



# SeRoN

**Security of Road  
Transport Networks**

FP7-ICT-SEC-2007-1  
Grant Agreement no. 225354  
[www.project-seron.eu](http://www.project-seron.eu)

**Final Report**

**Date of delivery:**  
**20/12/2012**

**Version: 1.0**

**Dissemination: CO**



## Project information

Grant Agreement no.: 225354

Project acronym: SeRoN

Project title: Security of Road Transport Networks

Funding scheme: Small or medium-sized focused research project

Period covered: from 1<sup>st</sup> November 2010 to 31<sup>st</sup> October 2012

Name, title and organisation of the scientific representative of the project's coordinator:

Dr.-Ing. Georg Mayer  
PTV Planung Transport Verkehr AG  
Kriegerstr. 15  
D-70191 Stuttgart  
Germany  
Tel: +49 711 16270 35  
Fax: +49 711 16270 70  
E-mail: [georg.mayer@ptv.de](mailto:georg.mayer@ptv.de)

Project website address: [www.seron-project.eu](http://www.seron-project.eu)

# Contents

<b>Project information.....</b>	<b>II</b>
<b>Contents.....</b>	<b>III</b>
<b>1. Final publishable summary report .....</b>	<b>1</b>
1.1 Executive summary .....	1
1.2 Summary description of project context and objectives.....	2
1.3 Description of the main S&T results/foregrounds .....	5
1.4 Potential impact including the socio-economic impact and the wider societal implications of the project so far, main dissemination activities and exploitation of results .....	17
1.5 Address of the project website and relevant contact details .....	25
<b>2 Use and dissemination of foreground .....</b>	<b>27</b>
2.1 Section A .....	27
2.2 Section B .....	32
<b>3 Report on societal implications .....</b>	<b>36</b>

# 1. Final publishable summary report

## 1.1 Executive summary

Interdisciplinary interaction of expertise and innovative simulation methods has been the basis for the development of the new SeRoN methodology. It is a four-step approach which provides a common framework to identify critical infrastructure objects and to investigate protection measures at critical infrastructure object level in detail with regard to their impacts onto risk mitigation and the road network. Its modular structure facilitates a stepwise application of the relevant analyses, adjusted to the respective level of detail required. It also allows using a wide range of other models than the ones taken or replacing the models by expert knowledge.

To examine improvements of the security level due to protection measures, the quantitative risk analysis (QRA) method has been applied. Hereby, the probability/likelihood of an event as well as the related degree of damage was taken into account. Cost-effectiveness of measures is determined based on the difference between risk with and without the implementation of the respective protection measure.

Based on a bow-tie analysis using fault trees (before event) and event trees (after event) the probabilities of the final states in the course of events and the corresponding risk were determined. Highly sophisticated models like computational fluid dynamics (CFD) models, short-time dynamics / blast models and Finite Element Method (FEM) models have been taken to calculate the effects and to quantify the impacts on infrastructure objects and road users in case of event. The effects on road users have been identified using an evacuation model which describes pedestrian movements depending on external influences, taking into account perception and behaviour. To determine the impacts of an event on the transport network a traffic and transport model was used.

Finally in order to be able to compare the different protection measures examined with regard to their cost-effectiveness, the risks are monetized. Cost-effectiveness was determined from the above-described direct and indirect consequences in case the infrastructure object fails due to an event. Hereby, the basis of assessment for decision-making whether a protection measure is cost-effective or not, can be adapted, if considered necessary, in order to be able to represent the characteristics of the network considered.

The SeRoN methodology allows road owners and operators identifying critical road infrastructure objects (like bridges and tunnels) and selecting suitable and cost-efficient measures to improve the resilience of the road transport network. Thus, it provides support in developing short-term and long-term strategies to improve the

security of transport infrastructures and offers guidance for future investments into protection measures and risk mitigation strategies. Hence, available financial means can be used optimally, i.e. in a purpose and goal-oriented way, to protect the road network for the benefit of the security of European citizens.

For more information on the SeRoN approach and its results, visit the project website under [www.seron-project.eu](http://www.seron-project.eu).

## 1.2 Summary description of project context and objectives

In line with the objectives formulated in the Directive of the Council 2008/114/EC on the identification and designation of European Critical Infrastructure and the assessment of the need to improve their protection, the SeRoN (**S**ecurity of **R**oad **T**ransport **N**etworks) project was set up. It responded to the Call: FP7-ICT-SEC-2007-1, Activity: Security Theme, Area: “Security systems integration, inter-connectivity and interoperability”, Topic: ICT-SEC-2007-1.0-01: “Risk assessment and contingency planning for interconnected transport or energy networks” of the 7th EC Framework Programme.

The European road network is of major importance for the European economy and equally for the mobility of the European citizens. For example, TEN-T road projects (like Elbe crossing A20 or Øresund bridge) play a major role. Therefore, one of the main challenges of road owners and operators in Europe is to ensure the availability of important links. Even smaller disruptions due to traffic disturbances or failure of some infrastructural elements of the road network may lead to severe traffic disruptions and result in high economic follow-up costs and negative environmental impacts. Due to the interdependence of the road transport network with other traffic modes like rail, air and shipping, failing important traffic connections could even have cascading effects.

Particularly bridges and tunnels are key elements of the road network. Based on geographical constraints they often have a bottleneck function. Besides severe accidents, e.g. involving trucks carrying dangerous goods, man-made attacks are one of the most dangerous threats to that kind of key infrastructure.

Transportation infrastructures are attractive targets for man-made attacks. They are rather easily accessible and their failure may have great impact on human lives and economic activities. Attacks may cause considerable damage, including structural damage or complete demolition, substantial numbers of human casualties, socio-economic losses (unemployment, relocation of firms, reconstruction costs) and socio-political damage (public uncertainty, confidence loss) and also result in environmental consequences; each damage being accompanied by the related costs.

The SeRoN project focused on security issues of the road transport network and its infrastructure objects. Its main objective was to investigate the risk and the impacts of possible man-made attacks on the transport network, in particular the resulting effects on long-distance transport links and their economic impacts. SeRoN focused on the development of a methodology which is to help owners and operators to analyse critical road transport networks or parts thereof with regard to possible man-made attacks. It evaluated suitable protection measures for critical road transport infrastructure objects concerning their impact on security and cost-effectiveness. Finally SeRoN gives adequate recommendations on the application of the SeRoN methodology for owners and operators of critical infrastructure to assist them in strengthening the robustness of their infrastructure objects.

In order to reach the project objectives a holistic risk-based approach was undertaken. Research work distinguished between object level, i.e. the individual infrastructure object, and network level, i.e. the impacts of any attack onto the larger road network. This distinction reflects the general idea that infrastructure objects like bridges or tunnels may be regarded as critical due to object-inherent factors, e.g. its structural prerequisites but also due to the wider network-related implications such as failure of a given bridge or tunnel and the consequences for the overall traffic flow, either region-wide, country-wide, or even EU-wide.

The SeRoN project was broken down into seven research-related work packages: First of all, a comprehensive threat analysis for transport infrastructures focusing on man-made attacks was undertaken (WP100). Then data on relevant infrastructure types and classes of the trans-European road network was gathered from infrastructure owners and operators in Europe (WP200). Apart from data already available to project partners or relevant owners, further survey data was obtained by questionnaires and interviews, contacting infrastructure owners and operators of road networks all over Europe, who have gathered these data, for example, in the course of national security research programmes. Road infrastructure owners and operators were ensured that data would be treated accordingly; data access was restricted to prevent unauthorised access. The data provided was evaluated to identify generic infrastructure types and classes critical in terms of vulnerability to man-made attacks, e.g. due to their type of construction. Infrastructure objects were classified according to the risk they are exposed to; the results of such classification were necessary input data for the developed knowledge database (WP300). Then suitable protection measures to reduce the risk and to improve the redundancy of vulnerable bridge and tunnel infrastructures were identified, broken down into structural, operational and organisational measures. They cover the time before (prevention), during (mitigation) and after (reconstruction and re-commissioning) an attack. Specific data relating to possible protection measures was equally obtained contacting owners and operators of road networks in Europe; the results again provided input data for the knowledge database developed.

As mentioned above, within SeRoN a knowledge database was established to bring together data gathered on the different objects (bridges and tunnels). It is a tool to

manage and maintain categorised critical infrastructures and associated possible protection measures. Such object-level information is needed for the calculations done at network level. The structure of the database is made available on the SeRoN project server.

Then the importance of the individual infrastructure for the transport network was determined. Using scenario analyses and macroscopic traffic flow models a road network or parts of it were analysed and the impacts of a failure of one or more critical infrastructure objects as well as the resulting traffic disturbances, disruptions or diversions examined (WP400). Network data included information on location and importance of infrastructures within the road network, traffic loads, etc. Following the analysis at network level critical infrastructure objects of the road network could be identified and ranked according to priority and benefit components for the risk assessment were calculated.

For each relevant structure a risk assessment was undertaken, taking into account countermeasures to thwart attacks (WP500). In addition to the assessment of the probabilities of the course of the scenarios the calculation of risks included the analysis of impact on the respective object with specific occurrence scenarios accounted for in a bow-tie approach. The impact was then estimated using traffic and transport models as well as other simulation models, e.g. escape simulations, explosives and smoke propagation simulations. Security improvements in the road network by measures applied to one or more infrastructures were determined. The monetary and economic impacts of the different measures were also examined by means of cost-benefit analyses in order to identify the cost-effective security measures.

Finally the newly developed SeRoN methodology was validated by applying the approach to other infrastructure objects on different European highway links (WP600).

Throughout the project the formulation and dissemination of project recommendations were in the focus of work (WP700). External expert knowledge and advice was gathered during project workshops to which selected experts (e.g. network owners and operators from different member states) had been invited. The concluding recommendations summarize the findings and include technical, institutional and macro-economic items.

The developed and validated innovative methodology of SeRoN provides a common framework for the identification of critical road infrastructure objects with respect to their importance within the European transport network by means of an interdisciplinary interaction of expertise and innovative simulation methods. Furthermore, applying this methodology, road infrastructure owners and operators can select suitable protection measures and evaluate them regarding their cost-effectiveness, which enables them to make reasonable use of their usually limited budget.

## 1.3 Description of the main S&T results/foregrounds

The European consortium of seven project partners consisting of PTV Planung Transport Verkehr AG as coordinator of the project, Federal Highway Research Institute, BAST (both DE), Parsons Brinckerhoff (UK), Technical University of Graz (A), Traficon (B), Ernst Basler + Partner (CH) and NIRAS (DK) has developed a risk-based, stepwise, holistic approach which allows to identifying critical road infrastructure objects (like bridges and tunnels) in a road network and selecting suitable and cost-efficient measures to protect them against man-made hazards. It is primarily aimed at owners and operators of potentially critical road infrastructure objects who want to improve the robustness of their objects. Thus, it contributes to the overall resilience of the European road network and its infrastructures.

