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Roadside infrastructure for safer European roads: D07 Summary of maintenance and operational procedures for roadside infrastructure

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D07: SUMMARY OF MAINTENANCE AND OPERATIONAL PROCEDURES FOR ROADSIDE INFRASTRUCTURE



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Objectives

All task participants investigated the current maintenance and operation procedures in their respective country with an interest on how these procedures can be used in the understanding, monitoring, or improving roadside safety. Participating organisations collected the current standards, guidelines and similar documents and then a summary of the contents was provided to the task leader. The current maintenance and operations practice for each country were assessed by identifying the answers to the following set of questions:

- How often should inspections occur?
- How often should repair works occur (plus response times)?
- What are the criteria of component replacement?
- Who reports the need for maintenance?
- What are the maintenance procedures after a road accident?
- Where is the information recorded and stored?
- Are there training systems for those responsible for maintenance?

One goal was to identify a list of variables used in the maintenance activities which could be exploited for the later activity of developing maintenance guidelines related to safety. Costs related to maintenance activities were also researched for different types of road infrastructure for the potential use in cost benefit analysis activities.

Partners

The table below presents the countries investigated and the organisations responsible for the collection of the maintenance practices. In total, eight different countries were investigated in the process.

Table 1: Countries Investigated for Maintenance Activities

Chalmers University of Technology (Chalmers)	Sweden
Vehicle Safety Research Centre (VSRC) University of Loughborough	UK
Centre d'Études du Techniques de l'Équipement (CETE)	France
Technical University of Graz (TUG)	Austria
Hierros Y Aplanaciones S.A. (HIASA)	Spain
Helsinki University of Technology (HUT)	Finland
The Netherlands Organization for Applied Scientific Research (TNO)	The Netherlands
Volkman and Rossbach (V&R)	Germany

The Roadside Area: Infrastructure and Hazards

The standards and guideline documents related to operation and maintenance of the roadside area cover an array of activities and physical features. With respect to roadside safety issues, infrastructure elements that were investigated should be relevant for single vehicle collisions. As was investigated in Work Package 3, a list of hazards has been developed which may be of interest in further investigations in maintenance activities. Hazards can be natural or man-made features which are located beside the road. The presence of these features may be required for road functionality (bridge pillars, signs, light poles, etc) and have to be attended to for different maintenance reasons. The roadside infrastructure features and hazards in the roadside area are discussed in Deliverable 5: Summary of European Roadside Design Standards and Guidelines from RISER Work Package 3. Photographs of various obstacles are also provided.

A list of common infrastructure features and hazards includes:

- anchors
- backslope
- beams
- bolts
- bridge piers
- buildings
- clear zone
- concrete road reference points
- culverts
- ditch
- drainage features
- drainage pipes
- electric transformers
- fasteners
- flexible barriers
- foreslope
- guard-rails
- lamp-posts
- masonry walls
- other roads
- pedestrians and cycle lanes
- posts
- property fences
- railway tracks
- recovery zone
- rigid barriers
- road restraint systems
- rock cuts
- rumble strips
- safety fences
- safety zone
- signals
- signs
- trees
- watercourses
- wire rope safety fences

Material Collected

Each partner made contacts with local / regional / national maintenance officials to determine the different requirements for roadside maintenance activities. In this process standards, guidelines, or policies could be determined for the relevant infrastructure (or hazards) of interest. It is important to realise that in some situations, no official requirements exist for this type of maintenance activity and thus the material may be very limited or may not exist at all. The following tables identify the type of information collected by each partner and the source of the data.

Summary of standards and guidelines

Sweden

Source	Type of document	Contents
Funktions- och standardbeskrivning (FSB) Function and standards description for Maintenance Management (FSB)	Swedish National Road Administration's (SNRA) Function and standards description for Maintenance Management (FSB)	Standard for operations and maintenance contracts between SNRA and contractors.
Vägverkets publikation 1990:51 Swedish National Road Administration Publication 1990:51	Standard and Advice Note	Standard for operations and maintenance.
Vägutformning 94 version S-2 (VU 94 S-2) typsnitt och storlek Geometric Road Design Manual 1994	Standard and Advice Note	Installation of highways and structures. General standard.
ATB VÄG 2003 publikation 2003:111 Pavement Design Manual Publication 2003:111	Standard and Advice Note	Installation of highways and structures. General standard.
CEN / TC 226-Road Equipment / Road Restraint Systems	Comité Européen de Normalisation (CEN)	European Standard for road equipment and road restraint systems.

