Road Safety Management

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Overview

Why do we need road safety management?

The high cost of motorized mobility to society and public health
Each year over 1 million people are killed and 50 million injured on roads around the world. Without new and effective action, deaths in low to middle-income countries are forecast to rise steeply. At the same time, progress has slowed in recent years in the better performing countries where investment in preventing and reducing serious health loss from road traffic injury is not commensurate with its high socio-economic cost. This cost has been estimated at around 2% of EU countries' gross domestic product - around Euro 180 billion and twice the EU's annual budget.

Road traffic injury is largely preventable
As highlighted in the *World Report on Road Traffic Injury Prevention*, fatal and long term crash injury is largely predictable, largely avoidable and a problem amenable to rational analysis and remedy. Research and experience in North America, Australasia and Europe has shown that very substantial reductions in road deaths and serious injuries have been achieved through the application of evidence-based measures against the background of increased motorization.

Achieving results
As the OECD has stated, setting ambitious targets is one thing; meeting them is another. The limits to improved road safety performance are shaped by a country's road safety management system which determines the results being sought and produces the interventions to achieve them.

- **The shift to *safe system* – the new performance frontier**
  Countries have become progressively more ambitious in terms of the results desired (see evolution of road safety management for results) culminating in *Safe System*. This concept represents the new performance frontier for road safety management in embracing ambitious long term goals to eliminate death and serious injury and interim targets, exacting intervention strategies and strengthened institutional management.
- **Road safety in a complex multi-sectoral context**
  In practice road safety is a shared responsibility at international, national, regional, and local levels. Achieving road safety results is a multi-disciplinary activity which takes place in a complex multi-sectoral context. Multi-sectoral activity provides both the opportunity for a holistic system-wide approach and the possibility that safety interests will be submerged by competing interests. It thus requires careful management and leadership.
- **Leadership, ownership, and accountability**
  Achieving road safety results requires long-term governmental ownership, leadership and political will. The World Bank and OECD recommend that all countries should commit to ensuring an effective road safety management system and, in particular, to review and seek to achieve a strong results focus through their institutional management arrangements and resolve any capacity weaknesses. This focus requires clear identification of: a lead agency/department; the core group of government ministries and agencies to be involved; their roles and responsibilities defined; high-level strategic review of performance; definition of a long term safe system goal, and the interim performance targets in terms of institutional outputs and intermediate and final outcomes to be achieved within a time-defined strategy. It requires high-level championing across society

The road safety management system

Safety is produced just like other goods and services and the production process is viewed as a management system with three levels: *institutional management functions* produce *interventions*, which in turn produce *results* [5]. Consideration of all elements of the road safety management system and the linkages between them becomes critical for any country seeking to identify and improve its current performance level [5] [52]

- **Institutional management functions**
  Seven institutional management functions are the foundation on which road safety management systems are built comprising *results focus* – the overarching function -, *coordination*, *legislation*, *funding and resource allocation*, *promotion*, *monitoring and evaluation* and *research and development and knowledge transfer*. These functions are delivered primarily by all the government agencies producing interventions, but they are also delivered in government partnerships with civil society and business entities to achieve the desired focus on results. Effective institutional management is a pre-requisite of successful results-focused intervention [5] [52].
- **Interventions**
  These comprise system-wide strategies and programmes of interventions to address safety targets. Interventions cover the planning, design and operation of the road network, the entry and exit of vehicles, and users into the road network, and the recovery and rehabilitation of crash victims. They seek to manage exposure to the risk of crashes, prevent crashes, and reduce crash injury severity and the consequences of crash injury. They comprise safety designs, standards, and rules and well as a combination of activity to secure compliance with these such as information, publicity, enforcement and incentive.
- **Results**
  In good practice, road safety results are expressed as long term goals and interim quantitative targets. Targets specify the desired safety performance endorsed by governments at all levels, stakeholders and the community. To be credible, interim targets must be achievable with cost-effective interventions. Targets are usually set in terms of final outcomes. They can also include intermediate outcomes consistent with their achievement, and institutional output measures required to achieve the intermediate results.

This text is based on two recent major pieces of work by the World Bank, 2008 [5] and the OECD 2008 [52] which set out the current state of the art in road safety management and its assessment and provide guidance to decision-makers and practitioners on steps to achieving ambitious results.

1. Why do we need road safety management?

1.1 The high cost of motorized mobility to society and public health

Each year over 1 million people are killed and 50 million injured on roads around the world. Without new and effective action, deaths in low to middle-income countries are forecast to rise steeply in the next decades. Progress has slowed in recent years in many OECD countries See IRTAD, 2008.

