ITS ACTION PLAN

FRAMEWORK SERVICE CONTRACT TREN/G4/FV-2008/475/01

D5 – Final Report
Action B - EU-wide real-time traffic information services

25 July 2014

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Directorate-General Mobility and Transport
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Versioning and Content Review Information Table

Version number	When	Changes / update	Author (Organisation name)	Reviewer (name of reviewer and organisation)
0.1	06-02-2014	Document setup	James Long	
1.0	12-04-2014	Final draft for review by the EC.	Tom van de Ven	Ian Wilkinson
2.0	20-05-2014	Final version for approval by EC.	Tom van de Ven, Mark Wedlock	Tom van de Ven
2.3	06-06-2014	Additions on request	Tom van de Ven	Tom van de Ven
3.0	25-07-2014	Final approved version, incl. French and German Management Summary	Tom van de Ven	Tom van de Ven

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M A N A G E M E N T   S U M M A R Y

On 16 December 2008 the European Commission adopted the ITS Action Plan (COM (2008) 886) for road transport and interfaces with other modes. The Action Plan aims to accelerate and coordinate the deployment of Intelligent Transport Systems (ITS) in road transport. One of the key priority areas involves optimal use of road, traffic and travel data. The scope of this study falls within that priority area.

The ITS Action Plan provided the basis for the ITS Directive, which defines a series of basic elements to be considered when elaborating on 'the necessary requirements to make EU-wide real-time traffic information (RTTI) services accurate and available across borders to ITS users'.

In December 2012 the EC commissioned a study regarding "the provision of EU-wide real-time traffic information services". This final report provides an overview of the results of the study, and presents its findings, conclusions and recommendations.

Technological innovations have fundamentally changed the RTTI services landscape. New technologies have created new ways of collecting more and more road and traffic data, at decreasing costs. Big data analytics have enabled the cost efficient processing and enrichment of available data. And technological developments have introduced new services platforms such as smartphones and personal navigation devices.

The desk research showed that this trend is likely to continue in the coming decade as new technologies will enter the market that too can cause a paradigm shift in the way road and traffic data is collected, processed and distributed to end-users. Technology that connect vehicles to the Internet (the *Connected Car*), to each other and roadside equipment (*Cooperative Technology*) for example, are expected to lead to a significant increase in available RTTI data at much lower costs.

Technological developments also lead to different road and traffic data needs. As more and more driving tasks are automated, the need for human-comprehensible traffic information (e.g. incident and traffic jam reports) will decrease and the demand for machine-readable road and traffic data will increase. Because machines can process more data much faster than humans, the demand will shift to high-volume, accurate road and traffic data that is much more accurate and updated much more frequently. Automated

vehicles will in particular require RTTI that will allow them to look past the range of their sensors and their cooperative range, providing them with forward awareness of potential traffic build-up (forecasts) and potentially dangerous traffic situations downstream (accidents, dangerous driving conditions, etc.).

The new data and services platforms in potential can provide road authorities with powerful means to manage traffic on their road more efficiently and more effectively.

Roles in the RTTI value chain will likely change in the coming years. Private traffic information service providers are well positioned to develop the new traffic information services, as they have the technology to process the volumes of new traffic data and develop profitable business models. Public authorities will however retain a key role in assuring societal interests in the RTTI value chain. How the new technology, the RTTI markets and the roles in the value chain will develop is difficult to predict. What does seem clear is that changes will occur and that both public and private organisations will have a role to play. Establishing a forum where public and private stakeholders in road data and traffic information find a platform to regularly discuss technical, organisational and legal issues, would allow for the gradual incorporation of new technologies, development of new cooperation models, coordinated development of new data coding, location coding and quality standards, etc.

The impact assessment showed that significant benefits to road safety and congestion reduction can be achieved against limited investments by mandating the deployment of public Traffic Management Information and Road Data updates on the Core and Comprehensive Trans-European Road Network (TERN).

In addition to the quantified impact there are also important additional impacts that should be taken into consideration. Respondents of the online survey for example believed that RTTI can have high impacts on both road safety and road user satisfaction.

Responses to the online survey showed broad support for actions by the EC to ensure and foster the provision of EU-wide RTTI.

Private companies indicated in the small group discussions and workshop, that public road authorities should support the business cases of private companies rather than compete with them, stating that there is a significant saving potential for Road Authorities withdrawing to a certain extent from RTTI. Public authorities too expressed their concern about potential interference of the RTTI market, and about possibly too stringent investment requirements for the public sector.

Public authorities should continuously evaluate their role in the RTTI value chain, and in general should concentrate on collecting the data, and providing the services that provide direct societal benefits to citizens, without hampering the RTTI market development.

A wide range of public and private parties are involved in the collection of road data, respectively traffic and traffic management information. These parties operate in an environment that is continuously changing as a result of technological innovations and developments in the RTTI market. To form of cooperation between all parties is required that can incorporate these changes. A practical way forward would be to establish two governance platforms; one for road data, and one for traffic and traffic management information. The first could be the TN-ITS platform[1], the second could be set up in cooperation with TISA. The forums should be open to public and private organisations and should encourage newcomers (SMEs) to join.

Based on the Public Sector Information (PSI) Directive, public authorities already are obliged to make data they collect available. This also applies to all road data, traffic information and traffic management information. These data should be made available in machine-readable formats to all service providers under the same conditions and without restrictions on the use- and re-use of the data.

Private companies collect more and more data. Until now, most safety-related traffic information (SRTI) was collected by public authorities. The advent of cooperative technology and connected cars will likely change this situation. It is expected that car manufacturers, their suppliers and/or service providers will obtain more and more SRTI, for example from the

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[1] www.tn-its.eu

CAN-bus or through messages from cooperative vehicles. Because this information is relevant for the imminent safety of other road users as well, privately held traffic data that is relevant to road safety should be made available to road operators and other service providers as defined in the Specifications for Action C of the ITS Directive.

Road Operators in general are concerned that if they publish their road network data it will take too much time for the end-user to receive these data in map updates in their satnav systems. At the same time the provision of notifications of changes to the road network would be of interest to Digital Map Providers to help streamline and optimise the road network survey processes. This situation could be resolved by establishing a Memorandum of Understanding, e.g. within the TN-ITS framework, between road authorities and digital map providers wherein road operators commit to regularly updating and publishing their road data, and digital map providers committing to the timely publication of road map changes in their end-user products.

Traffic management information is in general poorly developed and not available to service providers. In addition there is reluctance from Traffic Managers to share such information with ITS Service Providers as they are concerned the information might be used to recommend routes that are in the interest of the individual driver but not in the public interest. Service and satnav providers however indicate they would like to receive this information to better guide their customers away from congestion and incidents. Various trials have proven that it is possible to develop a cooperation model that serves both needs. Key to the solution is that road authorities classify their traffic management information (informative, recommended, mandatory) and that service and satnav providers present the information as such to their customers. A Memorandum of Understanding between road authorities and service and satnav providers could resolve this issues, wherein road operators commit to publishing traffic management information, and service providers commit to timely publishing the traffic management information, leaving the choice whether to abide to the information, recommendations or instructions from the road authorities, to the end-user.

Data privacy and service liability will become key issues for increasing amounts of data originating from vehicles and communities. The EC should encourage harmonisation of access conditions for data originating from the

car, drivers and passengers, by requesting the industry to drafts guidelines and submit them to the joint European data protection authorities.

Making RTTI data findable and accessible can be done by bringing it together in a central RTTI node, or by providing a registry of RTTI data sources. Because the volume of available privately and publicly held RTTI data is expected to increase dramatically a registry of RTTI data sources seems to be the most practical solution.

Broad adoption of RTTI standards can lower deployment and operational costs for public and private organisations, and can provide a stimulus to data exchange by lowering the interfacing costs.

For road data a common data collection, coding and data sharing method is being developed (TN-ITS). For RTTI and SRTI various data coding methods exist that are already widely used by most road authorities and private service providers, notably DATEX, TMC and TPEG. Most traffic management information can be coded in DATEX, although extensions are required to code specific data types.

Considering the rapid development of RTTI technology and the relatively slow pace of the legislative process there too is a risk that innovation is hampered if standards that meet the current needs are mandated for years to come. A sensible approach seems to recommend established standards and promote standardisation for new technologies.

Although there is broad consensus among stakeholders that quality management of RTTI is important this is an underdeveloped aspect of the RTTI value chain. Proven methods to measure, monitor and manage RTTI quality are missing and practical experience in applying them is limited, in particular in the public sector. The development and deployment of methods for the measurement, monitoring and validation of road data, traffic information and traffic management information, including the up-stream exchange of data for validation purposes should therefore be promoted.

The assessment of methods and means to measure and monitor the effects of a possible RTTI policy framework, suggested that the operational objectives can be best measures and monitored through a combination of Member State and 3rd Party reporting, and monitoring by the Governance Bodies.

S Y N T H E S E

Le 16 Décembre 2008, la Commission européenne a adopté le Plan d'Action STI (COM (2008) 886) relative au transport routier et ses interfaces avec les autres modes de transports. Le Plan d'Action vise à accélérer et coordonner le déploiement des Systèmes de Transports Intelligents (STI) dans le domaine du transport routier. Un des domaines prioritaires concerne l'utilisation optimale des données relatives à la route, à la circulation et aux déplacements. La présente étude a pour objet ce domaine prioritaire.

Sur la base du Plan d'action STI, la Directive STI (2010/40/UE) définit une série d'éléments à considérer pour l'élaboration des exigences nécessaires pour que les utilisateurs des STI disposent, par-delà les frontières, dans l'ensemble de l'Union, de services précis d'informations en temps réel sur la circulation (RTTI).

En décembre 2012, la Commission européenne a confié à des prestataires l'exécution d'une étude sur «la mise à disposition, dans l'ensemble de l'Union, de services d'informations en temps réel sur la circulation». Ce rapport final présente les résultats de cette étude, ainsi que ses conclusions et ces recommandations.

Les innovations technologiques ont fondamentalement changé le paysage des services RTTI. Les technologies récentes permettent aujourd'hui de collecter de plus en plus de données routières et de circulation, de façon toujours plus économique. Ainsi l'analyse de données massives (« Big Data ») a permis d'enrichir les données disponibles et d'en réduire les coûts de traitement, alors que les développements technologiques ont introduit de nouvelles plateformes de services telles que les téléphones intelligents (« Smartphones ») et les systèmes de navigation autonome (« PND »).

La recherche documentaire a montré que cette tendance va probablement continuer dans la décennie à venir, car de nouvelles technologies, susceptibles de causer un changement de paradigme dans la façon dont les données routières et de circulation sont collectées, traitées et fournies, vont apparaître sur le marché. Par exemple, il est attendu que les technologies qui connectent les véhicules à Internet (« Voiture connectée »), les véhicules entre eux ainsi qu'avec les équipements de bord de routes (« Technologies Coopératives »), accroîtront fortement les données RTTI disponibles à des coûts toujours plus faibles.

Les développements technologiques engendrent également différents besoins en données routières et de circulation. Comme la conduite est de plus en plus automatisée, le besoin en information de circulation compréhensible par les humains (e.g. accidents et congestions) diminuera alors que la demande en données lisibles par les machines augmentera. Les machines peuvent traiter plus de données et plus rapidement que les humains, c'est pourquoi la demande évoluera pour se tourner vers de grand nombre de données routières et de circulation beaucoup plus précises et mises à jour beaucoup plus fréquemment. Plus particulièrement, les véhicules autonomes nécessiteront des informations leur permettant de voir au-delà de la portée de leurs propres capteurs, afin d'anticiper les aléas routiers en amont (prévisions de circulation) ainsi que les situations à risques (accidents, conditions de conduites difficiles, etc.).

En théorie, les nouvelles plateformes de services et leurs données peuvent fournir aux autorités routières de puissants outils pour une gestion de la circulation plus efficace.

Par ailleurs, les rôles dans la chaîne de valeurs des données RTTI vont probablement évoluer dans les prochaines années. Etant donné qu'ils possèdent les technologies pour traiter ces nouvelles données et pour développer des modèles économiques rentables, les prestataires privés de services d'information sur la circulation sont bien positionnés pour développer de nouveaux services. Les autorités publiques vont toutefois conserver un rôle clef comme gardiennes des intérêts sociétaux. Il reste difficile de prévoir comment vont se développer précisément les nouvelles technologies, les marchés des services RTTI ainsi que les rôles dans la chaîne de valeur. En revanche, il paraît clair que des changements sont à venir et que les organisations tant publiques que privées auront un rôle à jouer. La mise en place d'un forum où les parties prenantes publiques et privées de l'information en temps réel sur la circulation trouvent un lieu pour régulièrement discuter des questions techniques, organisationnelles et juridiques, permettrait l'incorporation progressive des technologies nouvelles, le développement de nouveaux modèles de coopération, le développement coordonné de nouveaux codages de données, de localisations ainsi que des standards de qualité, etc.

L'analyse d'impact a montré des bénéfices significatifs pour la sécurité routière, tandis qu'une réduction globale des congestions peut être atteinte grâce à des investissements mesurés si les déploiements des informations publiques de gestion de la circulation et les mises à jour des données

routières sont rendus obligatoires sur le réseau global et le réseau principal du réseau routier transeuropéen (« TERN »).

En plus des impacts quantitatifs, d'importants impacts additionnels doivent être considérés. Par exemple, les personnes interrogées lors de l'enquête en ligne ont ainsi mis en valeur les forts impacts des services RTTI sur la sécurité routière et la satisfaction des usagers.

Les réponses de l'enquête en ligne ont également montré un fort soutien pour les actions menées par la Commission européenne qui visent à assurer et promouvoir la mise à disposition dans l'ensemble de l'Union d'informations en temps réel sur la circulation.

Lors des discussions en groupe restreint ainsi que durant l'atelier, les entreprises privées ont indiqué que les autorités routières publiques devraient soutenir leurs modèles économiques plutôt que de les concurrencer directement, affirmant que les services RTTI sont sources d'importantes économies potentielles pour les autorités routières. Les autorités publiques ont également exprimé leurs inquiétudes sur une possible ingérence du marché des services RTTI et sur les besoins en investissement provenant du secteur public.

Les autorités publiques devraient évaluer continuellement leur rôle dans la chaîne de valeur des services RTTI, et devraient principalement se focaliser sur la collecte des données ainsi que sur la fourniture de services aux bénéfices sociétaux directs pour les citoyens, sans freiner le développement du marché des services RTTI.

De nombreuses entités publiques comme privées sont impliquées dans la collecte des données routières, ainsi que pour les informations liées à la circulation routière et pour les informations de gestion de la circulation. Ces entités travaillent dans un environnement en perpétuelle évolution au gré des innovations technologiques et des mutations du marché économique. La formation d'une coopération entre toutes les parties est alors nécessaire, afin de s'adapter à ces changements. Une manière pratique d'y arriver serait de mettre en place deux plateformes de gouvernance : une en charge des données routières, et une seconde en charge des informations liées à la circulation routière et des informations de gestion de la circulation. La première citée pourrait être la plateforme existante TN-ITS, et la seconde pourrait être mise en œuvre en coopération avec TISA. Ces forums devront être ouverts aux organisations publiques et privées et devront favoriser l'adhésion de nouveaux arrivants (notamment les PMEs).

De par la directive sur la réutilisation des informations du secteur public (Directive PSI), les autorités publiques sont d'ores et déjà obligées de mettre à disposition les données qu'elles collectent. Cela s'applique aux données routières, aux informations liées à la circulation routière et aux informations de gestion de la circulation. Ces données devront être mises à disposition de tous les prestataires de services dans des formats lisibles par machine, sous des modalités communes, et sans restrictions d'utilisation et de réutilisation.

Les entreprises privées collectent quant à elle de plus en plus de données. Jusqu'à présent, les autorités publiques collectaient essentiellement des informations sur la circulation liées à la sécurité routière (SRTI). L'arrivée des systèmes coopératifs et des véhicules connectés va probablement modifier cette situation. Il est attendu que les constructeurs automobiles, leurs fournisseurs et/ou les prestataires de services vont acquérir de plus en plus de données SRTI, comme par exemple des données issues des bus CAN ou par l'intermédiaire des messages échangés entre véhicules connectés. Etant donné que ces informations sont pertinentes pour la sécurité ou pour les usagers, les données sur la circulation issues des opérateurs privés utiles pour la sécurité devront être également mises à disposition aux opérateurs routiers ainsi qu'aux prestataires de services, comme défini dans les spécifications pour l'action C de la directive STI.

Les opérateurs routiers sont généralement soucieux du temps de latence dans la mise à jour des données cartographiques dans les équipements de navigation, une fois leurs données routières publiées. En parallèle, la fourniture des notifications d'évolution du réseau routier profiterait aux fournisseurs de cartes numériques afin de les aider à rationaliser et optimiser leurs processus de levé des réseaux routiers. Cette situation pourrait être alors résolue en établissant un protocole d'accord, par exemple au sein de la structure TN-ITS, entre les autorités routières et les fournisseurs de cartes numériques, où les premiers s'engageraient à régulièrement mettre à jour et publier leurs données routières, et où les seconds s'engageraient à publier en temps utile ces modifications dans leurs produits finaux aux usagers.

D'une manière générale, les informations de gestion de la circulation sont peu développées et souvent indisponibles aux prestataires de services. Par ailleurs, les gestionnaires de circulation sont peu enclins à partager ces informations avec les prestataires de services STI car ils craignent que ces informations soient utilisées pour recommander des itinéraires intéressants pour le conducteur individuel mais contraire à l'intérêt public. Les

fournisseurs de services et de solutions de navigation indiquent toutefois qu'ils souhaitent acquérir ces informations afin de mieux guider leurs clients et de leur éviter les congestions et les accidents. Plusieurs expériences ont montré qu'il est possible de développer un modèle coopératif servant les intérêts des deux parties. La clef réside dans la classification des informations de gestion de la circulation (informatif, recommandé, obligatoire) par les autorités routières et que les fournisseurs de services et solutions de navigation présentent ces informations telles quelles à leurs clients. L'établissement d'un protocole d'accord entre ces deux parties, où les autorités routières s'engageraient à publier leurs informations de gestion de la circulation, et où les fournisseurs de services et de solutions de navigation s'engageraient à publier en temps utile ces informations à leurs clients (en leur laissant le choix et la responsabilité de respecter ou non les informations, recommandations et instructions des autorités routières), permettrait de résoudre ce problème.

La protection de la vie privée et les questions liées à la responsabilité vont devenir cruciales car les volumes de données traitées augmentent, notamment celles provenant des véhicules et des communautés d'utilisateurs. La Commission européenne devrait encourager l'harmonisation des conditions d'accès aux données provenant des véhicules, des chauffeurs et des passagers, en exigeant des industriels la création de lignes directrices et en soumettant ces dernières aux autorités européennes en charge de la protection des données.

Une première solution pour rendre les données RTTI repérables et accessibles serait de les centraliser dans un nœud commun, une seconde serait d'établir un registre identifiant les sources de données RTTI. Etant donné que les volumes de données RTTI, tant publiques que privées, vont probablement augmenter considérablement, la seconde solution semble la plus pragmatique.

Une vaste adoption des normes RTTI peut réduire les coûts de mise en œuvre ainsi que les coûts opérationnels pour les organisations publiques et privées, tout en favorisant les échanges de données, car cela réduirait les coûts d'interfaçages.

Une méthode harmonisée de collecte, codage et échange de données est en train d'être élaborée par TN-ITS pour les données routières. Cependant pour les données RTTI et SRTI, plusieurs méthodes de codage des données existent et sont aujourd'hui diversement utilisées par les autorités routières et les prestataires de services privés, notamment DATEX, TMC et

TPEG. La plupart des informations de gestion de la circulation peuvent être codées en DATEX, bien que des extensions soient encore requises pour certains types de données.

En comparant l'évolution très rapide des technologies RTTI et la relative lenteur des processus réglementaires, il semble que l'innovation serait bridée si des normes, qui répondent aux besoins d'aujourd'hui, étaient imposées dans les prochaines années. Une approche plus sensée consisterait à recommander les normes existantes tout en encourageant les travaux de normalisation sur les nouvelles technologies.

Bien qu'il y ait un large consensus entre les parties prenantes sur le fait que la gestion de la qualité des informations RTTI soit importante, cet aspect reste insuffisamment développé dans la chaîne de valeur actuelle. Des méthodes fondées de mesure, contrôle et gestion de la qualité des données RTTI restent à concevoir et les expériences pratiques sont limitées, en particulier dans le secteur public. Par conséquent le développement et la mise en œuvre de telles méthodes doivent être favorisés pour la mesure, le contrôle et la validation des données routières, des informations sur la circulation et des informations de gestion de la circulation, notamment à travers des échanges transversaux de données entre les acteurs.

L'analyse des méthodes et moyens pour mesurer et contrôler les effets d'un cadre réglementaire pour les données RTTI, a montré que les objectifs opérationnels seront déterminés et vérifiés au mieux à travers des évaluations combinées des Etats membres et des parties tierces, et sous le contrôle des organes de gouvernance.

M A N A G E M E N T   S U M M A R Y

Am 16. Dezember 2008 hat die Europäische Kommission den ITS Aktionsplan (COM (2008) 886) über den Güterverkehr und Schnittstellen zu anderen Verkehrsträgern angenommen. Der Aktionsplan hat zum Ziel den Einsatz von intelligenten Transport Systemen (ITS) zu beschleunigen und zu koordinieren. Ein Schwerpunktgebiet ist die optimale Nutzung von Straßen-, Verkehrs- und Reisedaten. Der Umfang dieser Studie fällt in dieses Schwerpunktgebiet.

Der ITS Aktionsplan liefert die Basis für die ITS Richtlinie. Diese definiert eine Reihe von Basiselementen, welche berücksichtigt werden müssen bei der Ausarbeitung von notwendigen Anforderungen, um „EU-weite Real-Time Traffic Information (RTTI), dt. Echtzeit Verkehrsinformationsdienste" für ITS Nutzer grenzüberschreitend und akkurat verfügbar zu machen."

Die EU-Kommission gab im Dezember 2012 eine Studie betreffend „der Bereitstellung von EU-weiten Echtzeit Verkehrsinformationsdienste" in Auftrag. Dieser abschließende Bericht gibt einen Überblick über die Resultate der Studie und präsentiert die daraus resultierenden Erkenntnisse, Schlussfolgerungen und Empfehlungen.

Die RTTI Landschaft hat sich durch technische Innovationen fundamental verändert. Die neuen Technologien ermöglichen es zu tieferen Kosten eine größere Fülle an Straßen- und Verkehrsdaten zu erheben. Große Datenanalysen ermöglichen die kosteneffiziente Anreicherung und Verarbeitung der vorhandenen Daten. Zudem haben technologische Entwicklungen, wie beispielsweise Smartphones und persönliche Navigationsgeräte, neue Dienstplattformen eingeführt.

Die Sekundärforschung zeigte, dass eine Fortführung dieses Trends in der kommenden Dekaden wahrscheinlich ist – insbesondere da neue Technologien in den Markt eintreten, welche ebenfalls einen Paradigmenwechsel herbeiführen können in der Art und Weise wie Straßen- und Verkehrsdaten gesammelt, verarbeitet und an den Endnutzer verteilt werden. Es wird erwartet, dass beispielsweise Technologien, welche das Fahrzeug mit dem Internet und untereinander verbinden (Connected Car), sowie straßenseitige Ausrüstung (kooperative Technologien) zu einem signifikanten Anstieg von verfügbaren RTTI Daten zu erheblich tieferen Kosten führen werden.

Technologische Entwicklungen führen auch zu einem anderen Bedarf an Straßen- und Verkehrsdaten. Da immer mehr Fahraufgaben automatisiert werden, sinkt der Bedarf an menschlich nachvollziehbaren Verkehrsinformationen (z.B. Störungs- und Staumeldungen) jedoch steigt der Bedarf an maschinenlesbaren Straßen- und Verkehrsdaten. Weil Maschinen Daten schneller verarbeiten können als Menschen wird sich die Nachfrage zu Großen und akkuraten Straßen- und Verkehrsdatenvolumen hin bewegen. Diese werden mit größerer Genauigkeit und in kürzeren Abständen erfasst. Automatisierte Fahrzeuge werden insbesondere RTTI benötigen, welche dem Fahrzeug ermöglichen über die Reichweite der eingebauten Sensoren und umliegenden kooperativen Systeme hinweg zu sehen. Die empfangenen Daten können so vorausschauend zu Prognosen über nachgelagerte potenzielle Verkehrsentwicklungen (Stauprognosen) und potenziell gefährliche Verkehrssituationen verarbeitet werden (Unfälle, gefährliche Straßenverhältnisse, usw.).

Potenziell sind die neuen Daten und Dienstplattformen für Straßenbehörden ein wirkungsvolles Mittel für ein effizienteres Verkehrsmanagement.

Die Rollen in der RTTI-Wertschöpfungskette werden sich voraussichtlich in den kommenden Jahren verändern. Private Anbieter sind gut positioniert, um die neuen Verkehrsinformationsdienste zu entwickeln, da sie über die Technologie verfügen die Großen Datenvolumen zu verarbeiten und daraus profitable Geschäftsmodelle zu entwickeln. Der öffentlichen Hand wird mit der Sicherung von gesellschaftlichen Interessen in der RTTI-Wertschöpfungskette jedoch weiterhin eine Schlüsselposition zukommen. Wie sich die neuen Technologien, der RTTI Markt und die Rollen in der Wertschöpfungskette entwickeln ist schwierig vorauszusagen. Was aber klar scheint ist, dass Veränderungen eintreten werden und dass sowohl Behörden als auch private Organisationen eine Rolle spielen werden. Die Einrichtung eines Forums für Straßendaten und Verkehrsinformation, welches öffentlichen und privaten Akteuren eine Plattform bietet sich regelmäßig über technische, organisatorische und rechtliche Aspekte auszutauschen, ermöglicht eine schrittweise Eingliederung neuer Technologien, die Entwicklung neuer Kooperationsmodelle, die koordinierte Entwicklung neuer Datenkodierung, Messstellenkodierung und Qualitätsstandards, usw.

Die Folgenabschätzung zeigte, dass signifikante Verbesserungen in Verkehrssicherheit und Staureduzierung mit vergleichbar geringen Investitionen durch den angeordneten Einsatz von öffentlichen Verkehrsmanagement-informationen und Straßendatenupdates auf dem

Kern- und umfassenden Transeuropäischen Straßennetz (TERN) erreicht werden können.