United Kingdom

Source	Type of document	Contents
BS 7669-3:1994. Vehicle restraint systems – Part 3: Guide to the installation, inspection and repair of safety fences	British Standard	Installation procedures; inspection procedures for safety fences; repair; transportation and storage; training
BD 63/94 and BA 63/94 - Inspection of Highway Structures	Highways Agency Standard and Advice Note	Specifies the requirements for inspections of highway structures
BD 62/94 – As Built, Operational and Maintenance Records for Highway Structures	Highways Agency Standard	Provides requirements for the provision of records and sets out the way in which these records are to be kept, updated and distributed
Incident Management Study, July 2002. Appendix B, Part 1 – Typically, What Happens	Highways Agency Report	The procedures involved in responding to a road accident; role of the maintenance team in incident clearance and repair
Incident on 28 February 2001 at Little Heck Railway Bridge (Highways Agency and TRL)	Highways Agency Report	Includes the procedures involved in undertaking highway inspections and maintenance
Trunk Road Maintenance Manual (TRMM) – Volume 2	Highways Agency Handbook	Maintenance and inspection procedures of highways and structures and categorisation of defects
Code of Practice for Maintenance Management	Institution of Highways and Transportation publication	Categorisation of defects; inspection procedures for fences and barriers

France

Source	Type of document	Contents
Schéma Directeur d'Exploitation de la Route : premiers éléments de réflexion pour l'organisation des services (master plan for road operations : first elements for the organization of services) – March 1993 – D.S.C.R.	Master plan	The document provides the definition of a level of intervention, the missions and the organisation of road operating patrols. Among other duties, patrols must check the proper functioning of the dynamic equipment.
Organisation des patrouilles exploitation de la route (Organization of road operating patrols) – November 1999 – S.E.T.R.A.	The French National Road Administration	Provides national road management services with a reference framework which can be studied in view of adapting their organisation to local implications, from both a road safety and user service point of view. A safety sheet for the anomalies related to roadside ancillaries and safety features (safety barriers, sign posting, emergency call boxes, lighting posts...).
Mise en œuvre, maintenance et surveillance des portiques, potences et hauts mats (implementation, maintenance and supervision of gantries, gallews and high masts)– November 1990 – Note d'information S.E.T.R.A.	The French National Road Administration	This note of information gives advice for the implementation and maintenance of gantries, gallews and high masts.
Guide technique « entretien préventif du réseau routier national » 1979- SETRA	The French National Road Administration	This document is about preventive maintenance. It contains detailed catalogue of roadway damages.
Guide technique "Entretien courant des chaussées » 1996- SETRA	The French National Road Administration	This document gives technical advice for maintaining and repairing minor damage on roadway.
Guide technique "Entretien courant des dépendances vertes» 1989- SETRA	The French National Road Administration	This document gives technical advice for maintaining on verges
Guide technique "Entretien courant de l'assainissement de la route» 1998- SETRA	The French National Road Administration	This document gives technical advice for maintaining for drainage work along the roadway.

Spain

Source	Type of document	Contents
Recommendation on Road Restraint Systems. Orden Circular 321/95	Spanish standard	Disposal of the Road Restraint Systems(RRS) on the roadside. RRS used of necessary form on new and maintenance roads. Technical description of several RSS that is necessary to used.
Route. Standard - 3.1_ Road Instructions	Spanish standard	Installation of Highways. News and olds - maintenance and redesign .
Road Vertical signposts. Standard - 8.1_ Road Instructions	Spanish standard	Installation of traffic signs vertical: - type, position, construction - posts. tolerances (height, vertical straightness etc.)
Superficial Drainage . Standard – 5.2_ Road Instructions.	Spanish standard	Installation of highways and structures.
Standard UNE 135124	Spanish standard	Installation methods of w-beam guardrail / improvement of w-beam guardrail: - position, height - ramped ends, anchorage - connections, bolts - posts, spacing foundation (soft soil etc.) Handle and storage conditions
Official Maintenances	Operations Annual Report and Accident Annual Report	Various operations of maintenance of highways. The zones appear where there have been realized the maintenance, reasons of the maintenance, material used for the maintenance and description of the accidents- in sometimes--.

All these standards and guidelines are valid for use in maintenance for inspection of highways.

