

# Hard Shoulder Running Fact Sheet

## Introduction

The CEDR TNM WG Fact Sheet on Hard Shoulder Running (HSR) is based on the proceedings and outputs of the 2<sup>nd</sup> CEDR Traffic & Network Management (TNM) Working Group Workshop under the CEDR FA3: SAFETY, OPERATIONS, MOBILITY & PERFORMANCE held in the National Traffic Management Center at Utrecht on 16-17 May 2018.

Scope of the HSR fact sheet is limited to the needs and requirements of NRAs towards HSR planning and deployment highlighting the main relevant issues and best-practice assessment results discussed in the working group. The aim is to summarize experiences with focus on impacts and factors related to HSR and give recommendations and arguments for NRAs to implement and operate HSR.

The Fact Sheet will not include basic concepts or technical deployment guidelines, as these guidelines are well known and published, e.g. the EasyWay HSR Deployment Guideline (<http://dq.its-platform.eu/DGs2012>). A good overview of HSR basic concepts and definitions can be found in CEDR Task Group T12 report Traffic Management to reduce congestion ([http://www.cedr.eu/download/Publications/2013/T12\\_Traffic\\_management.pdf](http://www.cedr.eu/download/Publications/2013/T12_Traffic_management.pdf)).

The CEDR TNM WG HSR Workshop minutes and presentations are available on the CEDR website in the members' area ([www.cedr.eu](http://www.cedr.eu)).

## Definition of Hard Shoulder Running

Hard shoulder running (HSR) enables dynamic use of hard shoulders as an extra driving lane with the aim to increase road capacity in times of high traffic demand (see CEDR T12 report).

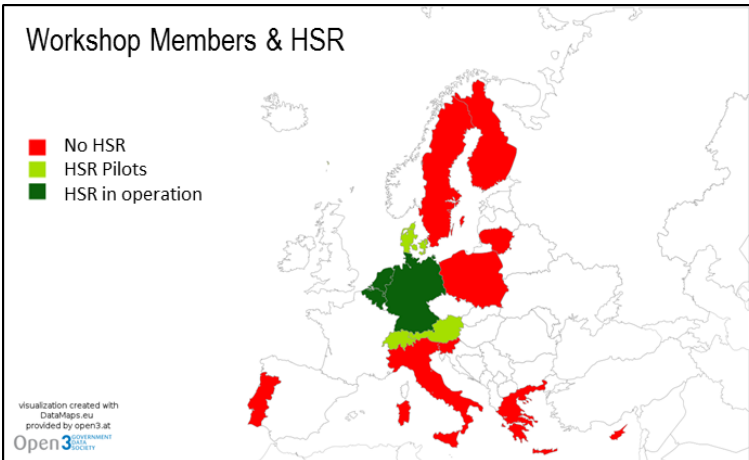
## Conclusion and Main Position of WG TNM on HSR

Based on the previous experiences of countries where HSR has been in operation for several years, **HSR could be recommended as useful measure** to (temporarily) increase capacity on sections of the road network to avoid or reduce (heavy) congestion and to reduce the probability of incidents, especially rear-end collisions.

Evaluation studies in the UK, Germany and the Netherlands reveal that with proper design and deployment of HSR can temporarily increase capacity by up to 25% and network performance up to 20%. Because of the reduced probability of congestion related incidents, the impact to road safety is rather positive and not negative when HSR is operated in an appropriate way. During the pilot phase, impact assessment studies in the UK on the M42 show a reduction of personal injury accidents of up to 20% after implementation of HSR on heavy congested sections. Such positive safety impacts of HSR deployment are supported by recent evaluation results in the Netherlands where significant improvements of more than 25% were seen in several HSR deployment locations evaluated over a period between 2000 and 2014.

HSR provides a valuable tool to react on traffic problems in a fast way. While the construction of an additional lane takes several years on average, the deployment of HSR normally can be realized in a

relative short space of time, with a more smooth-running planning process and normally without making the traditional environmental impact assessment. HSR could be the first step in solving capacity problems and help NRAs as a temporary solution until traditional lane widening are decided, financed and constructed.