Zusätzlich sollten noch weitere wichtige Auswirkungen berücksichtigt werden. Zum Beispiel glauben Teilnehmer der Online Befragung, dass RTTI große Auswirkungen auf Verkehrssicherheit und Straßennutzerzufriedenheit haben kann. Die Rückmeldungen aus der Webbefragung zeigen breite Unterstützung für Maßnahmen der EU-Kommission zur Förderung einer EU-weiten Regelung für RTTI.

Privatunternehmen forderten in Gruppendiskussionen und Workshops, dass die Straßenbehörden die Geschäftsszenarien der Privatunternehmen unterstützen und nicht dagegen konkurrieren sollten. Die Forderung wurde begründet mit einem signifikanten Sparpotenzial für die Straßenbehörden bei einem teilweisen Rückzug aus dem RTTI Markt. Die Behörden brachten ebenfalls ihre Sorgen über potenzielle Störungen des RTTI Marktes und die möglicherweise zu strengen Investitionsanforderungen für den öffentlichen Sektor zum Ausdruck.

Behörden sollten ihre Rolle in der RTTI-Wertschöpfungskette kontinuierlich evaluieren und sich grundsätzlich auf das Sammeln von Daten und das Bereitstellen von Diensten mit gesellschaftlichem Nutzen für die Bürger konzentrieren ohne dabei die RTTI-Marktentwicklung zu behindern.

Ein breites Spektrum an öffentlichen und privaten Parteien ist in das Sammeln von Straßendaten und Verkehrsinformationen sowie im Verkehrsmanagement involviert. Diese Parteien handeln in einem Umfeld, welches aufgrund technologischer Innovationen und Entwicklungen im RTTI-Markt einem kontinuierlichen Wandel unterliegt.

Es wird eine Form der Kooperation zwischen allen Parteien benötigt, welche diese Änderungen mit einbezieht. Ein geeigneter Weg wäre die Schaffung von zwei Steuerungsplattformen; eine für Straßendaten und die andere für Verkehrsinformationen und Verkehrsmanagement. Die erste könnte die TN-ITS Plattform sein und die zweite könnte in Zusammenarbeit mit TISA gebildet werden. Diese Foren sollen für private wie auch öffentliche Organisationen offen sein und auch Marktneulinge (KMU) ermutigen mitzuwirken.

Basierend auf der PSI Direktive über die Weiterverwendung von Informationen des öffentlichen Sektors sind Behörden bereits verpflichtet die von ihnen gesammelten Daten zugänglich zu machen. Dies gilt auch für sämtliche Straßendaten, Verkehrsinformationen und Daten im Bereich

Verkehrsmanagement. Diese Daten sollten allen Dienstanbietern in maschinenlesbarer Form und unter den gleichen Bedingungen und ohne Einschränkung auf die Ver- und Weiterverwendung der Daten zugänglich gemacht werden.

Privatunternehmen sammeln immer mehr Daten. Bislang werden vor allem sicherheitsrelevante Verkehrsinformationen (SRTI) von Behörden gesammelt. Das Aufkommen von kooperativer Technologie und „Connected Cars" wird diese Situation voraussichtlich verändern. Es wird erwartet, dass Autohersteller, Zulieferer und/oder Dienstanbieter vermehrt sicherheitsrelevante Verkehrsinformationen beziehen werden, zum Beispiel über den CAN-Bus oder durch Nachrichten von kooperativen Fahrzeugen. Da diese Informationen auch für die unmittelbare Sicherheit anderer Straßennutzer relevant sind, sollten privatgehaltene sicherheitsrelevante Verkehrsdaten den Straßenbetreibern und anderen Dienstanbietern nach der Definition von Aktionspunkt C der ITS Direktive zugänglich gemacht werden.

Generell sind die Straßenbetreiber besorgt darüber, dass die von ihnen veröffentlichten Daten zu lange brauchen, um beim Endnutzer als Kartenaktualisierung auf dem Satellitennavigationssystem zu erscheinen. Dabei wäre die Bereitstellung von Benachrichtigungen über Änderungen im Straßennetz von Interesse für digitale Kartenanbieter, um die Straßenüberwachungsprozesse zu optimieren. Diese Situation könnte durch den Einsatz einer Absichtserklärung gelöst werden. Zum Beispiel könnten sich zum einen Straßenverkehrsbehörden verpflichten ihre Straßendaten regelmäßig zu aktualisieren und zu veröffentlichen, worauf auf der anderen Seite die digitalen Kartenanbieter Straßenkartenänderungen zeitnah in ihre Endkundenprodukte einfließen lassen könnten.

Verkehrsmanagementdaten sind normalerweise schlecht entwickelt und den Dienstanbietern nicht zugänglich. Zusätzlich zögern Verkehrsmanager diese Informationen mit ITS Dienstanbietern zu teilen, da sie befürchten, dass die Information dazu verwendet werden könnte eine Routenempfehlung im Sinne des einzelnen Fahrers anstatt dem öffentlichen Interesse abzugeben. Dienst- und Navigationssystemanbieter hingegen möchten diese Informationen erhalten, um ihre Kunden besser von Stau und Störungen fernhalten zu können. Verschiedene Versuche haben bewiesen, dass die Entwicklung eines Kooperationsmodells, welches beide Bedürfnisse abdeckt, möglich ist. Der Schlüssel zur Lösung ist die Klassifikation der Verkehrsdaten durch die Verkehrsbehörden (informativ,

empfohlen, obligatorisch) und dass Dienst- und Navigationssystemanbieter die Information entsprechend ihren Kunden präsentiert. Eine Absichtserklärung zwischen Verkehrsbehörden und Dienst- und Navigationssystemanbietern, worin Straßenbetreiber sich verpflichten Verkehrsmanagementdaten zu veröffentlichen und Dienstanbieter die Daten zeitnah in ihren Produkten an ihre Kunden weitergeben, könnte diese Probleme lösen. Dabei wäre den Dienstanbietern freigestellt, ob sie alle Informationen, Empfehlungen oder lediglich obligatorische Daten an ihre Kunden weitergeben.

Datenschutz und Haftung werden zu einem Schlüsselthema für steigende Datenmengen aus Fahrzeugen und der Öffentlichkeit. Mit der Forderung an die Industrie zur Einsendung von Entwürfen für Richtlinien an die europäische Datenschutzbehörde sollte die EU-Kommission die Harmonisierung der Zugangsbedingungen zu Daten aus Autos, Fahrern und Passagieren unterstützen.

RTTI-Daten auffindbar und zugänglich zu machen kann über das Zusammenführen in einem zentralen RTTI-Knoten erreicht werden oder über die Bereitstellung eines Registers der RTTI-Datenquellen. Aufgrund des erwarteten drastischen Anstiegs des verfügbaren privaten und öffentlichen RTTI-Datenvolumens scheint ein Register der RTTI-Datenquellen die praktikabelste Lösung zu sein.

Eine breite Akzeptanz von RTTI-Standards kann die Verwendungs- und Betriebskosten für die privaten und öffentlichen Organisationen senken. Die dadurch tieferen Kosten für Schnittstellen wirken zudem als Anreiz für den Datenaustausch.

Für Verkehrsdaten wird eine gemeinsame Methode zur Sammlung von Daten, zur Kodierung und zum Datenaustausch entwickelt (TN-ITS). Für RTTI und SRTI Daten existieren bereits weit verbreitete Kodierungsmethoden, welche von den meisten Verkehrsbehörden und privaten Dienstanbietern genutzt werden, insbesondere DATEX, TMC und TPEG. Die meisten Verkehrsmanagementdaten können in DATEX kodiert werden, auch wenn Erweiterungen für codespezifische Datentypen benötigt werden.

Berücksichtigt man die rapide Entwicklung der RTTI-Technologie und die relativ langsame Geschwindigkeit des Gesetzgebungsverfahrens besteht das Risiko, dass Innovation behindert wird, wenn Standards, die die aktuellen Bedürfnisse abdecken, über Jahre hinaus vorgeschrieben

werden. Ein vernünftiger Ansatz scheint die Empfehlung von Standards und die Bewerbung von Standardisierung neuer Technologien.

Obwohl unter den beteiligten Akteuren ein breiter Konsens darüber herrscht, dass Qualitätsmanagement für RTTI wichtig ist, ist dieser Aspekt in der RTTI Wertschöpfungskette unterentwickelt. Erprobte Methoden RTTI zu messen, zu überwachen und zu verwalten sind fast nicht vorhanden. Praktische Erfahrungen in deren Anwendung fehlen ebenso, insbesondere im öffentlichen Sektor. Die Entwicklung und der Einsatz von Methoden zur Messung, Überwachung und Validierung von Straßendaten, Verkehrsinformation und Verkehrsmanagementdaten inklusive Vorabaustausch zu Validierungszwecken sollte daher gefördert werden.

Die Bewertung von Methoden und Mitteln, um die Effekte möglicher RTTI Rahmenbedingungen zu messen und zu überwachen, legen nahe, dass die operativen Ziele am besten durch eine Kombination aus Mitgliedsstaaten, Auswertungen durch Drittparteien und Überwachung durch ein Steuerungsgremium gemessen und überwacht werden können.

T A B L E   O F   C O N T E N T

1. Introduction

1.1. Background

Intelligent Transport Systems (ITS) can significantly contribute to a cleaner, safer and more efficient transport system. In 2010 the European Parliament and Council adopted the ITS Directive to accelerate the deployment of these innovative transport technologies across Europe. This Directive is an important instrument for the coordinated implementation of ITS in Europe. It aims to establish interoperable and seamless ITS services while leaving Member States the freedom to decide which systems to invest in.

Under this Directive the European Commission has to adopt specifications to address the compatibility, interoperability and continuity of ITS solutions across the EU. One of the priorities of the ITS Directive was defined as Priority Action B: the definition of the necessary requirements to make EU-wide real-time traffic information services accurate and available across borders to ITS users, based on:

- o The availability and accessibility of existing and accurate road and real-time traffic data used for real-time traffic information to ITS service providers without prejudice to safety and transport management constraints,
- o The facilitation of the electronic data exchange between the relevant public authorities and stakeholders and the relevant ITS service providers, across borders,
- o The timely updating of available road and traffic data used for real-time traffic information by the relevant public authorities and stakeholders,
- o The timely updating of real-time traffic information by the ITS service providers.

This document presents the final report of the study.

1.2. Study Scope

The Task Specification for the study elaborated further on the priority action, and added that the following had to be considered:

- o The necessary requirements for the collection by relevant public authorities and/or, where relevant, by the private sector of road and traffic data (i.e. traffic circulation plans, traffic regulations and recommended routes) and for their provision to ITS service providers

o The necessary requirements to make road, traffic and transport services data used for digital maps accurate and available, where possible, to digital map producers and service providers

Work on static data, such as traffic circulation plans, traffic regulations, recommended routes and road data, have been investigated in previous ITS studies, notably on ITS Action Plan actions 1.1, 1.2, 1.3, 1.4 and 2.1 [12, 13, 14, 39]. The purpose of the study was to support the EC in drafting specifications for a framework for the publishing of public, and exchange of public and private real-time road and traffic data. Because such a framework would have to be aligned with, or might also act as, the framework for the exchange of static data, the study also took note of the information and recommendations of previous studies on these topics and supported the EC as much as possible in establishing a framework to support the exchange of both real-time and static road and traffic data, without redoing the work of the previous studies.

Table 1 presents the relation of ITS Directive Priority Action B, which is subject of this study, to the priority areas and actions of the ITS Action Plan and ITS Directive. It illustrates that Priority Action B incorporates aspects of different ITS Action Plan actions.

Table 1   Relation to the priority areas and actions of the ITS Action Plan and ITS Directive.

ITS Directive	Priority Area I: Optimal use of road, traffic and travel data			
	Priority Action B: Real-time traffic information services			Priority Action C: Free safety related traffic information
ITS Action Plan	Action 1.1: EU-wide real-time traffic and travel information services	Action 1.2: Road data and traffic circulation plans, traffic regulations, recommended routes	Action 1.3: public data for digital maps and their timely updating	Action 1.4: free minimum universal traffic information services

The specifications of the EC for Priority Action B had to cover different types of road, traffic and travel data, incorporating the results of the studies already carried out on Action 1.1, 1.2, 1.3 and 1.4 of the ITS Action Plan, and on Action C of the ITS Directive. The study assumed that the

specifications will be structured as illustrated by Table 2. General principles can be drafted that apply to all types of information. Specifications for certain data types can build on the results from the previous studies. Action C of the ITS Directive (safety-related traffic information) is considered to be a subset of action B.

Table 2   Framework structure for the Action B Specifications.

General Principles	on the availability, quality and timely delivery of public and private data relevant for real-time traffic and travel information services		
Specific requirements per data / information type	For road data; based on Action 1.3 study	For real-time traffic data/information; based on Action 1.1 study	For traffic management information; based on Action 1.2 study
		For safety related traffic data/information; based on Action C study	

1.3. Study Objectives

The general objective of the study was to support the European Commission in the definition of an appropriate framework for accurate EU-wide real-time traffic information services through the adoption of specifications that tackle perceived bottlenecks and create a level playing field providing maximum benefits for Society and European citizens.

The specific objectives for the current study were:

1.   To identify the issues that need to be tackled, to define the level of detail that needs to be achieved including gaps to be covered, and to support analysis and definition of measures to be translated in clear rules & specifications;

2.   To analyse the impact of proposed measures including estimates on costs and benefits, and to fuel consensus building with key stakeholders in this;

3.   To support as and when necessary the Commission in its task of drafting of specifications for priority action (b) e.g. logistics support. This action shall consider existing standards and technologies, and

shall address the organisational, technical, legal and service provision-related aspects that would be required to ensure the compatibility, interoperability and continuity of the service from a EU-wide perspective;

4. To support and assist the Commission in the preparation of a qualified Impact Assessment for priority action (b) (including the complements required for action (c)) of the ITS Directive, by means of qualitative and quantitative analysis of impacts for the various fields and elements identified (this action is to build on the preparative work for action (c) undertaken in 2012). This also includes the possible fine tuning of policy options;

5. To investigate, analyse and recommend (additional) actions on a European scale to have the requested level playing field for EU-wide real-time traffic information services realised.

Further to the objectives, the Task Specification also defined study aims. The general aim of the study was to support the Commission in its task of drafting the specifications for priority action (b) of the ITS Directive by carrying out an impact assessment for the priority actions (b) (including necessary complements for action (c)).

More precisely the study aimed at:

o Identifying, assessing and documenting the precise issues and elements to be tackled (action (b));

o Providing quantitative and qualitative research and analysis to support and demonstrate the problem definition established by the Commission;

o Measuring the potential economic, social and environmental consequences of the various policy options described above;

o Consulting the various stakeholders on the envisaged options;

o Proposing operational objectives supporting the implementation of the policy options and their long term evaluation.


1.4. Overview Study Methodology

Figure 1 presents an overview of the study tasks. Per task group one or more tasks produced the results (indicated in bold in Figure 1) that were incorporated in this report.
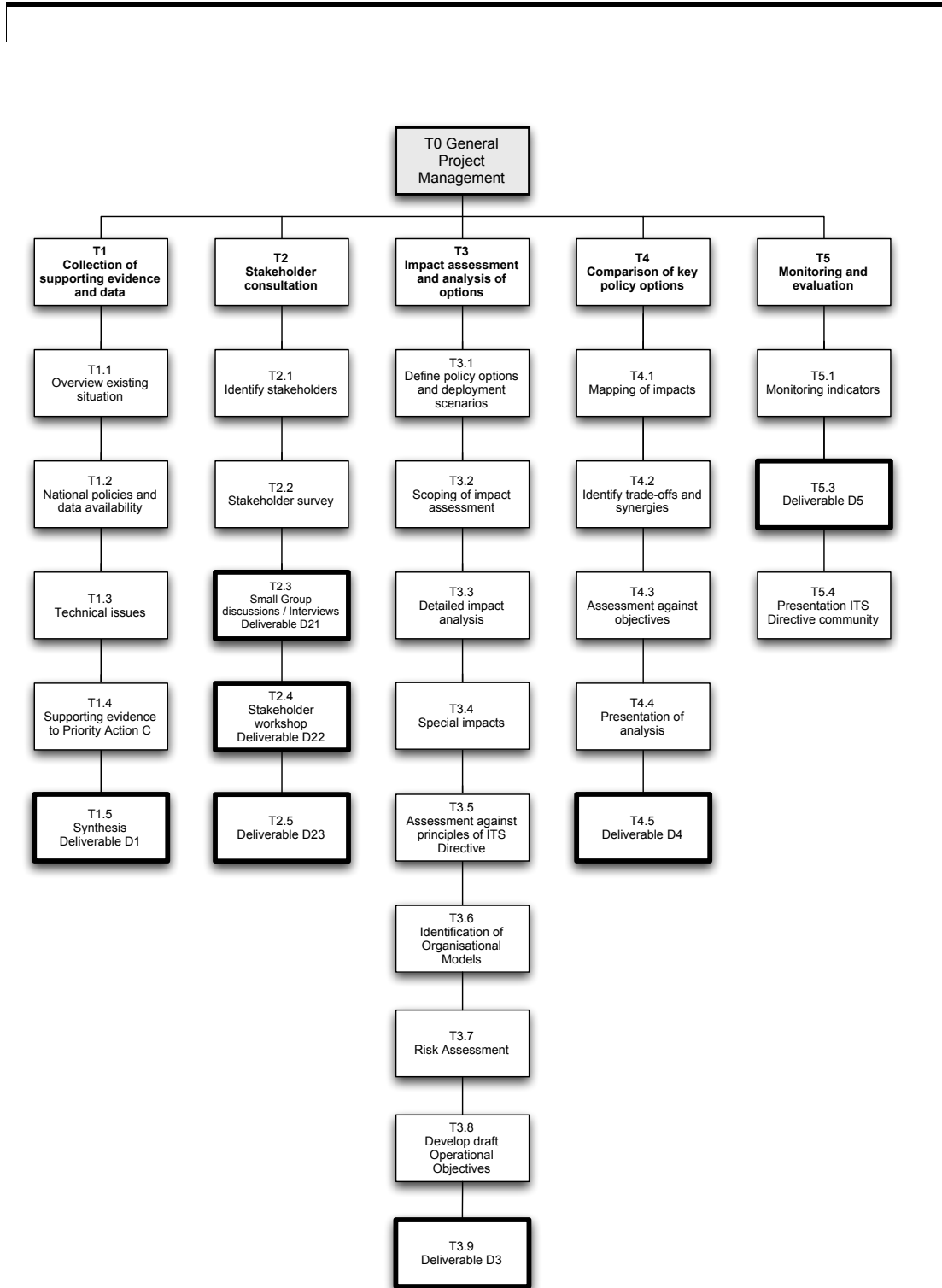
Figure 1   Study tasks.

1.5. Terminology

Table 3 provides a definition of the different data types, as used in this study. It should be noted that the categories are split in static and dynamic data and that there is semantic overlap (e.g. static speed limits are traffic regulations but are a standard attribute of digital roadmap datasets. But dynamic speed limits are considered traffic management information).

Table 3   Data type definitions used in the study.

Road data	**Geometry**	Road geometry and network topology.
	Link attributes, signage and locations	Speed limits and other (static) traffic regulations, physical road and lane characteristics, locations of traffic lights, accident hotspots and other safety related locations.
Real-time traffic information	**Safety-related**	Temporary slippery road, animal / people / obstacles / debris on the road, unprotected accident area, short term roadworks, reduced visibility, wrong-way driver, unmanaged blockage of a road, exceptional weather conditions [12].
	Other RTTI	Real-time traffic information other than SRTI, including information on traffic speed, travel time, congestion, protected accident areas, long-term roadworks, managed road blockages, and weather conditions.
Traffic management information	**Traffic management plans**	Traffic circulation or management plan, (dynamic) traffic regulations, recommended routes.
	Activation statuses	Activation status of traffic management measures.

In the study, the following definitions and terminology are used.

- o "Data" means pieces of information not suited for use by ITS users, such as traffic speed measures at a specific location, or an unverified accident report.

- o "Information" means data that has been made suited for use by ITS users, through aggregation and validation. For example the travel time on a specific road segment, a verified accident report, etc.

- o "Intelligent Transport Systems" means systems, in which information and communication technologies are applied, in support of road transport (including infrastructure, vehicles and users) and for the interfaces to other transport modes;

- o "interoperability" means the capacity of systems, and of the underlying business processes, to exchange data and to share information and knowledge;

- o "ITS application" means an operational instrument for the application of ITS;

- o "ITS service" means the deployment of an ITS application through a well- defined organisational and operational framework with the aim of contributing to the user safety, efficiency, comfort and/or to facilitate or support transport and travel operations;

- o "ITS service provider" means any provider of an ITS service, whether public or private;

- o "ITS user" means any user of ITS applications or services including travellers, road transport infrastructure users and operators, fleet managers and operators of emergency services;

- o "nomadic device" means an item of communication or information equipment that can be brought inside the vehicle by the driver to be used while driving, such as a mobile phone, navigation system or pocket personal computer;

- o "platform" means the encompassing functional, technical and operational environment enabling the deployment, provision or exploitation of ITS applications and services.

Acronyms used in the document are explained on page 112.

1.6. Reading Guide

This chapter provides a description of the overall study background.

Chapters 2, 3 and 4 provide a description and the challenges of the current situation, and an overview of the results of the desk research, small group discussions, the workshop and online user survey. The results of the Impact Assessment are described in chapter 5.

Chapter 6 elaborates the results of the comparison of the key policy options and their Impacts, the trade-offs and synergies between policy options, and the assessment of policy options against the objectives.

Chapter 7 presents the monitoring and evaluation options. It presents operational objectives, ex-post monitoring indicators and monitoring means.

Chapter 8 presents the findings, conclusions and recommendations of the study.

Literature references are numbered, marked by [square brackets], and refer to the Bibliography on page 114.

2. Overview Current Situation and Developments

The current situation concerning road and traffic data collection and processing, and real-time traffic information services in the EU, and the expected technological and market developments were described in detail in deliverable D1 [17]. This chapter summarises the findings.
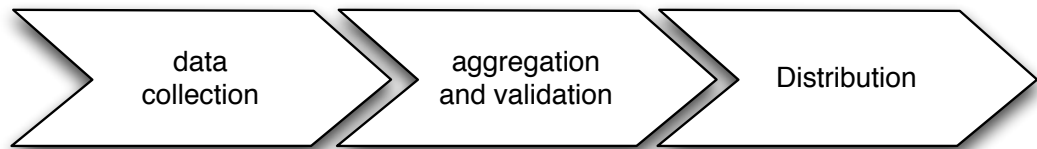
Figure 2   **High-level processes of the traffic information value chain**

2.1. Technological Developments

The emergence of low-cost delivery channels such as RDS and mobile internet, and the commoditisation of low-cost personal devices, such as personal navigation devices and smartphones, have enabled private companies to efficiently collect large volumes of real-time traffic data and deliver it to their customers. These companies have created an international market for traffic data and information, and traffic information services (Figure 3).
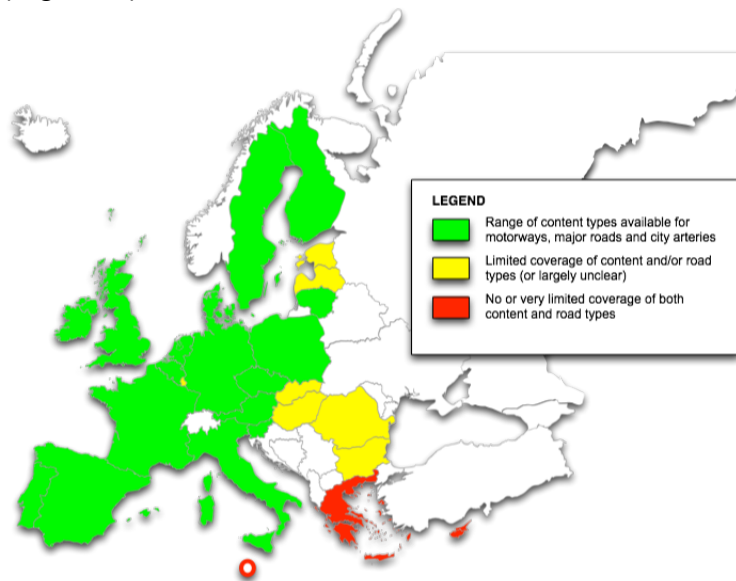
**Figure 3**   **Overall availability of traffic content in EU27.**

Currently, companies are quickly expanding their service portfolio, in particular in the less developed markets in Eastern Europe, introducing new RDS/TMC, DAB/TPEG and IP/TPEG services (Figure 4, Figure 5, Figure 6).
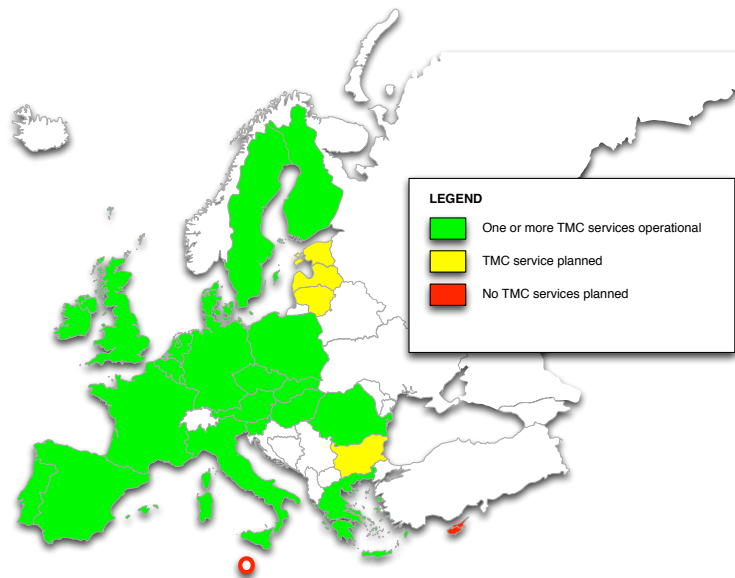
Figure 4   RDS-TMC service coverage early 2013 in EU27.
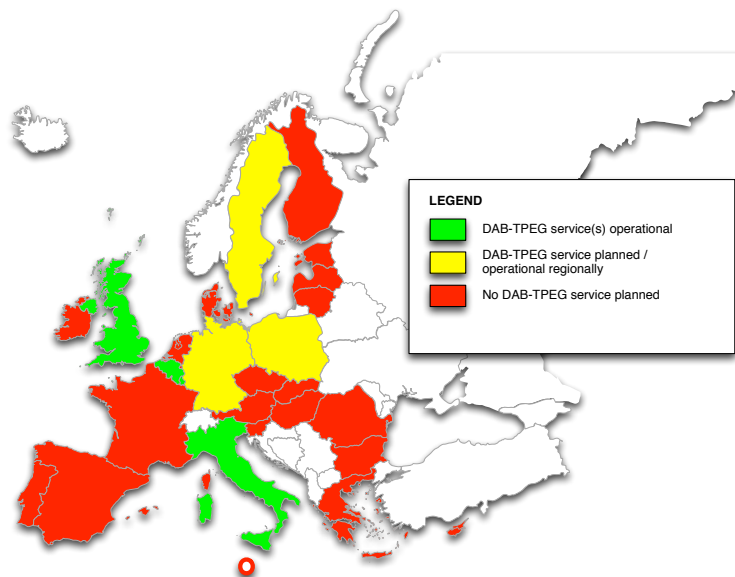
Figure 5   DAB-TPEG services early 2013 in EU27.
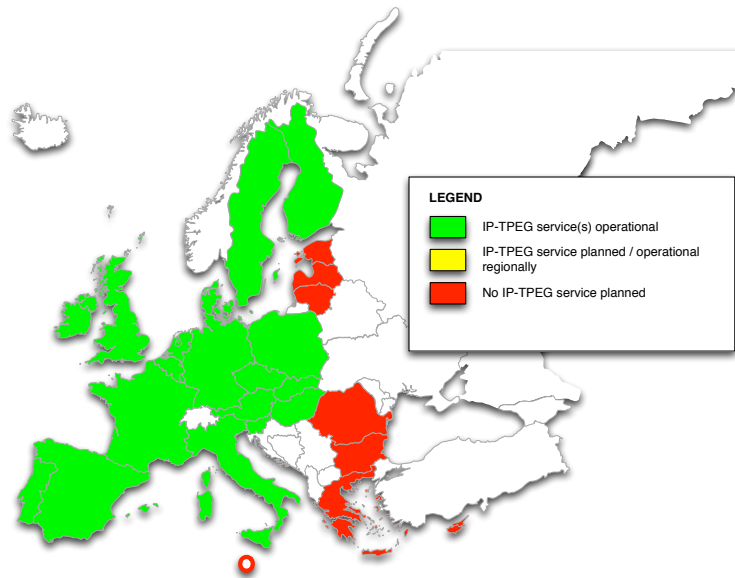
Figure 6   IP-TPEG service coverage early 2013 in EU27.

