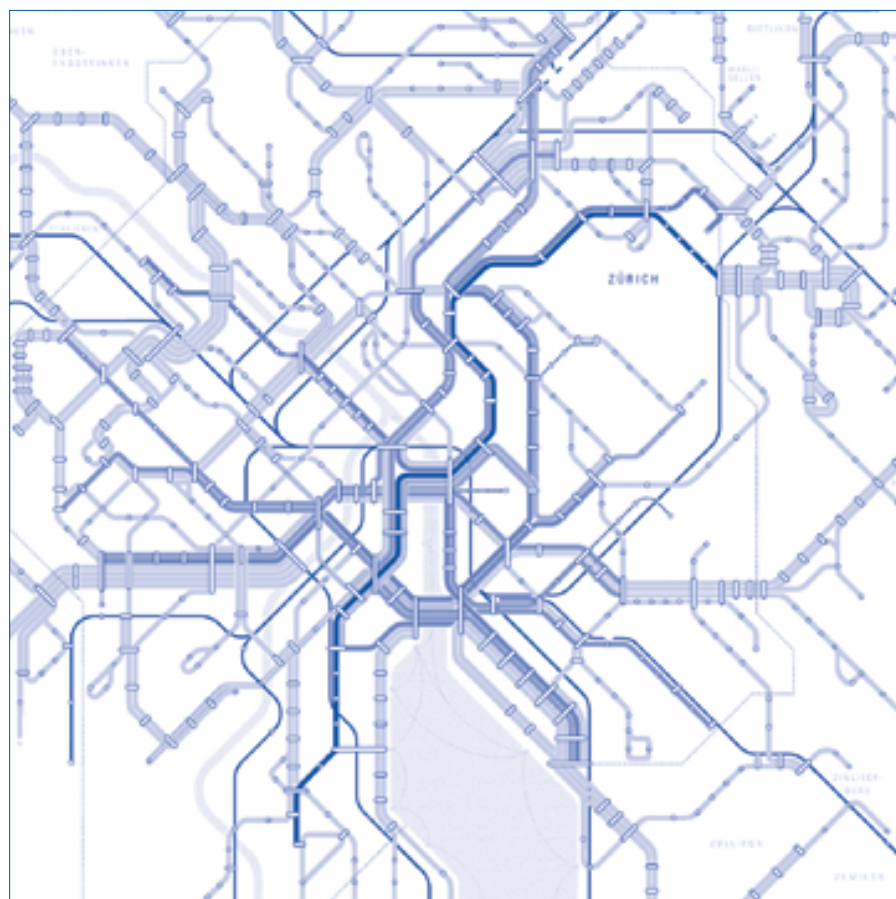
- a regional rail infrastructure (the Zurich S-Bahn); and
- a combined road and rail infrastructure serving as a regional transport system (Magadino area).

Further case studies are both advisable and necessary in order to provide a broad foundation for findings about the spatial impact of transport infrastructures.

### Findings

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A description will be produced of how each case study was conducted and about the results. Additionally, a synthesis report which analyses all of the case studies that have been carried out will contain a review of the methodology applied and possible modifications. The results will provide the input for the next stage of the project – the development of a monitoring system.



### What requirements have to be set for the case studies?

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- The case studies may look rail, road, air or water transport and should offer answers to typical problems that are representative of Switzerland as a whole.
- Case studies may examine transport systems that combine several modes of transport (e.g. road and rail).
- The transport infrastructures covered by the case studies should preferably have been in service for ten years, so that the relevant effects on the surrounding area can be observed.
- As an exception, case studies may be accepted for infrastructure projects that have only recently gone into service or are not yet complete. The methodology

that has been developed also looks at this special issue.

- The subject and content of the case studies are to be defined in close cooperation between the involved federal agencies and the cantons from which these case studies originate.



## **Notes on monitoring**

### **Task**

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The third phase of the project is intended to make practical use of the conclusions of the case studies as well as the refined methodology. This includes the application of the findings to a monitoring and controlling approach considering transport infrastructures and their spatial impacts on an ongoing basis.

### **Object**

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Monitoring refers to the continuous measurement and evaluation of the factors which determine or influence the spatial impact of transport infrastructures. One of its purposes is to establish a continuous spatial monitoring programme for Switzerland.

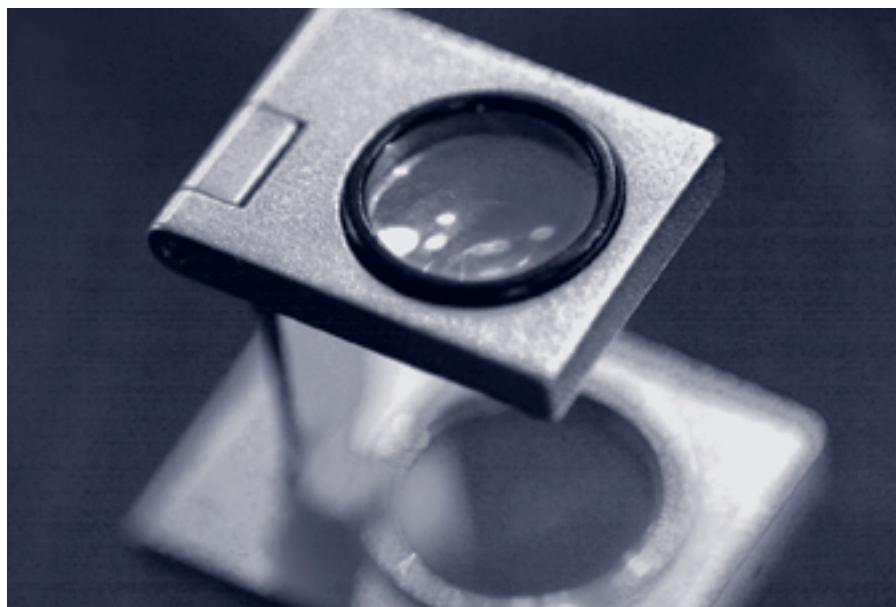
Controlling builds on such monitoring activities and compares target and realised outcomes with regard to the desired spatial impact of transport infrastructures. Controlling programmes may look, for example, at the attainment of objectives, the implementation of the infrastructure planning process or the impact that it has had. Specific input in this area is expected within the framework of the case studies.

### **Findings**

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In the third phase of the project, recommendations will be formulated towards suitable monitoring indicators and to the overall implementation of the monitoring.

The steps to be taken in this phase will be determined in greater detail once the case studies have been reviewed.



**Additional information**

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**Methodological report**

Räumliche Auswirkungen der  
Verkehrsinfrastrukturen. «Lernen aus  
der Vergangenheit» – Methodologische  
Vorstudie (only available in German)

Pub.: Federal Office for Spatial Develop-  
ment (ARE), Bern, December 2002

Authors: Güller Güller architecture  
urbanism, Zurich, Rotterdam (project  
management), with contributions from  
Synergo (CH), Ecorys (NL), Inregia (SE),  
P.H.A.B. (GB), and DREIF (FR).

Available on the Internet at: [www.are.ch](http://www.are.ch)



**Additional information**

A collaboration between the ARE and  
FEDRO  
FOT  
FOCA  
SAEFL  
as well as the cantons under the  
aegis of the Cantonal Planners'  
Conference





