

**Summary:**

# Holistic inspection of urban road facilities

## Method development and assessment

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*Existing road inspection systems are not well suited for examining how urban transportation facilities in total function for all road user groups. TØI recommends that these inspection systems be supplemented by a method for holistic inspection focusing on road user behaviour and interaction rather than on the physical design and regulation, as is commonly the case in current inspections.*

### The existing road inspection system

Road inspection can be described as systematic investigation of an existing road, with the aim of identifying problems and suggesting solutions. In the past 10 years, the Norwegian Public Roads Administration has published several handbooks on inspection, for example road safety inspection and bicycle path inspection.

A common characteristic of the existing inspection systems is that they focus either on a specific road user group or on a specific type of problem. Therefore several road user groups and problems are not fully dealt with in the inspection system, see figure I. At the same time, these inspections are not well suited to examine how urban transportation facilities overall function for all road user groups.

The purpose of our project has therefore been to assess whether it would be useful to introduce a method for holistic inspection of urban road facilities and, if so, to make suggestions as to how this could be done. To help answer these questions, we conducted five sub-studies:

1. Literature survey of road inspection systems in Norway and in other countries.
2. Review of existing data and databases for road and traffic, and assessment of how the data could be used in the inspection.
3. Literature survey of recommendations and experiences with tablet, PDA, laptop, smart phone and camera for data collection.
4. Literature survey of methods and experiences from crowdsourcing.
5. Inspection of three transport facilities in Oslo.

### Holistic rather than separate inspections

We propose that it would be better to supplement the existing inspection systems by a holistic inspection system for urban road facilities rather than by independent

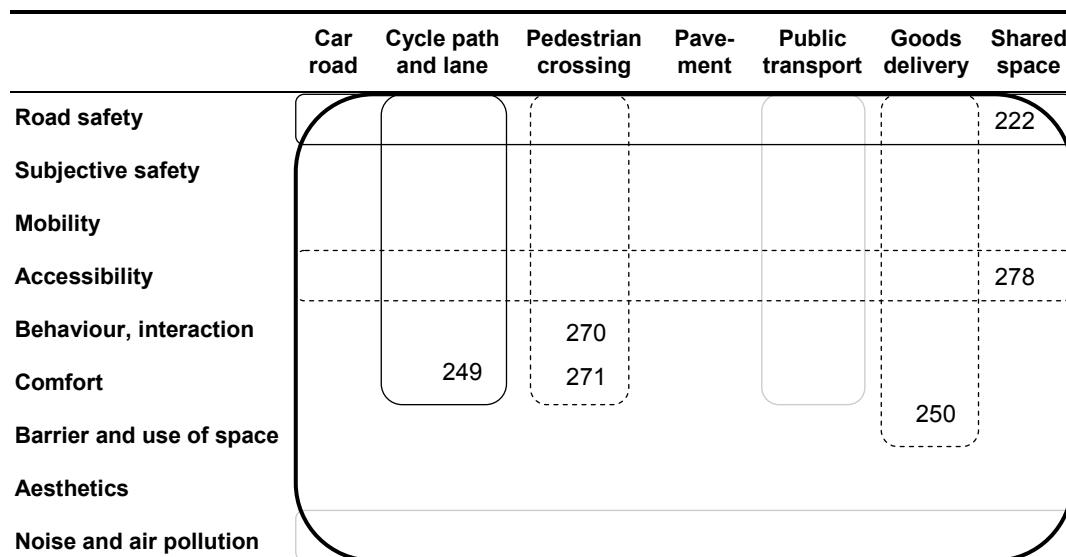
inspection systems for all parameters and road user groups. The arguments for this are:

- It is more rational and less costly to conduct a holistic inspection rather than many independent and separate inspections.
- In the future, more aspects of road use are likely to be included in the inspection system, requiring even more separate inspections.
- It is difficult in practice to prioritize between many, and possibly conflicting, recommendations from multiple inspections.

Our review shows that it may be appropriate to supplement the inspection system by one or two additional separate inspections to increase the focus on selected topics, see figure I.

### The overall inspection system

Our recommendation for an overall inspection system comprising separate inspections of selected themes and road user groups, combined with a holistic inspection, is depicted in figure I.