The newly developed SeRoN approach consists of the following four steps:

- ▶ Step 1: Road corridor selection and identification of potentially critical infrastructure objects
- ▶ Step 2: Calculation of network importance
- ▶ Step 3: Risk analysis (without measures)
- ▶ Step 4: Measure analysis

The below flowchart illustrates the above-mentioned steps being integrated in the overall approach and gives an overview on the needed prerequisites for the application of the SeRoN methodology. Each step will be described in detail later.

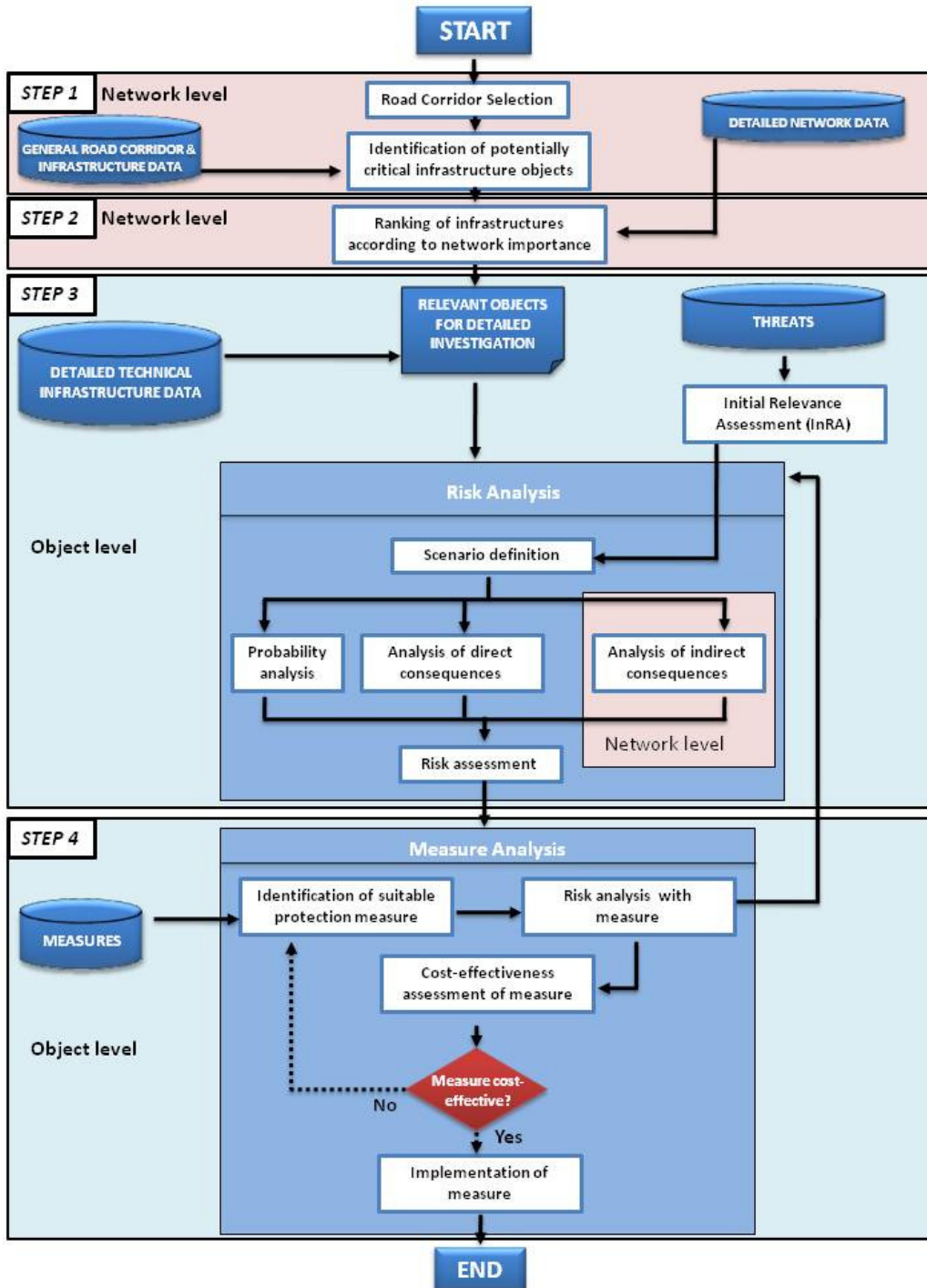


Figure 1: Flowchart of the SeRoN methodology

### 1.3.1 Step 1: Road corridor selection and identification of potentially critical infrastructure objects

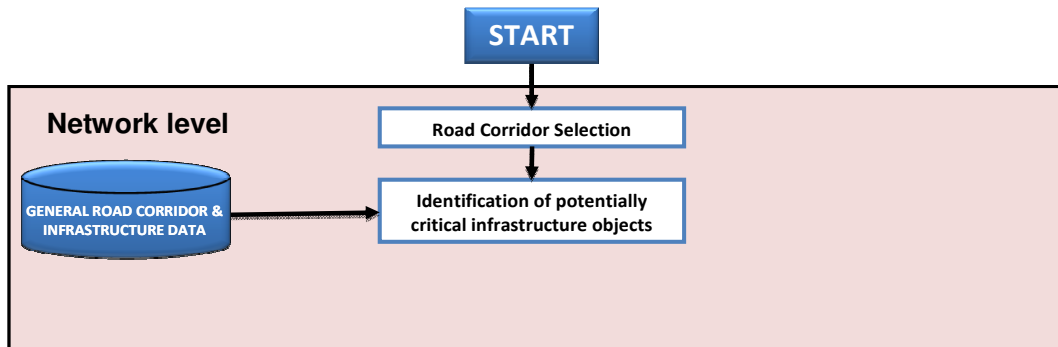


Figure 2: Step 1 of the SeRoN methodology: Road corridor selection and identification of potentially critical infrastructure objects

Step 1 serves the purpose of identifying potentially critical infrastructure objects located on a given road corridor. Therefore, first of all, road operators or owners select the road corridor they want to investigate. It could be any reasonably large road corridor they are responsible for as owners or operators, e.g. a TEN-T corridor which has a vital function in the overall road network of a country or within the EU (see Figure 2).

Once the road corridor has been selected, the relevant technical constructional and traffic-related data of the infrastructure objects along the selected corridor have to be collected. This includes general technical data of bridges and tunnels such as

- ▶ Length
- ▶ Type of bridge or tunnel
- ▶ Road network data such as average daily traffic (ADT) and heavy goods vehicle (HGV) percentage

Usually, road operators will have this data at hand in their own infrastructure databases. Further parameters fed into the database and taken into account are:

- ▶ Location
- ▶ Reconstruction time and
- ▶ Symbolic relevance.

After that, all infrastructure objects on the selected road corridor are investigated according to their potential criticality. To do so, the gathered data are entered or imported into the knowledge database which has been developed within the project. The knowledge database is a template for an extendable list of infrastructure objects including different assessment tools on Microsoft Excel © basis and contains 27 different parameters for bridges and 40 different parameters for tunnels, which are not only needed to execute Step 1, but also the later Steps 2, 3 and 4.

The assessment tool called “Critical Infrastructure (CI) Pre-selection Method” then automatically calculates the values of the criticality criteria, using a binary logic (1 = potentially critical; 0 = not critical). These criticality criteria are:

- ▶ Traffic volume
- ▶ Damage potential
- ▶ Economic consequences and
- ▶ Probability of attack.

For each criticality criterion threshold values can be defined. In SeRoN, for example, as far as traffic volume is concerned, an average daily traffic (ADT) of more than 100,000 vehicles per day or a percentage of heavy goods vehicle volume (HGV) higher than 20% on a given road infrastructure object was used. If the set threshold values are exceeded, the infrastructure object is considered critical regarding that criterion. Such threshold values may be adjusted according to the infrastructure stock and the particularities of the road network to which the method is to be applied. Based on their *total criticality scores* covering all criteria (ranging from 0 = no criticality to 4 = highest criticality) the infrastructure objects can be sorted and ranked, with the potentially most critical infrastructure objects at the top.

<b>Bridge / tunnel</b>						
Object	Critical due to criterion...				Overall criticality (4 = highest, 0 = no criticality)	Ranking (in words)
	<i>1<sup>st</sup> Traffic volume</i>	<i>2<sup>nd</sup> Damage potential</i>	<i>3<sup>rd</sup> Economic consequences</i>	<i>4<sup>th</sup> Probability</i>		
<b>A</b>	1	1	1	1	<b>4</b>	Most critical
<b>C</b>	1	1	0	1	<b>3</b>	2 <sup>nd</sup> most critical
<b>B</b>	1	0	1	0	<b>2</b>	3 <sup>rd</sup> most critical
<b>D</b>	1	0	0	0	<b>1</b>	4 <sup>th</sup> most critical

Table 1: Criticality ranking table

All in all, Step 1 serves as a first selection for the identification of potentially critical infrastructure objects in a given road corridor. It can be conducted by every road infrastructure owner or operator himself based on their data at hand. To find out whether these infrastructure objects are also critical at network level it has to be proceeded with Step 2 of the SeRoN methodology.

### 1.3.2 Step 2: Calculation of network importance

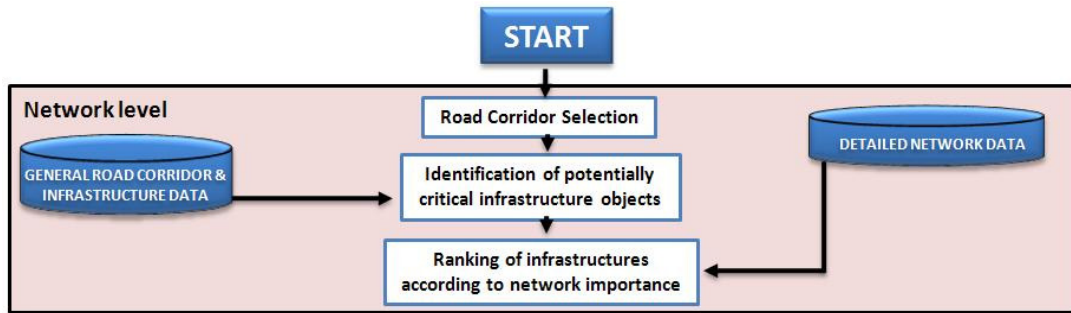


Figure 3: Step 2 of the SeRoN methodology: Calculation of network importance

The infrastructure objects previously identified as potentially critical (Step 1) have to be analysed in a more detailed manner (Steps 3 and 4). Further analyses will take into account specific threats and protection measures which have been determined to be relevant for the respective bridge or tunnel.