**Working Group Members:**

Austria, Belgium, Cyprus, Denmark, Finland, Greece, Italy, Lithuania, Netherlands, Poland, Portugal, Slovenia, Sweden

**Additional Participation or Support to HSR WS:**

Germany, Switzerland

### HSR Planning & Deployment Recommendations

Hard shoulder running is usually triggered by traffic demand or at fixed times, and applied for bottlenecks or problem stretches with recurrent – but not constant – lack of capacity (see CEDR T12 final report). For road operators and NRAs this traffic management measure is a feasible option to react on temporary traffic problems (peak hours) in short space of time. Nevertheless, not every stakeholder is convinced of the benefits of HSR, amongst others because of reservations in the field of traffic & road safety. The use of the hard shoulder as a temporary lane means less space for broken down vehicles, and rescue and emergency service vehicles may also have problems to access the incident location.

For a successful introduction and operation of HSR the following issues should be considered by NRAs as they are identified as important by the CEDR working group for the planning and deployment stage (without claim of completeness).

For HSR planning, the following issues are identified as important by CEDR TNM WG members:

- Clarity about the legal framework is necessary to enable HSR deployment
- Involvement and engagement from all stakeholders from the start is crucial to ensure effective implementation
- Assessment studies are useful for ex-post and ex-ante stages of HSR deployment to gain knowledge and fine-tune deployments
- Organizational resources need to be ensured prior to deployment
- Liability issues for HSR operation should be clarified in advance
- HSR needs to be viewed not only from a local scale but also from a network-scale to enable proper delivery and assessment.

For HSR deployment, the following issues were identified as important to consider by TNM WG members:

- Adequate lane widths need to be ensured for trucks
- Adequate capacity should be ensured for downstream sections of the HSR deployment area
- Debris clearing is essential prior to activation. Debris is defined and communicated according to DATEX II safety related message sets as general or environmental obstructions and obstacles on the road are posing a danger to drivers (DATEX II CEN/TS 16157)
- 100% CCTV coverage and continuous monitoring of hard shoulder during operation is needed
- Effective automatic incident detection methods could improve HSR operation (but is no “must” criteria)
- Proper delivery of emergency corridor when needed during HSR activation must be ensured
- Adequate Lane Control Systems (LCS) using VMS are necessary to indicate whether hard shoulder could be used or not (opened / closed)
- Hard shoulder should be considered and treated as normal lane in case it is opened. Speed limits or overtaking bans for trucks could be appropriate but it depends on the actual situation on the HSR section
- Continuous training of operation staff is required
- Continuous monitoring of HSR operation is required to fine-tune operation protocols
- In the winter time it is important to handle salting and snow removal on the hard shoulder with the right timing.

Many of the above issues are handled in detail in the EasyWay HSR deployment guidelines that can be used as good starting point for planning deployment of HSR along European harmonised framework (See link: <http://dg.its-platform.eu/DGs2012>). In addition, a useful source for HSR deployment requirements can be found in Highways Agency Implementation Guidance for Hard Shoulder Running (Interim Advice Note 111/09): See link: [http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian111\\_09.pdf](http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian111_09.pdf))

To counter reservations regarding traffic safety, NRAs should identify possible risk situations of hard shoulder usage and define additional safety measures. Possible risk situations and relevant safety measures are for instance:

Possible risk situation	Safety measure	Implementation NL	Implementation BE
Accidents - occur mostly due to congestion <ul style="list-style-type: none"> <li>• HSR to prevent congestion, but accidents still possible</li> </ul>	Informing road users of traffic jam	Implementation of overhead signals	LCS for closing hard shoulder and other lanes quickly
Inaccessible accident location <ul style="list-style-type: none"> <li>• HS not available for emergency vehicles</li> <li>• Safety and traffic flow risk</li> </ul>	Possibility to quickly clear a lane	Implementation of overhead signals	LCS incl. induction loops Local specific arrangements with emergency services
Vehicle breakdown <ul style="list-style-type: none"> <li>• No refuge for breakdown vehicle</li> </ul>	Create new refuge area; Informing road users of traffic jam	Emergency refuge areas every 1000 m Overhead signals	Emergency refuge areas every 500 m LCS incl. induction loops
Unclear status of the hard shoulder lane <ul style="list-style-type: none"> <li>• Closed -&gt; misuse -&gt; possible accidents with breakdown vehicle</li> <li>• Open -&gt; less utilization -&gt; decrease of capacity</li> </ul>	Clear design & good communication. Only activate HSR when extra capacity is actually needed	Solid line to emphasize closed situation Red cross on overhead signal above hard shoulder (whenever closed)	Red cross on overhead signal above hard shoulder (whenever closed)



Closed HS in Belgium



Opened HS in the Netherlands

## Benefits - Best Practice Assessment

During the workshop, assessment results were found in several ex-ante and ex-post HSR deployment reports. In general, hard shoulder running offers advantages for a better network performance due to

- Increase of capacity
- Decrease of congestion
- Reduction of delays
- Shorter travel times
- Benefits on traffic safety
- Positive impacts to secondary road network

### Netherlands:

When properly implemented and according to several evaluation results in the Netherlands, HSR deployment benefits include up to 20% improvement of overall traffic performance and up to 80% reduction of delays as well as a 25% reduction of overall congestion. By elimination of upstream congestion, HSR can result in significant improvement of traffic safety (25 - 85% reduction of accidents on several sections). The benefits for traffic safety mostly comes from the reduction of congestion related incidents (elimination of upstream congestion).

### Belgium, Flanders

The ex-post evaluation of HSR in Flanders confirms effective and significant decrease in lost vehicle hours and a perceptible decrease of travel times. Furthermore, positive impacts to the secondary road network could be observed due to a relocation of traffic from secondary roads to motorways. In some cases, there was an increase of congestion downstream latent bottlenecks. Therefore, the whole framework of HSR is important for the overall success. Regarding road safety, no significant change has been observed.

### Germany, Bavaria

Using hard shoulder as a lane can temporarily increase capacity up to 25%. On some stretches positive impacts to road safety resulting in a reduction of accidents up to 20% were possible. In general, no serious impairments to road safety has been established.

## Denmark

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In Denmark one pilot of HSR has been implemented in December 2013 and since evaluated. Considering all the analyses performed the overall key result of the pilot trial is that use of the hard shoulder as a traffic lane in the morning rush hour has generally improved traffic flow, increased capacity, reduced travel times, reduced the variation in travel times, resulted in shorter queues and shorter duration of queues. Further, it has reduced traffic on the local roads along the M13. It is too early to point out any effects on traffic safety, but so far there is no indication neither on positive nor negative effects. Evaluation of traffic safety is planned in 2019.

In addition, the road users are in general satisfied with the introduction of hard shoulder running in Denmark and feels comfortable driving on the hard shoulder.

A socio-economic assessment conducted according to the national guidelines and model for cost-benefit analysis of ITS systems with a 10-year time frame gave positive results and an internal rate of return of 26.8 %. Note that the assessment includes effects on traffic flow only. Safety and environmental effects are not included.

## Austria

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A first pilot has started in July 2018, a comprehensive assessment study is instructed to evaluate the impacts of HSR to traffic situation and road safety.