The emergence of new technologies, such as co-operative driving and LTE, and deployment of DAB/DVB and advanced FVD, also have the potential to cause a paradigm shift in the way the traffic information value chain is operated in EU Member States. It is expected that both public and private organisations will be able to collect more detailed traffic data for providing RTTI at much lower costs than is currently the case.

The emergence of automated driving will lead to different requirements for RTTI. It is expected that vehicles will gradually attain autonomous driving characteristics in the next 10 to 20 years. These vehicles will be able to process larger amounts of data and do not require data to be interpreted to information that can be understood by humans. E.g. autonomous vehicles are better served with accurate traffic flow data than with the traditional traffic jam reports.

2.2. Market Developments

The past decade has seen a clear change in the European RTTI market. 10 years ago, it was dominated by small and medium-sized companies which usually focused on one specific national market. Public authorities played a leading role in the collection of data, aggregation and validation of data, and the provisioning of RTTI services. Driven by the need for uniform traffic information for navigation services by PND manufacturers and the automotive industry, large companies started to collect their own RTTI data,

relying in particular on floating vehicle data and floating cellular data. Examples of these companies are INRIX, Google, TomTom and NOKIA-HERE.

The entry of large players in the market has forced smaller companies to merge (e.g. MediaMobile and Destia), and has led larger players to take over smaller companies (e.g. INRIX-ITIS). This consolidation of the RTTI market is expected to continue for the coming years.

The industry is well positioned to collect and provide traffic data services for autonomous vehicles, using cooperative V2V data mining and service providing over terrestrial or satellite data casting (DAB/DVB) or high-bandwidth mobile internet (LTE).

2.3. Current end-user propositions

RTTI services are available to road users through a number of platforms, using different price models.

Voice radio is available in all of Europe and many stations provide spoken traffic information. This information is free but information is not provided continuously, the amount of information that can be transmitted is limited, and always restricted to the specific language used.

In nearly all Member States TMC services are available. TMC allows RTTI to be transmitted continuously in a language independent data format. The bandwidth available to TMC is however limited. DAB-TPEG is the digital equivalent of TMC for which services are now emerging. It provides much higher bandwidths than TMC and coding of information in much more detail. While most TMC services are free, some high-end TMC and the DAB-TPEG services can only be used with a subscription. These subscriptions in general are provided with in-dash navigation systems and the costs are therefore hidden in the vehicle price. Providers of commercial TMC and DAB-TPEG services in Europe are for example NOKIA HERE, INRIX, BE-Mobile, TrafficMaster and MediaMobile.

Many Personal Navigation Devices (PND) are also capable of receiving TMC services and recently Garmin launched a PND that can receive DAB-TPEG. PNDs in general can connect to any public (free) TMC service and their purchase price in some cases includes a fee for access to a high-grade TMC or DAB-TPEG service.

Connected PNDs receive RTTI via a mobile internet connection. The fee for the service in general is included in the purchase price of the device. These services in general are provided by the manufacturer of the device and there is no option for the consumer to switch to a service from another supplier.

A wide range of Smartphone apps is available that provide traffic information. Nearly all smartphones feature an app that provides turn-by-turn navigation that takes into account RTTI when planning routes, such as Google Maps. Many other apps are available that provide RTTI for Android iOS and Windows Phone. Most of these apps are free and generate revenue through advertisements.

2.4. Changing Public and Private Roles

Private companies will be fast to adopt the new technologies, further accelerating their footprint in the European RTTI services market. The automotive industry and the navigation providers, are increasingly looking for services that are more advanced than RDS-TMC services. This is driving the expansion of DAB-TPEG and IP-TPEG services, in particular in the newer markets, but also in the more developed markets of Europe.

Despite the increased role of private companies in all links of the value chain, public authorities play a key role in the value chain as they are in general the original source of certain types of information, e.g. road regulations, information on road works, accidents and diversions, and traffic management information on publicly operated roads. Also, the new technologies will enable more comprehensive and efficient traffic management by road authorities in collaboration with private companies. It is clear that both public and private organisations will have a role to play in the value chain of the future. The increased interaction in the different steps of the value chain can be seen as a development into a Value Network (Figure 7).

RTTI Value Chain

RTTI Value Network
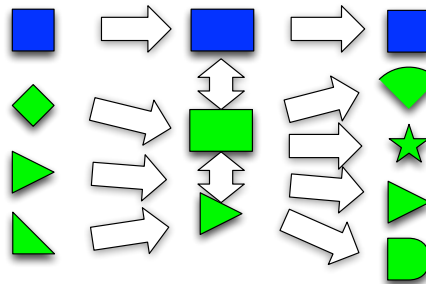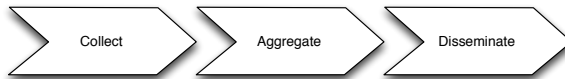
Figure 7 **Technology and market developments cause the linear Value Chain to turn into a Value Network with multiple players per link.**

Public organisations have a responsibility in improving road safety. RTTI data and services are indispensable tools for the prevention of accidents and the reduction of the impact of accidents. Public authorities in general have the most reliable and accurate information on accidents, road conditions, and other information that is collected by emergency services and road authorities. Not all safety-related traffic information (SRTI) types can be collected cost-efficiently which means private companies are unlikely to invest in the collection of these types of information, e.g. detection systems for wrong-way drivers on motorways. Assuring that sufficient data of adequate quality is available to timely warn road users for dangerous situations will therefore remain a task for public authorities for at least the next decade.

Public authorities manage and operate the major part of the road network. New technology will allow them to better manage traffic and timely issue warnings and advice to road users. This type of information is currently poorly developed and in general not available to service providers, although public authorities are the origin of traffic management information.

Private companies have developed methods for the cost-efficient collection, processing and aggregation of large volumes of traffic flow data, e.g. average speeds and travel times. As these companies in general combine large volumes of data from many different private and public data sources, they have developed advanced quality monitoring and management systems. These systems enable them to validate and improve public RTTI, e.g. pinpointing the current location of road works on a road section by looking at the speed profiles in their floating vehicle data.

The emergence of cooperative technology will further enhance the ability of private companies to cost-efficiently collect large volumes of RTTI data. These technologies will also enable them to collect SRTI, using vehicle based sensors to for example detect accidents and wrong-way drivers in real-time.

The role of private companies in the delivery of RTTI to the end-user has increased dramatically over the past decade. In most Member States private service providers deliver RTTI services to smartphones, navigation devices, TMC receivers and in-car telematics units. The larger service providers are quickly deploying TMC and TPEG services in the new markets.

The challenge for the EC is to define a policy framework that will foster cooperation between public and private organisations in a continuously changing value chain in such a way that all stakeholders take on the role where they add most value, and that all will be rewarded by achieving their societal or business goals.

2.5. Synthesis

From the desk research the following conclusions were drawn:
- The role of private companies in the RTTI value chains is increasing rapidly in the EU, and this development is likely to accelerate.
  - o Private companies collect, aggregate and validate traffic data more cost-effectively than public authorities.
  - o The emerging technologies for assisted, cooperative and automated driving will allow private companies to collect even more data at lowering costs.
  - o The level of innovation in data collection and service providing is higher in private companies than in public authorities.

- o Private companies have developed advanced methods for quality monitoring and management.
- Private parties are good at low-cost data collection, quality management, fast deployment of new technologies, and delivering RTTI to end-users, but they might refrain from investing in the collection of SRTI that is too costly to return a profit because they focus mainly on comfort rather than safety services.
- Public authorities will have a key role to play in the RTTI value chain for years to come.
  - o Providing safety related traffic information (SRTI) to service providers to increase road safety.
  - o In securing that safety-related information is publicly available, either by collecting it themselves, or by making privately held SRTI available to the public.
  - o Developing and publishing traffic management content in a structured format that can be used by service providers.
  - o Making information on the geometry and topology of their road network available to digital map providers.
- Because public and private organisations will have to exchange various forms of RTTI in the value chain, harmonisation of data exchange methods and the access and re-use conditions could lower costs for all parties.
- The number of sources of RTTI data is expected to increase dramatically over the coming years as both public and private organisations will discover they can collect more RTTI data more cost-effectively; e.g. regional and local road authorities and car manufacturers.
- A central node (TIC) processing all data might no longer be a practical solution considering the expected increase in data volume, but the data sources need to be findable and their output harmonised as much as possible.
- Measuring, monitoring and managing RTTI is a complex but important task needed to improve the RTTI value chain.

3. Challenges

3.1. Background

Chapter 2 concluded there is a well-developed market for RTTI in Europe, but that it has strategic weaknesses. Based on the results of the desk study the Study Team carried out a first analysis of the challenges in establishing an appropriate framework for accurate EU-wide real-time traffic information services. This was done by building a research model for the remainder of the study. It identified the topics that the framework will need to address per topic identified issues, preconditions, enablers, barriers, potential actions and remedies, and the possible or preferred domains.

The research model provided a basis for the EC to develop their *problem tree* (Figure 8).
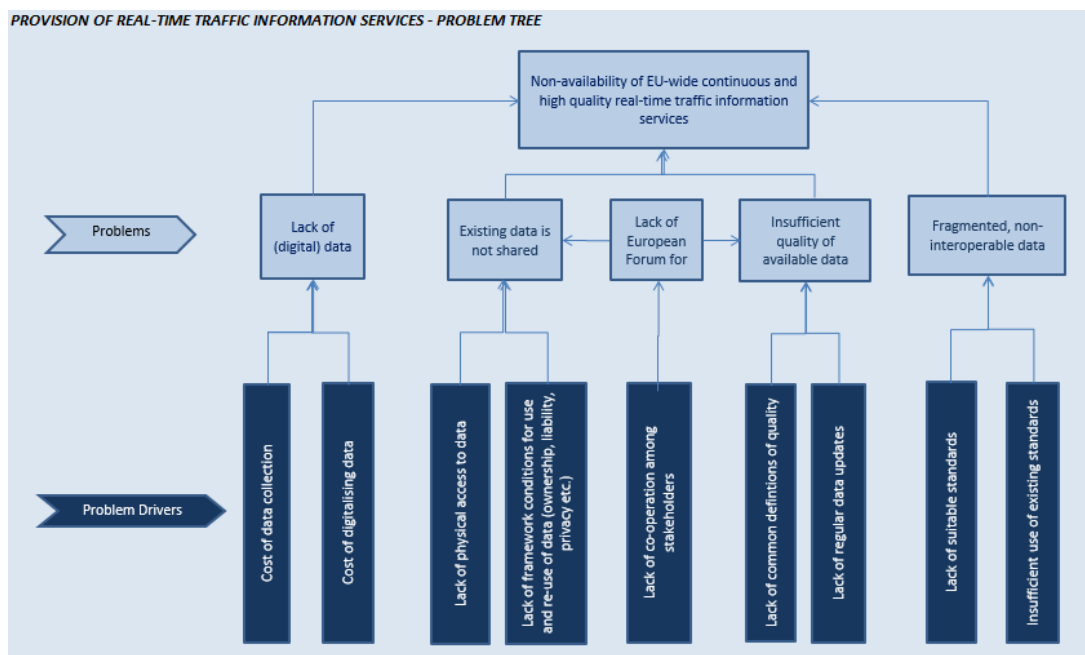
Figure 8   European RTTI Services Problem Tree

The following topics were identified in the Research Model, were analysed in detail in the Desk Study Report [17] and are summarised below:
- Availability of data
- Impact of data / info availability
- Technology and standards

- Impact of current and expected developments
- Organisation and Governance
- Legislation
- Data and information Quality

3.2. Availability of data

Few public road network data are currently available in a machine readable format. Road Operators in general are concerned that if they publish road network data it will take too much time for the end-user to receive map updates in their satnav.

In the absence of the publication of the information by Road Operators, Digital Map Providers have established their own mechanisms to detect changes and provide updates to the underlying digital maps for RTTI in a timely manner and at the level of quality/accuracy required for digital maps and the services that rely on them. Private road data is available from various digital map providers under commercial conditions, and from OpenStreetMap under the Open Data Commons Open Database License.

The provision of notifications of changes to the road network would be of interest to Digital Map Providers to help streamline and optimise the road network survey processes and should fall under the scope of the Transport Network of the INSPIRE Directive. However, due to delays in the implementation of INSPIRE and due to existing quality processes, it is expected that such updates from Road Operators would not eliminate the need to digital map providers to survey the road networks themselves.

Public real-time traffic data and information is available in most Member States but the road coverage and quality of the information varies. Real-time traffic data and information is available from various service providers under commercial conditions. Privately held RTTI in general focuses on flow data although journalistic incident reports are also community sourced by private organisations such as Waze of Google.

It is nearly impossible or very expensive for ITS Service Providers to access data or information relating to Traffic Management Plans as these are often not readily available in a machine readable electronic format from Road Operators, normally TMPs are only shared between the Road Operators affected and often in a format (e.g. pdf document), which cannot be automatically transferred into a machine readable format. In addition there

is a reluctance from Traffic Managers to share such information with ITS Service Providers, further information on this issue is given in section. This means that currently subscribers to RTTI services provided by ITS Service Providers are unlikely to be informed of official diversion routes via their in-vehicle equipment and will often receive routing advice which conflicts with formal diversion routes displayed on roadside VMS, this reduces the potential compliance with traffic management plans for Road Operators.

The willingness and means of public authorities to invest in data collection and sharing varies throughout Europe, and is under pressure from austerity measures. Private companies are willing to invest in the collection of data that will return a profit, i.e. they will not collect data types that are costly and/or do not lead to sufficient revenues (e.g. wrong-way driver detection data).

3.3. Impact of data / info availability

Making data available can have both positive and negative impacts. Better availability of road data can improve routing by satnavs. Better availability of RTTI and traffic management information can lead to better load balancing on the road network. Better availability of SRTI can improve road safety.

Road Operators and traffic managers generally believe that if traffic management data is shared with ITS Service Providers this will be used to provide services which benefit the individual through routing on non-official diversion routes rather than instructing users to follow the published official diversion routes [13].

In markets where private companies have built a business case on the collection of road or traffic data, the free availability of public data can disrupt the market conditions. This can reduce the willingness of private companies to invest in data collection and thereby reduce technological innovation in data collection methods. ITS Service Providers are generally unwilling to provide RTTI data and in particular estimated 'current' journey times to Road Operators, because there is a belief that the data will be used to augment existing free services from the Road Operator which directly compete with the paid service offered to their subscribers [13].

3.4. Technology and standards

For road data a common data collection, coding and data sharing method is being developed (TN-ITS). For RTTI and SRTI various data coding methods

exist that are already widely used by most road authorities and private service providers, notably DATEX, TMC and TPEG. Most traffic management information can be coded in DATEX, although extensions are required to code specific data types.

3.5. Impact of current and expected developments

Chapter 2 elaborated on the expected technological and market developments. Although it is difficult to forecast these developments it is clear that, as in the past, technological innovations are likely to have a significant impact on the market and the division of roles between private and public organisations. The challenge for the framework will be to accommodate such changes.

3.6. Organisation and Governance

RTTI data is currently sourced for a large part from the public sector and is processed and disseminated largely by the private sector. There is great variability in the understanding of the respective roles of these actors and hence difficulty in establishing good relationships and common contractual / legal bases for the sharing of data and the payment of royalties. This dysfunctional aspect of the market could be addressed by establishing a clearer framework for governance in the market – the means by which decisions are made (quickly) that could be binding on the whole market (by common consent) for the mutual interest of all. This is analogous to the governance framework established for developing GSM in Europe.

Both public and private organisations will have a role to play on the RTTI value chain for the coming years. What will be the most efficient division of tasks, considering the expected technological and market changes, is not completely clear. The framework will have to provide a governance and organisational setup that can balance the interests of society and industry and the individual and common interests of Member States in a setting of continuously changing technology.

3.7. Legislation

Legislation can provide an impetus to solve the aforementioned challenges, but can also limit flexibility of public and private organisations operating in the RTTI value chain.

The cost of market entry and the challenges of access and reuse of existing data sources, mean that the RTTI data supply chain is strongly vertically

integrated and often there are free ITS Information Services provided by public Road Operators operating in parallel with paid-for offerings from private ITS Service Providers. This can represent a barrier to entry to new companies capable of providing only some of the supply chain links.

By formalising rules for access and reuse of data sets, it should be possible to increase the level of trust between public and private stakeholders to allow the compatible goal of more efficient journeys for road users to be achieved, in addition such rules may allow new companies to enter the market, increasing competition and innovation.

3.8. Data and information Quality

Although there is broad consensus among stakeholders that quality management of RTTI is important this is an underdeveloped aspect of the RTTI value chain. Proven methods to measure, monitor and manage RTTI quality are missing and practical experience in applying them is limited, in particular in the public sector.

4. Results Stakeholder Consultation

During the study stakeholders were consulted through three small group discussions, a workshop, and an online survey. The results are presented in this chapter and summarised in the synthesis in section 4.4.

4.1. Small Group Discussions

4.1.1. INTRODUCTION

Three small group discussions (SGD) were organised in the spring of 2013 to provided key stakeholders from a specific domain to discuss their views on the topic with the EC and study team in detail.

The first group discussion was reserved for public authorities and included policy makers and road authorities on the Member State level. The second group brought together representatives of leading mapping companies and traffic information and navigation service providers. ITS experts were invited to the third group to elaborate on the more technical aspects and quality issues of RTTI.

The discussions of the three groups were reported in three different reports [18, 19, 20]. The following section provides a synthesis of the key outcomes of the three discussion groups.

4.1.2. PUBLIC-PRIVATE CO-OPERATION

The public authorities of SGD1 were conscious of the general tendency that private RTTI services are growing. But indicated that private services will always rely on road operator information (for some categories of information), and that road operators will always require traffic data for traffic management purposes.

The private companies in SGD2 indicated that they collect more and more floating vehicle data (FCD). The quality of this information is improving and costs of the FCD-technology are low compared to the conventional traffic measuring technologies, and that crowd-sourced information is already on a par with journalistic data in public RTTI services.

SGD1 participants indicated that today the quality of FCD is not sufficient for traffic management purposes, but that that could change. Investments between public and private parties should be shared intelligently.

The participants of SGD 2 indicated that public authorities should define the role and responsibilities they still want to assume, and at which cost, balancing costs and societal benefits. Traffic management and crisis management will always remain in the public domain but public authorities should be aware that new efficient tools from private companies are available for these purposes. All agreed that road operators should leave journey times production and provision to commercial actors.

Further, the private companies of SGD2 indicated that public road authorities should support the business cases of private companies rather than compete with them. There is a big saving potential for Road Authorities withdrawing to a certain extent from RTTI.

4.1.3. LIABILITY AND PRIVACY

Both the public authorities in SGD1 and the private companies in SGD2 agreed that liability clarifications are essential for the development of future ITS services.

The participants of SGD2 indicated that data privacy and service liability are key issues and that at least clear guidelines are needed. All agree that it would be helpful if the EC would harmonise access conditions (including liability, data/privacy protection) for data originating from the car, drivers and passengers, although participants have diverging opinions on whether this should apply to CAN-bus data only or information from for example built-in and nomadic navigation devices as well. It was suggested that industry drafts such guidelines and submit them to Working Party Article 29 (i.e. the joint European data protection authorities) for comment and to solicit a formal opinion in this matter.

4.1.4. BALANCING PUBLIC AND COMMERCIAL INTERESTS

Participants of SGD1 and SGD2 agreed that public authorities and private companies have by definition different interests and that routing advice of commercial services can for example conflict with public policy objectives, in particular in exceptional traffic situations.

The private companies of SGD agreed that public authorities should be able to influence routing by defining and digitally publishing restrictions, but pointed out that the road operator can already influence routing by adapting the road infrastructure itself (e.g. introducing speed bumps).

4.1.5. SAFEGUARDING CONSISTENCY OF PUBLIC RTTI

Public authorities in SGD1 agreed that they need to establish priority levels for information transfer and dissemination to service providers, in order to flag the importance and urgency of information regardless of the type of event.

4.1.6. WHAT EC ACTION IS APPROPRIATE

The public authorities of SGD1 indicated that the ITS specifications should accommodate the different policies concerning RTTI that are in place in the Member States. One way of doing that would be to define a set of core services for which public intervention is required. SGD1 participants indicated that a step-by-step approach should be followed, on a voluntary basis.

The private SGD2 participants indicated that they would like to see that the EC stimulates the cooperation between roads operators and service providers, and push for the standardisation of data access conditions.

4.1.7. PUBLIC DATA AVAILABILITY, ACCESS AND RE-USE CONDITIONS

For traffic regulations and Traffic Management Plans (TMPs), all public authorities in SGD1 agreed that information needs to be made available and timely updated. Currently some information is available but the mechanisms for their publication differ for each level (local, regional, national) in each Member State.

The private companies of SGD2 all agreed that journalistic data created or collected by road operators should be made available in a harmonised and machine readable format. All agreed that fixed and variable speed limits, parking information and traffic management information in general are not provided and that this information is required for developing good RTTI services.

Participants of both SGD1 and SGD2 indicated that projects are underway to develop methods on how service providers can process regulations and measures in their services, but that this needs to be developed further. All participants called on the EC to encourage cooperation between road operators and services providers, as well as between road traffic management and other modes of transports.

4.1.8. PRIVATE DATA AVAILABILITY AND ACCESS

SGD1 participants think it will be difficult from a political standpoint to impose re-use conditions on privately owned data, even for safety-critical situations. Still, having a common framework to access these data is needed. Having national registers of public and private content sources and their access and re-use conditions would be beneficial to RTTI development.

The private companies of SGD2 indicate they are ready to make their data available to road operators under commercial conditions. All participants agree that common principles on data sharing should be defined, but that conditions will differ on specific business cases. Safety critical information needs to be clearly defined; ghost driver information is considered as safety-critical, for other event types this is less evident. All participants agree that the current specifications on Action C are a good basis. FVD coming from the vehicle behaviour (through CAN-Bus) should somehow be accessible to third parties. Related privacy and data ownership issues have to be investigated.

4.1.9. HARMONISATION AND STANDARDISATION

All participants of SGD1 and SGD2 agreed that standards are already there for several years and actors learned how to deal with them all. All participants of SGD1 and SGD2 agreed that data formats and data exchange should be further harmonised throughout the EU, but private companies stress that this should be done on a voluntary basis.

4.1.10. QUALITY AND TECHNOLOGY

Participants of SGD1 are reluctant to define minimum quality levels for services. But they agreed that common definitions and understanding of quality criteria (latency, consistency…) could be a first good step.

The experts of SGD3 agreed that quality is a real but also a complex issue, requiring consensus not only on the technological approach, but also on what quality criteria, levels and thresholds are appropriate for what applications, under what circumstances, and for what data types. QUANTIS' work and approach should be taken into account. It defines quality parameters/objects for different services, with varying parameter definitions across services. It was sourced from an ISO quality standard. Because of the complexity all SGD3 participants agreed that establishing an organisational framework to deal with quality should be the first step. The

experts indicated that the ultimate goal should be the 'optimal' quality level, but that a 'minimum' quality level should be the first objective.

The SGD3 participants indicated that private service providers know that quality of their services is the basis of their business. From a commercial point of view, the less regulatory constraints related to quality there are, the better it is for market competition. The market will establish by itself a profitable quality level. On the other hand, this profitable quality level can be less than the minimum quality level (e.g. for SRTI). This is where public authorities have a responsibility.

The SGD3 experts agreed that certification of the whole chain is not possible as there are too many actors. A first step could be the introduction of self-declaration for data and service quality. They further agreed that it is important to tackle differently issues related to real-time information and issues those related to static information, and that it is also important to consider the specifications for priority actions (b) together with the specifications for the other priority actions (notably (a)).

All SGD3 participants agreed that descriptions of routes/traffic restrictions and regulations as well as TMPs are still missing in the current standards. There is a specific DATEX profile that has been recently drafted (partly by BMW) and that is proposed for standardisation.

The SGD3 participants suggest that in the specifications, the EC should at least create an appendix for technological explanations for the implementation of the standard prescribed (to avoid differences), and/or to mandate standardisation work. Further, the specifications should recommend data coding standards (TPEG, TMC, DATEX), and not be restrictive.

All SGD3 participants agreed that there is a need for national access points, registers, or data warehouses.

4.2. Stakeholder Workshop

In June 2013 a workshop was organised in Brussels, which was well attended by stakeholders covering well the various roles of the value chain. The following key findings were derived from the Workshop Minutes [21].