However, since the analyses undertaken in Step 3 and 4 can be very complex and require a lot of effort, it may not be possible to include all infrastructure objects identified as being potentially critical. Therefore, Step 2 undertakes the determination of the network importance of potentially critical infrastructure objects and their ranking according to their network importance (cf. Figure 3). The result allows limiting the subsequent analyses to those potentially critical infrastructure objects having top importance in the network. Here, detailed road network data are required and a specific traffic and transport model, e.g. PTV's Visum, should be used.

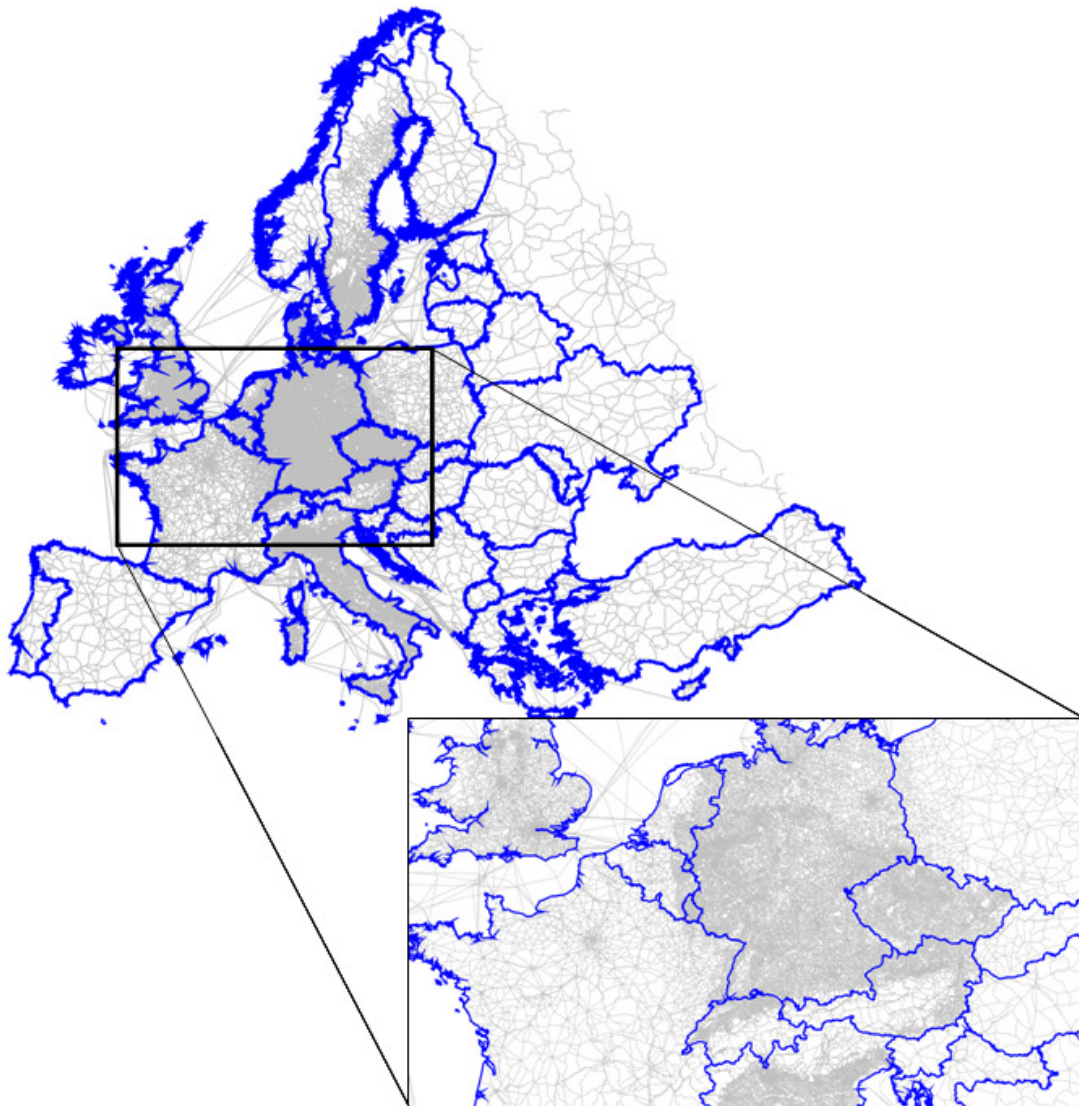


Figure 4: Example of a traffic and transport model

It is strongly recommended to apply the assessment procedure of Step 2 to be able to focus the detailed analyses on those infrastructure objects which are most important for the transport network in order to optimise the use of resources.

Network importance is defined as the benefit which arises from the prevented non-availability or failure of a certain infrastructure object. Hereby, the network importance of a road infrastructure object is not only reflected by the consequences of its non-availability for road transport, but by any kind of socio-economic effects resulting from a man-made attack, for example, on the transport infrastructure. Therefore, the developed assessment procedure is based on the comparison of two uniformly defined scenarios.

- ▶ Scenario A: Full destruction of infrastructure object due to an unspecified event, object not available for any kind of user
- ▶ Scenario B: “Normal” situation, no incident has taken place

The procedure takes into account that road users, traffic flow, the infrastructure object itself as well as the surrounding regional economy may also be affected, should an infrastructure object fail.

For both scenarios the resulting direct and indirect consequences are quantified, monetised and summed up to a *final importance value*. The obtained importance value describes the benefit resulting from the prevented failure or non-availability, and thus, the importance of the infrastructure object for a given road network.

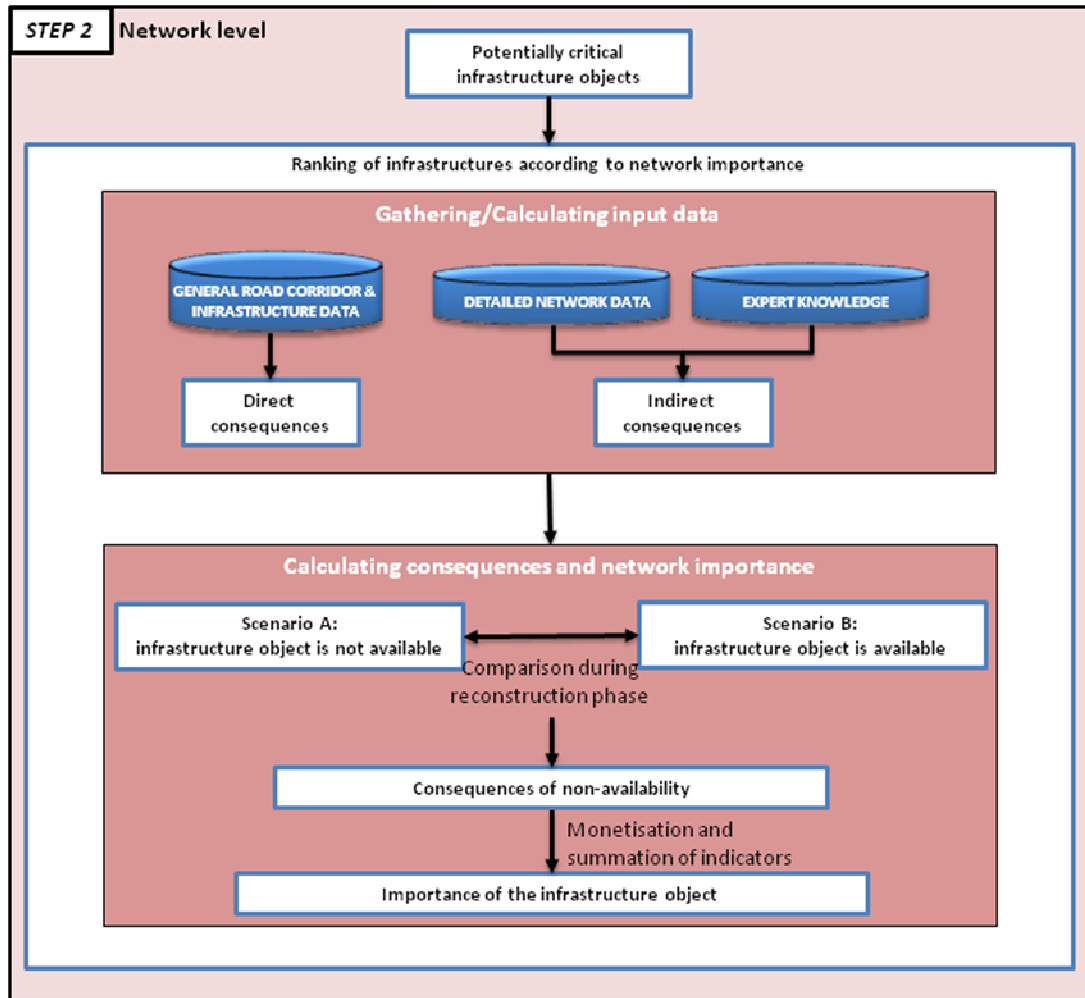


Figure 5: Step 2 procedure in detail

In contrast to the consequences for the road users and the infrastructure itself, which are calculated based on input data from the knowledge database, the consequences for traffic flow have to be calculated by applying the traffic and transport models. Experts who are very familiar with the transport network in question may be able to estimate the consequences for traffic flow. However, models will always achieve a higher validity and greater significance of the results due to the complex interdependencies. Therefore, despite the effort it constitutes to elaborate a specific one, it is recommended to use a traffic and transport model for Step 2, as it will also be needed for Steps 3 and 4.

From a network level point of view the highest-ranking infrastructure objects among those previously identified as critical at object level (Step 1) are then selected for further, more detailed investigation, i.e. for risk assessment.