Finland

Source	Type of document	contents
Tienrakennustöiden yleiset laatuvaatimukset ja työselitykset. TYLT 7210. Kaiteet. Tiehallinto 1999. General quality requirements and working instructions of road construction 7210; Guardrails. Finnra 1999.	Finnish National Road Administration Standard. 19 pp.	Installation of w-beam guardrail / improvement of old w-beam guardrail: position, height ramped ends, anchorage connections, bolts posts, spacing foundation (soft soil etc.)
Tienrakennustöiden yleiset laatuvaatimukset ja työselitykset. Varusteet ja erityislaitteet. Tiehallinto 1993. General quality requirements and working instructions of road construction; Equipment. Finnra 1993.	Finnish National Road Administration Standard. 21 pp.	Installation of traffic signs, vertical and overhead signs (and supports), game fences: type, position, construction posts tolerances (height, vertical straightness etc.)
Hoidon ja ylläpidon tuotekortit. Tiehallinto 2002. Product descriptions of maintenance works. Finnra 2002.	Finnish National Road Administration Standard. 37 pp.	Maintenance and repair of guardrails, traffic signs etc. quality requirements need for repair schedule of repair
Kaiteiden hoito ja ylläpito. Kirjallisuustutkimus. Hanna Reihe. TKK 2003. Maintenance of guardrails. Literature and interview study. HUT 2003.	Students' report in the Laboratory of Highway Engineering at HUT.	Guardrails: inspections repair procedure costs
Kunnossapidosta vastaavien haastattelu. Muistio. TKK 28.3.2003. Interviews of maintenance personnel. Memo. HUT 28.3.2003.	Researcher's memo in the Laboratory of Highway Engineering at HUT.	Guardrails, lighting columns: inspections reporting of damage repair procedure

The Netherlands

Source	Type of document	Contents
Handboek bermbeveiligingsvoorzieningen	Dutch guideline barriers	Installation procedures; transportation and storage
Beheer en Verkeer: Droog Blok	Course for road inspector	NA.
Handleiding technische inspectie(gerichte schouw)	Technical manual visual inspection	Guidelines for technical visual inspections of the road

Germany

Source	Type of document	Contents
Recommendations for passive safety facilities	German road and traffic research association traffic guidance and road safety group	Quality requirements for guard-rails

Summary

The maintenance standards collected to date vary in detail between the countries reviewed. The information gathered reflected national, regional, and local standards and guidelines and even documents with an uncertain status. The guidelines are very much directed to procedures for installing, inspecting, and repairing guardrails, barriers and fences. However the other aspects of the roadside environment (ditches, trees, stones, etc) are not explicitly described. In a few cases the organisation of inspection patrols is described.

Analysis / Review

An overview of the operational practices is provided in this section. In particular, the questions presented in the Objectives section were compared between the different countries. The data obtained from each partner is presented in the Appendix A.

Table 2: Summary of Current Maintenance Practice by Country

Country	SWE		UK		FR		AU		SP		FIN		NL		GER	
	w	o	w	o	w	o	w	o	w	o	w	o	w	o	w	o
Recommends inspection interval	Y		Y		Y		N	N		Y		Y		Y	--	--
Recommends repair frequency	Y		Y			Y	N	N		Y	Y			Y	--	--
Defined criteria for component replacement	Y		Y		Y		N	N	Y	Y	Y	Y	Y		--	--
Defined repair notification process		Y	Y		Y		N	N		Y	Y	Y		Y	--	--
Defined maintenance procedure after and accident		Y	Y		Y		N	N	Y	Y	Y	Y		Y	--	--
Archives maintenance data		Y	Y		Y		N	N		Y				Y	--	--
Maintenance training courses	Y		Y			Y	N	N	Y	Y		Y		Y	--	--

w the information written (standard, publication, manual)

o the information given is oral (through interview)

N no standards

Inspection / Repair Frequency

In this table the identification of the recommended frequency for inspecting or repairing roadside infrastructure of different maintenance activities such as inspection and repair is shown for the countries involved.

Table 3: Occurrence of Standards and Guidelines by Country

Country	Sweden	UK	France	Austria	Spain	Finland	The Netherlands	Germany
Installation	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Inspection	Yes	Yes	Yes	No	Yes	Yes	--	No
Repair	Yes	Yes	Yes	No	Yes	Yes	Yes	No

Frequency of inspections

For the countries that specified a frequency for inspecting roads, the rate of inspections depended on the type of road. Motorways and main roads were inspected on a daily basis while smaller roads were inspected on a weekly or monthly basis. Sweden had the most structured classification of inspection rates. The reason for the detailed categorisation in Sweden might be that the actual work is performed by a contractor. This means that an agreement valid for several years is signed and legal difficulties will rise if the contract is not waterproof in all details. These types of contract are negotiated on a regional level.