*Figure I. Recommendation for a future inspection system. Existing inspections are indicated in black and by handbook number. Dashed line indicates that the handbook is only indirectly a handbook for inspection. Grey indicates a group and a parameter that might perhaps be inspected separately. Bold indicates the area for holistic inspection.*

The idea behind this recommendation is that it is both legitimate and appropriate that certain road user groups and problems are inspected separately and thus given the highest priority. There are often many and conflicting interests in an urban area and it is impossible to satisfy everyone. However, the proposed system – focusing on safety and environmentally friendly transport – would help prioritize between the different objectives. Others might perhaps argue that the mobility of private cars and freight vehicles is more important.

In the overall inspection system, there would be some overlap between the separate and the holistic inspection. The idea is that separate inspections would

deal with the detailed physical design and regulation as well as operation and maintenance, while the holistic inspection would focus on behaviour and interaction.

The purpose of the holistic inspection would be to assess the overall functioning of the road and not to review whether the individual elements were right or wrong. This inspection is important because all the individual elements could be right without the facility functioning properly.

### **The responsible inspector**

The responsible inspector would have to be independent, have the relevant educational background and at least five years' relevant practical experience. He/she should have participated in a course preparing for holistic inspection. This means that the Norwegian Public Roads Administration should develop and implement such a course.

Holistic inspection covers too many different disciplines for one person to cope with, and should therefore be carried out by a group of between two and four persons with different expertise and knowledge of the area.

### **Overall approach for holistic inspection**

Inspired by other inspection systems, the overall approach for holistic inspection could be divided into six steps:

- |  |                                    |
|--|------------------------------------|
| 1. Selection of locations              | 4. Conclusions and recommendations |
| 2. Description of the locations        | 5. Implementation                  |
| 3. Inspection/analysis of the location | 6. Evaluation.                     |

### **Selection of locations**

Since roads authorities do not have the resources to implement holistic inspection of an entire road network, it is necessary to be selective when choosing the locations most relevant for inspection. This is difficult. The method has to be standardized, systematic, based on existing data and include information about all road users and potential traffic problems. The challenge lies in the fact that these data are very different in character.

### **Preparation and initial analysis**

Prior to inspection, the inspector must produce an initial description and analysis, the purpose being:

- The inspector becoming familiar with the location.
- To clarify the primary function of the location. This is important if there are conflicts of interest at the location that are difficult to resolve.
- To formulate initial hypotheses about any possible problems that ought to be given special attention in the inspection.

The initial description and analysis should be based on existing data corresponding to the data included in the selection. In addition, maps and photographs can be important sources of information.

## The inspection

As already described, we recommend that holistic inspection be conducted as an observation of behaviour and interaction rather than as a detailed inspection of the deficiencies in the physical road design. The matrix in table I illustrates the different aspects of behaviour of different road user groups that should be included in the inspection. This serves as a checklist.

Observation of the interaction between different road users is also a very important part of the inspection. Interaction includes conflicts, distance between road users and respect and consideration shown among drivers.

*Table I. Aspects of behaviour that should be considered for each road user group.*

	Private person transport	Public transport	Goods delivery	Bicyclists	Pedestrians
<b>Speed and acceleration</b>					
<b>Travel time and waiting</b>					
<b>Traffic flow and queuing</b>					
<b>Route</b>					
<b>Manoeuvre</b>					
<b>Parking</b>					
<b>Rule compliance</b>					
<b>Showing of intentions and dissatisfaction</b>					
<b>Aggressiveness and passivity</b>					

The focus on behaviour and interaction does not mean that inspections should ignore the physical design and regulation of the road. To be able to explain and make suggestions it is necessary to observe the physical layout of significance for the observed behaviour.

The inspection should be conducted on foot and from sites that provide a good overview of the location. The actual time spent would depend on the size and complexity of the location and on the experience and expertise of the inspection team, but limited to about one day. The inspection should include observations both during and outside the morning and afternoon rush hours. Inspection at night and in winter might sometimes be desirable, but not mandatory.

## Further development of the methodology

The purpose of this project has been to make initial suggestions for a method of holistic inspection. We recommend that the Norwegian Public Roads Administration continue the development of this method in order to make it part of a complete inspection system. Important in this would be: clarifying, testing and evaluation of the method; clarifying the formal procedure for holistic inspection; development of a method for selecting sites for inspection; development and implementation of courses on holistic inspection; and development of a handbook.