# Deliverable 5.0 Introduction to STTRIDE Evaluation Process Guidelines



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**Project:**                                  STTRIDE

**Project full title:**                       **S**MARTER **T**RAVEL **T**ECHNOLOGY
                                              **R**EVIEW FOR **I**NVESTMENT **DE**CISIONS

**Research Services Agreement:**              CEDR TRANSNATIONAL ROAD RESEARCH
                                              PROGRAMME - Agreement for CEDR Call 2015:
                                              User Needs: Smarter Travel Technology Review for
                                              Investment Decisions (STTRIDE)

**Date:**                                     20 June 2018

**Version:**                                  6

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# Supported by

# Document Information

| | |
|---|---|
| **Contractual date of delivery to CEDR** | 30 June 2018 |
| **Actual date of delivery to CEDR** | 11 June 2018 |
| **Work package contributing** | WP 5 |
| **Circulation** | TBC |
| **Abstract** | TBC |
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| **Reviewer** | Marcus Jones |

# Document Status

| Version | Date | Contributor | Reason of change/remarks |
|---|---|---|---|
| 1 | 30.04.18 | Jean Hopkin | First draft Background and Process sections |
| 2 | 14-23.05.18 | Jesse Fahnestock, Niklas Fernqvist, Erkki Siira | First draft Selecting Technologies sections |
| 3 | 23.05.19 | Jean Hopkin | Added introduction, edited other sections |
| 4 | 05.06.18 | Niklas Fernqvist, Jesse Fahnestock | Further points in response to team review |
| 5 | 06.06.18 | Jean Hopkin | Added navigation diagrams, hyperlinks |
| 6 | 20.06.19 | Jean Hopkin | Corrected hyperlink to D5.0 in Fig 2.2 |

## CONTENTS

# 1    About the STTRIDE Evaluation Process Guidelines

These guidelines are intended to be used by National Road Authorities, their consultants and contractors at both policy and practitioner level.  They provide a methodology and a set of tools for identifying technology-based interventions to implement and for evaluating their impacts. While the primary focus is on interventions aimed at encouraging mode shift towards sustainable travel, the method and the tools are also suitable for interventions addressing other key objectives of National Road Authorities, such as those aimed at improving road safety or reducing congestion.

The guidelines are available on the STTRIDE web site. They consist of this overview document and a series of modules covering the various stages involved in investigating potential technologies or interventions to test or implement and planning and conducting evaluation into the impacts.  The modules are accompanied by templates for users to download and edit to create their own evaluation documentation.

The STTRIDE Evaluation Process Guidelines provide a common framework for CEDR authorities and their consultants to use when investigating and evaluating the impact of technology-based interventions aimed at encouraging modal shift.  It is intended to provide a consistent basis for planning, conducting, analysing and reporting on such interventions that will enable the various authorities to share and compare their results, learn from the lessons of others and build an evidence base for decision-making.  It provides a 'menu' from which authorities can plan their evaluations within an overall project management programme, taking account of their own national and local objectives and priorities and national guidance on evaluation, potentially incorporating this into their own guidance documents.

# 2   Background

## 2.1   Introduction to STTRIDE

STTRIDE is a European project funded by the Conference of European Directors of Roads. The project is addressing how best to use technological advances to deliver positive modal shift towards sustainable travel, with a particular emphasis on the inter-urban network managed by National Road Authorities.

Technology innovation in the mobility sector is moving at a rapid pace.  Many emerging technologies are having or could have a significant impact on people's preferred mode of transport over the next twenty years. This technology-driven paradigm shift provides an opportunity for significant change in traveller behaviour without necessarily requiring major infrastructure investment or legislative intervention. Indeed, this could result in a substantial difference in future transport network demands, emissions and the contribution to healthy lifestyles.

Harnessing the potential of technological development can make more efficient use of existing transport infrastructure and services, as well as facilitating the introduction of new and improved ones. For example, passenger information systems could increase the occupancy of buses, which improves the business case for investing in improvements to the service, thereby encouraging further modal shift.