### 1.3.3 Step 3: Risk analysis (without measures)

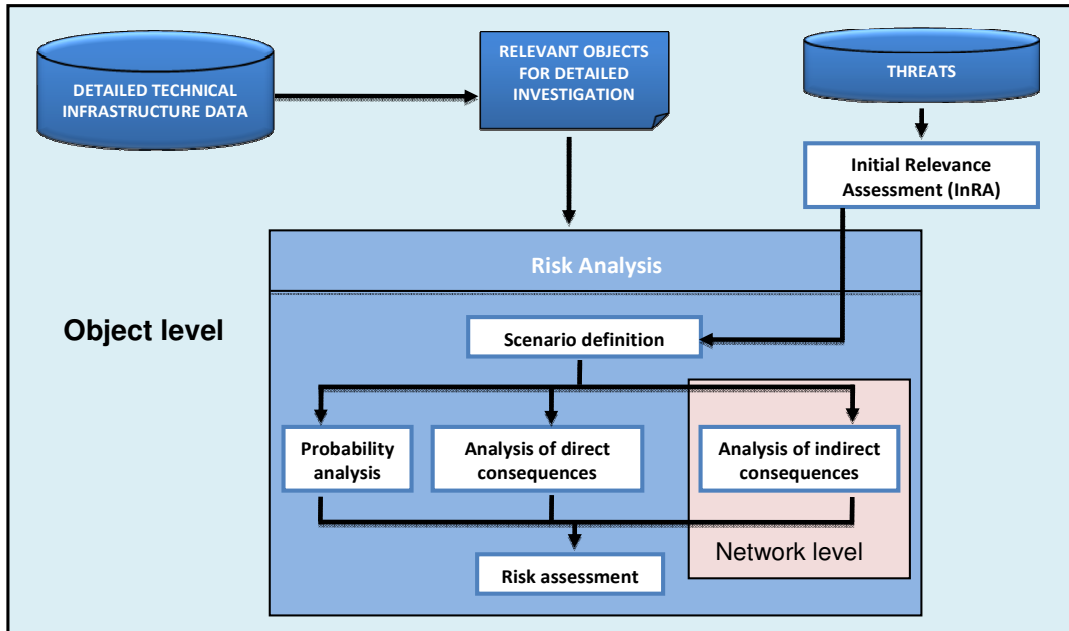


Figure 6: Step 3 of the SeRoN methodology: Risk analysis (without measures)

In Step 3, a risk assessment is carried out for the preselected infrastructure objects of Step 2 (see Figure 1) in order to assess the monetised risk of one threat scenario on a specific infrastructure object (without protection measures) and to identify key risk contributors to enlighten the selection of protection measures done in Step 4, i.e. to allow selecting suitable protection measures which reduce the risk of the key risk contributors.

First of all, for all infrastructure objects to be analysed detailed technical data has to be gathered including technical drawings, information about materials, existing protection measures, life cycles etc. Then previously determined risk or threat scenarios are investigated based on most likely threat/object combinations, which were identified by the Initial Relevance Assessment method (InRA) developed in SeRoN. InRA addresses feasibility of attack, damage potential, shock effect, and symbolic relevance. Hereby, it turned out that the most relevant threats in terms of man-made attacks are:

- ▶ Attacks with explosives on both bridges and tunnels
- ▶ Attacks with fires in tunnels

However, the approach can equally be applied to other threat/object combinations.

The subsequent risk analysis is composed of two elements: probability analysis and consequence analysis. Hereby, a bow-tie analysis has been adopted to assess probabilities in relation to the occurrence of an attack. It is graphically represented by a bow-tie diagram.

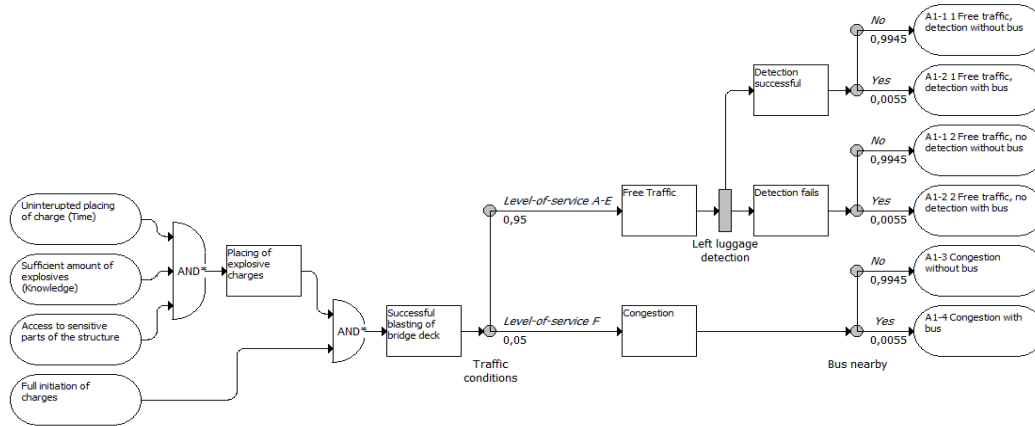


Figure 7: Example of a bow-tie analysis for explosive blasting of a bridge deck, produced with SafetyBarrierManager, a software program developed by the Technical University of Denmark

Because not all preconditions of successful attack can be addressed, the probability of an event was set / normalised to 1. Therefore, the resulting probability will not be absolute but rather conditional. Therefore, the term of *conditional probability* has been introduced.

In the above diagram each branch of the event tree (right hand side of bow-tie diagram) represents a consequence scenario. For each scenario, the consequences (impacts) on the analysed object as well as the surrounding traffic network, differentiated into direct (i.e. fatalities as flat rate per deceased and structural damage, e.g. reconstruction time and costs) and indirect consequences (i.e. economic costs, e.g. increased emissions, higher number of accidents, additional travel time etc.), are taken into account.

Risk is understood as the product of the probability (that an attack occurs) multiplied by the (expected/calculated) consequences if it occurs. Therefore, in the final risk assessment the conditional monetised risks of all branches of the bow-tie analysis are summed up to the *total conditional monetised risk* (in €).

The result of Step 3 of the SeRoN methodology is the monetised risk for a given scenario without considering any possible protection measure.

### 1.3.4 Step 4: Measure analysis

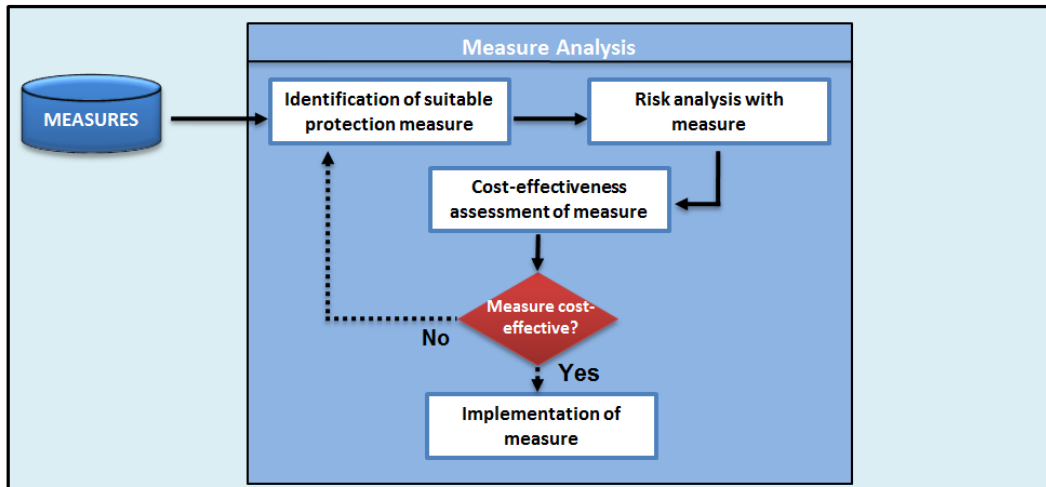


Figure 8: Step 4 of the SeRoN methodology: Measure analysis

In Step 4 of the SeRoN methodology suitable protection measures for the relevant scenarios are analysed by cost-benefit calculations. Hereby, different pre-selected protection measures are included in the risk assessment calculation. This means that for each scenario, the monetised risk is calculated without the implementation of a certain protection measure (as done in Step 3) and after the ‘hypothetical’ implementation of the selected protection measure.

The identification of suitable protection measures may involve some creative thinking as every combination of infrastructure objects and threats is unique. Therefore, protection measures have to be selected on a case-by-case basis. A list of protection measures, though not exhaustive, has been compiled in project deliverable D200.

Once selected, the protection measure has to be conceptually designed. The level of detail here should allow determining two aspects: Annual costs and effectiveness of the protection measure in terms of risk reduction.

The annual costs include all the costs associated with the protection measure, in terms of

- ▶ Direct costs of planning, design and implementation of the measure
- ▶ Direct costs of operation, maintenance and monitoring of the protection installations during its lifespan
- ▶ Indirect costs of restrictions and delays of the traffic caused by implemented measures.

The effectiveness of a protection measure should be assessed based on analysis, experience, demonstration, simulation, expert judgement etc.

Then the total monetised conditional risk is recalculated after implementing the protection measure with exactly the same method as applied to the risk assessment in Step 3. However, the probabilities or consequences are updated due to the influence of the selected protection measure. As a result, the total monetised conditional risk after implementing a protection measure should be lower than before its implementation. The difference between the two situations, i.e. the monetised risk reduction, is then compared to the costs of the protection measure in order to assess the cost-effectiveness of the protection measure.

Based on the risk reduction and the costs of the selected protection measure the break-even frequency of the considered scenario is calculated. This break-even frequency defines the point at which a particular protection measure can be evaluated as cost-effective.

$$\text{Break-even frequency} = \frac{\text{Annual cost}}{\text{Risk reduction}}$$

The break-even frequency is one of several factors relevant for decisions on the implementation of protection measures. If the break-even frequency is above a plausible frequency, then the measure should be implemented solely from a cost-effectiveness point of view. Otherwise, the measure is not cost-effective. However, other factors or combinations of factors such as reduction of risk regarding safety aspects or other factors (e.g. information on homeland security from sources such as national intelligence services, taking into account international developments as well as the national or political attitudes) may influence the decision for implementing of measures, even if assessed 'not cost-effective' when applying SeRoN criteria.

This above-described procedure allows selecting specifically suitable protection measures for all considered scenarios and all investigated infrastructure objects. Thus, infrastructure owners and operators are provided with a basis for decision-making in order to make best use of the available budget and the knowledge which measures to implement in order to improve the resilience of a specifically critical infrastructure object. It has to be noted, that the effort needed for the application of the described risk based approach can be rather high. Therefore it should be applied especially for tunnels and bridges with a high criticality.

### 1.3.5 Required input data

The SeRoN approach requires some basic infrastructure and network data to be collected before starting with its above-described steps. Data includes general technical data of bridges and tunnels such as, for example, length, and type of construction or materials used. In Step 2, in particular, detailed network data is needed in order to calculate detailed traffic simulations. For Steps 3 and 4, further technical infrastructure object data needs to be collected including structural

particularities, details on operation and incident management as well as traffic volume data.

A full list of relevant data required has been compiled in the project deliverables D200 and D300 of this project. The knowledge database developed within the project supports this process and may be used as a template for collecting relevant data and providing data for the subsequent calculations. The structure of the database can be downloaded from the SeRoN project website [www.seron-project.eu](http://www.seron-project.eu).

### 1.3.6 Conclusions from the project

Taking the research results of the SeRoN project into account, the SeRoN consortium gained important knowledge and experience regarding the identification and protection of critical infrastructure objects in the road network of the EU.