In the discussions in the workshop both public and private organisations stressed that a one-size-fits-all solution will not work. The value chains are

organised in different ways in the various Member States, regions and cities, and investments have been made based on the established form of cooperation. Any new legislation should respect these existing arrangements by allowing for flexibility in the deployment.

The workshop showed the concern of both private and public organisations on the level of intervention by the EC. A common concern was that an intervention could disrupt existing arrangements between public and private organisations in the different Member States. The industry was concerned if EC demands availability of all public data, price erosion might occur in the market. Public authorities were concerned that intervention by the EC could lead to extra costs as legacy systems might need to be replaced or depreciated earlier.

Both public and private organisations pointed out that developments in the market and technology in general outpace legislation. Various people expressed that the EC should provide a *framework,* should substantiate costs and benefits, and that deployment should then be left to the Member States, coordinated in European regions.

There was broad consensus that quality is an important issue that needs to be tackled. New were suggestions from several participants to create an up-stream exchange of data for validation purposes, e.g. service providers verifying public data using their own floating vehicle data and reporting the results back to the public data source. Experience with such a solution is limited. ROSATTE did experiment with it for road data and similar experiments could be initiated for RTTI and traffic management data. Co-operation between road operators and service providers in the area of traffic management is also still very limited, and would benefit from additional R&D.

On the publication of road and traffic regulations, opinions in the public authorities seemed to be divided. Some argued that public authorities create these regulations and should therefore be responsible for the timely publication. Others argued that the industry already found technological solutions to circumvent the lack of data and that public authorities should therefore not be forced to invest in publication of the regulations.

Having commonly accepted data coding methods was considered important, but opinions on whether specific standards should be mandated

diverged. One suggestion was to have a set of accepted standards and to establish a platform for the governance of what standards are used.

4.3. Stakeholder Survey

In December 2013 the EC published a questionnaire on the 'Your Voice in Europe' section of its web site. The questionnaire was open to any respondents until mid March 2014.

In total 101 people and organisations completed the questionnaire, with a good mix of all stakeholders in the traffic information value chain (with 20 stakeholder groups) and representing 22 Member States.

The stakeholders considered time accuracy and general accuracy as the most important quality criteria. Private companies asked for more frequently updated data in comparison to public authorities, notably for Road closures and road works.

The road coverage for RTTI provision to end-users that were deemed most important were: all motorways and major national roads across the EU, and within major European urban areas.

Respondents believed that RTTI can have high impacts on road safety on road user satisfaction, and showed broad support for actions by the EC to ensure and foster the provision of EU-wide RTTI (Figure 9). It should however be noted that both public and private organisations put forward conditions for their support in the free text responses. Private parties in general insist on remaining in charge of the use and re-use conditions that apply to sharing their data. Public authorities too are concerned about potential interference of the RTTI market, and about possibly too stringent investment requirements for the public sector.
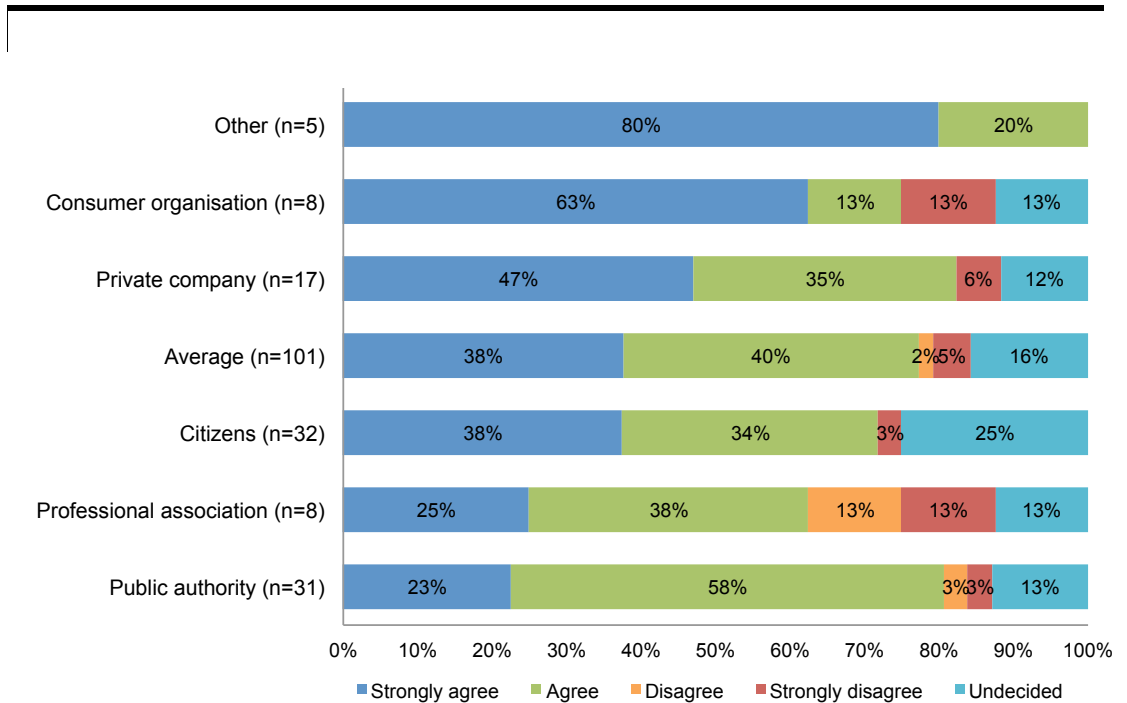
Figure 9   EU-action desired to ensure the provision of EU-wide RTTI services

In particular the definition of a harmonized set of data to be made available and the definition of requirements for data exchanges between stakeholders were supported.

A large majority of the respondents (85%) declared that road authorities and/or road operators should have the responsibility to collect an agreed set of data for the roads that they are responsible for. According to the stakeholders, this set of data should comprise in priority Road Closure, all Road works, all Speed limits, Access restrictions, End of queue information and Expected delays. Annex D provides an overview of best practices in national roadworks databases.

The respondents were more divided on the types of data service providers should collect in addition. The most favoured types of data were End of queue information, Expected delays, Estimated travel times, Road closures, Recommended Routes, Adverse weather information, and all parking related information.

The survey showed broad agreement for making available to ITS service providers an agreed set of data collected by road authority/operator, in a pre-defined format. However there was no consensus whether the definition of this set of data should be left to market players.

The respondents also supported the setup of national access point for all sources of road, traffic and RTTI data, yet they did not call for a mandated type of access point (registry of link, data warehouse…).

A notable part of the respondents also agreed that RTTI generated by any service provider should be available to public authorities and public or private road operators, provided that appropriate safeguards are in place regarding its (re-)use. In the same way, some respondents also support that RTTI generated by any service provider should be made available to other service providers in a non-discriminatory way and under specific agreement. This is especially the case for SRTI.

However several major public authorities and private organisations would rather prefer not to put obligations on privately owned data, justifying that the principles of commercial innovation and competition should not be undermined.

Only few divides appeared in the quorum, e.g. while private companies were largely favourable to the availability of TMPs (by 94% against 71% on average), they were 41% to disagree (against 29% in average) with the obligation to route their customers in accordance with TMPs.

The response also illustrated that there is a need to establish a common EU framework (i.e. common conditions, specific requirements) for the different data processes, especially for the re-use of data used to provide RTTI services.

Finally regarding the interfaces with other modes of transport, the majority of the respondents (78%) agreed that RTTI services for road users should be integrated with travel information for other modes of transport and highlighted that multi-modal journey information is critical to enable travellers to make the best choice about their journey options, or to encourage the use of more sustainable alternatives. Along this line the large majority of citizens (81%) declared that RTTI is somehow affecting their own travel behaviour.

4.4. Synthesis

The small group discussions (SGDs), the workshop and the survey showed a general consensus that both public and private organisation have a role to play in the RTTI value chain.

Stakeholders in all three forums agreed that the collection of journalistic data, traffic and crisis management should remain a public responsibility,

but that these tasks can be facilitated and optimised by commercial data and services. The industry representatives in the SGD2 called on the public authorities to publish route restrictions in a common machine-readable format so that these restrictions can be integrated in their route planning and navigation services. This action was also widely supported by the survey respondents.

The workshop showed the concern of both private and public organisations on the level of intervention by the EC. Any new legislation should respect existing arrangements in Member States. Various people expressed that the EC should provide a *framework,* should substantiate costs and benefits, and that deployment should then be left to the Member States. This was confirmed by participants of SGD1 that indicated that a voluntary step-by-step approach should be followed, that accommodates the standing arrangements in the Member States.

SGD2 participants indicated that they would like the EC to push for the standardisation of data access conditions and harmonise legislation concerning the privacy and liability aspects of RTTI services in Europe, for example of CAN-bus data and data from SatNav devices.

All forums agreed that quality is an important issue. But the experts of SGD3 stated that a pragmatic step-by-step approach is needed to gradually improve measuring, monitoring and managing RTTI information and service quality. Workshop attendees suggested creating an up-stream exchange of data for validation purposes. The experts in the SGD3 agreed that commonly accepted methods to indicate the urgency and importance of public RTTI should be better developed.

5. Overview Results Impact Assessment

Based on the results from the desk research and the consultations an impact assessment (IA) was carried out quantifying the costs and impacts of possible measures.

This section provides an outline of:
- The key deployment options scenarios investigated as part of the impact assessment
- The results of the impact assessment broken down by:
  - Costs above the baseline scenario
  - Benefits above the baseline scenario
  - The benefit-to-cost ratio
  - Special impacts
    - Impacts on existing markets
    - Impacts on fundamental rights
    - Impacts on consumers
    - Impacts on SMEs
    - Impacts on technological development and innovation
  - Assessment against ITS Directive Principles
  - Risk assessment

The Action B IA took account of the economic, social, environmental, and market impacts that a range of scenarios might have. The economic IA took the form of a spreadsheet based model.

It identified the implementation and operational costs, using the EC Standard cost model approach, associated with the key deployment options (e.g. modification of the national nodes for sharing the required traffic management information, incident information, locations of roadworks and updates to road data attributes).

The IA identified the benefits on the basis of the number of users that would receive and act upon the provided traffic management messages for each scenario.

The benefits derived from each scenario varied depending on:
   a. whether or not the scenario involved a mandatory deployment (i.e. whether a scenario would accelerate the data availability

relative to the baseline, or mandating the availability of data by a certain date)

b. the scenarios geographic coverage

c. the types of data made available for the scenario (e.g. incident data, roadworks data, network changes etc.).

The Impact Assessment was conducted in line with the advice set out in the EC IA Guidelines.

The analysis conducted within this study, drew on the analysis of costs and benefits study for Safety Related Traffic Information, in particular adopting the same time scale, and utilising some of the underlying data specifically, the anticipated accident rates for 2015-2025, the network lengths for the EU27, plus the estimates for the costs of delays related to incidents.

This helps to ensure that the studies conducted for the Priority Actions under the ITS Directive are aligned and consistent in their use of the available data sets.

5.1. Underlying Assumptions for the Impact Analysis

The underlying assumptions for the impact assessment conducted for within this study are as follows:-

1. Congestion on the road network causes a cost to society in terms of loss of productive time due to the travel delay hours experienced by road users

2. Travel delay hours can be reduced by effective dynamic routing to avoid congestion on the road network and by using official diversion routes when activated.

3. There are two types of congestion on the road network which cause delays to users:-

   a. Recurrent congestion – i.e. congestion hotspots caused by demand exceeding capacity and these hotspots can be identified through the analysis of historic traffic data

   b. Non-recurrent congestion – caused by temporary reduced capacity on the network due to incidents on the network (accidents, breakdowns, roadworks, events), this congestion cannot by its nature be identified by historic traffic data analysis

4. Traffic Management plans and their associated measures are activated as a result of incidents on the network and seek to minimise the overall travel delay hours experienced by all road users.
5. Road Operators typically use the following channels to disseminate Traffic Management information and messages:-
    a. Variable message signs – the effectiveness of response to this information is dependent on the network coverage of VMS and the user response to messages displayed
    b. Radio broadcasted traffic information messages and advice – the effectiveness of response to this information is dependent on the proportion of users that are listening to the radio bulletins and the associated user response to such advice.
    c. RDS/TMC or TPEG Services – the effectiveness of response to this information is dependent on the number of vehicles which are capable of receiving such information, the user response rate and the information that is broadcast. Currently this is often limited to the location of incidents and roadworks on the network and the associated impacts. Currently no road operator publishes diversion routes via this channel.
6. By publishing details of active traffic management plans to ITS Service Providers via a DATEXII feed, the ITS Service Providers equipped users can be informed of the official diversion routes to enable more efficient routing and reduce travel delay hours
7. By disseminating details of incidents and roadworks and their impacts on the road network to ITS Service Providers via a DATEXII feed, ITS Service Providers can provide this information to equipped vehicles and optimise the routing to minimise travel delay hours for users
8. The introduction of a Governance Framework for the development of European RTTI Services would speed up (quicker than the baseline scenario) the voluntary publication, by Road Operators and Member States, of information, via DATEXII, about incidents and roadworks on the network enabling ITS Service Providers to enable their equipped users to optimise their routing to minimise the travel delay hours experienced.
9. The introduction of a Common Reuse Framework for RTTI data would speed up (quicker than the baseline scenario) the voluntary

publication, by Road Operators and Member States, of information, via DATEXII, about incidents, roadworks and active traffic management plans on the network enabling ITS Service Providers to enable their equipped users to optimise their routing to minimise the travel delay hours experienced.

10. The development of common specifications for RTTI data under the scope of Action B would reduce the costs for Road Authorities and ITS Service Providers for sharing data

11. It is more cost effective to modify existing national nodes, DATEXII (SRTI) and INSPIRE (Transport Network) nodes to support additional data types rather than to introduce new nodes and the associated operational costs

12. The existence of such nodes may encourage Road Operators to voluntarily publish information to help with Traffic Management objectives

13. Road Operators are the custodians of data relating to long term changes (> 12 months) on the road network such as physical alterations to the network, changes to static regulatory speed limits, road closures and roadworks. Based on the work conducted in Study 1.3, this information also falls under the scope of the Transport Network of the INSPIRE Directive

14. Digital Map Providers and ITS Service Providers currently use a number of methods to survey the network for changes such as physical layout changes and changes to speed limits, the operational costs of these survey activities could be reduced through optimisation if Road Operators published notification of changes via the national INSPIRE node.

5.2. Scenarios

The following table provides a summary of the key policy options explored during the impact assessment.

	IA 0	IA1	IA2	IA3	IA4	IA5	IA6	IA7	IA8	IA9	IA10	IA11
Framework and Rules												
Establish Governance Framework for EU RTTI Services		X	X	X	X	X	X	X	X	X	X	X
Common Reuse Framework for RTTI data			X	X	X	X	X	X	X	X	X	X
DATEXII Specifications												
Current VMS messages				X	X	X	X	X	X	X	X	X
Active Traffic Manangement Plan				X	X	X	X	X	X	X	X	X
Active Roadworks					X					X	X	X
Incidents on Network (location and journalistic info)					X					X	X	X
INSPIRE Specifications												
Physical network change notification					X			X	X	X	X	X
Physical network change notification (roadworks > 12m)					X			X	X	X	X	X
Physical network change notification (road closures > 12m)					X			X	X	X	X	X
Network change notification (static speed limit change)					X			X	X	X	X	X
National Node updates												
National DATEXII Node update (ready to publish info if available)				X	X	X	X	X	X	X	X	X
National INSPIRE Node update (ready to publish info if available)					X			X	X	X	X	X
Mandated Content												
VMS Messages						X	X	X	X	X	X	X
Active Traffic Management Plan information						X	X	X	X	X	X	X
Active Roadworks										X	X	X
Incidents on Network (Journalistic)										X	X	X
Physical Network Change								X	X	X	X	X
Planned Roadworks > 12M								X	X	X	X	X
Planned road closures > 12M								X	X	X	X	X
Changes to static speed limits								X	X	X	X	X
Short term closures and diversion routes										X	X	X
Mandated Geographic Coverage												
CORE TERN plus Motorways						X		X				X
COMPREHENSIVE TERN plus Motorways and National/Primary Roads							X		X	X		
Motorways, National/Primary and Secondary Road networks											X	

Table 4: Overview of the key policy options per scenario.

The key policy content is described below.

Governance framework
It is anticipated that a governance framework would accelerate deployment and market development by bringing together the actors required to agree and coordinate the delivery of services which meet the compatible goals of the actors involved.

The EC has an opportunity to establish a governance framework to identify the scope of the required actions, and to establish the manner in which the data is to be shared. Various organisational models have been proposed for how this could be delivered (see D3 [37] for further analysis).

Re-use rules
One of the key findings of the research and engagement with stakeholders is the lack of a common set of rules for the reuse of data owned by Road Operators and ITS Service Providers.

In principle, data held by public authorities should fall within the scope of the PSI Directive. Additional provisions could be put in place to govern the re-

use of data by non-public authorities (e.g. private Road Operators, ITS Service Providers).

Non-mandatory data specifications
The preparation of non-mandatory data specifications would result in an obligation to publish the information for the appropriate network, if that information is available.

The levels of data content are as follows:
- Minimum data content (TMI)
  - Traffic management messages associated with incidents on the network, and information presented via VMS, made available via DATEX II
- Extended data coverage (TMI plus Road Data)
  - Minimum data content plus Road Data details of network extensions and changes to link attributes e.g. static speed limit
- Full data coverage (TMI, Road Data updates and Other RTTI)
  - Extended data content plus information on planned roadworks

Mandatory data content for mandated geographic coverage
Depending on the mandated geographic coverage, the EC may specify the data to be made available for that network. The options for data content are described in the section above.

Mandatory geographic coverage
The EC could mandate the geographic coverage for the availability of the necessary data types. There are 4 key options explored within the scenarios:
- Mandatory deployment on the Core TERN
- Mandatory deployment on the Core TERN and motorway network (national road operators only, i.e. not including the metropolitan nodes)
- Mandatory deployment on the Comprehensive TERN, motorway network and national/primary road networks
- Mandatory deployment on the Comprehensive TERN, motorways, national/primary roads plus the secondary road network

5.3. Details of Scenario Costs and Benefit assumptions

The following Table 5 provides a high level overview of the elements of the costs and benefits that are quantified for each scenario in the detailed analysis.

Table 5 IA Scenarios Cost and Benefit Overview

	Cost Elements	Benefits Elements
IA1	• Cost of establishment of Governance Framework • Cost of participation in Governance Framework for Road Operators and ITS Service Providers • Costs associated with accelerated DATEXII publication above baseline assumptions	• Accelerated provision of information about Traffic Management information for Incidents via DATEX II by Road Operators on the TERN – leading to less delays for road users as a result of more efficient routing
IA2	• Scenario 1 plus • additional costs for development and agreement of the Common Reuse Framework for RTTI • Costs associated with accelerated DATEXII publication above baseline assumptions	• Scenario 1 plus • Accelerated provision of information about location of roadworks via DATEX II by Road Operators on the TERN – leading to less delays for road users as a result of more efficient routing
IA3	• Scenario 2 plus • Costs for development of Traffic Management Information DATEXII profile specification • Costs associated with adaptation of National SRTI DATEXII nodes	• Scenario 2 plus • Increased accelerated provision of information about incidents via DATEX II by Road Operators on the TERN – leading to less delays for road users as a result of more efficient routing
IA4	• Scenario 3 plus • Costs for development of Road Data INSPIRE Specification • Costs for the development of RTTI (Roadworks, Incident Information) DATEXII profile specification • Cost associated with adaptation of national INSPIRE node	• Scenario 3 plus • Increased accelerated provision of information about location of roadworks via DATEX II by Road Operators on the TERN – leading to less delays for road users as a result of more efficient routing

IA5	• Scenario 3 plus • Additional costs (implementation & 10 year operation) for all CORE TERN Road operators (including city nodes) to publish TMI via DATEXII	• Traffic Management Information provided for Core TERN via DATEXII from 2015 and provided to all equipped ITS Service Provider Users enabling TMI to be provided for the whole of the TERN even where there is no VMS coverage
IA6	• Scenario 3 plus • Additional costs (implementation & 10 year operation) for all COMPREHENSIVE TERN Road operators (including city nodes) to publish TMI via DATEXII	• Traffic Management Information provided for Comprehensive TERN via DATEXII from 2015 and provided to all equipped ITS Service Provider Users enabling TMI to be provided for the whole of the TERN even where there is no VMS coverage
IA7	• Scenario 5 plus • Additional costs (implementation and operation) to provide Road Data (Geometry Changes, Link attributes) via INSPIRE Node for the CORE TERN	• Traffic Management Information provided for Core TERN via DATEXII from 2015 and provided to all equipped ITS Service Provider Users enabling TMI to be provided for the whole of the TERN even where there is no VMS coverage • Reduced costs for Digital Map Providers and ITS Service Providers due to more efficient Road Network surveys on the CORE TERN
IA8	• Scenario 7 plus • Further Additional costs (implementation and operation) to provide Road Data (Geometry Changes, Link attributes) via INSPIRE Node for the COMPREHENSIVE TERN	• Traffic Management Information provided for Comprehensive TERN via DATEXII from 2015 and provided to all equipped ITS Service Provider Users enabling TMI to be provided for the whole of the TERN even where there is no VMS coverage • Further reduced costs for Digital Map Providers and ITS Service Providers due to more efficient Road Network surveys on the COMPREHENSIVE TERN
IA9	• Scenario 8 plus • Additional costs associated with provision of RTTI information by Road Operators on the Comprehensive TERN • Implementation and operation of National roadworks databases for those MS not already publishing info	• Traffic Management Information provided for Comprehensive TERN via DATEXII from 2015 and provided to all equipped ITS Service Provider Users enabling TMI to be provided for the whole of the TERN even where there is no VMS coverage • Further reduced costs for Digital Map Providers and ITS Service

		Providers due to more efficient Road Network surveys on the COMPREHENSIVE TERN • More efficient routing for Users due to provision of RTTI (Incident info, short term closures, roadworks) for Comprehensive TERN via DATEXII from 2015

IA10	• Scenario 10 plus
	• Costs for Road Operators of the secondary road network
	  ○ Publication infrastructure
	  ○ Provision of TMI costs
	  ○ Provision of Road Data costs
	  ○ Provision of RTTI (incidents, closures, roadworks)
		• Scenario 9 plus
		• More efficient routing for equipped Users on Secondary Road network due to provision of Traffic Management Information via DATEXII
		• Reduced network survey costs for Digital Map providers for the secondary road network
		• More efficient routing for equipped Users on the Secondary road network due to provision of RTTI (Incident info, short term closures, roadworks) via DATEXII from 2015

IA11	• Scenario 7 plus • Additional costs associated with provision of RTTI from 2015 (incidents, closures, roadworks) for those Road operators already not voluntarily doing so in Baseline Scenario	• More efficient routing for equipped Users on CORE TERN network due to provision of Traffic Management Information via DATEXII • Reduced network survey costs for Digital Map providers for the CORE TERN • More efficient routing for equipped Users on the CORE TERN network due to provision of RTTI (Incident info, short term closures, roadworks) via DATEXII from 2015

The following sections summarise the policy content of each of the key deployment options.

5.3.1. BASELINE SCENARIO

This is the 'no further intervention' option. This means that consideration will be taken of what might happen in the absence of any further interventions being made by the EC[2] beyond those already required by the ITS Directive.

The criteria that were investigated for this scenario include:
- A review of the anticipated costs of delays of non-recurrent congestion associated with unplanned incidents (accidents, breakdowns, roadworks, events);
- The current state of the channels used to disseminate Traffic Management messages;
- The network coverage of traffic management messages published via DATEX II.

The development of the baseline scenario showed that congestion costs amount to about 13.6 billion Euro in EU27 in 2015.

Without further intervention the costs for congestion caused by accidents and incidents on the network are expected to decrease from 11.4 billion Euro in 2015 to 9.5 billion Euro in 2025, this is due to a predicted reduction in the number of accidents due to existing EU Policy and other priority actions under the ITS Directive. The costs for congestion caused by roadworks are expected to increase from 6.9 billion Euro in 2015 to 7.8 billion Euro in 2025.

The number of drivers with access to real-time traffic and travel information (RTTI) via in-vehicle or personal devices is expected to increase from 60% in 2015 to 100% in 2025 in the baseline scenario, and VMS coverage is expected to increase from 25% in 2015 to 33% in 2025 of the TEN-T Comprehensive network.

Without EC intervention it is expected that some RTTI (journalistic information about incidents, roadwork locations, journey times) will be available via DATEX for about 51% of the TEN-T Core network and 12% of the Comprehensive network in 2015, increasing to respectively 77% and

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[2] A time horizon of 2025 was selected to be consistent with the IA conducted for Action C Safety Related Traffic Information to allow direct comparison of benefits between the 2 complimentary actions

19% in 2025. This is based on the MS who currently have an operational DATEX II interface (and publish incident and/or roadworks data using that interface), and assuming that another 10 MS will publish the necessary information by 2025.

For the baseline scenario it has been assumed that due to the lack of trust between stakeholders in particular Road Operators and ITS Service Providers that active Traffic Management Plan information will not be voluntarily published via DATEXII by Road Operators during the analysis period.

5.3.2. SCENARIO 1 – GOVERNANCE FRAMEWORK, NO GEOGRAPHIC COVERAGE

Scenario 1 differs from the baseline by introducing a Governance Framework to support the definition of services, identification of best practice, and oversight of development and delivery. The Governance Framework was highlighted by stakeholders as a key forum to enable different members of the value chain (e.g. Road Operators, ITS Service Providers, Member States, User representatives) to come together and discuss the needs and requirements for a service in a collaborative manner. At this stage, the formation of the Governance Framework has not been prescribed, although D3 [37] does highlight some possible organisational models that the EC could adopt to introduce a suitable Framework.

Scenario 1 does not mandate the adoption of any data specifications, nor does it prescribe a network coverage for data availability.

5.3.3. SCENARIO 2 – GOVERNANCE FRAMEWORK AND RULES, NO GEOGRAPHIC COVERAGE

Scenario 2 builds on Scenario 1 by retaining the introduction of a Governance Framework and adds to it by creating rules relating to the re-use of data by members of the value chain. The PSI Directive already covers the re-use of data by public authorities, but there are no such provisions covering the re-use of data by non-public bodies. The rules introduced by Scenario 2 would cover the re-use of specific data types by non-public bodies.

Scenario 2 does not mandate the adoption of any data specifications, nor does it prescribe a network coverage for data availability.