The pace of change is such that it could be a challenge for road and transport authorities to understand the potential impacts and timescales associated with a wide range of technologies. Once a new technology has appeared, it can also be difficult to assess its impacts.  As a result there is a knowledge gap for authorities wishing to understand how to support, respond to, or invest in, the technologies that will deliver their preferred outcomes.

STTRIDE has identified and analysed technologies which can be seen making impact on positive modal change over the next 20 years and used this analysis to support CEDR authorities by providing a toolkit for selecting investment options for new technologies and a common evaluation framework that can be used to assess the impacts of implementing such technologies.  These comprise the Evaluation Process Guidelines.

The focus is on five thematic areas in relation to emerging technologies; many technologies actually contribute to more than one of these themes:

- **Automation of vehicles**. Although the principal driver of automation is likely to be safety, it could also provide many of the benefits of passenger transport (e.g. productive use of travelling time and reduced concern about car parking) in private vehicles, potentially encouraging shift away from mass transport.  Conversely, this technology could also be an enabler of vehicle sharing and demand-responsive services to provide access to public transport and so reduce the proportion of single-occupancy journeys.
- **Information**. Real time multi modal information provision can identify alternative travel options, both before and during the journey, enabling plans to be revised in real time, which reduces the risk and uncertainty associated with public transport and enabling better use to be made of travelling and interchange time. This reduces the 'generalised cost' of public transport in demand modelling theory, and would be expected to encourage greater uptake of it.
- **Journey efficiency**. New technologies can help transport authorities to give greater priority to public transport vehicles, making it more attractive compared to driving. It can also help operators to make better use of capacity enabling improved cost-effectiveness, potentially leading to lower fares and improved investment.
- **Mobility as a Service (including payment).** Enabling the provision of new mobility services, such as bike hire or car sharing, which cannot realistically be managed without sophisticated information and payment systems.

- **Safety**. This covers technological improvements to individual modes or the wider environment, which would impact the perception of safety and people's willingness to use alternative modes.  For example, an improved environment for cyclists through new transport infrastructure, including more advanced junction designs.

## 2.2    Using these guidelines

These guidelines are based on experience, consultation and best practice in evaluation guidance for transport interventions. They provide a common framework for CEDR authorities and their consultants, to use when evaluating the impact of technology-based interventions, particularly but not exclusively those aimed at encouraging modal shift and identifying the extent to which they have met their objectives after implementation.  Evaluation is a key element of implementing any scheme involving new technology where the impacts and consequences are not well known and understood.

These guidelines are aimed at directors, strategic planners and scheme evaluators, whether employees or contractors of National Road Authorities. Evaluation is often carried out by an organisation that is independent of those involved in implementing the intervention so that it can be clearly seen as an unbiased assessment.

Roles and responsibilities are changing with the increasing use of new technology to manage and operate roads and transport systems.  Specialists in the private sector have a growing role in service delivery, while road authorities are expected to focus more on coordinating actions and setting principles, standards and boundaries. These guidelines are intended to support road authorities in this role.

The impacts which the guidance can be used to evaluate might include the transport impacts of 'non-transport' interventions and the potential benefits of the transport industry implementing technologies from other industries to achieve transport objectives, as well as applying technology to transport interventions.  It is intended to provide a consistent basis for planning, conducting, analysing and reporting on such interventions within an overall project management programme that will enable the various authorities to share and compare their results, learn from the lessons of others and build an evidence base for decision-making.  It is however important to note that objectives and priorities may vary from one country to another, so the scope of evaluations may vary within the overall 'menu' provided in this framework. Countries may also need to take account of national guidance on conducting evaluation and may potentially incorporate this document into their own guidance.

These guidelines cover each stage in the process of selecting, testing and evaluating interventions involving new technologies to achieve modal shift and may be used at any point in this process.

The guidelines are divided into a series of modules, as shown in Figure 2.1 below.  Hyperlinks in each stage of the diagram enable users to navigate to other modules.

In addition to the modules shown in Figure 2.1, a supporting module on the STTRIDE web site provides references for further reading and a glossary of terms.