More information on case studies can be found in the following links:

- <http://www.verkeerscentrum.be/verkeersinfo/studies/overzicht> (in Flemish)
- Annex of the EasyWay HSR Deployment Guidelines. See link: <http://dg.its-platform.eu/DGs2012>
- HSR Fact Sheet from CEDR Working Group T12 “Traffic Management to reduce congestion” Final Report ([http://www.cedr.eu/download/Publications/2013/T12\\_Traffic\\_management.pdf](http://www.cedr.eu/download/Publications/2013/T12_Traffic_management.pdf))
- Highways Agency Implementation Guidance for Hard Shoulder Running (Interim Advice Note 111/09): See link: [http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian111\\_09.pdf](http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian111_09.pdf)
- Danish Road Directorate. Evaluation summary of “Pilot trial with Hard Shoulder Running on the Hillerød Motorway” in English and full evaluation report in Danish. See links: [http://www.vejdirektoratet.dk/DA/viden\\_og\\_data/temaer/its/Documents/Summary%20af%20Hard%20Shoulder%20Running%20evalueringsrapport.pdf](http://www.vejdirektoratet.dk/DA/viden_og_data/temaer/its/Documents/Summary%20af%20Hard%20Shoulder%20Running%20evalueringsrapport.pdf) and [http://www.vejdirektoratet.dk/DA/viden\\_og\\_data/publikationer/layouts/delegate/pages/GetPublication.ashx?id=1292381633](http://www.vejdirektoratet.dk/DA/viden_og_data/publikationer/layouts/delegate/pages/GetPublication.ashx?id=1292381633)

## Recommendations and Next Steps

It is of value for NRAs/CEDR countries to exchange and discuss experiences, partly to learn from each other and partly to get closer to a more harmonised approach that will benefit all NRAs.

The workshop on hard shoulder running showed the necessity, advantages and the success of sharing, exchanging and discussing experience, knowledge and best practice examples in a specific field of traffic management measures. The mix of participants from experts having years of operational experience,

countries with first experience from pilots to countries with interests in introducing the measure ensures a fruitful discussion of the overall process from planning, deploying to operating and therefore a useful output for several members of CEDR. It has also strengthened the network between the involved experts, which is expected to make it easier to keep in touch and share knowledge in the future.

As added value to the thematic recommendations regarding hard shoulder running, the necessity and the benefit of having workshops on specific topics like HSR were confirmed and the structure of the workshop was established as successful. Existing guidelines, assessment studies and best practice examples including lessons learnt are very useful and helpful in order to avoid unnecessary mistakes and introduce new measures efficiently. For that reason, such guidelines and documents should further be established and updated.

The following recommendations for continuing the work were developed in the CEDR TNM HSR Workshop by the workshop participants:

- Develop a Knowledge Base of best-practice HSR deployment case studies building on the CEDR members' HSR evaluation reports and international deployment reports, as well as the Knowledge Base of European best-practice HSR deployments found in the EasyWay HSR Deployment Guideline.
- In coordination with EU ITS Platform, CEDR members to set up a mechanism and resources to update existing Guidelines, e.g. the EasyWay HSR Deployment Guidelines, in line with latest developments and evaluation reports in HSR deployments.
- Based on the KPIs agreed in the last TNM WG Workshop on KPIs and to be used for annual reporting of TNM deployment by TNM WG members, the following KPIs are proposed for reporting HSR deployment and impact of operations:
  - o Level of HSR Deployment:
    - Number of HSR deployments categorised according to length of section on which the HSR is being deployed (< 2 km, section length and more than 2 km)
    - % of road network length covered by HSR preferably measured against number of motorway km with peak hour congestion
  - o Congestion/Incident Impact: of HSR
    - No. of incidents by type per km of corridor
    - Average delay per veh. km. of corridor (hours/veh.km.)
    - Average travel time variation per corridor
  - o TM Efficiency:
    - Average Incident Response/Clearance/Duration per km of corridor by type of incident
    - Average TMC ticket resolution time by ticket type
  - o Safety Impact:
    - Number of accidents by type per veh.km. of corridor
  - o User Satisfaction:
    - Measure of user satisfaction levels and safety perception levels after HSR deployment on motorways

## Contribution

This position paper was compiled by CEDR WG Traffic and Network Management.

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CEDR HSR Utrecht Workshop minutes and presentation are available in the Members' Area under FA3.3 on the CEDR website ([www.cedr.eu](http://www.cedr.eu)).