5.3.4. SCENARIO 3 - GOVERNANCE FRAMEWORK AND RULES, NON-MANDATORY MINIMUM DATA CONTENT, NO GEOGRAPHIC COVERAGE

Scenario 3 consists of prescribing a Governance Framework and a set of re-use rules for certain data types (as per Scenario 2), plus the preparation of data specifications for a particular set of data types.

As described above in section 5.1, the preparation of voluntary specifications for certain data types would result in an obligation to publish the information for the appropriate network, if that information is available. The voluntary data specifications for Scenario 3 would cover a 'minimum' data content. This would include traffic management information messages associated with incidents on the network, and information presented via VMS, made available via DATEX II.

5.3.5. SCENARIO 4 - GOVERNANCE FRAMEWORK AND RULES, NON-MANDATORY EXTENDED DATA CONTENT, NO GEOGRAPHIC COVERAGE

Scenario 4 would consist of mandating the creation of a Governance Framework and a set of re-use rules for certain data types, plus the preparation of data specifications for a particular data types.

As described above in section 5.1, the preparation of voluntary specifications for certain data types would result in an obligation to publish the information for the appropriate network, if that information is available. The way that Scenario 4 differs from Scenario 3 is that the voluntary data specifications for Scenario 4 would cover an 'extended' data content. This would include traffic management messages associated with incidents on the network; information presented via VMS, made available via DATEX II; and road data updates to geometry (extensions and changes) and link attributes (static) speed limit changes.

5.3.6. SCENARIO 5 - GOVERNANCE FRAMEWORK AND RULES, MANDATORY MINIMUM DATA CONTENT, GEOGRAPHIC COVERAGE ON CORE TERN

Scenario 5 consists of prescribing the formation of a Governance Framework, the preparation of a set of re-use rules, and the preparation of specifications for a minimum data content that would need to be made available on a mandatory basis for the Core road network (including the metropolitan nodes).

The data types that should be made available for the Core road network are traffic management messages associated with incidents on the network,

and information presented via VMS. This information should be made available via DATEX II.

5.3.7. SCENARIO 5A - GOVERNANCE FRAMEWORK AND RULES, MANDATORY MINIMUM DATA CONTENT, GEOGRAPHIC COVERAGE ON CORE TERN (NO NODES)

Scenario 5 consists of prescribing the formation of a Governance Framework, the preparation of a set of re-use rules, and the preparation of specifications for a minimum data content that would need to be made available on a mandatory basis for the Core road network (this does not include the metropolitan nodes).

The data types that should be made available for the Core road network (but not including the metropolitan nodes on the Core network) are traffic management messages associated with incidents on the network, and information presented via VMS. This information should be made available via DATEX II.

5.3.8. SCENARIO 6 - GOVERNANCE FRAMEWORK AND RULES, MANDATORY MINIMUM DATA CONTENT, GEOGRAPHIC COVERAGE ON COMPREHENSIVE TERN

Scenario 6 consists of prescribing the formation of a Governance Framework, the preparation of a set of re-use rules, and the preparation of specifications for a minimum data content that would need to be made available on a mandatory basis for the Comprehensive road network.

The data types that should be made available for the Comprehensive road network are traffic management messages associated with incidents on the network, and information presented via VMS. This information should be made available via DATEX II.

5.3.9. SCENARIO 7 - GOVERNANCE FRAMEWORK AND RULES, MANDATORY EXTENDED DATA CONTENT, GEOGRAPHIC COVERAGE ON CORE TERN

Scenario 7 consists of prescribing the formation of a Governance Framework, the preparation of a set of re-use rules, and the preparation of specifications for an extended data content that would need to be made available on a mandatory basis for the Core road network (including the metropolitan nodes).

The data types that should be made available for the Core road network are: traffic management messages associated with incidents on the network; information presented via VMS; road data geometry updates; and static speed limit changes. This information should be made available via DATEX II and the national INSPIRE infrastructure as appropriate.

5.3.10. SCENARIO 7A - GOVERNANCE FRAMEWORK AND RULES, MANDATORY EXTENDED DATA CONTENT, GEOGRAPHIC COVERAGE ON CORE TERN (NO NODES)

Scenario 7a consists of prescribing the formation of a Governance Framework, the preparation of a set of re-use rules, and the preparation of specifications for an extended data content that would need to be made available on a mandatory basis for the Core road network (not including the metropolitan nodes).

The data types that should be made available for the Core road network (but not the metropolitan nodes) are: traffic management messages associated with incidents on the network; information presented via VMS; road data geometry updates; and static speed limit changes. This information should be made available via DATEX II and the national INSPIRE infrastructure as appropriate.

5.3.11. SCENARIO 8 - GOVERNANCE FRAMEWORK AND RULES, MANDATORY EXTENDED DATA CONTENT, GEOGRAPHIC COVERAGE ON COMPREHENSIVE TERN

Scenario 8 consists of prescribing the formation of a Governance Framework, the preparation of a set of re-use rules, and the preparation of specifications for an extended data content that would need to be made available on a mandatory basis for the Comprehensive road network.

The data types that should be made available for the Comprehensive road network are: traffic management messages associated with incidents on the network; information presented via VMS; road data geometry updates; and static speed limit changes. This information should be made available via DATEX II and the national INSPIRE infrastructure as appropriate.

5.3.12. SCENARIO 9 - GOVERNANCE FRAMEWORK AND RULES, MANDATORY FULL DATA CONTENT, GEOGRAPHIC COVERAGE ON COMPREHENSIVE TERN

Scenario 9 consists of prescribing the formation of a Governance Framework, the preparation of a set of re-use rules, and the preparation of specifications for the full data content that would need to be made available on a mandatory basis for the Comprehensive road network.

The data types that should be made available for the Comprehensive road network are: traffic management messages associated with incidents on the network; information presented via VMS; road data geometry updates; static speed limit changes; and information about planned roadworks. This information should be made available via DATEX II and via the national INSPIRE infrastructure as appropriate.

Additionally, Scenario 9 involves the preparation of voluntary specifications for the extended data content. These specifications would not be mandatory, and would have no prescribed geographic coverage.

5.3.13. SCENARIO 10 - GOVERNANCE FRAMEWORK AND RULES, MANDATORY FULL DATA CONTENT, GEOGRAPHIC COVERAGE ON COMPREHENSIVE TERN PLUS SECONDARY NETWORKS

Scenario 10 consists of prescribing the formation of a Governance Framework, the preparation of a set of re-use rules, and the preparation of specifications for the full data content that would need to be made available on a mandatory basis for the Comprehensive and secondary road networks.

The data types that should be made available for the Comprehensive and secondary road networks are: traffic management messages associated with incidents on the network; information presented via VMS; road data geometry updates; static speed limit changes; and information about planned roadworks. This information should be made available via DATEX II and the national INSPIRE infrastructure as appropriate.

Additionally, Scenario 10 involves the preparation of voluntary specifications for the extended data content. These specifications would not be mandatory, and would have no prescribed geographic coverage.

5.3.14. SCENARIO 11 - GOVERNANCE FRAMEWORK AND RULES, MANDATORY FULL DATA CONTENT, GEOGRAPHIC COVERAGE ON CORE TERN

Scenario 11 consists of prescribing the formation of a Governance Framework, the preparation of a set of re-use rules, and the preparation of specifications for the full data content that would need to be made available on a mandatory basis for the Core road network (including metropolitan nodes).

The data types that should be made available for the Core road network are: traffic management messages associated with incidents on the network; information presented via VMS; information about road data geometry updates; static speed limit changes; and information about planned roadworks. This information should be made available via DATEX II and the national INSPIRE infrastructure as appropriate.

Additionally, Scenario 11 involves the preparation of voluntary specifications for the extended data content. These specifications would not be mandatory, and would have no prescribed geographic coverage.

5.3.15. SCENARIO 11A - GOVERNANCE FRAMEWORK AND RULES, MANDATORY FULL DATA CONTENT, GEOGRAPHIC COVERAGE ON CORE TERN (NO NODES)

Scenario 11a consists of prescribing the formation of a Governance Framework, the preparation of a set of re-use rules, and the preparation of specifications for the full data content that would need to be made available on a mandatory basis for the Core road network (not including metropolitan nodes).

The data types that should be made available for the Core road network (not including the metropolitan nodes) are: traffic management messages associated with incidents on the network; information presented via VMS; information about road data geometry updates; static speed limit changes; and information about planned roadworks. This information should be made available via DATEX II and the national INSPIRE infrastructure as appropriate.

Additionally, Scenario 11a involves the preparation of voluntary specifications for the extended data content. These specifications would not be mandatory, and would have no prescribed geographic coverage.

5.4. Results Impact Assessment

D3 [37] provides a detailed analysis of the impact assessment results for each key deployment option. An excerpt from this document is included in Annex C – Details of Economic Impact Assessment. This section summarises those results.

The impact assessment consisted of a quantitative and qualitative analysis.

The quantitative analysis determined per scenario:
- Required investment and operational costs
- Impact on accident rates (per accident and road type), and associated costs
- Impact on delays (per cause), and associated costs

The qualitative analysis determined per scenario:
- ITS Directive Principles
- Special impacts, e.g. impact on existing markets, on consumers, on SMEs, technological developments and innovation, etc.
- Risks

The table below provides a summary for each explored Scenario of the:
- Costs
- Benefits
- Net benefits (benefits-costs)
- Benefits-cost ratio [3]
- Assessment against the ITS Directive Principles
- Stakeholder risk assessment (+++ means low risk)

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[3] Note BCR in Table 6 is calculated by dividing Benefits (2015-2025) by Costs (2015-2015) e.g. for scenario 1 BCR = 130.498.797/80,189,120 = 1.63

		IA elements					
		Costs (2015-2025)	Benefits (2015-2025)	Net benefit (2015-2025)	BCR	ITS Directive Principles	Risk assessment
Scenarios	0	-	-	-	1	-	o
	1	€ 80,189,120	€ 130,498,797	€ 50,309,677	1.63	2.0	++
	2	€ 124,004,420	€ 320,794,989	€ 196,790,570	2.59	2.3	+++
	3	€ 125,330,244	€ 350,403,960	€ 225,073,716	2.80	2.2	+
	4	€ 140,563,303	€ 386,927,918	€ 246,364,615	2.75	2.4	+
	5	€ 170,764,820	€ 359,033,255	€ 188,268,435	2.10	2.2	+
	5a	€ 123,340,980	€ 359,033,255	€ 235,692,275	2.91	2.2	+
	6	€ 293,311,380	€ 2,294,956,313	€ 2,001,644,934	7.82	2.4	+
	7	€ 193,096,272	€ 363,614,710	€ 170,518,438	1.88	2.2	+
	7a	€ 142,972,432	€ 363,614,710	€ 220,642,278	2.54	2.2	+
	8	€ 270,204,572	€ 2,348,791,374	€ 2,078,586,802	8.69	2.7	+
	9	€ 1,151,626,470	€ 4,912,131,891	€ 3,760,505,421	4.27	2.7	+
	10	€ 4,034,605,495	€ 11,171,438,987	€ 7,136,833,492	2.77	2.7	o
	11	€ 501,066,166	€ 412,296,237	-€ 88,769,929	0.82	2.2	+
	11a	€ 285,242,326	€ 412,296,237	€ 127,053,911	1.45	2.2	+

Table 6: Impact Assessment estimates summary

The sections below describe the key trends associated with the scenarios.

5.4.1. COSTS AND BENEFITS

Generally speaking, if the Scenario mandates the availability of certain data types on a specific geographic network (e.g. the Core road network), then the associated costs are higher than a scenario without any mandatory availability requirements. That is because if the availability of data is mandated, then stakeholders such as road authorities and Member States would be required to tools/services to publish and share the necessary information.

5.4.1.1. TRENDS ASSOCIATED WITH COSTS OF DATA PROVISION

Depending on the data specification content (e.g. minimum (TMI), extended (TMI + Road Data) or full (TMI, Road Data, Other RTTI)), investments would need to be made to ensure that the necessary data could be made available in the correct format.

The minimum data specification content would mean that investments would be required to ensure that the DATEX II nodes were modified to take account of the additional information types that would be exchanged (e.g. traffic management messages). This would be the case for Scenarios 5, 5a and 6.

If the extended data (TMI + Road Data) specification content was to be made available, there would be additional costs associated with the provision of network update and speed limit changes to 3rd parties. This would include the MS modifying the national INSPIRE infrastructure to take account of network changes and speed limit changes for the required network, as well as the costs of entering the changes into the INSPIRE infrastructure. This is would be the case for Scenarios 7, 7a and 8.

For the full data (TMI, Road Data, Other RTTI) specification content to be made available, investments would need to be made in the implementation and/or operation of a National Roadworks Database, which has been shown to be the most cost effective approach for countries that have already implemented real-time provision of roadworks information (for those scenarios involving the mandatory availability of the roadworks database, i.e .Scenarios 9, 10, 11 and 11a).

Hence, the more prescriptive the scenario in terms of the mandatory availability of certain data types, the higher the costs.

5.4.1.2. TRENDS ASSOCIATED WITH THE COSTS DUE TO GEOGRAPHIC COVERAGE

If the mandated geographic coverage increases, then the costs for providing the necessary data about the network also increase. For example, the cost of entering network changes for the Comprehensive TERN network including motorways and the Primary/National networks (e.g. Scenario 8) is greater than the costs of entering the network changes for the Core TERN plus motorway network (e.g. Scenario 7).

Likewise, if the Road Operators of the metropolitan nodes are included in the scope of the policy option (e.g. Scenario 7), then the costs are higher than if they were not (e.g. Scenario 7a). This is because it is assumed that certain costs would need to be replicated by each road operator (such as messaging middleware costs).

Consequently, the greater the mandatory geographic coverage, the larger the implementation and operational costs.

5.4.1.3. TRENDS ASSOCIATED WITH THE DERIVED BENEFITS
The benefits derived from a Scenario are directly affected by the geographic coverage and data content of any mandated measures.

However, the relationship between the baseline and the benefits to be derived from the different Scenarios is less linear. This is particularly the case when comparing the impact that a mandatory measure might have relative to a voluntary measure.

An example of this is the impact of making roadwork data available. A particular deployment rate has been taken about the level of roadwork information that is currently made available (in the case of the baseline scenario), or would be made available should a Governance Framework be introduced (for the purposes of the Scenarios without a mandatory geographic coverage). As a result, the benefits derived from mandating the availability of roadwork information (e.g. Scenarios 7-11a), has little impact relative to those Scenarios involving the voluntary sharing of the information (e.g. Scenarios 1-6).

5.4.1.4. DISTRIBUTION OF COSTS BY STAKEHOLDER GROUP

In general, due to the nature of the actions considered, the majority of the costs are borne by the public authorities and in particular the road operators of the TERN networks within each Member State to enable the provision of Traffic Management information, Road Data and Other RTTI.

In the analysis it has been assumed that ITS Service Providers will also have costs associated with their participation on the Governance Framework and associated activities plus costs associated with updating their DATEXII and INSPIRE infrastructure to enable receipt of the new data feeds from the Road Operators.

5.4.1.5. DISTRIBUTION OF BENEFITS BY STAKEHOLDER GROUP

In the assumptions for the impact assessment it has been assumed that congestion on the road network causes a cost to Member States which is realised in a reduction of GDP. In the detailed analysis, the benefits associated with congestion reduction are calculated by placing a monetary value on the reduced number of delay hours for Road Users, depending on the perspective that this is viewed from, this can either be seen as a benefit to individual road users or to society within a Member States as a whole due to an increase in productive time or reduced costs which in turn will contribute to an increase in GDP.

The provision of Road Data by Road Authorities, in particular those not covered by INSPIRE will provide reduction in costs for ITS Service Providers associated with the maintaining and updating of the underlying

digital maps, however, the monetary values are several orders of magnitude less than the benefits associated with the reduction of congestion. The estimated maximum benefit, €17M over 10 years, provides an indication of the maximum commercial value of such a European dataset to ITS Service Providers. If Road Authorities decided for example to set a fee which was equivalent to the additional administrative burden for generating the data set then the benefit to ITS Service Providers would be reduced to €8.7M.

A less obvious benefit to Road Authorities, which is assumed in the analysis, is that distribution of Traffic Management Information to Vehicles via ITS Service Providers, enables traffic management to be performed for the network as a whole and not necessary be limited to areas of the network where there is VMS Coverage or on the ground presence to perform physical traffic management.

5.4.1.6. GEOGRAPHIC DISTRIBUTION OF COSTS AND BENEFITS ACROSS MEMBER STATES

The analysis of costs and benefits has been presented at an EU level, to assess the overall effectiveness of the proposed actions at a European level to support the decision for action at an EU level.

In general the implementation costs (modification to national DATEXII node and INSPIRE infrastructure) are assumed to be distributed evenly across the Member States, however, there are differences between Member States in terms of the operational costs and anticipated benefits due to reduced congestion, this is primarily due to differing incident rates (Accidents) per Member State and the length of the road network in each Member State.

5.4.2. REVIEW AGAINST THE PRINCIPLES OF THE ITS DIRECTIVE

All of the investigated Scenarios are aligned to and supportive of the key principles advocated in the ITS Directive.

There are general trends indicating that those Scenarios (e.g. Scenarios 7-11) with the mandatory availability of data types based on the extended or full data content are stronger at meeting the principles of 'delivering interoperability' and 'supporting the continuity of services'.

The 'voluntary' scenarios (e.g. Scenarios 1-4) that do not mandate the availability of certain data on a specific geographic network tend to be stronger at supporting the principle of 'respecting existing national infrastructure and network characteristics'. This is because they do not

require the Member States or public bodies to change their current approach to managing their network.

5.4.3. Review against the Stakeholder Risk Assessment

The risk assessment executed as part of the Impact Assessment (full details reported in D3 [37]) indicated certain broad trends.

The more prescriptive scenarios (5-11a) indicated a positive impact on market competitiveness, operational efficiency, market size, innovation, and on the level, cost and quality of the available services. The positive impacts generally tend to increase as the geographic coverage becomes wider and the data specification content becomes more comprehensive.

The Scenarios involving a mandated deployment (5-11a), have been evaluated as reducing the risks to both ITS Service Providers and Users, due to the greater availability of data, and the associated impact that that would have on the availability of services. However, it could be judged that there could be additional risks placed on those ITS Service Providers who already have sunk investments in place that collect the data that would be made available to them through any EC interventions associated with this action. Additionally, some ITS Service Providers (particularly those with an already established market share) could perceive additional risks connected with new entrants to market on the back of the data being made available.

Scenarios 5-11a appear to present greater risks to MS and Road Operators due to the fact that the costs associated with making the necessary data available and supporting any EC interventions (e.g. introducing regulations/legislation, cost of compliance/monitoring activities) are likely to be borne by them. However, there are indications that certain risks to MS and Road Operators could be lowered by an EC intervention, particular in terms of the improved operations on the network (e.g. encouraging best practice, and the provision of certain data/nodes), as well as a more competitive market for service providers and the associated services to Users.

5.5. Synthesis

All but one of the Scenarios return a benefit to cost ratio of greater than one, indicating that the investigated scenarios would deliver a greater level of benefits during the study window (2015-2025) than it would cost to implement, operate and maintain the measures.

The Scenarios consisting of non-mandatory policy options (Scenarios 1-4) returned a BCR of between 1.6 and 2.8. This suggests that the establishment of non-mandatory measures can bring significant benefits in its own right by developing a Governance Framework and other supporting mechanisms (re-use rules etc.).

Scenarios 5-11a returned a BCR of between 1.4 and 8.6, with Scenario 11 returning a BCR of 0.8.

This provides us with the following conclusions:

- Policy Options targeting the Comprehensive network, mandating the availability of either the minimum (TMI) or extended (TMI + Road Data) data specification coverage, are likely to return the greatest BCR (Scenarios 6 and 8 fall into this category with BCRs or 7.8 and 8.6 respectively).

- If a requirement to make the full data content (TMI, Road Data + Other RTTI) available is included in Scenario, the BCRs can remain at a reasonable level, however, the costs become substantially higher.

  This is because the full data content includes roadworks data and so would require the creation, population and maintenance of a national roadworks database.

- Scenarios for the Core road network have a substantially larger BCR if an obligation to cover the urban nodes is excluded.

- Disseminating traffic management messages and Road Data Updates delivers the greatest benefits.

- Disseminating the Traffic Management and Roadworks information on the Comprehensive road network indicates an increase in net benefits of 20 times that of just disseminating the information on the Core network.

- Mandating the availability of roadworks information on the Core brings little benefit above that of a voluntary deployment.

- If a requirement to record and publish network or speed limit changes is mandatory for the CORE TERN and motorway, it reduces the overall benefit level of the scenario due to the greatly increased

costs of publishing the data, and implementing/operating the necessary databases/INSPIRE nodes., however, if the geographic coverage is extended to the COMPREHENSIVE TERN, Motorways, and National/Primary Roads then the overall level of benefit is increased

- Generally, the risks to MS and Road Operators increase as the Scenarios become more prescriptive. This is primarily because the costs associated with making the data available fall to those stakeholder groups.

- The risks to ITS Service providers and Users are reduced and the benefits increase as the Scenarios become more prescriptive.

The indications based on the results of the detailed impact assessment suggest that there are 2 alternative approaches that will achieve the greatest objectives for Priority Action B of the ITS Directive:-

The first would be for the Specifications prepared to mandate the deployment of Traffic Management messages on the Core or Comprehensive networks, and through the introduction of the Governance Framework and Common Reuse Framework support the accelerated voluntary deployment of roadwork information, and network and speed limit changes by Member States, i.e. IA 5a or IA6.

IA5a is predicted to give a net benefit of more that €235M in the period 2015 – 2025 with a BCR of 2.91 and IA6 is predicted to give a net benefit of more than €2b in the period 2015 – 2025 with a BCR of 7.82. These benefits are principally due to reduction in travel delay hours as a result of more optimal routing based on information about traffic management measures as result of incident on the network and avoidance of delays associated with roadworks on the network.

The second approach would be for the specifications to mandate the deployment of Traffic Management Information and Road Data updates on the Core or Comprehensive networks, and through the introduction of the Governance Framework and Common Reuse Framework support the accelerated voluntary deployment of other RTTI by Member States, i.e. IA 7a or IA8

IA7a is predicted to give a net benefit of more that €220M in the period 2015 – 2025 with a BCR of 2.54 and IA6 is predicted to give a net benefit of more than €2.07b in the period 2015 – 2025 with a BCR of 8.69. For Scenario 7a the provision of Road Data updates reduces the overall benefits and BCR when compared to Scenario 5a, however, for Scenario 8 the addition of Road Data Updates increase the overall levels of benefits primarily due to a much greater network length for which updates are provided reducing the survey costs associated with digital map updates for a similar implementation cost.

6. Comparison of Key Policy Options

6.1. Key Policy Options and Impacts

This section presents an assessment of the implications that the key policy options may have for the different stakeholder groups (Member States, Road Operators, ITS Service Providers and Users).

6.1.1. MEMBER STATES AND DELEGATED AUTHORITIES

Governance Framework

All of the scenarios, apart from the Baseline Scenario, assume that the specifications for Action B will include the definition of a Governance Framework for the development of European RTTI Services.

Member States will be expected to actively participate in the Governance Framework and as such abide by the defined decision making process and mechanisms for ensuring compliance.

This Governing Body would provide a forum where Member States, Road Operators, ITS Service Providers and Users can discuss and agree the scope and direction of any Pan-European Traffic Information Services, enabling the more rapid development of coordinated RTTI services which meet the requirements of both Users and Road Operators. By allowing the parties to air their concerns, improve mutual understanding, make binding decisions, and identify and deal with issues of compliance, the Governing Body would help to break down the current barriers that exist between Road Operators and ITS Service Provides that limit the extent and scope of data sharing. It is expected that the introduction of such a Governance Framework, would accelerate deployment and market development by bringing together the actors required to agree and coordinate the delivery of services which meet the compatible goals of the actors involved.

However, the introduction of the Governance framework may place restrictions or additional demands on Member States relating to the deployment of RTTI Services within their territory.

Common Reuse Framework

All of the scenarios, apart from the Baseline Scenario and Scenario 1, assume that the specifications for Action B will include the definition of a common reuse Framework for RTTI.

The definition of a Common Reuse Framework, is expected to have little impact on Member States apart from the requirement to implement the common reuse terms for data published via the national DATEXII and INSPIRE infrastructure.

Common Electronic Data Specifications

Scenarios 3 to 11 require Member States to ensure that the National DATEXII and INSPIRE infrastructure are updated to be compatible with the specifications for RTTI data adopted by the Governing Body.

In addition Member States will be required to either mandate that Road Operators that publish electronically RTTI data which fall within the scope of the specifications to do so according to the agreed specifications or to translate the published data prior to its publication via the national infrastructure.
This could be done by adopting the specifications published by the Governing Body for RTTI into National Standards.

Mandated Data RTTI electronic publication for specified geographic coverage

Scenarios that include the mandated publication of certain types of RTTI data for specific areas of the road network within Member States will have the greatest financial impact for Member States. This is because Member States will have to bear the additional costs for Road Operators to publish the required data for the specified network.

Where the specified network is restricted to the Core TERN and motorway network it is expected that for the majority of Member States this will only place obligations on the National Road Authorities to publish the required data. For the comprehensive TERN, national/primary and secondary road networks this potentially will require city road authorities that are nodes on these networks to be required to publish RTTI data electronically, this

requirement leads to an exponential increase in the implementation and operational costs to be borne by each Member State.

Whilst there is an exponential rise in the implementation and operational costs in such scenarios, the anticipated benefits to society of reduced traffic congestion and reduction in travel delay hours for experienced in the movement of people and goods outweigh the increased costs and the BCR ratios increase significantly for scenarios that mandate coverage for the comprehensive TERN network.

6.1.2. ROAD OPERATORS

Governance Framework

As previously mentioned, all the investigated Scenarios (with the exception of the Baseline) assume that the specifications for Action B would include the definition of a suitable Governance Framework.

The establishment of a Governance Framework would enable the Road Operators to come together with other members of the stakeholder community (such as MS, ITS Service Providers and User representatives) in a forum environment to discuss and agree the scope and direction of any necessary services.

By enabling the interested parties to come together and express their interests and air their concerns, it would support a mutual understanding of any issues, and enable the delivery of services to be scoped and agreed.

As well as establishing a forum for airing issues, a Governance Framework can also go some way to helping Road Operators to acquire examples of best practice from the other relevant stakeholders. This can bring efficiency savings when it comes to implementing any changes in their organisation and activities.

Common Reuse Framework

The majority of the investigated Scenarios (with the exception of the Baseline and Scenario 1) work on the basis that the specifications for Action B will include the definition of a Common Reuse Framework for RTTI.