**Figure 2.1 Modules of STTRIDE Evaluation Process Guidelines**

 1 Evaluation in the context of STTRIDE

 2 Evaluating technology-based interventions to encourage mode shift

 3 Investigate potential technologies

 4 Analyse potential technologies

 5 Define user needs and resource plan

 6 Describe the intervention

 7 Describe the intervention logic

 8 Define evaluation objectives

 9 Frame the research questions

 10 Pre-assessment of outcomes and impacts

 11 Define assessment methods and write evaluation plan

 12 Data collection and analysis

 13 Report results

The modules of the guidelines are made up of the following elements:

- The Evaluation Process diagram, with shading to indicate the stage covered by the current module
- Green text boxes summarise the main points of each stage
- Blue text within narrower text boxes gives examples of the concepts relevant to specific technologies
- Links are provided to blank templates for use in each stage of technology selection and evaluation planning
- Completed templates are included on the STTRIDE web site to illustrate the process, including templates for a common structure for writing an evaluation plan and a common framework for reporting results to enable road authorities to compare their results
- Separate files are provided containing templates which can be used as the basis of working through the various stages of the Evaluation Process Guidelines and producing an Evaluation Plan and an Evaluation Results Report.

Figure 2.2 provides a map of the modules and templates comprising the Evaluation Process Guidelines. Users may click on hyperlinks within the cells of Figure 2.2 to reach the modules and template files.

**Figure 2.2 Links to documents, modules and templates in the STTRIDE Evaluation Process Guidelines**

## 2.3    Evaluating new technologies and their impact on mode shift

The STTRIDE Evaluation Process Guidelines bring together techniques from technology and innovation assessment and evaluation best practice into one process for selecting and evaluating new technologies and their impact on mode shift.  The key innovative elements of this approach are summarised here.

The guidance connects horizon scanning with evaluation by integrating the investigation of potential technologies (in the 'Investigate potential technologies' module on the toolkit page of the STTRIDE web site) into an overall process which includes selection of relevant technologies and evaluation of the impacts of those technologies after they have been implemented.

In the 'Analyse potential technologies' module on the toolkit page of the STTRIDE web site, the guidance sets out the principles and main points about new technologies that need to be understood in order to use them to encourage mode shift and evaluate their impacts.

The guidance illustrates how to integrate user needs both into the process of selecting technologies to implement (in the 'Investigate potential technologies' and 'Analyse potential technologies' modules) and in the planning of evaluation to assess impacts of the technologies implemented (in the 'Define User Needs' module).  This can be done through dialogue with stakeholders and users and their representatives, on a one-to-one basis, in groups or through surveys and public consultation.

The approach maintains a focus on relevant impacts and considers external influences that affect the technologies by using logic mapping. The 'Describe the intervention logic' module on the toolkit page of the STTRIDE web site illustrates a method for mapping out the types of change in mode use that may be brought about by the technology, the context and 'inputs' that affect an intervention and the links to its short and medium outcomes as well as its long term impacts.

The 'Define assessment methods and write evaluation plan' module on the toolkit page of the STTRIDE web site illustrates how new technologies bring in new data sources that can be used in the evaluation.  These data may be generated by the technology itself or may include new sources that are made possible through technology advances, such as 'Open Data'.

# 3      Selecting technologies to test or implement

## 3.1      Investigate potential technologies

Technology innovation in the mobility sector may have a significant impact on citizens' preferred mode of transport. Infrastructure, vehicles and end-user handsets are becoming increasingly intelligent and instrumented with sensors and broadband connectivity. This in turn enables a wide range of future smart mobility services, e.g. from usage-based vehicle insurance to multimodal trip planning and to seamless door-to-door mobility services. Potentially, this type of change could provide a substantial difference in future transport network demands, emissions and in the contribution which travel makes to healthy lifestyles.

Significant changes in traveller behaviour do not necessarily require major infrastructure investment or legislative intervention.  However, it is important to highlight that it may be too optimistic to rely only on information campaigns to bring about significant voluntary behavioural changes of end users' mode choices.

In order to identify and select the relevant technologies to test or implement, it is recommended, based on the experiences from the STTRIDE project, to focus on technologies that are emerging and are assumed to positively affect traffic or road users' modal choice.