It developed a comprehensive four-step methodology that can be used on a modular basis. Road infrastructure owners or operators using the approach may opt to use Step 1 only to do a “rough” assessment and classification of their infrastructure stock regarding potentially critical infrastructure objects, or, they may apply Step 2, 3 and/or 4 to consider the network criticality of a given object and additionally to identify cost-effective protection measures (Step 3 and 4).

However, the application of Steps 2, 3 and 4 requires mandatorily expert knowledge. The range of possible supporting tools that may be used to follow the methodology in Steps 2-4, even though a greater technical ability is required, also means that the entire approach can be implemented by external experts not being part of the consortium.

For the practical use of the approach, however, decisive experience has been gathered and should be considered when further developing the approach.

First of all, due to the so far low numbers of terrorist attacks in Europe only few cost-effective measures could be identified for the selected infrastructure objects to which the approach was applied. This is a result of the statistical insignificance of terrorist attacks which renders the calculation of cost-effective measures very unlikely. Furthermore, within the application of the methodology for selected objects, the risk reduction effects were reduced to security aspects (not taking into account risk mitigation from a safety point of view). If the understanding of terrorist intent and actions has improved, or the available approaches estimating this ‘threat’ have improved, the range of measures that become cost-effective may increase. These changes, if they occur, may be incorporated in the methodology at a later date.

Nevertheless, it should be taken into account that damage to critical infrastructures may occur also by non-intentional, severe accidents (as the tunnel catastrophes in

the alps have shown) or even due to extreme weather hazards to be expected due to the changing climate. Given that the SeRoN approach is able to integrate both security and safety aspects within a wider context of resilience, it could therefore be used as a universally applicable tool to identify critical infrastructure objects, to rank them, and to determine effective protection measures which strengthen the overall resilience of the European road transport network. To achieve this, it is necessary to extend the hazard focus of the SeRoN approach to natural hazards and severe traffic accidents.

In general, the SeRoN consortium made the experience that less expensive measures sometimes have the greatest effects on infrastructure objects considered critical. This effect is even raised for protection measures that may be relevant and therefore can be applied to multiple scenarios. For instance, fencing that might have a protective effect against terrorist attacks as well as accidents, or protection measures that may have relevance in terms of protection against natural hazard scenarios like flooding, too.

Following the suggestions of the EPCIP directive, the SeRoN approach provides a basis for a unified approach that can be used by all Member States to identify and protect their critical road infrastructures. However, the actual implementation and usage of the approach still lies in the responsibility of the respective Member State or the individual road infrastructure owner or operator. The aim of the SeRoN consortium therefore will be to further disseminate the SeRoN approach in European and national boards and bring in and implement their experience and knowledge gained into respective directives and guidelines. Their efforts will be accompanied by further developing and extending the approach to different hazards and to practical applications.

## **1.4 Potential impact including the socio-economic impact and the wider societal implications of the project so far, main dissemination activities and exploitation of results**

### **1.4.1 Potential impact including the socio-economic and the wider societal implications of the project so far**

The EPCIP directive issued in 2008 defines the need to identify and designate European critical infrastructures. The developed SeRoN methodology could be used as a proper tool to meet that demand, thus supporting the implementation of the EPCIP directive at national level. A precondition would be that the SeRoN approach is used as a European CI standard identification tool, allowing the EU and its Member States as well as road infrastructure owners and operators to identify critical infrastructures throughout Europe in a comparative way.

A coherent approach would show which infrastructure objects are the most critical and for which the additional expenditure for protection measures may be justified based on objective and cost-effectiveness considerations. To achieve that, there is the need to implement the SeRoN approach at European and national boards or committees as well as in EU directives. For its practical use, however, the approach still needs to be made more specific and broken down to a simple level with standardized procedures. The methodology, in particular the sections on risk analysis and the cost-effectiveness calculation of protection measures, is open to the use of different assessment tools. This may lead to slightly different outcomes for the same set of objects.

Furthermore, the full application of the SeRoN approach requires a lot of expert knowledge. A first assessment of infrastructures can be done easily, for in-depth assessment expert knowledge is necessary. Therefore, it is essential to make the approach more easily applicable to non-experts, too.

Further research needs are also arising due to the fact that from the cost-benefit view it showed that most investigated protection measures are not effective when terrorist attacks are considered only. In practice, network operators have to deal with a variety of external threats, such as climate change, extreme weather hazards, general safety concerns, etc. Therefore, it is reasonable to investigate the developed methodology in a more comprehensive context to determine the cost-effectiveness of measures and to adapt the procedure to a broader range of application. Also, not only infrastructure objects within the Trans-European network may be the target for terrorist attacks, but also other kinds of infrastructure such as energy supply infrastructure or objects with high symbolic character could be considered within further research work. From a transport sector point of view, there is a need to extend the methodology and results of SeRoN to intermodal aspects, including rail, air and waterways.

The economic success of the SeRoN methodology and tools is very closely linked with the above-mentioned points. The SeRoN approach could also be extended to an all-hazard approach. The consideration of other threats such as extreme weather hazards and traffic accidents would make the approach universally applicable and thus raise its market opportunities.

The SeRoN methodologies and tools not only support risk management for existing infrastructure objects but also for planned infrastructure objects in the design stage.

The significance of an impact on infrastructure is assessed in terms of cross-cutting criteria comprising the following:

- ▶ Casualties (assessed in terms of the potential number of fatalities or injuries)
- ▶ Economic impacts (assessed in terms of the significance of economic loss and/or degradation of products or services; including potential environmental impacts)

- ▶ Public effects (assessed in terms of the loss of public confidence, physical suffering and disruption of daily life; including failure of essential services).

The SeRoN methodology and tools together with the experience made during the specific analyses of bridges and tunnels provide a major contribution to the recommended analyses in EPCIP, with the potential of saving costs for road administrators and owners.

## 1.4.2 Main dissemination activities

During the SeRoN project a great variety of dissemination activities was undertaken by the consortium to address stakeholders like road transport infrastructure owners and operators as well as other interested parties, among them:

### SeRoN project flyer

For dissemination purposes a project flyer was designed by BAST and PTV providing the interested public with the relevant information on the project. It was updated and revised mid-project to address a wider, interested public.

### SeRoN project website

First of all a SeRoN project website was established, which can be found under URL [www.seron-project.eu](http://www.seron-project.eu). The website provides all relevant information on the project, its purpose and objectives, the consortium and the contact details. Concise public versions of the submitted deliverables submitted to the European Commission can be downloaded there. Under the *News& Events* tag the newsletters as well as all presentations held during the events organized by the consortium are available, in addition to any other publications like lectures and presentations held on related conferences and meetings. As a discussion forum an Open Web Observatory has been established and linked to the project website.

### SeRoN newsletters

In the course of the project two SeRoN newsletters were produced and sent to more than 350 interested parties like road infrastructure owners and operators and other stakeholders in order to provide information on the project itself, to describe the progress of research work and to communicate preliminary results to as well as to announce upcoming major events like the SeRoN workshops.

### SeRoN workshops

According to the Description of Work of the project two major events, i.e. workshops with external experts, were planned during the project lifetime to gain input from external experts and to present the project results. Therefore, on 3rd November 2010 the 1st SeRoN Workshop was held in Berlin, on the premises of the German Federal Ministry of Transport, Building and Urban Development (BMVBS). This 1<sup>st</sup>

workshop was designed to get input from stakeholders to be considered in future project work and to inform stakeholders about the project and its first results. In total 30 experts from eight European member states (including SeRoN partners) participated in the workshop.

As an outcome of the workshop the SeRoN consortium gained good insight in the national experience and procedures followed in different countries and got valuable feedback from the participating experts concerning the assessment of the criticality of infrastructure objects in their countries. The participants showed great interest in the final knowledge database, which will implement an important part of the SeRoN methodology by the connected external tools. The feedback obtained from the experts attending the workshop was taken into account in the further project work particularly as far as the knowledge database and the risk assessment were concerned.



Figure 9: 1<sup>st</sup> SeRoN Workshop, 3 November 2011

The 2<sup>nd</sup> SeRoN Workshop held on the 26th of April, 2012 in Cologne was conceptualized as a follow-up event of the 1<sup>st</sup> workshop. The purpose of the workshop was twofold, on the one hand, to inform interested workshop participants of the previous event but also others about the progress made and the results of the SeRoN project obtained so far; on the other hand, to receive expert feedback and input for the finalization of the project regarding the methodology of the SeRoN approach.

After the presentations the more than 40 workshop participants, among them the SeRoN project Officer, Mr. Ortiz de la Torre and the project's external expert, Mr. Polidori, discussed the approach undertaken in SeRoN and their own experience made as private or public operators of major infrastructure objects. One of the final conclusions made was that the SeRoN approach should integrate both security and safety aspects in order to be used as a universal tool to identify critical infrastructure objects, rank them, and determine effective protection measures to strengthen the overall resilience of the European road transport network.



Figure 10: 2<sup>nd</sup> SeRoN Workshop, 26 April 2012

### **Infrastructure Risk & Resilience Conference**

The Infrastructure Risk & Resilience Conference was an additional, i.e. originally not planned, major event towards the end of the project. It took place on 11<sup>th</sup> October 2012 at the Institution of Engineering and Technology (IET) in London. The IET was very interested in informing their members on current research results of EC projects in the field of security. They used their network for the invitations, took care of the organization and hosted the conference.

The purpose of the conference was sharing knowledge about the issues of assessing and managing infrastructure risk and resilience with respect to natural, man-made and terrorist hazards in which the topics of the SeRoN project were embedded. It allowed presenting the SeRoN project work and results in a wider context and their further dissemination beyond potential users addressed so far.



Figure 11: Infrastructure Risk and Resilience conference, 11<sup>th</sup> October, 2012, London

Apart from the above-mentioned dissemination activities, the SeRoN project results were presented and discussed with experts and stakeholders on various conferences and committee meetings, e.g. TRA Europe 2010, IABSE-IASS Symposium 2011, ISTSS 2012, RILEM Workshop 2011, SUSI 2012 etc. A fair number of publications in peer reviewed publications were made or respectively are going to be made within the next few weeks after the end of the project (see also tables below).

### 1.4.3 Exploitation of results by SeRoN partners

During the SeRoN project the project partner **PTV** has been able to deepen its understanding of indirect costs. The findings and the developed tools for assessing such costs will be the basis for further research work in this field. Research work will especially focus on developing a multi-modal approach which takes all transport modes into account: Up to now the assessment procedure allows analysing infrastructure objects which are part of the road network. Other transport modes are considered in case their routes

- ▶ Were tracked beneath the bridge or above the tunnel to be analysed or
- ▶ Passed the bridge or tunnel considered.

In that case it is assumed that the affected transport route of other modes was closed.