Frequency of repair

The repair time for a damaged item was found to be dependent on the road type and also to the damage severity in many cases. When the damage is likely to cause a risk to traffic, the repairs are required to be completed in one day. Minor repairs tended to be left for 1 to 2 weeks. In the Netherlands, the inspector will determine the repair time based on their expert judgement. It has to be a balance between the costs for keeping a road patrol alert at all times and the costs for accidents, delays and vehicle operation. With the repair work done within the Road Authority an expert judgement may be the optimal solution while with a contractor every possible future occasion has to be planned for and agreed upon in economic terms.

Little information is provided for infrastructure elements like signs, ditches and trees although Finland does specify seasonal inspections for objects like road signs.

Criteria for Component Replacement

For some of the countries (Sweden, UK, Finland, and Spain) there are some descriptions for the replacement criteria for the infrastructure elements. These are typically visual inspections for cracks or broken elements (Sweden, UK, France, and Spain). The Netherlands have additional replacement criteria regarding recycling or environmental issues.

Individuals Responsible for Reporting Maintenance Issues

In all reporting countries the road owner (state or private) appear to have an identifiable group that is reporting maintenance activities. The police are also involved in this activity as they must attend the scene of any significant accident. Sweden and Finland officially recognise the public as a reporting mechanism for road maintenance issues.

Procedures After an Accident

The procedures after an accident are almost identical for all countries involved. The police attending an accident involving road infrastructure damage will contact the road owner. The road owner then dispatches individuals to inspect the damage and assess the repair needs. The main difference between countries is the time of repair actions. In some countries the road owner must be prepared

to begin immediate repairs. In the Netherlands, the road owner must be available within one hour.

Maintenance Data Storage

The type of data stored for maintenance operation varies between the countries. The UK has the only formal data archiving system which has separate systems for safety fences and other road structures. Spanish road concessionaires maintain documentation of accidents that is to be made available to the government. Sweden and the Netherlands have some data storage at the local level. In Sweden and Finland this record is essentially an invoicing record for the repairs. Other countries have no official storage system listed for maintenance of roadside infrastructure.

Training of Maintenance Personnel

The data collected indicated that training courses are provided for maintenance staff. Sweden and the UK provide training for all levels of maintenance activities while the Netherlands has courses for the inspectors. Spanish road operators also provide training for their workers. Other countries have no official training activities for maintenance activities.

Summary:

The objective of the review was to identify existence or non-existence of maintenance practice in the participating countries. The answers give a good insight in how far formal procedures and regulations are developed. There are obvious differences in between the countries although some elements of the maintenance practice are common between the countries.

Some countries have national standards and publications while others have guidelines on a regional or local level. As is identified in Table 2, some information was collected by interviews since written documentation was unavailable.

It seems from the summary of standards and guidelines that the United Kingdom is most regulated by national standards. Sweden, France, Spain, and Finland have some guidelines for both inspections and repair while the Netherlands only shows guidelines for inspections.

Potentials for setting up standards and guidelines are obvious for several of the countries and some of the presented guidelines could very well serve as examples for development of national standards or if in the case the National Road Authority prefer a regional or local standard. It could be noted that the requirements for formal standards is dependent on the organisation responsible for the actual work. For example, subcontracting of maintenance activities will require legal contracting documents that specify a level of performance standard for the services.

Discussion and Conclusion

Sufficient information about standards and guidelines is available from several countries and can be used in the preparation of new common guidelines. The documentation collected indicates a similar structure exists between countries, that is, the maintenance effort determined by dividing the roads into categories and prioritising the main road sections. Data available from the referenced sources will be sufficient for preparation of common guidelines. The review suggests that official procedures are not necessarily implemented in all countries. However, a minimum standard could be a first step to a European standard for safer roads

The seven questions about current practice were answered with various levels of documentation. Some questions lead to references in official documentation while other questions are only answered informally through interviews with maintenance officials. When documentation was not available, the information tended to reflect regional policies and may not be the common practice within the entire country. This makes it difficult to generalise the national maintenance practice for some countries.

The information available about cost related to maintenance activities in the roadside area is given at such an aggregated level that it is of no use and therefore not presented in the report.