The 'Investigate Potential Technologies' module on the toolkit page of the [STTRIDE web site](#) describes in more detail how such an investigation could be conducted. The module outlines a five-step process to help in the task and describes these steps in detail. The module also offers templates to use in the investigation. The templates can be used as checklists to ensure a thorough investigation even if they are not completed, as they indicate the various things to think about when doing the investigation. As with all the guidance and templates provided in the STTRIDE Evaluation Process Guidelines, the stages set out in the module and the details in the templates can be modified to match individual requirements.

## 3.2      Analyse potential technologies

In the STTRIDE project, most of the technologies analysed were identified as being on middle of the Technology Readiness Level (TRL) mapping scale, which means that they are under exploratory development. This is natural as many of the identified potential technologies are emerging or not yet widely deployed within the fields of traffic or modal choice. However, it is important to note that some of the relevant technologies may be abstract enough that even if a first version arrives on the market in 5 years, it might still take 20 years to become main stream. In addition, for many of the technologies other actors apart from the National Road Authority are involved in the realisation of new services. Therefore in order to evaluate the possibilities of new technologies, more 'systemic' evaluation schemes are necessary.

In order to investigate or assess the relevance of, or the possibilities for, a technology, two different stages of largely qualitative analysis can be applied based on the information gathered in the 'Investigate potential technologies' stage described in Section 3.1. In the first stage, the analysis may be concerned with rating the extent to which technologies are relevant to the context and mode shift issue that is being addressed, perhaps on a three point scale (representing high medium, low). A suggested list of criteria might include:

- Meets significant user need (safety, easy of use, cost, reduced travel time)
- Implemented by a system operator
- Implemented by a private company
- Distributed/ peer to peer service
- Promotes shift away from cars
- May favour public transport on National Road Authority network
- Increases vehicle sharing

- Direct relevance to National Road Authority network
- Indirect relevance to National Road Authority network
- System/ component
- Enables/ optimises decisions.

Thorough analyses are suggested in order to guide policy decisions or actions on selecting future technologies. However, to make a first scan of the potential systemic impact of new technologies, relevant factors can be identified, selected and scored by experts, for example in expert interviews.  Scoring could be considered from point of view of the Road Operator, Travellers and the Local Authority.

The second stage in the analysis would then involve using this assessment and the information gathered in the initial investigation to select a shortlist of technologies for further investigation and consideration.  This shortlisting process might assess the emerging technology according to the following criteria (again scoring them on a 'high/ medium/ low' scale):

- Scale of potential impacts
- Nature of potential impacts on mode choice - direct or indirect
- Extent of existing research.

In order to determine which technologies to select and implement, the scoring of the shortlist can then be used to identify a few higher scoring technologies for further examination. This would then look at:

- Future impact logic – overall assessment of the scale and nature of the impact which deployment of the technology will have on end users' mode choice, as well as the road authority's role and ability to influence the impact
- Future market characteristics and potential: who are the suppliers and customers, what is the geographic scope and potential market size?
- Innovation characteristics – what are the main challengers and enablers to the development and deployment of the technology, in a transport system perspective?

There are a number of different options for identifying challengers and enablers for generation, diffusion, and utilisation of a new technology. Two examples are PESTLE analysis (Political Economic, Societal, Technological, Legal and Environmental) of challengers and enablers and Technological Innovation System (TIS) Analysis. Further information about these techniques is available in Module 4 'Analyse Potential Technologies'. STTRIDE deliverables D3.1 and D3.2 on the STTRIDE web site include examples of such analysis that were carried out in the STTRIDE project.

## 3.3    Select technologies to test or implement

To help in determination of which technologies to select and implement via pilot, demonstration or full-scale deployment, a preliminary analysis of the technologies' development and potential can be of value. Based on its own assessment of 10 technology groups, the STTRIDE project recommends an examination of:

- The future impact logic: An overall assessment of the scale and nature of the impact the technology's deployment will have on modal choice, as well as the road authority's role and ability to influence the impact.
- The future market characteristics and potential: who are suppliers and customers, what is the geographic scope and potential market size?