However, other transport modes are considered in case of modal shifts. Within the SeRoN project intermodal shifts have been considered to some extent:

- ▶ For reasons of simplicity it was assumed that road users (passenger and freight transport) would normally stick to their transport mode. Taking into account that road traffic is more flexible especially in terms of freight transport than rail or even shipping traffic, this assumption seemed reasonable. Nevertheless, there will always be road users who decide to shift to other transport modes in case a specific road link is closed.
- ▶ In SeRoN such modal shifts have only been incorporated in case no attractive alternative road transport routes other than the one passing the analysed bridge or tunnel are available. In that case modal shifts to railway traffic or shipping traffic were considered.

In order to simulate real-world conditions, the assessment procedure has to be developed further so that

- ▶ Modal shifts can generally be taken into account and
- ▶ Infrastructure objects of other transport modes can also be assessed in terms of indirect costs.

In addition, further need for research has been identified in terms of assessing long-term impacts of man-made attacks on the transport infrastructure. The current assessment procedure allows quantifying indirect consequences which arise during the reconstruction period of the damaged infrastructure. Hereby, it is assumed that road users will return to their old habits in terms of travel behaviour after the infrastructure object has been reconstructed.

The assumption is reasonable in the current situation in which terrorist attacks on road infrastructure are still quite rare. Should the frequency of man-made attacks change, e.g. five subsequent spectacular attacks on road bridges of symbolic values happen, road users may become frightened and stop using transport routes with many bridges. In that case, changes in travel behaviour have to be taken into account for the indirect costs calculation. Further research activities should also focus on that aspect.

Work on the SeRoN project took PTV also a further step towards a better quantification and assessment of risks concerning man-made attacks. Additionally PTV has also been able to gain further experience in and improve fire and evacuation simulation and the determination of the degree of damage of events.

**BASt** will use its involvement in several boards like PIARC (World Road Association), Technical Committee C4 Road Tunnel Operation), in ITA-COSUF (International Tunnelling Association), in the TRB (Transport Research Board, USA) ABE 40 Critical Transportation Infrastructure Protection Committee and the national RABT (Richtlinien für die Ausstattung und den Betrieb von Straßentunneln) to implement the SeRoN approach here aiming at its placement in the respective

national and international guidelines and directives. From a research point of view, the results of SeRoN as well as of other, national projects SKRIBT and SKRIBT+ have been widely considered also within the SecMan project, initiated by BAST together with ILF Consulting Engineers, ELEA and DARS. It conceptualizes a security manual for road infrastructure owners and operators regarding security risk management processes (for more details please refer to [www.secman-project.eu](http://www.secman-project.eu)). It responds to the demand of making the SeRoN approach more easily applicable to non-experts.

As a result of their involvement with the SeRoN project, **PB** has added significantly to its expertise in the field of infrastructure resilience. As a result of their increased exposure and recognition within industry, opportunities have arisen to collaborate on other projects that will further explore the issues associated with interdependencies between different infrastructure systems and networks (i.e. 'systems of systems').

With respect to academic purposes **TU Graz** will use the gained expertise in future student projects and for teaching purposes. The application of knowledge in line with practical application has always been very beneficial for the students' understanding. The relevance of the learning matter can be visualised in a very figurative way, which represents a step towards application-oriented lecturing.

Regarding marketing issues for the educational and research institutes within the consortium, the project offers the perspective of gaining more relevance as a service provider. The consortiums' research institutions intend to play a key role in consulting network operators, for example, who are interested in applying the methodology.

Based on the results of the SeRoN project **Traficon** has been able to improve its video-based automatic incident detection (AID) algorithms, more specifically in terms of stopped vehicle, left luggage and pedestrian detection. Said improved algorithms have been, still are and will be implemented into any upgrade versions of Traficon's AID systems, products and services. SafeWalk® and C-Walk, for instance, are being launched as pedestrian detection solutions based on the findings and results of the SeRoN project at hand.

**EBP** will use the developed methodological approach and the findings of the SeRoN project within other projects regarding critical infrastructures in Switzerland and – if possible – abroad. Since the developed methodological approach is not limited to road infrastructures, EBP will try to apply it within other fields.

With reference to our core expertise in physical protection of buildings, infrastructure, installations and other assets **NIRAS** will exploit the experience gained through contributions to assessments of consequence and risk with:

- ▶ Continued development of the SeRoN four-step risk assessment methodology  
- what NIRAS would consider a commercially interesting development



includes, for example, an approach including natural disaster threats and other threats not connected to malicious intent.

- ▶ Use of risk assessment in projects in general and risk assessment in connection with infrastructure protection in particular
- ▶ Analyses of blast propagation and loads on structures using commercially available 3D software HEXDAM
- ▶ Modelling of blast propagation, loads on structures and structural dynamic behaviour with commercially available 3D LS-Dyna finite element code.

## 1.5 Address of the project website and relevant contact details

The project logo, the project website address, project coordinator details and the full list of beneficiaries including the relevant contact details are given below.

### SeRoN project logo



### SeRoN website

The SeRoN project website can be found under the URL <http://www.seon-project.eu>. It is meant to provide information on the project, its objectives, the consortium and to reflect the manifold activities undertaken to disseminate the project results: Concise public versions of all deliverables produced in the course of the project, project-related publications and newsletters are provided for download; links to other, related projects and an Open Web Observatory as a discussion forum have been offered.

### SeRoN project coordinator

Dr.-Ing. Georg Mayer  
Head of Tunnel Equipment and Control Department  
Kriegerstr. 15, 70191 Stuttgart, Germany  
Tel: +49 711 16270-35  
[georg.mayer@ptvgroup.de](mailto:georg.mayer@ptvgroup.de)

## SeRoN list of beneficiaries and contact details

Partner	Partner code	Institution	Name	Address	Phone	E-mail contact person
01	PTV	<b>PTV Planung Transport Verkehr AG</b>	Georg Mayer	Kriegerstr. 15, 70191 Stuttgart, Germany	+49 711 16270 35	<a href="mailto:georg.mayer@ptv.de">georg.mayer@ptv.de</a>
02	BAST	<b>Bundesanstalt für Straßenwesen</b>	Jürgen Krieger	Brüderstraße 53, 51427 Bergisch Gladbach, Germany	+49 2204 43 800	<a href="mailto:juergen.krieger@bast.de">juergen.krieger@bast.de</a>
03	PB	<b>Parsons Brinkerhoff</b>	Steve Denton	Queen Victoria House; Redland Hill, Bristol, BS6 6US, United Kingdom	+44 117 933 9129	<a href="mailto:dentons@pbworld.com">dentons@pbworld.com</a>
04	TU Graz	<b>Technische Universität Graz, Institut für Baustatik</b>	Christian Dünser	Lessingstraße 25/II, 8011 Graz, Austria	+43 316 873 - 6184	<a href="mailto:duenser@tugraz.at">duenser@tugraz.at</a>
05	TRF	<b>Traficon International N.V.</b>	Stephan Adriaenssens	Vlamingstraat 19, 8560 Wevelgem, Belgium	+32 56 36 17 31	<a href="mailto:stephan.adriaenssens@traficon.com">stephan.adriaenssens@traficon.com</a>
06	EBP	<b>Ernst Basler + Partner AG</b>	Christoph Zulauf	Zollikerstrasse 65, 8702 Zollikon, Switzerland	+41 44 395 12 68	<a href="mailto:christoph.zulauf@ebp.ch">christoph.zulauf@ebp.ch</a>
07	NIR	<b>NIRAS A/S</b>	Solveig Qvist	Sortemosevej 19, 3450 Allerød, Denmark	+45 4810 4381	<a href="mailto:sog@niras.dk">sog@niras.dk</a>

## 2 Use and dissemination of foreground

### 2.1 Section A

A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, IN ORDER OF PUBLICATION DATE										
No.	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date of publication (dd/mm/yyyy)	Relevant pages	Permanent identifiers <sup>1</sup> (if available)	Is/Will open access <sup>2</sup> provided to this publication ?
1	<i>Disruptive influence</i>	PTV	<i>Traffic Technology International</i>	-	UKIP Media & Events Ltd.	London, UK	April/May 2011	p. 46	-	Yes
2	<i>SeRoN – Security of Road Transport Networks</i>	PTV	<i>The Parliament Magazine</i>	334	Dods Parliamentary Communications	Brussels, Belgium	26/09/2011	p. 77	-	Yes
3	<i>Critical assessment</i>	PTV	<i>Traffic Technology International</i>	-	UKIP Media & Events Ltd.	London, UK	January 2013	p. 015	-	Yes
4	<i>Risk and resilience under review as a research project reports findings</i>	PB	<i>Bridge design and engineering</i>	69	Hemming Information Services	London, UK	December 2012	p. 23	-	Yes
5	<i>Sizing up threats to critical infrastructure</i>	PTV	<i>ITS International</i>	-	Route One Publishing Ltd	Kent, UK	Nov./Dec. 2012	p. 67/68	-	Yes

Further publications are envisaged in spring 2013, after termination of the project.

<sup>1</sup> A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).

<sup>2</sup> Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

## A2: LIST OF DISSEMINATION ACTIVITIES

No.	Type of activities <sup>3</sup>	Main leader	Title	Date/period (dd/mm/yyyy)	Place	Type of audience <sup>4</sup>	Size of audience	Countries addressed
1	Presentation	PTV, BAST	Fraunhofer Symposium "Future Security" - 4th Security Research Conference Karlsruhe, 2009/ Protection of European Road Transport Networks	30/09/2009	Karlsruhe, Germany	Scientific community, policy makers	approx. 100	EU countries
2	Press release	BAST	Press release on start-up of SeRoN project; no. 01/2010	14/01/2010	Bergisch Gladbach, Germany	Policy makers, civil society, transport infrastructure owners and operators	-	Germany
3	Poster	PTV	SeRoN – Security of Road Transport Networks	09/03/2010	Madrid, Spain	Scientific community, policy makers, civil society, transport infrastructure owners and operators	-	EU countries
4	Presentation	BAST	TRA Konferenz 2010, Session 11:5 "Infrastructure related safety issues, part 2"/ Protection of vulnerable Infrastructures in a Road Transport Network	09/06/2010	Brussels, Belgium	Scientific community, policy makers	approx. 50	EU countries
5	Presentation	NIR	Presentation of the SeRoN project for the Great Belt Link	21/06/2010	Copenhagen, Denmark	Civil society	1	Denmark
6	Presentation	NIR	Presentation of the SeRoN project for the Danish Road Directorate	24/06/2010	Copenhagen, Denmark	Civil society	8	Denmark
7	Flyer	PTV	SeRoN project flyer No. 1	31/07/2010	Stuttgart, Germany	Scientific community, transport infrastructure owners and operators	approx. 1,500	EU countries

<sup>3</sup> A drop down list allows choosing the dissemination activity: publications, conferences, workshops, web, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters, Other.