The road operators who are public bodies are already covered by the terms of the PSI Directive, and so the establishment of a Common Reuse

Framework would have little impact on them other than the requirement to implement the common reuse terms for the data published via the DATEX II and INSPIRE infrastucture.

At the present time, when Road Operators and ITS Service Providers negotiate agreements relating to the re-use of data it can be a time-consuming process, and needs to be repeated with each additional Service Providers. The definition of a Common Reuse Framework for RTTI could reduce the level of effort involved in negotiating and drafting those agreements.

The public sector road Operators may perceive the definition of a Common Reuse Framework to bring benefit due to the fact that the same terms would apply to private sector providers, and so go some way to levelling the terms in the market.

Additionally, Road Operators may feel that the establishment of a Common Reuse Framework would bring benefits to them because they can see that the information that they share with service providers for certain data types would be passed on to Users via the necessary services.

Common Electronic Data Specifications

Scenarios 3-11a require the creation of common electronic data specifications for RTTI.

The establishment of common electronic data specifications, would potentially bring benefits to Road Operators due to the fact that the common specifications could reduce the costs associated with building bespoke interfaces to share RTTI data with ITS Service Providers.

However, Road Operators would potentially need to publish any available RTTI data in a different format to that that they do at the present time, and this could present a further burden to those stakeholders.

Mandated Data RTTI electronic publication for specified geographic coverage

Any requirement to make certain data available in a particular format would represent a burden to Road Operators. This is due to a number of factors including:

- The cost and effort associated with observing compliance with the regulations
- The investment needed to make the necessary data available may be in competition with other planned investments and budgets
- A challenge to the Road Operator capability (e.g. a road operator may be very strong at operating and maintaining the physical infrastructure, but not necessarily at managing the collation and electronic publication of the necessary data)

However, mandating the availability of certain data could present an opportunity to enhance their operations by providing an incentive to gain funding to manage their network differently and inform their users of any issues.

6.1.3. ITS SERVICE PROVIDERS

Governance Framework

All of the scenarios, apart from the Baseline Scenario, assume that the specifications for Action B will include the definition of a Governance Framework for the development of European RTTI Services.

One of the main issues raised by the ITS Service Providers during the small group discussions and the workshop was the lack of a European forum where all interested parties were represented in order to discuss and resolve issues associated with the deployment and provision of RTTI Services across Europe.

All 'do something' scenarios will provide ITS Service Providers with the opportunity to participate in European Forum responsible for the development of European RTTI Services.

Common Reuse Framework

All 'do something' scenarios apart from Scenario 1 will include within the terms of reference for the Governing Body to develop and issue a common reuse framework complying with the principles set out in the Specification for Action B.

Inclusion of the statement of principles within the Action B should help to reduce diversity in reuse terms set for Road Operator data and overcome

the current impasse in the market, bringing the key stakeholders together on a more trusting basis, and accelerate progress on sharing new data.

For ITS Service Providers this would end sooner the time-consuming approach of negotiating bilateral and ad-hoc group agreements with Road Operators, having to accommodate a wide range of reuse terms within an RTTI-enabled ITS service, thereby reducing the costs and barriers to entry for new ITS Service Providers. It could also help make new data available, stimulating the emergence of new or improved services for Users.

The common reuse framework would also place common restrictions on Road Operators on their use of data received from ITS Service Providers, which will help to build trust and facilitate collaborative data exchange

Common Electronic Data Specifications

The introduction of the common electronic data specifications for RTTI and the requirement for Member States to ensure that national nodes are modified to be compatible with the defined standards, will mean that ITS Service Providers will have a common electronic interface to receive RTTI data from Member States that publish via the national node.

This will reduce the costs associated with building bespoke interfaces to receive RTTI data from Road Operators.

Mandated Data RTTI electronic publication for specified geographic coverage

For scenarios 1 to 4, which do not mandate the electronic publication of RTTI data by Road Operators on any specific road networks or corridors in Europe, individual Road Operators could decide whether and what to publish, as long as they comply with all other existing obligations. Some could also choose not to publish it at all. Much potentially useful data could remain either not published at all, or only published patchily, including TMP and activation status data.

ITS Service Providers wishing to provide services on a given network will have to manage with a patchy coverage that varies by Member State and Road Operator, potentially preventing the delivery of a consistent service to the User, frustrating or preventing the commercial exploitation of new services.

The remaining complexity of the market could restrict RTTI ITS Service provision to bigger, vertically integrated organisations capable of achieving a degree of physical presence across the entire network in order to access data.

The Scenarios investigated during the Impact Assessment deal with different data types. The inclusion of those data types, in any mandatory data specifications can bring varying levels of benefit to ITS Service Providers. Based on the results of the study to date, it would appear that the order of priority for making the data types available would be as follows:
1. Traffic management plans and activation status
2. Speed limit updates
3. Network extensions
4. Active roadwork locations

6.1.4. USERS

Governance Framework

If the EC determined that an intervention was necessary and involved the creation and implementation of a Governance Framework, then it would include a range of stakeholders, and this would likely include User representatives. This would enable User views to be put forward in the definition of services etc.

If the adopted Scenario did not include the mandatory availability of RTTI data, then there would be a risk to Users that any resulting services would be made available on an inconsistent basis in Europe. This would not present a reliable service for Users during their journeys.

Common Reuse Framework

The requirement for a Common Reuse Framework (as presented in Scenarios 2-11a) could represent a positive impact on Users. This is because ITS Service Providers would be obliged to re-use the data made available by Road Operators etc. Consequently, a greater level of information would be available for those services provided to Users.

Common Electronic Data Specifications

The establishment of Common Electronic Data Specifications for RTTI would make more information available for services provided to Users. However, as previously mentioned, there is a risk that Users would experience an inconsistent level of service during their journeys.

Mandated Data RTTI electronic publication for specified geographic coverage

The Scenarios mandating the availability of RTTI data for a particular geographic coverage (Scenarios 5-11a) would bring the greatest level of benefit to Users. This is because ITS Service Providers would be able to offer consistent levels of service across a guaranteed geographic area. Additionally, as has been assessed in other chapters, mandating the availability of data has the potential to open up the market to additional providers. This could provide both an enhanced level of choice to the Users, and a more competitive set of Service Providers.

6.2. Trade-offs and Synergies

This section presents a précis of the trade-offs and synergies associated with the key policy options. The policy option groupings are summarised in Table 7.

Policy Option	Policy Option Grouping			
	A	B	C	D
Governance Framework	✓	✓	✓	✓
Re-Use Rules		✓	✓	✓
Data Specification (non-mandatory)			✓	✓
Mandated Deployment				✓

Table 7: Policy Option grouping

The previous section (6.1) considers each of the policy options from the stakeholder's perspective, whereas this section summarises the trade-offs and synergies for the Policy Option groupings explored in this IA across the whole value chain. Each set of policy options consist of trade-offs and synergies at both a policy level and service level.

6.2.1. POLICY GROUP A: GOVERNANCE FRAMEWORK ONLY

The trade-offs and synergies are summarised in the table below:

	Trade-offs	Synergies
Policy Related	• Risk of market led deployment not delivering the necessary change	• Brings together European stakeholders to agree a common way forward • Reduced administrative burden and implementation costs to MS/Road Operators (relative to mandated options)
Service related	• Reduced benefits to users due to inconsistent level of service	• N/A

Table 8: Policy Group A: Trade-offs and synergies

6.2.2. POLICY GROUP B: GOVERNANCE FRAMEWORK + RE-USE RULES

The trade-offs and synergies are summarised in the table below:

	Trade-offs	Synergies
Policy Related	• A well-functioning re-use framework could lower the need for a governance framework • Slower and more fragmented deployment of services compared to a mandatory policy option	• Brings together European stakeholders to agree a common way forward • Brings clarity on how data is used by the members of the value chain • A functioning governance framework can contribute to drafting and maintaining the re-use rules
Service related	• Reduced benefits to users due to inconsistent levels of service across Europe	• Supports increased trust between Road Operators and ITS Service Providers • Reduces the level of negotiation involved in data sharing agreements

Table 9: Policy Group B: Trade-offs and synergies

6.2.3. POLICY GROUP C: GOVERNANCE FRAMEWORK, RE-USE RULES + DATA SPECIFICATIONS

The trade-offs and synergies are summarised in the table below:

	Trade-offs	Synergies
Policy Related	• Voluntary adoption of services (i.e. lower administrative burden, implementation costs etc.) Vs. Sporadic coverage of services • A well-functioning re-use framework could lower the need for a governance framework • Expectation that MS would be required to invest in updating the national nodes, but there is no obligation for them to be used by data providers/service providers	• Brings together European stakeholders to agree a common way forward • Brings clarity on how data is used by the members of the value chain • A well-functioning governance framework can contribute to the drafting and maintenance of the data specifications • The investment in the extension of national nodes for data exchange, is an enabling action that can support the outputs from the governance framework/re-use framework
Service related	• Reduced benefits to users due to inconsistent level of service	• Supports increased trust between Road Operators and ITS Service Providers • Reduces the level of negotiation involved in data sharing agreements

Table 10: Policy Group C: Trade-offs and synergies

6.2.4. POLICY GROUP D: GOVERNANCE FRAMEWORK, RE-USE RULES, DATA SPECIFICATIONS + MANDATED DEPLOYMENT

The trade-offs and synergies are summarised in the table below:

	Trade-offs	Synergies
Policy Related	• High cost of implementation and administrative burden (for both MS and Road Operators) Vs. Seamless RTTI services for users (with associated benefits to society, and a	• All parties working together in a common framework to deliver collaborative services

	Trade-offs	Synergies
	reduction in congestion levels)	
Service related	• N/A	• Seamless services available to the user • More efficient user journeys

Table 11: Policy Group D: Trade-offs and synergies

6.3. Assessment against Objectives

This section presents the results of the assessment of how the described scenarios contribute to the specific objectives of priority action B.

These objectives are:

1. The availability and accessibility of existing and accurate road and real-time traffic data used for real time traffic information to ITS Service Providers
2. The facilitation of electronic data exchange between the relevant public authorities and stakeholder and the relevant ITS service providers, across borders
3. The timely updating of available road and traffic data used for real-time traffic information by the relevant public authorities and stakeholders
4. The timely updating of real-time traffic information by the ITS Service Providers
5. The necessary requirements for the collection by relevant public authorities and/or where relevant by the private sector of road and traffic data (i.e. traffic circulation plans, traffic regulations and recommended routes) and for their provision to ITS service providers
6. The necessary requirements to make road traffic and transport services data used for digital maps accurate and available, where possible, to digital map producers and service providers

Each scenario was rated as follows:

-    Negatively affects the objective
     Does not affect the objective
+   Positively affects the objective
++   Contributes to achieving the objective
+++ Strongly contributes to achieving the objective

The results are presented in Table 12.

Table 12   Contribution to objectives Priority Action B per scenario.

Obj.:	1	2	3	4	5	6	Overall
Sc.							
0							
1	+		+	+		+	**+**
2	+		+	+		+	**+**
3	++	+	++	++	+	+	**++**
4	++	+++	+++	++	+	++	**++**
5	++	+	++	++	++	+	**++**
5a	++	+	++	++	++	+	**++**
6	++	+	++	++	++	+	**++**
7	+++	++	+++	++	++	+	**++**
7a	+++	++	+++	++	++	+	**++**
8	+++	++	+++	++	++	++	**++**
9	+++	+++	+++	+++	+++	++	**+++**
10	+++	+++	+++	+++	+++	+++	**+++**
11	+++	+++	+++	+++	+++	++	**+++**
11a	++	+++	+++	+++	+++	++	**+++**

None of the scenarios contributes to an objective in a negative way. The more stringent the scenario is the higher the overall score. Scenarios 9 to 11a contribute the most to the objectives because they mandate the collection and sharing of most types of data for either the comprehensive or extended road network.

6.4. Synthesis

This section provides an overview of the results of the impact assessment, the analysis of the scenarios against the ITS Directive Principles and Objectives of Priority Action B, and the Risk Assessment. The key scenario characteristics and analysis results have been aggregated in Table 13.

Table 13   Overview of results analyses.

	IA 0	IA1	IA2	IA3	IA4	IA5	IA5a	IA6	IA7	IA7a	IA8	IA9	IA10	IA11	IA11a
Framework and Rules															
Establish Governance Framework for EU RTTI Services		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Common Reuse Framework for RTTI data			X	X	X	X	X	X	X	X	X	X	X	X	X
DATEXII Specifications															
Current VMS messages				X	X	X	X	X	X	X	X	X	X	X	X
Active Traffic Manangement Plan				X	X	X	X	X	X	X	X	X	X	X	X
Active Roadworks				X								X	X	X	X
Incidents on Network (location and journalistic info)				X								X	X	X	X
INSPIRE Specifications															
Physical network change notification				X				X	X	X	X	X	X	X	X
Physical network change notification (roadworks > 12m)				X				X	X	X	X	X	X	X	X
Physical network change notification (road closures > 12m)				X				X	X	X	X	X	X	X	X
Network change notification (static speed limit change)				X				X	X	X	X	X	X	X	X
National Node updates															
National DATEXII Node update (ready to publish info if available)			X	X	X	X	X	X	X	X	X	X	X	X	X
National INSPIRE Node update (ready to publish info if available)				X				X	X	X	X	X	X	X	X
Mandated Content															
VMS Messages						X	X	X	X	X	X	X	X	X	X
Active Traffic Management Plan information						X	X	X	X	X	X	X	X	X	X
Active Roadworks												X	X	X	X
Incidents on Network (Journalistic)												X	X	X	X
Physical Network Change								X	X	X	X	X	X	X	X
Planned Roadworks > 12M								X	X	X	X	X	X	X	X
Planned road closures > 12M								X	X	X	X	X	X	X	X
Changes to static speed limits								X	X	X	X	X	X	X	X
Short term closures and diversion routes												X	X	X	X
Mandated Geographic Coverage															
CORE TERN minus urban nodes						X			X						X
CORE TERN plus Motorways					X			X						X	
COMPREHENSIVE TERN plus Motorways and National/Primary Roads								X		X	X				
Motorways, National/Primary and Secondary Road networks													X		
Results Analyses															
Costs (G€)	0,00	0,08	0,12	0,13	0,14	0,17	0,12	0,29	0,19	0,14	0,27	1,15	4,04	0,50	0,29
Net benefits (G€)	0,00	0,05	0,20	0,23	0,25	0,19	0,24	2,00	0,17	0,22	2,08	3,76	7,14	-0,1	0,13
BCR	1,00	1,63	2,59	2,80	2,75	2,10	2,91	7,82	1,88	2,54	8,69	4,27	2,77	0,82	1,45
ITS Directive Principles	O	++	++	++	++	++	++	++	++	++	++	+++	+++	+++	++
Risk Assessment	O	++	+++	+	+	+	+	+	+	+	+	+	O	+	+
Objectives Priority B	O	+	+	++	++	++	++	++	++	++	++	++	+++	+++	+++

All but one of the Scenarios return a benefit to cost ratio of greater than one. Scenarios 6 and 8 produce the highest benefit-cost ratios.

None of the scenarios produces adverse effects on the ITS Directive Principles or the objectives of Priority Action B. The analysis against the ITS Principles showed that the scenarios which mandate the provision of information relating to traffic management and roadworks on the Comprehensive TERN have the highest overall alignment with the ITS Directive Principles, primarily because they provide the greatest enablers for the development of seamless European RTTI services for provision to users by ITS Service Providers.

Overall, all scenarios but one reduce the risks for the combined stakeholders. The less stringent scenarios 1 and 2 produce the lowest risk as they do not require significant investments from public authorities and respect the status quo for all stakeholders.

However, the more stringent scenarios could pose a risk to private service providers. When public data is made available for free then they might experience price pressure on their services or even redundancy of sunk investments. Additionally, ITS Service Providers with an already established market share could perceive additional risks connected with new entrants to market on the back of the data being made available.

The more stringent scenarios also present greater risks to Member States and Road Operators due to the fact that the costs associated with making the necessary data available and supporting any EC interventions are likely to be borne by them. For this reason scenario 10, providing full road coverage, is considered more risky than the other scenarios.

The assessment of the scenarios against the Objectives for Priority Action B showed that none of the scenarios contributes in a negative way. The more stringent scenarios produce higher overall scores. Scenarios 9 to 11a contribute the most to the objectives because they mandate the collection and sharing of most types of data for either the comprehensive or extended road network.

The combined set of analyses provided the basis for the overall analysis, and resulting recommendations, presented in the final chapter of the document. Overall the quantitative and qualitative impact assessment showed that:
- Coverage of the roads of the comprehensive road network provide the highest benefit-cost ratio: IA6 and IA8.
- The less stringent scenarios IA2, IA3 and IA5 produce positive BCRs while requiring limited invested and thus generating limited risks.
- The most ambitious scenarios provide the highest compliance with the Priority B Objectives but their high deployment and operational costs lead to low BCRs and high risks.

7. Monitoring and Evaluation

To enable the effectiveness of the adoption of the specifications related to the availability of traffic management information, road data and other RTTI within the scope of Action B, it is necessary to propose and define a set of measurable indicators. These indicators will be used to identify the progress made in reaching the operational objectives.

7.1. Operational Objectives

The following draft operational objectives have been defined for each of the identified elements of the specifications that were considered in this study.

The exact selection of the operational objectives can only be made once the content of the specification for Action B is finalised and should be considered in the light of how they contribute to the overall policy objectives:-

- *The Governance Framework for the development of RTTI in Europe shall be established by the end of 20xx.*
- *The Common Reuse framework for RTTI is developed and published by the end of 20xx*
- *The European Commission shall work with the European Standardisation Organisations to ensure that the standards and specifications required for the dissemination, via DATEXII, of Traffic Management Information (e.g. active traffic management plans, VMS messages, official diversion routes) are in place by the end of 20xx*
- *The European Commission shall work with the European Standardisation Organisations to ensure that the standards and specifications required for the dissemination, via INSPIRE (TN-ITS), for updates to road data (geometry, link attributes) are in place by the end of 20xx*
- *The European Commission shall work with the European Standardisation Organisations to ensure that the standards and specifications required for the dissemination, via DATEXII, of RTTI (incident information, short term closures & diversions, roadworks) are in place by the end of 20xx*

- *By the end of 20xx in scope Traffic Management Information which are relevant to the CORE/COMPREHENSIVE TERN shall be published via the national DATEXII node by the relevant Road Operators*
- *By the end of 20xx in scope Road Data updates which are relevant to the CORE/COMPREHENSIVE TERN shall be published via the national INSPIRE infrastructure by the relevant Road Operators*
- *By the end of 20xx in scope RTTI which is relevant to the CORE/COMPREHENSIVE TERN, shall be published via the national DATEXII node by the relevant Road Operators.*

In order to fulfil the above operational objectives at EU level, these need to be translated into Operational Objectives that can be measured at the level of Member States as follows:-

- *Member States shall actively participate in the development of European RTTI Services in accordance with the requirements of the Governance Framework.*
- *Member States shall promote the use of the Common Reuse Framework for RTTI*
- *Member States shall adapt the national DATEXII nodes to provide Traffic Management Information Messages (TMI) and RTTI (incidents, short term closures and diversions, roadworks) in accordance with the commonly agreed specifications by the end of 20xx*
- *Member states shall adapt national INSPIRE infrastructure to provide Road Data update (geometry and link attributes) in accordance with the commonly agreed specifications by the end of 20xx*
- *Traffic Management Messages (TMI) which are relevant to the CORE/COMPREHENSIVE TERN in the Member State shall be published via the national DATEXII node by the end of 20xx*
- *Road Data updates which are relevant to the CORE/COMPREHENSIVE TERN in the Member State shall be published via the national INSPIRE infrastructure by the end of 20xx*

- *In scope RTTI which is relevant to the CORE/COMPREHENSIVE TERN in the Member State shall be published via the national DATEXII node by the end of 20xx*

Each Member State will be required to contribute to these objectives by:

Operational Objective 1
Actively participating in the development and promotion of European RTTI Services through active involvement and participation in the Governance Framework for the development of RTTI.

Operational Objective 2
Promotion of the common reuse framework for RTTI within the Member State and prescribing its use by Road Authorities when data is made available to ITS Service Providers.

Operational Objective 3
Adapting the National DATEXII node to ensure that can receive and provide Traffic Management Information and RTTI from Road Operators and publish them in accordance with the agreed specifications to ITS Service Providers.

Operational Objective 4
Adapting the National INSPIRE infrastructure to ensure that can receive and provide Road Data updates from Road Operators and publish them in accordance with the agreed specifications to ITS Service Providers.

Operational Objective 5
Working with the Road Operators of the CORE/COMPREHENSIVE TERN network within the country to ensure that by the end of 2015, Traffic Management Information is published electronically via the National DATEXII node and made available to ITS Service Providers in accordance with the common RTTI reuse rules.

Operational Objective 6
Working with the Road Operators of the CORE/COMPREHENSIVE TERN network within the country to ensure that by the end of 2015, Road Data updates are electronically via the National INSPIRE infrastructure and made available to ITS Service Providers in accordance with the common RTTI reuse rules

Operational Objective 7

Working with the Road Operators of the CORE/COMPREHENSIVE TERN network within the country to ensure that by the end of 2015, information relating to in scope RTTI are published electronically via the National DATEXII node and made available to ITS Service Providers in accordance with the common RTTI reuse rules.

7.2. Ex-post Monitoring Indicators

In order to monitor Member State's progression towards achieving the above operational objectives a number of potential indicators have been identified for each operational objective.

The exact selection of monitoring indicators will be dependent on the contents of the Specifications that are prepared under Action B of the ITS Directive

	Indicator	Contribution to operational objective	Achievability
Operational Objective 1 Actively participating in the development and promotion of European RTTI Services through active involvement and participation in the Governance Framework for the development of RTTI.	• List of organisations within the Member State actively participating in Governance framework	A high level indicator which provides in indication of the level of active involvement from the Member State in the Governance Framework for RTTI	List of participants
	• Annual Effort of Member State Participants in the Governance Framework activities	A high level indicator which will provide an indication of the commitment (investment) of organisations in the operation and development of the governance framework for RTTI	Declaration of efforts expended by participants or could be recorded centrally by the governance organisation itself
	• Level of Contribution to work items of the Governance Framework	A lower level indicator which highlights the areas of particular interest of Member States	Declaration of efforts expended by participants or could be recorded centrally by the governance organisation itself
Operational Objective 2 Promotion of the common reuse framework for RTTI within the Member State and prescribing its use by Road Authorities when data is made available to ITS Service Providers	• Number of Road Operators publishing data according common reuse framework	High level indicator which provides evidence of the level of adoption within Member States of the Common Reuse Framework	Simple list of Road Operators who's reuse policies comply with the common reuse framework
	• Number of data sets/feeds published according to common reuse framework	Indicator which provides an overview at the Member State level of the numbers of data sets whose access and reuse is in accordance with the common reuse framework	Simple list that can be compiled from Road Operator reports
	• Total number of active common reuse framework agreements in place	Indicator which will vary over time and indicate the number of users (ITS Service Providers) by Member State	This can either be collected from the Road Operators or via analysis of the subscribers to

	Indicator	Contribution to operational objective	Achievability
			updates from the national DATEXII and INSPIRE infrastructures
Operational Objective 3 Adapting the National DATEXII node to ensure that can receive and provide Traffic Management Information and RTTI from Road Operators and publish them in accordance with the agreed specifications to ITS Service Providers.	• Registry of DATEX II nodes within Member State	High level indicator which provides the identification of DATEXII nodes within the Member State that publish relevant information	Simple list of DATEX II nodes within the Member State
	• List of specifications supported by DATEX II node(s)	High level indicator which provides an overview of the DATEXII services that can be subscribed to in the Member State	Simple overview of the Traffic Management Information that are available via the DATEX II nodes
	• Number of organisations subscribing to received TMI, and RTTI data publications	Indicator which provides an overview of the level of usage by ITS Service Providers and other organisations of the published data	List of subscribers to relevant DATEX II feeds However it is recognised that if a data aggregator subscribes, then the MS are unlikely to know who the final users of that data are
Operational Objective 4 Adapting the National INSPIRE infrastructure to ensure that can receive and provide Road Data updates from Road	• Registry of INSPIRE infrastructure	High level indicator which provides the identification of INSPIRE infrastructure within the Member State that publish relevant information	List of Road Data update publishers in the national infrastructure
	• List of specifications supported national INSPIRE infrastructure	High level indicator which provides an overview of the Road Data updates that are published in the Member State	Simple overview of the Road Data updates that are available via the national infrastructure
	• Number of organisations	Indicator which provides an overview of the level of usage by ITS	List of subscribers to Road Data updates

	Indicator	Contribution to operational objective	Achievability
Operators and publish them in accordance with the agreed specifications to ITS Service Providers	receiving updates to Road Data via national INSPIRE infrastructure	Service Providers, Digital Map Providers and other organisations of the published data	However it is recognised that if a data aggregator subscribes, then the MS are unlikely to know who the final users of that data are
Operational Objective 5 Working with the Road Operators of the CORE/COMPREHENSIVE TERN network within the country to ensure that by the end of 2015, Traffic Management Information is published electronically via the National DATEXII node and made available to ITS Service Providers in accordance with the common RTTI reuse rules.	• Number of Road Operators publishing TMI via national node	Provides an overview of the number of Road Operators that publish TMI in the Member State	This indicator should be relatively straight forward for the Member State to establish from the number of publishers connected to the DATEX II node
	• % of motorway network covered by TMI	Indicator that provides an overview of the proportion of the motorway network for which TMI coverage is provided by Member State	This should be a relatively straight forward for the Member State to collate and report, where TMI is published by a Road Operator it is likely that 100% of its motorway network will covered.
	• % of primary / national road network covered by TMI provision	Indicator that provides an overview of the proportion of the Primary/National network for which TMI coverage is provided by Member State	This should be a relatively straight forward for the Member State to collate and report, where TMI is published by a Road Operator it is likely that 100% of its network will covered.
	• % of secondary road network covered by TMI	Indicator that provides an overview of the proportion of the Secondary network for which TMI coverage is provided by Member State	This will be challenging for Member States to report accurately as it is unlikely that TMI will

	Indicator	Contribution to operational objective	Achievability
			be provided for the whole of the secondary networkby Road Operators
	• Number of published TMPs available	Indicator that provides an indication of the volume of Traffic Management Plans that available to ITS Service Providers within a Member State	Dependent on how this is organised in the Member State this can be relatively straight forward to collate and should be reported by the Road Operators
	• Annual total of activated TMPS	Indicator that provides an overview of the level of traffic management plan activations within a Member State.	This can be reported by the Road Operators or determined via the number of TMP activation Status messages sent via the DATEX II node
	• Number of VMS locations where messages are published via DATEX II	An indicator which over time will show whether Road Authorities are expanding or reducing VMS usage as a mechanism for Traffic Management.	This should be a relatively straight forward indicator for Road Operators to report
	• Annual total of incidents which resulted in publication of TMI	Indicator which quantifies the number of incidents for which Traffic Management Information was published, this can be used to estimate the reduction in travel delay as a result of the Action B Specification.	This will be a challenging indicator to quantify and will require Road Operators to report this to enable collation at Member State Level
	• Annual total of published VMS messages via DATEX II	Indicator which provides an indication of the total number of Traffic Management Messages displayed via VMS in a Member State	This can be reported by the Road Operators or determined via a simple counter in the DATEX II node which is incremented each time a VMS Publication message is broadcast

	Indicator	Contribution to operational objective	Achievability
Operational Objective 6 Working with the Road Operators of the CORE/COMPREHENSIVE TERN network within the country to ensure that by the end of 2015, Road Data updates are electronically via the National INSPIRE infrastructure and made available to ITS Service Providers in accordance with the common RTTI reuse rules	• Number of Road Operators publishing Road Data Updates via national INSPIRE Infrastructure	Provides an overview of the number of Road Operators that publish Road Data updates in the Member State	This indicator should be relatively straight forward for the Member State to establish from the number of publishers connected to the INSPIRE Infrastructure
	• % of motorway network covered by Road Data Updates	Indicator that provides an overview of the proportion of the motorway network for which Road Data updates are provided by Member State	This should be a relatively straight forward for the Member State to collate and report, where Road Data updates is published by a Road Operator it is likely that 100% of its motorway network will covered.
	• % of primary / national road network covered by Road Data Updates provision	Indicator that provides an overview of the proportion of the Primary/National network for which Road Data updates are provided by Member State	This should be a relatively straight forward for the Member State to collate and report, where Road Data updates are published by a Road Operator it is likely that 100% of its network will covered.
	• % of secondary road network covered by Road Data updates	Indicator that provides an overview of the proportion of the Secondary network for which Road Data updates are provided by Member State	This should be a relatively straight forward for the Member State to collate and report, where Road Data updates are published by a Road Operator it is likely that 100% of its network will covered

	Indicator	Contribution to operational objective	Achievability
	• Total Number of Geometry Updates per year	Indicator which provides a quantification of the number of road geometry updates per year that are published in each Member State. Can be used to estimate the cost saving associated with providing this information	This is a relatively simple indicator to quantify and can be implemented in a simple counter in the INSPIRE Infrastructure which is incremented each time a relevant road geometry update is sent
	• Total number of Road link updates by attribute type	Detailed indicator which will quantify the level of updates to Road Link attributes by attribute type. e.g. speed limits,..	This is a relatively simple indicator to quantify and can be implemented in a simple counter in the INSPIRE Infrastructure which is incremented each time a relevant road geometry update is sent
Operational Objective 7 Working with the Road Operators of the CORE/COMPREHENSIVE TERN network within the country to ensure that by the end of 2015, information relating to in scope RTTI are published	• Number of Road Operators publishing RTTI via national node	Provides an overview of the number of Road Operators that publish RTTI via the DATEX II in the Member State	This indicator should be relatively straight forward for the Member State to establish from the number of publishers connected to the DATEX II node
	• % of motorway network covered by RTTI	Indicator that provides an overview of the proportion of the motorway network for which RTTI coverage is provided by Member State	This should be a relatively straight forward for the Member State to collate and report, where RTTI is published by a Road Operator it is likely that 100% of its motorway network will covered.