The results of all this analysis can be summarised alongside potential impact on modal shift, user needs, market characteristics etc. in a single table to support selection of technologies for piloting/ testing/ demonstrating/ deployment. Table 4.1 in the 'Analyse Potential Technologies' module on the toolkit page of the STTRIDE web site provides an example.

# 4      Process for trying out the selected technology

## 4.1     Evaluating technology-based interventions to encourage modal shift

The STTRIDE evaluation framework provides a common, consistent basis for CEDR members to use when evaluating new technologies to encourage mode shift away from single occupancy car journeys and then reporting on the results in a consistent manner. This consistency is intended to help CEDR members to compare different interventions and benefit from a pool of evaluation results focused on interventions addressing this specific objective. Additionally, in cases where trial interventions are managed via external research or consulting engagements, the framework can provide guidance on evaluation *from* a CEDR member *to* its contracting partner.

To understand the impacts of STTRIDE interventions, evaluation will tend to focus on changes in single occupancy car use on the inter-urban network, and resulting impacts on congestion and wider policy impacts such as improving safety, environment, health and well-being. However the framework is intended to be sufficiently generic that it can help users to think through the issues relevant to evaluating this type of intervention and then prepare an evaluation plan that is tailored to their own context and planned intervention.  Thus not all of the details set out in the framework will be relevant to all contexts and types of intervention.  However when using this common framework, there will be some national differences in the way that it can be applied, for example due to the need to take account of national guidance or due to differing roles of National Road Authorities.

Usually in the case of interventions involving new technologies, a trial is undertaken before full scale implementation. Evaluation of the trial will then inform the decision on whether or not to proceed with further implementation. The approach to evaluation set out in this framework is appropriate for both trials and full scale implementations.

Module 1 of the guidance on the Toolkit page of the STTRIDE web site explains evaluation in the context of STTRIDE.

Module 2 on the toolkit page of the STTRIDE web site explains what evaluation is, makes the case for doing it and how it fits into the project life cycle and project management processes for a transport intervention aimed at encouraging mode shift away from singly-occupied cars. It also considers the most appropriate approach to use for evaluations within the scope of STTRIDE.

## 4.2     Overview of stages in impact evaluation

Following best practice principles, the STTRIDE evaluation framework involves working through a series of stages in the process of evaluating the impacts of an intervention, from the initial investigation of what users need from the evaluation to the reporting of evaluation results. These stages are set out in Figure 4.1 below which covers the evaluation planning, execution and reporting stages of the Evaluation Process Guidelines shown in Figure 2.1. Clicking on the cells of Figure 4.1 will link to the evaluation modules on the toolkit page of the STTRIDE web site.

The process of defining evaluation of a trial or a new larger scale intervention starts at the point when a decision is made to proceed with the trial or intervention. It is important that evaluation is planned before implementation so that the current situation can be accurately monitored to provide a baseline against which to compare the intervention's impacts. Monitoring and evaluation are an important part of project management and programme risk management, and the approach presented here can be incorporated within project management processes.

**Figure 4.1 Stages in the evaluation process**

| | |
|---|---|
| STTRIDE | 5 Define user needs and resource plan |
| STTRIDE | 6 Describe the intervention |
| STTRIDE | 7 Describe the intervention logic |
| STTRIDE | 8 Define evaluation objectives |
| STTRIDE | 9 Frame the research questions |
| STTRIDE | 10 Pre-assessment of outcomes and impacts |
| STTRIDE | 11 Define assessment methods and write evaluation plan |
| STTRIDE | 12 Data collection and analysis |
| STTRIDE | 13 Report results |

## 4.3    Evaluation Plan

In each module of this guidance, an example is provided to indicate how the information summarising each stage can be set out systematically in a table or diagram.  These tables and diagrams are compiled in an evaluation plan. The evaluation plan is a living document, built up and agreed by the various members of the evaluation team.  It provides a single reference source for use throughout the evaluation process.  It is intended to be stand-alone, but may need to summarise and refer to other key documents.  A template for an evaluation plan is set out in Template 11b of the guidance on the STTRIDE web site.