Summary

Ex-post evaluations of infrastructure projects
Taking decisions about constructing and improving infrastructure requires a great deal of responsibility, for very quickly hundreds of millions of euro are at stake in these projects. To ensure such important decisions receive careful consideration, multiple ex-ante evaluations are conducted. However, this concentrated attention for pre-project assessments stands in stark contrast to the evaluations conducted after a project's completion. Yet, it is indeed extremely worthwhile to assess infrastructure projects once they are completed and in use. Much can be learned from such ex-post evaluations: learning from past projects not only improves the quality of future ex-ante evaluations, but also, by extension, the quality of our decision-making processes.

Learning and validation
Ex-post evaluations have various objectives: learning and validation. We can learn from ex-post evaluations, because they give us a sense of how accurate the ex-ante estimates were, and this process not only allows us to improve upon future models, but also to then conduct meta-evaluations. When multiple ex-post evaluations are available, we are able to assess which type of projects and which project conditions have had positive effects for society. Validation is also an objective of ex-post evaluations, in which case, for example, assessments are made to ascertain if the funds were spent wisely and/or if the correct decisions were taken.

Ex-post evaluations are not always, not systematically and not comprehensively conducted for all Dutch infrastructure projects; however, this is not a new or unique situation: the Ministry of Transport, Public Woks and Water Management, as well as other departments, seldom conduct unprompted ex-post evaluation research.

Reasons for disinterest in ex-post evaluations
There are four primary reasons for the lack of interest in ex-post evaluations: the political- administrative and policy context, psychological processes, organisational barriers, and methodological problems.

1. The desire to look ahead is a key factor in the political-administrative and policy context: policymakers are, by nature, focused on the future, not the past.
2. Certain psychological processes, moreover, can render one disinclined to pursue evaluations. What is known as an 'optimism bias' can play a role at the start of a project, meaning that those involved (ex-ante) often have overly optimistic views about a project, with the result being that people subsequently oppose any actions that may

compromise this positive view of the project. More specifically, negative evaluations can ultimately damage a person's professional reputation.

3. Organisational barriers may also impede ex-post evaluations. Project directives are often discontinued immediately after the 'ribbon cutting'. Moreover, owing to a lack of funding and/or organisational capacity, ex-post evaluations are often supplanted by more urgent matters. Additionally, a combination of normal personnel turnover cycles and the long turnaround times of infrastructure projects can lead to a dissipation of departmental knowledge and expertise.
4. The main methodological problem is that it is not only exceedingly difficult to isolate the effects of a particular project, but also to envision what the world would be like had that project never been commissioned. In addition, the timing of an evaluation is an issue that demands particular attention.

These various obstacles are indeed challenging, but they can be overcome. Comparable problems have emerged in ex-post evaluations conducted in foreign countries, and these foreign experiences prove that workable solutions can be found. Such solutions could inform the structuring of future ex-post evaluations.

A framework for ex-post evaluations

In light of the previously stated obstacles, careful consideration must be given to the structure of ex-post evaluations. Because there are many choices that can and must be made when evaluating infrastructure, a framework that focuses on content, process, and method is required. Based on experiences in foreign countries, the experiences of various Dutch respondents, and our own case study analysis, we provide, per facet, what we regard as the most pertinent options (see table S1).

Content

Choices must be made regarding the content and objectives of ex-post evaluations. Do people want to:

- appraise or learn? Appraisal is indeed a worthwhile objective, but a possible downside of this is the emergence of a certain 'heels in the sand' resistance, as people attempt to avoid damaging professional reputations. Consequently, the willingness to evaluate diminishes. Conducting evaluations for the purpose of learning, however, opens doors that would have otherwise remained closed.
- evaluate all projects or only a limited number of projects? In principle, all infrastructure projects have something to teach us. The pertinent question is if the investments outweigh the benefits? Evaluating only limited numbers of projects places less stress on the organisation's capacity. When we choose to evaluate all projects costing 500 million euro or more, we also always evaluate an additional 20% of all 2009 MIRT (Multi-Year Program for Infrastructure, Spatial Development and Transport) road and rail projects.
- conduct equally in depth studies of all facets (costs, traffic volumes,

travel time gains, etc) of a project, or rather be selective in this? Choices can also be made regarding the comprehensiveness of ex-post evaluations. It is recommended – as with OEI ex-ante evaluations - to study all facets of a project, although this does not mean that all aspects must be studied with equal depth. The various facets can be 'deeply or 'lightly' researched.

Process
Choices must also be made regarding the timing of evaluations; for example, we may conduct evaluations one, three and/or five years after the completion and opening of an infrastructure project. If we choose to evaluate shortly after the opening (for example, after one year), we may disregard the so-called 'ingrowth effects', as they emerge only over the longer term, full exploitation of the infrastructure. However, if people decide to evaluate after five years, then the assessment is indeed disrupted by new developments (other new infrastructure, changes in economic situation, etc), and the relevant question then becomes: Are we actually assessing what we intended to assess? In light of this, conducting ex-post evaluations after three years seems to be the happy medium.

Method
Choices must be made with respect to methodology as well. Causality presents us with a complicated issue. The question here is to what extent we can attribute certain effects to a particular project. We can approach this problem in various ways.
The simplest solution is to ignore the whole issue. After an infrastructure project is completed, we can for example limit ourselves to measuring a few quantities, such as traffic volumes, which we can compare to the original estimates. When these pre and post-calculations differ only slightly, we may conclude that the project's objectives were achieved. Such comparisons are relatively easy to make and can indeed be informative, but this will preclude the many possible disruptive developments that have subsequently emerged. If the causality question is avoided, we cannot learn very much from the project ex-post.
A second issue in play here is the degree to which infrastructure projects are interwoven with other projects. A certain project, such as the construction of a highway, can affect other roadways, and this therefore raises the question as to what level the evaluation must be conducted on: the level of the individual project, or of the entire (road) programme? Given the fact that projects that perform well, and those that perform poorly, average out when evaluations are conducted on the programme level, we can learn the most from evaluations conducted on the individual project level.

Table S1
Framework for ex-post evaluations
Choices regarding content, process and method are required to facilitate the ex-post evaluation process. The choice of a light form of evaluation on the individual project level, with special attention devoted to disruptive factors (see X), is seemingly the most promising approach to take.

Summary of choices

FRAMEWORK			
Content	*Appraising*	*Learning* X	
	All projects	*Limited number of projects* X	
	All facets studied in depth	*Some facets studied in greater depth than others* X	
Process, evaluation after	*1 year*	*3 year* X	*5 year*
Method, causality	*Disruptive factors ignored*	*Disruptive factors considered* X	
	Programme level	*Project level* X	

A lighter form of evaluation?
Depending on the choices made regarding content, process and method, we have the option of pursuing light, medium or deep forms of evaluation. We learn less from lighter forms of evaluation, but lighter evaluations are indeed easier to conduct, and this, given the previously identified obstacles, is an important advantage. We have not yet reached the stage of mandatory ex-post evaluations, and, indeed, experiences in France have shown that this offers no guarantee of success. It is precisely because ex-post evaluations are not yet widely embraced that we must ensure they are easy and feasible to conduct. A lighter form of evaluation is therefore the preferred choice.

Follow-up study
These suppositions must now be tested in actual practice, by means of a concrete case study. In order to gain a sense of the practical situation, this study analysed the A5-Zuid motorway, although it did not do so in the form of a comprehensive ex-post evaluation. It is therefore recommended that a follow-up study be conducted to evaluate all the various facets of such a case study.