The goal of the review of maintenance activities was to identify the maintenance and operations aspects of roadside infrastructure. The results of the exercise indicate that only road restraint systems (guardrails, safety fences, etc) are explicitly addressed. Other road infrastructure elements (trees, rocks, ditches) that also affect the road safety are not explicitly discussed in the maintenance policies. Future development of maintenance and operations procedures can apply the existing experience with road restraint systems and apply them to all roadside infrastructure elements.

Appendix A: Summary of current practice regarding inspection, repair and training

Sweden

Item	Findings	Source
How often should inspections occur?	Safety inspection intervals for different road categories. Category 1 1 day Category 2 2 days Category 3 7 days Category 4 14 days Category 5 21 days Safety barrier: Wire barriers, every 3 years check the wire tension.	Swedish National Road Administration's (SNRA) Function and standards description for Maintenance Management (FSB)
How often should repair works occur?	If there is a hazardous situation that can cause accidents or if there is a possibility that the damage will become worse. Repairs must be performed in one hour (work days 07-16), other hours 3h. Other not hazardous damage: Category 1-3 in 10 days Category 4-5 in 20 days	FSB
What are the criteria for component replacement ?	Safety barrier: Beams, posts, anchors and fasteners should not have visible cracks or stress raiser.	FSB
Who reports the need for maintenance ?	Road inspectors, police, fire brigade or citizens.	Interviews of maintenance personnel.
What is the procedure after a road accident?	Emergency call centre (LAC) alerts police and rescue personal, they report if there is any damage done. If so, LAC contacts SNRA or the maintenance contractor and they sends out a road inspector (RI). The RI determines the damage and if possible repairs or marks the spot for later repairs. If this affects the traffic, it is reported to the traffic information central (TIC). If the accident was severe SNRA have there own commission of inquiry.	Interviews of maintenance personnel.
Where is the information recorded and stored?	No database or other detailed registration system. The maintenance measures are documented in invoice from the contractor to SNRA, there can be regional and local differences in practice.	Interviews of maintenance personnel.
Are there training systems for those responsible for maintenance ?	The road sectors education centre (VUC) run courses for clerks of work, inspectors, technicians, engineers and road workers.	SNRA

United Kingdom

Item	Findings	Source
How often should inspections occur?	Safety inspections = Weekly/monthly Detailed inspections = Every 5 years (every 2 years over 10/15 years old)	BS 7669-3
	Fences every 5 years Tensioning bolts every 2 year	Code of Practice for Maintenance Management
	Fences and barriers every 2 years Boundary fences every 6 months	Trunk Road Maintenance Manual (Volume 2)
	Highway structures: General inspection every 2 years Principal inspection every 6 years	BD 63/94
How often should repair works occur (plus response times)?	Category 1 within 24 hours Category 2 as part of routine maintenance programme. Also R1 = within 24 hours R2 = within 5 days R3 = within 4 weeks R4 = next available programme	Code of Practice for Maintenance Management
	Safety barrier repairs within 7 days	Incident Management Study
What are the criteria for component replacement ?	Scope = beams, posts, anchors and fasteners. Procedures for replacement of tensioned and untensioned fence beams, and tensioned fences post.	BS 7669-3
Who reports the need for maintenance ?	The Maintaining Agent (MA), who informs the Term Maintenance Contractor (TMC) of the repair needs. Police also inform MA of need for accident repairs.	Highways Agency; Incident Management Study; Incident on 28 Feb at Little Heck Railway Bridge.
What is the procedure after a road accident?	Police contact MA. The MA contact TMC who then attend accident scene and either temporarily or permanently repair damage. Permanent repairs must be completed within 7 days	Incident Management Study
Where is the information recorded and stored?	Fences: at "base office" within 24 hours and retained for 6 years.	BS 7669-3
	Highway structures: at MA and Regional Office.	BD 62/94
Are there training systems for those responsible for maintenance ?	National Fencing Training Authority run courses for erectors and supervisors, clerks of work, inspectors, technicians and engineers.	BS 7669-3

Spain

Item	Findings	Source
How often should inspections occur?	At least 1 time a week – on the roads assigned to maintenance operator. When appear irregularities or an accident has been the action will be taken according to the expert judgement, and repair in a little time	Interviews of maintenance personnel.
How often should repair works occur (plus response times)?	Depends on the risk that supposes to the traffic and the protection that can provide this element. An expert technician will make the decision.	Maintenance work reports of the operator
What are the criteria for component replacement ?	Beams, posts, and others component have no damage such as cracks, stress raisers, folds, corrosion or have been involved in a crash – accident .	Maintenance work reports of the operator and standard
Who reports the need for maintenance ?	Police informs Maintaining Agent – contractor- of need for accident repairs or due to the inspection do it on the part of contractor	Maintenance work reports of the operator and standard and Police
What is the procedure after a road accident?	Police contacts the road owner and deliveries a report. The contractor go on the spot and decide the importance. If is necessary, the contractor makes repairs on the spot. If there is no immediate danger a planning is made to repair the damage. In any case the site is signed	Maintenance work reports of the operator and standard
Where is the information recorded and stored?	At Contractor Office and at disposal to the government	Maintenance work reports of the operator and standard
Are there training systems for those responsible for maintenance ?	The contractor trains its workers	Maintenance work reports of the operator and standard