<sup>4</sup> A drop down list allows choosing the type of public: Scientific community (higher education, research), Industry, Civil society, Policy makers, Medias, Other ('multiple choices' is possible).

8	Workshop	NIR/BASt/ PTV	Workshop with presentation of the SeRoN project to the Danish transport infrastructure owners and operators; European bridge and tunnel types and technical infrastructure data for test regions	15/09/2010	Copenhagen, Denmark	Civil society, transport infrastructure owners and operators	Approx. 12	Denmark (Sweden, Germany)
9	Website	PTV	SeRoN Website	22/10/2010	-	Scientific community, transport infrastructure owners and operators	-	World-wide
10	Workshop	BASt	1 <sup>st</sup> SeRoN Workshop; European Bridge and Tunnel Types & Knowledge Database for Road Infrastructures	03/11/2010	Berlin, Germany	Scientific community, policy makers; transport infrastructure owners and operators	approx. 30	EU countries
11	Presentation	BASt	TRB 2011, Workshop "Bridge and Tunnel Safety and Security"; Safety and Security Research Activities for Bridges and Tunnels in Germany	23/01/2011	Washington D.C., USA	Scientific community, transport infrastructure owners and operators	approx. 50	World-wide
12	Presentation	NIR	Presentation of the SeRoN project	11/03/2011	Copenhagen, Denmark	Industry	1	Denmark
13	Presentation	NIR	Presentation of the SeRoN project for the Danish Security and Intelligence Service	15/03/2011	Copenhagen, Denmark	Civil society	2	Denmark
14	Article	PTV	Disruptive influence	April/May 2011	London, UK	Scientific community	approx. 18,000	World-wide
15	Conference	EBP	Engineering and Construction Conference 2011	06-08/06/2011	Zurich; CH	Civil society (re insurance experts)	50	World-wide
16	Presentation	NIR	Presentation of the SeRoN project for Danish road infrastructure owners	07/06/2011	Copenhagen, Denmark	Civil society	2	Denmark (Sweden, Germany)
17	Presentation	BASt	Vortrag bei der russischen deutschen verkehrswissenschaftlichen Konferenz zur Vorbereitung der olympischen Winterspiele 2014 in Sotschi	23-24/06/2011	Sotschi, Russia	Scientific community, policy makers	approx. 50	Russia, Germany

18	Presentation	BASt	IABSE - IASS Symposium; Identification and Classification of Relevant European Bridge and Tunnel Types	21/09/2011	London, UK	Scientific community	approx. 500	EU countries
19	Article	PTV	SeRoN – Security of Road Transport Networks	26/09/2011	Brussels, Belgium	Policy makers	approx. 3,000	EU countries
20	Press release	BASt	Press release on 1 <sup>st</sup> SeRoN Workshop; no. 25/2010	16/11/2010	Bergisch Gladbach, Germany	Policy makers, transport infrastructure owners and operators	-	Germany
21	Newsletter	BASt	SeRoN newsletter No. 1	01/12/2011	Bergisch Gladbach, Germany	Scientific community, policy makers, industry, transport infrastructure owners and operators	approx. 150	EU countries
22	Flyer	PTV	SeRoN project flyer No. 2	21/12/2011	Stuttgart, Germany	Scientific community, transport infrastructure owners and operators	approx. 1,500	EU countries
23	Forum	PTV	SeRoN Open Web Observatory	30/12/2011	Stuttgart, Germany	Scientific community, transport infrastructure owners and operators	-	World-wide
24	Thesis	TU Graz	SeRoN - Untersuchung einer Spannbetonbrücke	01/01/2012	Graz, Austria	Scientific community	-	German- speaking countries
25	Workshop	BASt	TRB 2012, Workshop "Bridge and Tunnel Safety and Security"; International Perspectives in Bridge and Tunnel Safety and Security	22/01/2012	Washington D.C., USA	Scientific community	approx. 60	World-wide
26	Presentation	BASt	Fifth International Symposium on Tunnel Safety and Security (ISTSS 2012); Identification of critical Tunnels in a Road Network	14/03/2012	New York, USA	Scientific community, transport infrastructure owners and operators	approx. 100	World-wide
27	Workshop	BASt	2 <sup>nd</sup> SeRoN Workshop; Recommendations and experiences from project results	26/04/2012	Cologne, Germany	Scientific community, transport infrastructure owners and operators	approx. 50	EU countries
28	Presentation	BASt	Jahrestagung 2012 der Schutzkommission beim BMI; Straßenverkehr in Krisenzeiten	17/05/2012	Frankfurt, Germany	Scientific community, policy makers	approx. 50	Germany
29	Newsletter	BASt	SeRoN newsletter No. 2	25/05/2012	Bergisch Gladbach, Germany	Scientific community, policy makers, industry, transport infrastructure owners and operators	approx. 350	EU countries

30	Press release	BASt	Press release on 2 <sup>nd</sup> SeRoN Workshop; no. 11/2012	30/05/2012	Bergisch Gladbach, Germany	Policy makers, transport infrastructure owners and operators	-	Germany
31	Presentation	NIR	Structures Under Shock and Impact 2012: Cost-effectiveness of Protection Measures to Mitigate Terrorist Attacks on Bridges and Tunnels	04/09/2012 – 06/09/2012	Kos, Greece	Scientific community, Industry	50	World-wide
32	Workshop	NIR	Workshop with Danish stakeholders	26/09/2012	Copenhagen, Denmark	Civil society	7	Denmark (Sweden, Germany)
33	Conference	PB/BASt	"Infrastructure Risk & Resilience", IET-SeRoN Conference; Identification of Critical Infrastructures	11/10/2012	London, UK	Scientific community, policy makers, civil society	approx. 70	EU countries
34	Article / Blog	PTV	PTV Compass no. 03/2012 <a href="http://compass.ptvgroup.com/2012/11/am-ende-licht/">http://compass.ptvgroup.com/2012/11/am-ende-licht/</a>	28/11/2012	Karlsruhe, Germany	Scientific community, policy makers, civil society, industry, medias	approx. 6,000	German-speaking countries
35	Teaser	PTV	PTV Group Newsletter	30/11/2012	Karlsruhe, Germany	Scientific community, Industry, medias	1,300	German-speaking countries
36	Article	PTV	Sizing up threats to critical infrastructure (ITS)	Nov./Dec. 2012	London, UK	Scientific community, policy makers, industry, transport infrastructure owners and operators	approx. 22,000	World-wide
37	Article	PB	Risk and resilience under review as a research project reports findings (Bd&e)	December 2012	London, UK	Scientific community, policy makers, industry, transport infrastructure owners and operators	approx. 25,000	World-wide
38	Article	PTV	Critical assessment (TTI)	January 2013	London, UK	Scientific community, policy makers, industry, transport infrastructure owners and operators	approx. 18,000	World-wide

Further dissemination activities in form of presentations and articles in national press are envisaged after the end of the project, e.g. PTV will be issuing reports in national and technical press magazines, PB will be presenting a paper on highway resilience and approach adopted within the SeRoN project at the Bridges 2013 Conference, to be held in Birmingham in the UK on 10<sup>th</sup> April 2013

The SeRoN Project has also been shortlisted for two categories ('Managing Risk Across Boundaries' and 'Partnership of the Year') at the Institute of Risk Managers Global Awards, which will take place on 28<sup>th</sup> February 2013.

## 2.2 Section B

(Confidential<sup>5</sup> or public: confidential information to be marked clearly!)

### 2.2.1 Part B1

<b>B1: LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC.</b>						
<b>Type of IP rights<sup>6</sup>:</b>	<b>Confidential, Yes/no</b>	<b>Foreseen embargo date (dd/mm/yyyy)</b>	<b>Application reference(s) (e.g. EP123456)</b>	<b>Subject or title of application</b>	<b>URL of application (mandatory for patents)</b>	<b>Applicant (s) (as on the application)</b>
-	-	-	-	-	-	-

<sup>5</sup> Not to be confused with the "EU CONFIDENTIAL" classification for some security research projects.

<sup>6</sup> A drop down list allows choosing the type of IP rights: Patents, Trademarks, Registered designs, Utility models, Others.

## 2.2.2 Part B2

Type of exploitable foreground <sup>7</sup>	Description of exploitable foreground	Confidential Yes/no	Foreseen embargo date (dd/mm/yyyy)	Exploitable product(s) or measure(s)	Sector(s) of application <sup>8</sup>	Timetable for commercial or any other use	Patents or other IPR exploitation (licences)	Owner & other beneficiary(s) involved
General advancement of knowledge and understanding, commercial exploitation of R&D results	SeRoN methodology	No	-	Findings and developed tools for the assessment of indirect costs; experience gained in quantification and assessment of risks as well as improvement of fire simulation and determination of degree of damage of events	M71.1.2 - Engineering activities and related technical consultancy	2012 onwards	-	SeRoN Consortium, PTV
Exploitation of R&D results via standards	SeRoN methodology	No	-	Implementation of developed SeRoN approach in national and international guidelines and directives	M71.1.2 - Engineering activities and related technical consultancy	2012 onwards	-	SeRoN Consortium, BAST
General advancement of knowledge, expert knowledge in the field of infrastructure resilience	SeRoN methodology	No	-	Advancement of expertise and increased industry profile leading to broader industry engagement	M71.1.2 - Engineering activities and related technical consultancy	2012 onwards	-	SeRoN Consortium, PB

<sup>19</sup> A drop down list allows choosing the type of foreground: General advancement of knowledge, Commercial exploitation of R&D results, Exploitation of R&D results via standards, exploitation of results through EU policies, exploitation of results through (social) innovation.

<sup>8</sup> A drop down list allows choosing the type sector (NACE nomenclature) : [http://ec.europa.eu/competition/mergers/cases/index/nace\\_all.html](http://ec.europa.eu/competition/mergers/cases/index/nace_all.html)

Type of exploitable foreground <sup>7</sup>	Description of exploitable foreground	Confidential Yes/no	Foreseen embargo date (dd/mm/yyyy)	Exploitable product(s) or measure(s)	Sector(s) of application <sup>8</sup>	Timetable for commercial or any other use	Patents or other IPR exploitation (licences)	Owner & other beneficiary(s) involved
General advancement of knowledge	SeRoN methodology	No	-	Service provision and consulting of network operators	P85.4 - Higher education; M71.1.2 - Engineering activities and related technical consultancy	2012 onwards	-	SeRoN Consortium, TU Graz
Commercial exploitation of R&D results	Improvement of video-based automatic incident detection (AID) algorithms	Yes	-	Video-based automatic incident detection (AID) systems	C26.5.1 - Manufacture of instruments and appliances for measuring, testing and navigation	2012 onwards	-	TRF
General advancement of knowledge; commercial exploitation of R&D results	SeRoN methodology	No	-	Extension of developed approach to other fields of application and application within investigations taking into account security, safety and availability aspects	M71.1.2 - Engineering activities and related technical consultancy	2012 onwards	-	SeRoN Consortium, EBP
General advancement of knowledge; commercial exploitation of R&D results	SeRoN methodology	No	-	Methodology for assessment of protection measures	F42.1.3 - Construction of bridges and tunnels	2012 onwards	-	SeRoN Consortium, NIRAS

## Explanations

**PTV:** Findings and developed tools for assessing indirect costs; basis for further research work on a multi-modal approach taking into account other transport modes (including modal shifts) and on long-term effects of infrastructure failure due to man-made attacks, Improved quantification and assessment of risks concerning man-made attacks and gained experience and improvement of fire simulation and determination of the degree of damage applicable and useful for future projects in this field.