	Indicator	Contribution to operational objective	Achievability
electronically via the National DATEXII node and made available to ITS Service Providers in accordance with the common RTTI reuse rules.	• % of primary / national road network covered by RTTI provision	Indicator that provides an overview of the proportion of the Primary/National network for which RTTI coverage is provided by Member State	This should be a relatively straight forward for the Member State to collate and report, where RTTI is published by a Road Operator it is likely that 100% of its network will covered.
	• % of secondary road network covered by RTTI	Indicator that provides an overview of the proportion of the Secondary network for which RTTI coverage is provided by Member State	This will be challenging for Member States to report accurately as it is unlikely that RTTI will be available for all secondary roads managed by Road Operators
	• Total number of RTTI messages published via DATEX II node per year	Indicator which provides a quantification of the number of RTTI messages per year that are published in each Member State.	This is a relatively simple indicator to quantify and can be implemented in a simple counter in the DATEX II nodes which is incremented each time a relevant RTTI message is sent

Table 14   List of potential indicators to monitor and evaluate the implementation of Action B Specifications.

7.3. Monitoring Means

There are a number of alternatives for monitoring the above indicators and for some indicators it may be more efficient to monitor the indicators centrally rather than for each Member State to establish a separate reporting function.

7.3.1. MEMBER STATE REPORTING

Typically Member States are required to report annually on progress towards the achievement with the specifications prepared under the ITS Directive. It is recommended that the following indicators (if taken forward within the specification) are reported annually by Member States to the European Commission:-

- Number of Road Operators publishing data according common reuse framework
- Number of data sets/feeds published according to common reuse framework
- Total number of active common reuse framework agreements in place
- Registry of DATEX II nodes within Member State
- List of specifications supported by DATEX II node(s)
- Number of organisations subscribing to received TMI, and RTTI data publications
- Registry of INSPIRE infrastructure
- List of specifications supported national INSPIRE infrastructure
- Number of organisations receiving updates to Road Data via national INSPIRE infrastructure
- % of motorway network covered by TMI
- % of primary / national road network covered by TMI provision
- % of secondary road network covered by TMI
- Number of VMS locations where messages are published via DATEX II
- % of motorway network covered by Road Data Updates
- % of primary / national road network covered by Road Data Updates provision
- % of secondary road network covered by Road Data updates
- % of motorway network covered by RTTI
- % of primary / national road network covered by RTTI provision
- % of secondary road network covered by RTTI

7.3.2. GOVERNANCE BODY MONITORING

Through the day to day operation of the Governance Body, it will be able to centrally determine a number of the proposed indicators for all Member States and it is recommended that it be the responsibility of the Governing body to compile and report the following indicators at least on an annual basis

- List of organisations within the Member State actively participating in Governance Framework
- Annual Effort of Member State Participants in the Governance Framework activities
- Level of Contribution to work items of the Governance Framework by Member State

7.3.3. 3RD PARTY REPORTING

A number of the proposed indicators can be determined from the analysis of the messages that are published via the national DATEX II and INSPIRE infrastructure, for reasons of efficiency it is proposed that this is conducted by a single independent organisation on behalf of the Member States and ITS Service Providers.

It is recommended that the following indicators could be compiled almost automatically on a monthly or quarterly basis, simply by subscribing to the available infrastructure in each of the Member States:-

- Number of Road Operators publishing TMI via national node
- Number of Road Operators publishing Road Data Updates via national INSPIRE Infrastructure
- Number of Road Operators publishing RTTI via national node
- Number of published TMPs available
- Annual total of activated TMPS
- Annual total of incidents which resulted in publication of TMI
- Annual total of published VMS messages via DATEX II
- Total Number of Geometry Updates per year
- Total number of Road link updates by attribute type
- Total number of RTTI messages published via DATEX II node per year

8. Findings, Conclusions and Recommendations

This final chapter of the report provides an overall analysis of the findings of the study. It also presents conclusions and recommendations for the EC per challenge.

Technological innovations have fundamentally changed the real-time traffic information (RTTI) services landscape. New technologies have created new ways of collecting more and more road and traffic data, at decreasing costs. For example, floating vehicle and floating cellular data and Bluetooth and Wifi-tracking. Big data analytics have enabled the cost efficient processing and enrichment of available data. And technological developments have introduced new services platforms such as smartphones and personal navigation devices (PNDs).

The desk research showed that this trend is likely to continue in the coming decade as new technologies will enter the market that too can cause a paradigm shift in the way road and traffic data is collected, processed and distributed to end-users. Technology that connect vehicles to the Internet (the *Connected Car*), to each other and roadside equipment (*Cooperative Technology*) for example, are expected to lead to a significant increase in available RTTI data at much lower costs.

Technological developments also lead to different road and traffic data needs. As more and more driving tasks are automated, the need for human-comprehensible traffic information (e.g. incident and traffic jam reports) will decrease and the demand for machine-readable road and traffic data will increase. Because machines can process more data much faster than humans, the demand will shift to high-volume, accurate road and traffic data that is much more accurate and updated much more frequently. Automated vehicles will in particular require RTTI that will allow them to look past the range of their sensors and their cooperative range, providing them with forward awareness of potential traffic build-up (forecasts) and potentially dangerous traffic situations downstream (accidents, dangerous driving conditions, etc.).

The new data and services platforms in potential can provide road authorities with powerful means to manage traffic on their road more efficiently and more effectively.

Roles in the RTTI value chain will likely change in the coming years. Private traffic information service providers are well-positioned to develop the new

traffic information services, as they have the technology (e.g. forecasting) to process the volumes of new traffic data and develop profitable business models. Public authorities will however retain a key role in assuring societal interests in the RTTI value chain. How the new technology, the RTTI markets and the roles in the value chain will develop is difficult to predict. What does seem clear is that changes will occur and that a both public and private organisations will have a role to play. Establishing a forum where public and private stakeholders in road data and traffic information find a platform to regularly discuss technical, organisational and legal issues would allow for the gradual incorporation of new technologies, development of new cooperation models, coordinated development of new data coding, location coding and quality standards, etc.

Considering that different parties are involved in the collection of road versus traffic and traffic management information, a practical way forward would be to establish two governance platforms; one for road data, and one for traffic and traffic management information. The first could be the TN-ITS platform, the second could be set up in cooperation with TISA.

This Governing Body would provide a forum where Member States, Road Operators, ITS Service Providers and Users can discuss and agree the scope and direction of any Pan-European Traffic Information Services, enabling the more rapid development of coordinated RTTI services which meet the requirements of both Users and Road Operators. The forums should be open to public and private organisations and should encourage newcomers (SMEs) to join.

It is expected that the introduction of such a Governance Framework, would accelerate deployment and market development by bringing together the actors required to agree and coordinate the delivery of services which meet the compatible goals of the actors involved.

Recommendation 1 – Establish a forum where public and private stakeholders in the **road data** find a platform to regularly discuss technical, organisational and legal issues concerning the development of **digital roadmap data** in Europe. The forum should be open to public and private organisations and should encourage newcomers to join.

Recommendation 2 – Establish a forum where public and private stakeholders in the **traffic information and traffic management information** find a platform to regularly discuss technical, organisational and legal issues concerning the development of **RTTI services** in Europe.

The forum should be open to public and private organisations and should encourage newcomers to join.

Public authorities collect road and traffic data for various purposes: e.g. for traffic management and for public RTTI services. Over the past decade private companies have developed business cases collecting and processing road data, and providing RTTI services.

The impact assessment showed that significant benefits to road safety and congestion reduction can be achieved against limited investments by mandating the deployment of Traffic Management Information and Road Data updates on the Core and Comprehensive Trans-European Road Network (TERN).

In addition to the quantified impact there are also important additional impacts that should be taken into consideration. Respondents of the online survey for example believed that RTTI can have high impacts on both road safety and road user satisfaction.

Recommendation 3 – Public road authorities make existing road data available for the Core and Comprehensive TERN.

Responses to the online survey showed broad support for actions by the EC to ensure and foster the provision of EU-wide RTTI.

Private companies indicated in the small group discussions and workshop, that public road authorities should support the business cases of private companies rather than compete with them, stating that there is a significant saving potential for Road Authorities withdrawing to a certain extent from RTTI. Public authorities too expressed their concern about potential interference of the RTTI market, and about possibly too stringent investment requirements for the public sector.

Public authorities should therefore continuously evaluate their role in the RTTI value chain, and in general should concentrate on collecting the data, and providing the services that provide direct societal benefits to citizens, without hampering the RTTI market development. Because the level of development of the RTTI market varies between Member States, a generic rule should be adopted that can be used regardless of the market conditions.

Recommendation 4 – Require road authorities to collect RTTI data that is not available from private companies (at the required quality level), and that

is critical to road safety and traffic management for the Core and Comprehensive TERN.

Based on the Public Sector Information (PSI) Directive, public authorities already are obliged to make data they collect available. This also applies to all road data, traffic information and traffic management information. These data should be made available in machine-readable formats to all service providers under the same conditions and without restrictions on the use- and re-use of the data.

Recommendation 5 – Require public authorities to make the road data, traffic information and traffic management information they already collect available to private companies as *open data*, i.e. without specific use- and re-use conditions.

Private companies collect more and more data. Until now most safety-related traffic information (SRTI) was collected by public authorities. The advent of cooperative technology and connected cars will likely change this situation. It is expected that car manufacturers, their suppliers or service providers will obtain more and more SRTI, for example from the CAN bus or through messages from cooperative vehicles. Because this information is relevant for the imminent safety of other road users as well, this information should be shared with road operators and other service providers.

Recommendation 6 – Privately held traffic data that is relevant to road safety should be made available to road operators and other service providers as described in the Specifications for Action C.

Road Operators in general are concerned that if they publish road network data it will take too much time for the end-user to receive map updates in their satnav. The provision of notifications of changes to the road network would be of interest to Digital Map Providers to help streamline and optimise the road network survey processes

Recommendation 7 - Encourage the forums to establish Memorandums of Understanding (MoUs) between road authorities and digital map providers: road operators commit to regularly update and publish their road data, digital map providers commit to the timely publication of road map changes in their end-user products.

Traffic management information is in general poorly developed and not available to service providers. In addition there is reluctance from Traffic Managers to share such information with ITS Service Providers as they are

concerned the information might be used to recommend routes that are in the interest of the individual driver but not in the public interest. Service providers however would like to receive this information to better guide their customers away from congestion and incidents. Various trials have proven that it is possible to develop a cooperation model that serves both needs. Key to the solution is that traffic management information is classified (informative, recommended, mandatory) and that service providers present the information as such to their customers.

Recommendation 8 - Encourage the forums to establish MoUs between road authorities and service providers: road operators commit to publishing traffic management information, service providers commit to timely publication of traffic management information, leaving the choice whether to abide to the information, recommendations or instructions from the road authorities, to the end-user.

Data privacy and service liability will become key issues for data originating from vehicles and communities.

Recommendation 9 - The EC should encourage harmonisation of access conditions for data originating from the car, drivers and passengers, by requesting the industry to drafts guidelines and submit them to Working Party Article 29 (i.e. the joint European data protection authorities).

Making RTTI data findable and accessible can be done by bringing it together in a central RTTI node, or by providing a registry of RTTI data sources. Because the volume of available privately and publicly held RTTI data is expected to increase dramatically a central node processing all data might no longer be a practical solution.

Recommendation 10 – Request Member States to establish a central registry that allows public and private RTTI providers to make their data findable.

Broad adoption of RTTI standards can lower deployment and operational costs for public and private organisations, and can provide a stimulus to data exchange by lowering the interfacing costs.

For road data a common data collection, coding and data sharing method is being developed (TN-ITS). For RTTI and SRTI various data coding methods exist that are already widely used by most road authorities and private service providers, notably DATEX II, TMC and TPEG. Most traffic

management information can be coded in DATEX II, although extensions are required to code specific data types.

Considering the rapid development of RTTI technology and the relatively slow pace of the legislative process there too is a risk that innovation is hampered if standards that meet the current needs are mandated for years to come. A sensible approach seems to recommend established standards and promote standardisation for new technologies.

Recommendation 11 – Specifications should recommend established RTTI standards without mandating them. For the encoding of traffic information and traffic management information DATEX II should be recommended for data exchange between road authorities and service providers. For road data the TN-ITS specifications should be adopted.

Recommendation 12 – Encourage the development of new technologies for the collection of road and traffic information data, the exchange of road data, traffic information and traffic management information, and the subsequent standardisation of the protocols and methods through ISO and CEN, or publication under a GNU license.

Although there is broad consensus among stakeholders that quality management of RTTI is important this is an underdeveloped aspect of the RTTI value chain. Proven methods to measure, monitor and manage RTTI quality are missing and practical experience in applying them is limited, in particular in the public sector.

Recommendation 13 – Stimulate the development and deployment of methods for the measurement, monitoring and validation of road data, traffic information and traffic management information, including the up-stream exchange of data for validation purposes.

Monitoring of the operational objectives can be achieved through a combination of Member State and 3rd Party reporting, and monitoring by the Governance Bodies.

Recommendation 14 – Establish a monitoring system based on Member State and 3rd Party reporting, and monitoring of indicators by the Governance Bodies.

- End of main document -

List of Acronyms

CAM	Cooperative Awareness Message
CEN	European Committee for Standardization
DAB	Digital Audio Broadcasting
DENM	Decentralised Environmental Notification Message
DMB	Digital Multimedia Broadcast
EC	European Commission
ETSI	European Telecommunications Standards Institute
EU	European Union
FM	Frequency Modulation
FCD	Floating car data
FVD	Floating vehicle data
I2V	Infrastructure-to-Vehicle Communication
IP	Internet Protocol
ISO	International Organisation for Standardization
ITS	Intelligent Transport Systems
MMS	Multimedia Messaging Service
MoU	Memorandum of Understanding
MS	Member State
OCA	Open traffic systems City Association
OCIT	Open Communication Interface for road Traffic control systems
OTAP	Open Travel data Access Protocol
OTS	Open Traffic Systems
PPP	Public Private Partnership
PSI	Public Sector Information
R&D	Research and Development
RDS	Radio Data System
RTTI	Real Time Traffic Information
SME	Small and Medium Sized Entreprises
SMS	Short Message Service
SRTI	Safety-related traffic information
SWOT	Strengths, Weaknesses, Opportunities, Threats
TERN	Trans-European Road Network
TIC	Traffic Information Centre
TMC	Traffic Message Channel
TMP	Traffic management plan
TPEG	Transport Protocol Experts Group
UTMC	Urban Traffic Management and Control
V2I	Vehicle-to-Infrastructure Communication
V2V	Vehicle-to-Vehicle Communication

V2X	Refers to either V2V, V2I or I2V
VHF	Very High Frequency
VMS	Variable Message Signs

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[33]	A new public-private model for creating a national database of local roadworks	Elgin	2013
[34]	Speed limit change budget estimate	Transport for Buckinghamshire	2012
[35]	Strategic Review of Travel Information Research	University of West England	2007
[36]	Travel Time Advantages By Dynamic Route Guidance In Germany: Status Quo And Improvement Potential	AET	2006
[37]	D3 – Intermediate Report. Action B - EU-wide real-time traffic information services.	Rapp Trans	Feb 2014
[38]	[TISA Position Paper]		
[39]	ITS Action Plan - D8 – Final Report - Study Regarding Guaranteed Access To Traffic And Travel Data And Free Provision Of Universal Traffic Information	Tom van de Ven, Mark Wedlock	09-03-2011

Annex A – Management Section

This Annex presents the contractor's view on the achievements of the study, and the execution of the project.

Achievement of Study Objectives

The Terms of Reference of the study described study objectives and aims. The table below describes per objective and aim the achievements of the Study Team.

	Objective / aim	Achievements
Study objectives	To identify the issues that need to be tackled (this can be illustrated in the form of a problem tree, diagram, table...), to define the level of detail that needs to be achieved including gaps to be covered, and to support analysis and definition of measures to be translated in clear rules & specifications;	A step-wise analysis was carried out in the development of the Research Model. This model identified issues and topics, their preconditions, enablers, barriers, potential actions and remedies, and the possible or preferred domains of action. It also elaborated possible EC Action per combination of topics - data types.
	To analyse the impact of proposed measures including estimates on costs and benefits, and to fuel consensus building with key stakeholders in this;	For the impact assessment, the Study Team built a range of scenarios with varying EC actions. The costs and potential effects of the scenarios on road safety and congestion were assessed through an elaborate quantitative analysis. Economic, social and environmental impacts were assessed using a structured, step-by-step qualitative assessment method.
	To support as and when necessary the Commission in its task of drafting of specifications for priority action (b) e.g. logistics support. This action shall consider existing standards and technologies, and shall	The Study Team developed a Vision Document in the early stages of the study to support the EC in the development of ideas for the Specifications. During the study the Study Team provided insight and expert knowledge to

	address the organisational, technical, legal and service provision-related aspects that would be required to ensure the compatibility, interoperability and continuity of the service from a EU-wide perspective;	the EC during meetings and conference calls.
	To support and assist the Commission in the preparation of a qualified Impact Assessment for priority action (b) (including the complements required for action (c)) of the ITS Directive, by means of qualitative and quantitative analysis of impacts for the various fields and elements identified (this action is to build on the preparative work for action (c) undertaken in 2012). This also includes the possible fine tuning of policy options;	The Impact Assessment method and tools the Study Team developed for the study can be reused by the EC.
	To investigate, analyse and recommend (additional) actions on a European scale to have the requested level playing field for EU-wide real-time traffic information services realised.	Chapter **Error! Reference source not found.** presents the findings and conclusions of the Study. It also provides the EC with a concise and clear set of recommendations of the Study Team on the further development of the RTTI services market in the EU.
Study aims	Identifying, assessing and documenting the precise issues and elements to be tackled (action (b));	The Research Model identified issues and topics, their preconditions, enablers, barriers, potential actions and remedies, and the possible or preferred domains of action.
	Providing quantitative and qualitative research and analysis to support and demonstrate the problem definition established	The tool the Study Team developed for the impact assessment is available to the EC. It contains all the base data,

by the Commission;	assumptions and formulas used in the quantitative impact assessment.	
Measuring the potential economic, social and environmental consequences of the various policy options described above;	The qualitative impact assessment is described in detail in deliverable D3, the Intermediate Report.	
Consulting the various stakeholders on the envisaged options;	Stakeholders were consulted through 3 *small group discussions*, a workshop, and an online survey. The results are described in details in deliverables D21, D22 and D23.	
Proposing operational objectives supporting the implementation of the policy options and their long term evaluation.	The operational objectives were developed in the final phase of the study and are included in chapter 7 of this report.	

Deliverables

The table below provides an overview of the planned and produced deliverables.

Nr	Title	Status
D0	Inception Report	Delivered 26 Feb 2013
D1	Desk Study Results	Delivered 20 May 2013
D21	Small Group Discussion - Provision Of Eu-Wide Real-Time Traffic Information Services – • Public Authorities • Commercial Actors • Quality & Technological Evolution	Delivered as three separate reports on 24 Jun 2013
D22	Workshop Minutes	Delivered 28 Jun 2013
D23	Questionnaire Results	Delivered 26 mar 2014
D3	Intermediate Report	Delivered 27 mar 2014
D4	Comparison of options	Integrated into D5
D5	Final Report	This report

Expected vs. carried out work, use of resources

Extra work was carried out in the early stages of the project (in particular the elaboration of EC Actions in the Research Model, and the development

of the Vision). After summer 2013 the project was put on hold for external reasons, and then restarted after the contract was extended. This pause and restarting the work required an additional effort by the Study Team. During the impact assessment phase, adjustments of the scenarios and elaboration of specific steps of the assessment led to additional work but this was anticipated in the budget based on the experience in previous studies. Overall the hour budget was exceeded but not significantly as was the case in previous studies.

Annex B - Presentation

B.1 – Study objectives and key questions

B.2 – Methodology

B.3 – Conclusions and recommendations

Annex C – Details of Economic Impact Assessment

C.1 Model Assumptions

COST ELEMENTS

1. Cost of establishment and operation of Governance Framework for all stakeholders – assumed to be a fixed annual cost per Member State and Governance Framework participant
2. Costs for development and agreement of the Common Reuse Framework for RTTI – assumed to be a single fixed cost
3. Costs for development of Traffic Management Information DATEXII profile specification – assumed to be a single fixed cost equivalent to a CEN Project Team to fast track the drafting of the profile
4. Costs for development of Road Data INSPIRE Specifications – assumed to be a single fixed cost equivalent to a CEN Project Team to fast track the drafting of the profile
5. Costs for the development of RTTI (Roadworks, Incident Information) DATEXII profile specification – assumed to be a single fixed cost equivalent to a CEN Project Team to fast track the drafting of the profile
6. Costs associated with adaptation of National SRTI DATEXII nodes – assumed to be a single fixed cost of €50k per Member State per additional profile supported (TMI, Roadworks, Incidents)
7. Cost associated with adaptation of national INSPIRE infrastructure – assumed to be a single fixed cost of €50k per Member State per additional profile supported (TMI, Roadworks, Incidents)
8. Costs (implementation & 10 year operation) for Road operators (including city nodes) to publish TMI via DATEXII – assumed to include an annual cost for the information provision infrastructure via a DATEXII publisher – no additional administrative costs
9. Costs (implementation and operation) to provide Road Data (Geometry Changes, Link attributes) via INSPIRE infrastructure – assumes a fixed cost per update, number of updates is proportional to network length
10. Costs associated with provision of RTT data by Road Operators – no additional costs above provision of TMI information
11. Costs (implementation and operation) of National roadwork databases – assumes a fixed implementation and annual operational cost per Member State plus additional administrative costs to provide roadwork updates including a fixed cost per update of €15 with the number of roadworks dependent on network length.

COST ELEMENTS BY STAKEHOLDER GROUP

The following sections provide an overview of the cost elements by Stakeholder group which are used in the calculation of costs for each of the scenarios depending on the elements required and the required geographic coverage.