Finland

Item	Findings	Source
How often should inspections occur?	Everyday (main roads) 1...2 times a week (other roads)	Interviews of maintenance personnel.
How often should repair works occur?	Guardrails: hazardous damages in two weeks (marked immediately) other damages in one month wintertime: all damages must be repaired latest 31st May. In case of hazardous damages the tendency is towards immediate repairing actions. Traffic and vertical signs: still working; in three weeks not working; next working day if possible	Product descriptions of maintenance works. Finnra 2002. Interviews.
What are the criteria for component replacement ?	Guardrails: broken rails and posts replaced by new ones according to Finnra standard TYLT 7210;	Maintenance of guardrails. Literature and interview study. HUT 2003. General quality requirements and working instructions of road construction 7210; Guardrails. Interviews of maintenance personnel.
Who reports the need for maintenance ?	police -> contractor (-> sub-contractor) comes out during inspection (contractor, sometimes sub-contractor) road user -> Finnra Traffic Management Centre -> Contractor	Maintenance of guardrails. Literature and interview study. Interviews of maintenance personnel.
What is the procedure after a road accident?	Severe accident/damage to guardrail: contractor gets the information from police immediately damaged spot is marked immediately and repaired in two weeks Less severe accident/damage to guardrail contractor gets information as reported above (few days...one week) damage repair as reported above	Maintenance of guardrails. Literature and interview study. Interviews of maintenance personnel.
Where is the information recorded and stored?	No database or other detailed registration system. The maintenance measures are documented in invoice from the contractor to Finnra or motor insurance companies.	Interviews of maintenance personnel
Are there training systems for those responsible for maintenance ?	No.	Interviews of maintenance personnel

The Netherlands

Item	Findings	Source
How often should inspections occur?	Inspections of the road are done every day. If damages or irregularities are found extra inspections will be carried out, action will be taken according to the expert judgement. Every 2 till 3 month's big technical inspection is done.	Rijkswaterstaat, responsible for unit Amsterdam
How often should repair works occur (plus response times)?	Depends on expert judgement. Normally maintenance together with maintenance of road, to avoid delay times of traffic	Rijkswaterstaat, responsible for unit Amsterdam
What are the criteria for component replacement?	For barriers (to recycle) there are standards how much corrosion can occur before renovating or changing the guardrails	Handboek bermbeveiligingsvoorzieningen
Who reports the need for maintenance?	The inspections done by the fieldworkers will report their findings or take immediately action themselves. If big maintenance or replacement of the barrier is necessary it should be combined with maintenance at the road. The responsible is the 'road owner' in the specific area	Rijkswaterstaat, responsible for unit Amsterdam
What is the procedure after a road accident?	Police contacts the road owner. The inspectors go on the spot and decide the importance. If immediate repair necessary then the road builder has to be available within 1 hour. If there is no immediate danger a planning is made to repair the damage	Rijkswaterstaat, responsible for unit Amsterdam
Where is the information recorded and stored?	The road owner makes his own registration	Rijkswaterstaat, responsible for unit Amsterdam
Are there training systems for those responsible for maintenance?	2 days training for inspection specific items and quality system training are available. Inspections are only done by persons who have taken this course	Construction department Rijkswaterstaat

Germany

Item	Findings	Source
How often should inspections occur?	Expansion joints and anchoring points of posts with base plate on concrete cappings	Recommendations for passive safety facilities
How often should repair works occur (plus response times)?	N.A.	N.A.
What are the criteria for component replacement?	In case of high corrosion on guard-rails	Recommendations for passive safety facilities
Who reports the need for maintenance?	N.A.	N.A.
What is the procedure after a road accident?	N.A.	N.A.
Where is the information recorded and stored?	N.A.	N.A.
Are there training systems for those responsible for maintenance?	Not explicit for maintenance but for installation	Recommendations for passive safety facilities