- BASt:** Based on their involvement in several national and international boards they are aiming at implementing the SeRoN approach and placing it in the respective national and international guidelines and directives. From a research point of view, the results of SeRoN as well as those of other, national projects SKRIBT and SKRIBT+ have also been widely taken into consideration within the SecMan project, which was initiated by BASt together with ILF Consulting Engineers, ELEA and DARS. It conceptualizes a security manual for road infrastructure owners and operators regarding security risk management processes (for more details please refer to [www.secman-project.eu](http://www.secman-project.eu)). It responds to the demand of making the SeRoN approach more easily applicable to non-experts.
- PB:** As a result of their increased exposure and recognition within industry, opportunities have arisen to collaborate on other projects that will further explore the issues associated with interdependencies between different infrastructure systems and networks (i.e. ‘systems of systems’), encompassing natural hazards (e.g. climate change, flooding and solar flare activity) as well as man-made hazards.
- TU Graz:** Gained expertise used for service provision and consulting of transport network operators interested in applying the developed methodology; possibility of application-oriented teaching and lecturing, future student projects.
- TRF:** Improvement of video-based automatic incident detection (AID) algorithms in terms of stopped vehicle, left luggage and pedestrian detection.
- EBP:** Extension of developed approach to other fields of application and application within investigations taking into account security, safety and availability aspects
- NIRAS:** Commercial use of the developed methodology in the detailed design phase of future larger infrastructure projects.

### 3 Report on societal implications

#### A General Information *(completed automatically when Grant Agreement number is entered.*

Grant Agreement Number:	225354
Title of Project:	SeRoN – Security of Road Transport Networks
Name and Title of Coordinator:	Dr.-Ing. Georg Mayer

#### B Ethics

<b>1. Did your project undergo an Ethics Review (and/or Screening)?</b> <ul style="list-style-type: none"> <li>If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports?</li> </ul> <p>Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 'Work Progress and Achievements'</p>	<b>No</b>
<b>2. Please indicate whether your project involved any of the following issues (tick box) :</b>	
<b>RESEARCH ON HUMANS</b>	
• Did the project involve children?	
• Did the project involve patients?	
• Did the project involve persons not able to give consent?	
• Did the project involve adult healthy volunteers?	
• Did the project involve Human genetic material?	
• Did the project involve Human biological samples?	
• Did the project involve Human data collection?	
<b>RESEARCH ON HUMAN EMBRYO/FOETUS</b>	
• Did the project involve Human Embryos?	
• Did the project involve Human Foetal Tissue / Cells?	
• Did the project involve Human Embryonic Stem Cells (hESCs)?	
• Did the project on human Embryonic Stem Cells involve cells in culture?	
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	
<b>PRIVACY</b>	
• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	
• Did the project involve tracking the location or observation of people?	
<b>RESEARCH ON ANIMALS</b>	
• Did the project involve research on animals?	
• Were those animals transgenic small laboratory animals?	
• Were those animals transgenic farm animals?	
• Were those animals cloned farm animals?	
• Were those animals non-human primates?	
<b>RESEARCH INVOLVING DEVELOPING COUNTRIES</b>	
• Did the project involve the use of local resources (genetic, animal, plant etc)?	



<ul style="list-style-type: none"> <li>Was the project of benefit to local community (capacity building, access to healthcare, education etc)?</li> </ul>	
<b>DUAL USE</b>	
<ul style="list-style-type: none"> <li>Research having direct military use</li> <li>Research having the potential for terrorist abuse</li> </ul>	Yes

**C Workforce Statistics**

**3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).**

Type of Position	Number of Women	Number of Men
Scientific Coordinator		1
Work package leaders		5
Experienced researchers (i.e. PhD holders)		12
PhD Students		
Other	2	19

<b>4. How many additional researchers (in companies and universities) were recruited specifically for this project?</b>	<b>1</b>
Of which, indicate the number of men:	0

**D Gender Aspects**

<b>5. Did you carry out specific Gender Equality Actions under the project?</b>	<input type="checkbox"/>	Yes
	<input checked="" type="checkbox"/>	No

<b>6. Which of the following actions did you carry out and how effective were they?</b>		
	Not at all effective	Very effective
		e
<input type="checkbox"/> Design and implement an equal opportunity policy	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Set targets to achieve a gender balance in the workforce	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Organise conferences and workshops on gender	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Actions to improve work-life balance	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Other: <input style="width: 200px;" type="text"/>		

<b>7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?</b>
<input type="checkbox"/> Yes- please specify
<input checked="" type="checkbox"/> No

**E Synergies with Science Education**

<b>8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?</b>
<input checked="" type="checkbox"/> Yes- please specify (student Bachelor and Master projects, involvement of MAS students)
<input type="checkbox"/> No

<b>9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?</b> <input type="checkbox"/> Yes- please specify <input type="text"/> <input checked="" type="checkbox"/> No		
<b>F Interdisciplinarity</b>		
<b>10. Which disciplines (see list below) are involved in your project?</b> <input checked="" type="checkbox"/> Main discipline <sup>9</sup> : 2.3 <input checked="" type="checkbox"/> Associated discipline: 2.1   <input checked="" type="checkbox"/> Associated discipline: 1.1		
<b>G Engaging with Civil society and policy makers</b>		
<b>11a Did your project engage with societal actors beyond the research community? (if 'No', go to Question 14)</b>	<input checked="" type="checkbox"/> <input type="checkbox"/>	Yes No
<b>11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes- in framing the research agenda <input type="checkbox"/> Yes - in implementing the research <input type="checkbox"/> Yes, in communicating /disseminating / using the results of the project		
<b>11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?</b>	<input type="checkbox"/> <input checked="" type="checkbox"/>	Yes No
<b>12. Did you engage with government / public bodies or policy makers (including international organisations)</b>  <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes- in framing the research agenda <input type="checkbox"/> Yes - in implementing the research agenda <input checked="" type="checkbox"/> Yes, in communicating /disseminating / using the results of the project		
<b>13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?</b> <input checked="" type="checkbox"/> Yes – as a <b>primary</b> objective (please indicate areas below- multiple answers possible) <input type="checkbox"/> Yes – as a <b>secondary</b> objective (please indicate areas below - multiple answer possible) <input type="checkbox"/> No		

<sup>9</sup> Insert number from Frascati Manual

<b>13b If Yes, in which fields?</b>			
Agriculture Audiovisual and Media Budget Competition Consumers Culture Customs Development Economic and Monetary Affairs Education, Training, Youth Employment and Social Affairs		Energy Enlargement Enterprise Environment External Relations External Trade Fisheries and Maritime Affairs Food Safety <b>Foreign and Security Policy</b> Fraud Humanitarian aid	x Human rights Information Society Institutional affairs Internal Market Justice, freedom and security Public Health Regional Policy Research and Innovation Space Taxation <b>Transport</b> x
<b>13c If Yes, at which level?</b>			
<input type="checkbox"/> Local / regional levels <input checked="" type="checkbox"/> National level <input checked="" type="checkbox"/> European level <input checked="" type="checkbox"/> International level			
<b>H Use and dissemination</b>			
<b>14. How many articles were published / accepted for publication in peer-reviewed journals?</b>			<b>4</b>
<b>To how many of these is open access<sup>10</sup> provided?</b>			<b>4</b>
<b>How many of these are published in open access journals?</b>			<b>4</b>
<b>How many of these are published in open repositories?</b>			<b>0</b>
<b>To how many of these is open access not provided?</b>			<b>0</b>
<b>Please check all applicable reasons for not providing open access:</b>			
<input type="checkbox"/> publisher's licensing agreement would not permit publishing in a repository <input type="checkbox"/> no suitable repository available <input type="checkbox"/> no suitable open access journal available <input type="checkbox"/> no funds available to publish in an open access journal <input type="checkbox"/> lack of time and resources <input type="checkbox"/> lack of information on open access <input type="checkbox"/> other <sup>11</sup> : .....			
<b>15. How many new patent applications ('priority filings') have been made?</b> ( <i>"Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant</i> ).			<b>0</b>

<sup>10</sup> Open Access is defined as free of charge access for anyone via Internet.

<sup>11</sup> For instance: classification for security project.



<b>16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).</b>	Trademark	0
	Registered design	0
	Other	0
<b>17. How many spin-off companies were created / are planned as a direct result of the project?</b> <i>Indicate the approximate number of additional jobs in these companies:</i>		0 -
<b>18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:</b> <input type="checkbox"/> Increase in employment, or <input type="checkbox"/> Safeguard employment, or <input type="checkbox"/> Decrease in employment, <input checked="" type="checkbox"/> Difficult to estimate / not possible to quantify <input type="checkbox"/> In small & medium-sized enterprises <input type="checkbox"/> In large companies <input checked="" type="checkbox"/> None of the above / not relevant to the project		
<b>19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (FTE = one person working fulltime for a year) jobs:</b>  Difficult to estimate / not possible to quantify	<i>Indicate figure:</i>  <input checked="" type="checkbox"/>	
<b>I Media and Communication to the general public</b>		
<b>20. As part of the project, were any of the beneficiaries professionals in communication or media relations?</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
<b>21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
<b>22. Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?</b>		
<input checked="" type="checkbox"/> Press Release <input type="checkbox"/> Media briefing <input type="checkbox"/> TV coverage / report <input type="checkbox"/> Radio coverage / report <input checked="" type="checkbox"/> Brochures /posters / flyers <input type="checkbox"/> DVD /Film /Multimedia	<input checked="" type="checkbox"/> Coverage in specialist press <input checked="" type="checkbox"/> Coverage in general (non-specialist) press <input type="checkbox"/> Coverage in national press <input type="checkbox"/> Coverage in international press <input checked="" type="checkbox"/> Website for the general public / internet <input type="checkbox"/> Event targeting general public (festival, conference, exhibition, science café)	
<b>23. In which languages are the information products for the general public produced?</b> <input checked="" type="checkbox"/> Language of the coordinator <input checked="" type="checkbox"/> English <input type="checkbox"/> Other language(s)		