GOVERNANCE BODY COSTS
- Annual Operational cost for the Governance Body - €521,000
- Cost to accelerate standardised DATEXII profile for Traffic Management - €50,000
- Cost for accelerating the development of full data specifications (TMP, VMS, network extensions, speed limit updates, Roadworks) - €300,000
- Cost for development of Common Reuse Framework - €100,000

MEMBER STATES
- Annual participation costs in Governance Framework - €20,000
- National DATEXII node modification (VMS & TMP) - €50,000
- National DATEXII node modification (Roadworks) - €50,000
- National INSPIRE infrastructure modification (Network Extensions) - €100,000
- National INSPIRE infrastructure modification (Speed Limit updates) - €100,000

NATIONAL ROAD AUTHORITIES
- Annual cost of messaging middleware to publish information to national DATEXII node - €15,900
- Roadworks Database implementation cost - €1,200,000
- Roadworks Database annual operational cost - €840,000
- Cost of providing Traffic Management Messages – no additional costs
- Cost of providing information on Road Network extensions – no additional costs as already required by INSIPIRE Directive
- Cost of providing information on Speed Limits updates – variable dependent on network length and frequency of speed limit changes, fixed cost of €15 per individual update
- Cost of providing information on roadworks – variable dependent on network length and frequency of roadworks on network, fixed cost of €15 per individual update

OTHER ROAD AUTHORITIES (INCLUDING CORE AND COMPREHENSIVE TERN NODES)

- DATEXII Publisher instance (conversion of electronic data to DATEXII format) - €50,000
- Annual cost of messaging middleware to publish information to national DATEXII node - €15,900
- Annual subscription to use national roadworks database electronic interface - €10,000
- Cost of providing Traffic Management Messages – no additional costs
- Cost of providing information on Road Network extensions – no additional costs as already required by INSIPIRE Directive
- Cost of providing information on Speed Limits updates – variable dependent on network length and frequency of speed limit changes, fixed cost of €15 per individual update
- Cost of providing information on roadworks – variable dependent on network length and frequency of roadworks on network, fixed cost of €15 per individual update

ITS SERVICE PROVIDERS

- Annual participation costs in Governance Framework - €10,000
- DATEXII interface (for those who have yet to implement for SRTI) - €50,000
- INSPIRE webservices interface (for those who have not already implemented) - €50,000

BENEFIT ELEMENTS

1. Accelerated provision of information about Traffic Management information for Incidents via DATEX II by Road Operators
   In the baseline scenario there is an assumption about the proportion of the network for which information is voluntarily provided by Road Operators, in scenarios where there is accelerated provision, the benefit is calculated for the increased network coverage for each year of the study period based on an average incident rate and routing diversion rates to give a reduction in travel delay hours through optimised routing.

2. Accelerated provision of information about location of other RTT Data via DATEX II by Road Operators

In the baseline scenario there is an assumption about the proportion of the network for which information is voluntarily provided by Road Operators, in scenarios where there is accelerated provision, the benefit is calculated for the increased network coverage for each year of the study period based on an average incident rate and routing diversion rates to give a reduction in travel delay hours through optimised routing.

3. More efficient routing for equipped Users network due to provision of Traffic Management Information via DATEXII including areas of the network where there is no VMS
   This is calculated per Member State based on Network Length, Accident Rate, proportion of network covered via VMS, proportion of equipped vehicles, VMS and in-vehicle diversion rates to give a reduction in travel delay hours through optimised routing

4. More efficient routing for Users due to provision of RTTI (Incident info, short term closures, roadworks) via DATEXII from 2015
   This is calculated per Member State based on Network Length, Accident Rate, proportion of network covered via VMS, proportion of equipped vehicles, VMS and in-vehicle diversion rates to give a reduction in travel delay hours through optimised routing

5. Reduced costs for Digital Map Providers and ITS Service Providers due to more efficient Road Network surveys.
   This is calculated per Digital Map Provider in terms of a reduced Network Survey costs per Member State, based on rate of change of network in each Member State, plus an annual number of speed limit changes based on network length

C.2 IA Scenarios 1 to 4 - Governance Framework, Rules and Specification Development

The first set of possible interventions (Scenarios 1 to 4) consist of voluntary measures, with a proposed governance framework, rules for the re-use of data, and data coverage specifications. This first group of scenarios do not include any minimum deployment coverage requirements.

Table 15 provides a detailed summary of the costs and benefits for scenarios 1-4 for the period of 2015-2025. It should be noted that the costs and benefits shown in the table below are those that could be achieved beyond the baseline.

	1	2	3	4
Accrued Benefits 2015 - 2025 (EU27)				
Traffic Management Incidents	€ 130,498,797	€ 138,175,197	€ 167,784,168	€ 167,784,168
Map Updates	€ -	€ -	€ -	€ -
Roadworks info	€ -	€ 182,619,792	€ 182,619,792	€ 219,143,751
Speed limit changes	€ -	€ -	€ -	€ -
Total Benefit (EU27)	€ 130,498,797	€ 320,794,989	€ 350,403,960	€ 386,927,918
Accrued Costs 2015 - 2025				
Governance Framework	€ 15,610,000	€ 15,610,000	€ 15,610,000	€ 15,610,000
Re use Rules	€ -	€ 100,000	€ 100,000	€ 100,000
Minimum Data Specifications	€ -	€ -	€ 50,000	€ -
Extended Data Specification	€ -	€ -	€ -	€ 300,000
Messaging Middleware costs	€ 879,120	€ 879,120	€ 1,054,944	€ 1,054,944
DATEX II publisher	€ 2,750,000	€ 2,750,000	€ 3,300,000	€ 3,300,000
DATEXII Node modification for Provision of TM and VMS	€ 2,750,000	€ 2,750,000	€ 3,300,000	€ 3,300,000
INSPIRE Node modification for Network Changes	€ -	€ -	€ -	€ -
INSPIRE node modification for Speed limit changes	€ -	€ -	€ -	€ -
National Roadworks database (implementation & operation)	€ 58,200,000	€ 58,200,000	€ 58,200,000	€ 64,440,000
Licence to use National roadworks database	€ -	€ -	€ -	€ -
Provide Traffic management information	€ -	€ -	€ -	€ -
Populate Roadworks database costs	€ -	€ 43,715,300	€ 43,715,300	€ 52,458,359
Enter network updates to INSPIRE Node	€ -	€ -	€ -	€ -
Enter Speed Limit changes to INSPIRE Node	€ -	€ -	€ -	€ -
Total Costs (EU27)	€ 80,189,120	€ 124,004,420	€ 125,330,244	€ 140,563,303
Net Benefit	€ 50,309,677	€ 196,790,570	€ 225,073,716	€ 246,364,615
BCR	1.63	2.59	2.80	2.75

Table 15 Detailed IA Summary Scenarios 1-4

SCENARIO 1 ANALYSIS SUMMARY

Scenario 1 deviates from the baseline scenario, by involving the preparation of a governance framework.

The benefits illustrated in Table 15 for Scenario 1 relate to the savings that could be anticipated on the basis of a governance framework speeding up the rate of deployment of services by 1 year.

The cost section for Scenario 1 includes the cost for each MS that does not already publish incident/roadworks data via DATEX II. Additionally, the cost of implementing and operating a National Roadworks Database is included on the basis of 1 new MS implementing a National Roadworks Database each year for 2015-2025.

Scenario 1 results in a Benefit: Cost Ratio (BCR) of 1.63.

SCENARIO 2 ANALYSIS SUMMARY

Scenario 2 consists of the costs from Scenario 1 and builds on it by including costs for the preparation of rules relating to the re-use of the necessary data.
We have assumed that the introduction of the Common Reuse framework will speed up the voluntary provision of Roadworks and Traffic Management messages on the network, therefore there is additional costs above the baseline for the provision of the information. Additionally, Scenario 2

includes a cost for populating the National Roadworks database by the National Road Authority (the cost is calculated on the basis of the network length, multiplied by the cost of entering the roadwork details (€15 per roadwork)).

The benefits for Scenario 2 include the savings derived from providing users with diversion information relating to delays caused by roadworks and incidents on the network via DATEXII [4] according the length of the network covered .

Scenario 2 results in a BCR of 2.59.

SCENARIO 3 ANALYSIS SUMMARY

Scenario 3 builds on Scenario 2 by including the costs for the preparation of minimum data specification for the extension of a DATEX II profile to exchange the TMP data.

By providing the minimum data specification it is assumed that it would accelerate the number of MS providing the necessary messages, from 1 extra MS (as assumed in Scenario 1 and 2) from 2016-2025, to 2 extra MS per year from 2020 (and 1 extra per year from 2016-2019). The same level of deployment acceleration is assumed for the cost of providing the suitable DATEX II node and publisher.

The benefits for Scenario 3 is projected to be larger than Scenario 2 for the provision of diversion information relating to delays caused by incidents. This is due to the accelerated provision of traffic management messages relative to Scenarios 1 and 2.

Scenario 3 results in a BCR of 2.80.

SCENARIO 4 ANALYSIS SUMMARY

Scenario 4 builds on Scenario 3 by replacing the costs for the preparation of the minimum data specification for the extension of a DATEX II profile to exchange the TMP data, with the cost of preparing the extended data specification for TMP data plus roadworks data.

Scenario 4 results in a BCR of 2.75.

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[4] http://www2.liikennevirasto.fi/ew/ew-dtx-dg01_datexii_01-02-00.pdf

C.3 IA Scenarios 5 and 6 – mandating the availability of the minimum data content

The second set of possible interventions (Scenarios 5 to 6) build on Scenario 3 by including specifications on the minimum data content that would need to be made available for the Core and Comprehensive road networks.

Table 16 provides a detailed summary of the costs and benefits for scenarios 5-6 for the period of 2015-2025. It should be noted that the costs and benefits shown in the table below are those that could be achieved beyond the baseline.

		5		5a		6
Accrued Benefits 2015 - 2025						
Traffic Management Incidents	€	176,413,463	€	176,413,463	€	2,112,336,521
Map Updates	€	-	€	-	€	-
Roadworks info	€	182,619,792	€	182,619,792	€	182,619,792
Speed limit changes	€	-	€	-	€	-
Total Benefit (EU27)	€	359,033,255	€	359,033,255	€	2,294,956,313
Accrued Costs 2015 - 2025						
Governance Framework	€	15,610,000	€	15,610,000	€	15,610,000
Re use Rules	€	100,000	€	100,000	€	100,000
Minimum Data Specifications	€	50,000	€	50,000	€	50,000
Extended Data Specification	€	-	€	-	€	-
Messaging Middleware costs	€	40,439,520	€	4,315,680	€	133,786,080
DATEX II publisher	€	11,300,000	€	-	€	40,500,000
DATEXII Node modification for Provision of TM and VMS	€	1,350,000	€	1,350,000	€	1,350,000
INSPIRE Node modification for Network Changes	€	-	€	-	€	-
INSPIRE node modification for Speed limit changes	€	-	€	-	€	-
National Roadworks database (implementation & operation)	€	58,200,000	€	58,200,000	€	58,200,000
Licence to use National roadworks database	€	-	€	-	€	-
Provide Traffic management information	€	-	€	-	€	-
Populate Roadworks database costs	€	43,715,300	€	43,715,300	€	43,715,300
Enter network updates to INSPIRE Node	€	-	€	-	€	-
Enter Speed Limit changes to INSPIRE Node	€	-	€	-	€	-
Total Costs (EU27)	€	170,764,820	€	123,340,980	€	293,311,380
Net Benefit	€	188,268,435	€	235,692,275	€	2,001,644,934
BCR		2.10		2.91		7.82

Table 16 Detailed IA Summary Scenarios 5 & 6

SCENARIO 5 ANALYSIS SUMMARY

Scenario 5 builds on Scenario 3 by mandating that the minimum set of data (i.e. traffic management messages associated with TMPs) must be made available for the Core network in each MS.

Consequently, additional costs over the baseline are included for equipping all MS and Core nodes with DATEX II publisher interfaces, and for providing

the messaging middleware to populate the DATEX II interfaces for the National Road Authorities and the nodes on the Core road network.

As mentioned, Scenario 5 only deals with the minimum data content (i.e. is limited to the sharing of traffic management information relating to incident data) and as such there are no additional benefits to be derived from the sharing of roadwork information than those already covered by Scenario 3. However, there are additional benefits derived from making the minimum data content available for the whole of the Core road network from 2015 (this applies to traffic management messages relating to incidents). Please note that the benefits derived from the availability of roadworks data is not expected to be any greater that those described in Scenario 3.

Scenario 5 results in a BCR of 2.10.

SCENARIO 5A ANALYSIS SUMMARY

Scenario 5a is the same as Scenario 5 with the exception of the fact that the deployment coverage for making the minimum data content available does not include the nodes on the Core road network. The consequence of this is that the benefits remain much the same, but the costs reduce due to the fact that there is no need for the Core node road authorities to be equipped with a DATEX II publisher, or to have the messaging middleware software.

Scenario 5a results in a BCR of 2.91.

SCENARIO 6 ANALYSIS SUMMARY

Scenario 6 builds on Scenario 5 by mandating that the minimum set of data (i.e. traffic management messages associated with TMPs) must be made available for the Comprehensive network in each MS.

Consequently, additional costs over the baseline are included for equipping all MS and Comprehensive nodes with DATEX II publisher interfaces, and for providing the messaging middleware to populate the DATEX II interfaces for the National Road Authorities and the nodes on the Comprehensive road network.

As mentioned, Scenario 6 only deals with the minimum data content (i.e. is limited to the sharing of traffic management information relating to incident data) and as such there are no additional benefits to be derived from the sharing of roadwork information than those already covered by Scenario 3. However, there are additional benefits derived from making the minimum

data content available for the whole of the Comprehensive road network from 2015 (this applies to traffic management messages relating to incidents). Please note that the benefits derived from the availability of roadworks data is not expected to be any greater that those described in Scenario 3.

Scenario 6 results in a BCR of 7.82.

C.4 IA Scenarios 7&8 – mandating the availability of the extended data content

The third set of possible interventions (Scenarios 7 to 8) build on Scenario 4 by including specifications on the extended data content that would need to be made available for the Core and Comprehensive road networks.

Table 17 provides a detailed summary of the costs and benefits for scenarios 7-8 for the period of 2015-2025. It should be noted that the costs and benefits shown in the table below are those that could be achieved beyond the baseline.

	7	7a	8
Accrued Benefits 2015 - 2025			
Traffic Management Incidents	€ 176,413,463	€ 176,413,463	€ 2,112,336,521
Map Updates	€ 154,036	€ 154,036	€ 315,036
Roadworks info	€ 182,619,792	€ 182,619,792	€ 219,143,751
Speed limit changes	€ 4,427,419	€ 4,427,419	€ 16,996,066
Total Benefit (EU27)	€ 363,614,710	€ 363,614,710	€ 2,348,791,374
Accrued Costs 2015 - 2025			
Governance Framework	€ 15,610,000	€ 15,610,000	€ 15,610,000
Re use Rules	€ 100,000	€ 100,000	€ 100,000
Minimum Data Specifications	€ -	€ -	€ -
Extended Data Specification	€ 300,000	€ 300,000	€ 300,000
Messaging Middleware costs	€ 40,439,520	€ 4,315,680	€ 133,786,080
DATEX II publisher	€ 11,300,000	€ -	€ 40,500,000
DATEXII Node modification for Provision of TM and VMS	€ 1,350,000	€ 1,350,000	€ 1,350,000
INSPIRE Node modification for Network Changes	€ 2,700,000	€ 2,700,000	€ 2,700,000
INSPIRE node modification for Speed limit changes	€ 2,700,000	€ -	€ 2,700,000
National Roadworks database (implementation & operation)	€ 64,440,000	€ 64,440,000	€ 64,440,000
Licence to use National roadworks database	€ -	€ -	€ -
Provide Traffic management information	€ -	€ -	€ -
Populate Roadworks database costs	€ 52,458,359	€ 52,458,359	€ -
Enter network updates to INSPIRE Node	€ -	€ -	€ -
Enter Speed Limit changes to INSPIRE Node	€ 1,698,393	€ 1,698,393	€ 8,718,492
Total Costs (EU27)	€ 193,096,272	€ 142,972,432	€ 270,204,572
Net Benefit	€ 170,518,438	€ 220,642,278	€ 2,078,586,802
BCR	1.88	2.54	8.69

Table 17 Detailed IA Summary Scenarios 7 & 8

SCENARIO 7 ANALYSIS SUMMARY

Scenario 7 builds on Scenario 4 by mandating that the extended set of data (i.e. traffic management messages associated with TMPs, plus information about map updates and speed limit changes) must be made available for the Core network (including the nodes) in each MS.

As a result, additional costs over the baseline are included for equipping all MS and Core nodes with DATEX II publisher interfaces, and for providing the messaging middleware to populate the DATEX II interfaces for the National Road Authorities and the nodes on the Core road network. There are additional costs included for modifications to the INSPIRE node for network and speed limit changes, as well as the costs of populating the INSPIRE nodes with speed limit changes relative to the Core road network.

As mentioned, Scenario 7 includes the benefits to be derived from making the extended data content available for the Core road network from 2015. As well as including incident data, the extended content also includes information relating to map updates and speed limit changes. Consequently, savings are derived from 3rd parties not having to make their own surveys of the road network for changes to the speed limits and physical network. Please note that the benefits derived from the availability of roadworks data are not expected to be any greater that those described in Scenario 5.

Scenario 7 results in a BCR of 1.88.

SCENARIO 7A ANALYSIS SUMMARY

Scenario 7a is the same as Scenario 7 with the exception of the fact that the deployment coverage for making the extended data content available does not include the nodes on the Core road network. The consequence of this is that the benefits remain much the same, but the costs reduce due to the fact that there is no need for the Core node road authorities to be equipped with a DATEX II publisher, or to have the messaging middleware software.

Scenario 7a results in a BCR of 2.54.

SCENARIO 8 ANALYSIS SUMMARY

Scenario 8 builds on Scenario 7 by mandating that the extended set of data (i.e. traffic management messages associated with TMPs, plus information about map updates and speed limit changes) must be made available for the Comprehensive network in each MS.

As a result, additional costs over the baseline are included for equipping all MS and Comprehensive nodes with DATEX II publisher interfaces, and for providing the messaging middleware to populate the DATEX II interfaces for the National Road Authorities and the nodes on the Comprehensive road

network. There are additional costs included for modifications to the INSPIRE node for network and speed limit changes, as well as the costs of populating the INSPIRE nodes with speed limit changes relative to the Comprehensive road network.

As mentioned, Scenario 8 includes the benefits to be derived from making the extended data content available for the Comprehensive road network from 2015. As well as including incident data, the extended content also includes information relating to map updates and speed limit changes. Consequently, savings are derived from 3rd parties not having to make their own surveys of the road network for changes to the speed limits and physical network. Please note that the benefits derived from the availability of roadworks data are not expected to be any greater that those described in Scenario 4.

Scenario 8 results in a BCR of 8.69.

C.5 IA Scenarios 9 – 11a – mandating the availability of the full data content

The fourth set of possible interventions (Scenarios 9 to 11a) build on Scenarios 7 and 8 by including specifications on the full data content that would need to be made available for the Core and Comprehensive road networks.

Table 18 provides a detailed summary of the costs and benefits for scenarios 9-11a for the period of 2015-2025. It should be noted that the costs and benefits shown in the table below are those that could be achieved beyond the baseline.

	9	10	11	11a
Accrued Benefits 2015 - 2025				
Traffic Management Incidents	€ 2,112,336,521	€ 4,756,862,765	€ 176,413,463	€ 176,413,463
Map Updates	€ 315,036	€ 399,793	€ 154,036	€ 154,036
Roadworks info	€ 2,782,484,268	€ 6,101,165,211	€ 231,301,319	€ 231,301,319
Speed limit changes	€ 16,996,066	€ 313,011,219	€ 4,427,419	€ 4,427,419
Total Benefit (EU27)	€ 4,912,131,891	€ 11,171,438,987	€ 412,296,237	€ 412,296,237
Accrued Costs 2015 - 2025				
Governance Framework	€ 15,610,000	€ 15,610,000	€ 15,610,000	€ 15,610,000
Re use Rules	€ 100,000	€ 100,000	€ 100,000	€ 100,000
Minimum Data Specifications	€ -	€ -	€ -	€ -
Extended Data Specification	€ 300,000	€ 300,000	€ 300,000	€ 300,000
Messaging Middleware costs	€ 133,786,080	€ 267,572,160	€ 40,439,520	€ 4,315,680
DATEX II publisher	€ 40,500,000	€ 40,500,000	€ 11,300,000	€ -
DATEXII Node modification for Provision of TM and VMS	€ 1,350,000	€ 1,350,000	€ 1,350,000	€ 1,350,000
INSPIRE Node modification for Network Changes	€ 2,700,000	€ 2,700,000	€ 2,700,000	€ 2,700,000
INSPIRE node modification for Speed limit changes	€ 2,700,000	€ 2,700,000	€ 2,700,000	€ 2,700,000
National Roadworks database (implementation & operation)	€ 259,200,000	€ 259,200,000	€ 259,200,000	€ 113,400,000
Licence to use National roadworks database	€ 81,000,000	€ 162,000,000	€ 22,600,000	€ -
Provide Traffic Management Information	€ -	€ -	€ -	€ -
Populate Roadworks database costs	€ 605,661,898	€ 3,236,307,812	€ 143,068,253	€ 143,068,253
Enter network updates to INSPIRE Node	€ -	€ -	€ -	€ -
Enter Speed Limit changes to INSPIRE Node	€ 8,718,492	€ 46,265,523	€ 1,698,393	€ 1,698,393
Total Costs (EU27)	€ 1,151,626,470	€ 4,034,605,495	€ 501,066,166	€ 285,242,326
Net Benefit	€ 3,760,505,421	€ 7,136,833,492	-€ 88,769,929	€ 127,053,911
BCR	4.27	2.77	0.82	1.45

Table 18 Detailed IA Summary Scenarios 9-11

SCENARIO 9 ANALYSIS SUMMARY

Scenario 9 builds on Scenario 8 by mandating that the full set of data (i.e. traffic management messages associated with TMPs and roadworks data, plus information about map updates and speed limit changes) must be made available for the Comprehensive network in each MS.

As a result, additional costs over the baseline are included for creating and populating National Roadworks Databases in each MS for any roadworks on the Comprehensive network. Furthermore, costs are included for equipping all MS and Comprehensive nodes with DATEX II publisher interfaces, and for providing the messaging middleware to populate the DATEX II interfaces for the National Road Authorities and the nodes on the Comprehensive road network. There are additional costs included for modifications to the INSPIRE node for network and speed limit changes, as well as the costs of populating the INSPIRE nodes with speed limit changes relative to the Comprehensive road network.

As mentioned, Scenario 9 includes the benefits to be derived from making the full data content available for the Comprehensive road network from 2015. As well as including incident and roadworks data, the full content also includes information relating to map updates and speed limit changes. Consequently, savings are derived from 3rd parties not having to make their

own surveys of the road network for changes to the speed limits and physical network.

Scenario 9 results in a BCR of 4.27.

SCENARIO **10** ANALYSIS SUMMARY

Scenario 10 builds on Scenario 9 by mandating that the full set of data (i.e. traffic management messages associated with TMPs and roadworks data, plus information about map updates and speed limit changes) must be made available for the Comprehensive plus secondary network in each MS.

As a result, there are additional costs over Scenario 9 for providing the messaging middleware to populate the DATEX II interfaces for the National Road Authorities and the nodes on the Comprehensive and secondary road network. There are also further costs associated with purchasing licences for using the National Roadworks Database. Due to Scenario 10s larger network size, there are bigger costs associated with populating the National Roadworks Database and entering speed limit changes into the INSPIRE node.

As mentioned, Scenario 10 includes the benefits to be derived from making the full data content available for the Comprehensive and secondary road network from 2015.

Scenario 10 results in a BCR of 2.77.

SCENARIO **11** ANALYSIS SUMMARY

Scenario 11 builds on Scenario 7 by mandating that the full set of data (i.e. traffic management messages associated with TMPs and roadworks data, plus information about map updates and speed limit changes) must be made available for the Core network in each MS.

As a result, additional costs over the baseline are included for creating and populating National Roadworks Databases in each MS for any roadworks on the Core network. Furthermore, costs are included for equipping all MS and Core nodes with DATEX II publisher interfaces, and for providing the messaging middleware to populate the DATEX II interfaces for the National Road Authorities and the nodes on the Core road network. There are additional costs included for modifications to the INSPIRE node for network and speed limit changes, as well as the costs of populating the INSPIRE nodes with speed limit changes relative to the Core road network.

As mentioned, Scenario 11 includes the benefits to be derived from making the full data content available for the Core road network from 2015. As well as including incident and roadworks data, the full content also includes information relating to map updates and speed limit changes. Consequently, savings are derived from 3rd parties not having to make their own surveys of the road network for changes to the speed limits and physical network.

Scenario 11 results in a BCR of 0.82.

SCENARIO 11A ANALYSIS SUMMARY

Scenario 11a is the same as Scenario 11 with the exception of the fact that the deployment coverage for making the full data content available does not include the nodes on the Core road network. The consequence of this is that the benefits remain much the same, but the costs reduce due to the fact that there is no need for the Core node road authorities to be equipped with a DATEX II publisher, or to have the messaging middleware software.

Scenario 11a results in a BCR of 1.45.

Annex D – Best Practices Roadworks Databases

France

The French government has established a national information platform (Tipi - http://diffusion-numerique.info-routiere.gouv.fr/acces-aux-donnees-evenementielles-r13.html) to collect and provide roadworks data to any third party on a simple contractual and technical basis.

Information is produced by the road operators (national road operators, regional road operators, and some local road operators, as well as motorways concessionaires), police forces and emergency services, and then validated by the regional and national traffic management centers.

Together with other RTTI data, planned road works information is provided in DATEX 2 standards. Specific road works (extraordinary works) are also sometimes provided in a journalistic document (release, bulletin).

Data re-use conditions are simple: Non-exclusive access to third parties. Information is provided free of charge. Commercial re-use is allowed as long as the national traffic operation policies are safeguarded. "

United Kingdom

The national government of the United Kingdom developed a plan to establish a national roadworks database (roadworks.org). The plan argues that policymakers in central Government and senior executives within local government should support participation in a national open roadworks portal as best practice for Highway Authorities. Since the market itself cannot both invest in aggregating local roadworks information and making it available on open terms, it is proposed that a new model of private-public sector engagement for roadworks information is adopted that

- satisfies public sector policy objectives for coordinating roadworks, highways efficiency, informing the public, and stimulating industry.
- satisfies market competition principles of a public body by making its data available on a level playing field to all.

Roadworks.org does not replace local and devolved administration national initiatives – rather it enhances their attempts to publish roadworks data as widely as possible.

The Netherlands

The Dutch government has established a national information platform, 'Wegwerkzaamheden actueel' (current roadworks) to collect and provide data to any third parties. This platform is funded by the Dutch programme 'Optimising Use'.

Eleven 'optimising use' regions have agreed to provide the current road works data to NDW in 2014. The NDW (National Datawarehouse for traffic information, www.NDW.nu) hosts the current planning data of road authorities. Service providers provide this data to consumers. A national rollout in all regions will follow later in 2014.

There are two possibilities to access the data; a subscription to the services of NDW (this is a serviced subscription) or you can access the open data portal which is non serviced. Then data are accessible through standards techniques (push/pull methods according to the DATEX2 protocol).

Data re-use conditions are simple: Non-exclusive access to third parties. Commercial re-use is allowed as long as the national traffic operation policies are safeguarded.