The quality of daily road travel touches the lives of almost all European citizens either as road crash victims or their family, friends and colleagues. In the European Union, road crashes comprise over 90% of all transport crash deaths and crash costs and are the leading cause of death and hospital admission for people younger than 50 years. Within the EU, an international comparison of death rates in road traffic in the Annual Statistical Report 2007 (Figure 2) indicates a substantial variation in road safety performance. The socio-economic cost has been estimated at around 2% of EU countries' gross domestic product - around Euro 180 billion and twice the EU's annual budget [25] A high price is currently being paid for motorized mobility in human and economic terms.

1.2 Road traffic injury is largely preventable

Based on current knowledge, fatal and long term crash injury is largely predictable, largely avoidable and a problem amenable to rational analysis and remedy [54] [56]. Research and experience in North America, Australasia and Europe have shown that very substantial reductions in road deaths and serious injuries can be achieved against the background of increased motorization [65]. In 2004, the World Report of Road Traffic Injury Prevention [56] provided a global call to action and blueprint for effective intervention based on past best practice as well as innovative, ambitious 'safe system' approaches. International organizations such as the World Health Organization [56], the World Bank [6] [5] the OECD [53] [52] and the ECMT (now the International Transport Forum) [19] all acknowledge that the key to achieving better performance in road safety is by more effective safety management.

1.3 Achieving results

Establishing safety performance targets supported by action plans that set out the specific interventions needed to achieve them is well established as international good practice [54] [5] [6] [53] [52]. However, as the OECD has noted recently, setting ambitious targets is one thing; meeting them is another. Without new effort, many OECD countries will not meet their highly ambitious targets [52].

The limits to improved road safety performance are shaped by the road safety management system operating in a country. This system determines the results being sought and produces the interventions to achieve them. The limits to a country's road safety performance are constrained by its institutional capacity to implement efficient and effective interventions, and the subsequent results may fall short of what is technically feasible with any particular set of road safety interventions [5] [52].

The *World Report* and the follow up *World Bank Transport Note* focussing on implementing its recommendations highlighted the importance of addressing road safety management weaknesses and the need for effective institutional management as a pre-requisite of successful results-focused intervention. New guidelines based on good practice institutional management have been produced recently by the World Bank [5].

The shift to a safe system approach – the new performance frontier

Countries have become progressively more ambitious in terms of the results desired (see evolution of road safety management for results) culminating in ambitious safe system approaches. Today, the safe system concept represents the new performance frontier for road safety management embracing long term visions or goals to eliminate death and serious injury (as recommended by the OECD [52], challenging but achievable interim targets, exacting intervention strategies and the need for strengthened institutional management systems [5] [52].

What was previously seen as radical and unachievable by many road safety practitioners and policy-makers has quickly become the benchmark and central debating point for analyses of what constitutes acceptable road safety results. The tools and accumulated practices used to support the safety performance framework for *Safe System* are the same as those used in the past to prepare targeted national plans. Targets are still set as milestones to be achieved on the path to the ultimate goal, but the interventions are now shaped by the level of ambition, rather than vice versa. Innovation becomes a priority to achieve results that go well beyond what is currently known to be achievable [5]

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OECD [52] ***Recommendations:***

Develop a Safe System approach, essential for achieving ambitious targets

It is recommended that all countries, regardless of their level of road safety performance, move to a Safe System approach to road safety. This approach: builds on existing road safety interventions but reframes the way in which road safety is viewed and managed in the community. It addresses all elements of the road transport system in and integrated way with the aim of ensuring crash energy levels are below what would to cause fatal or serious injury. It requires acceptance of shared overall responsibilities and accountability between system designers and road users. It stimulates the development of the innovative interventions and new partnerships necessary to achieve ambitious long term targets.

Adopting a safe system approach

A Safe System approach is the only way to achieve the vision of zero road fatalities and serious injuries and requires that the road system be designed to expect and accommodate human error.

A Safe System approach has the following characteristics:

- It recognizes that prevention efforts notwithstanding, road users will remain fallible and crashes will occur.
- It stresses that those involved in the design of the road transport system need to accept and share responsibility for the safety of the system, and those that use the system need to accept responsibility for complying with the rules and constraints of the system.
- It aligns safety management decisions with broader transport and planning decisions that meet wider economic, human and environmental goals.
- It shapes interventions to meet the long term goal, rather than relying on “traditional” interventions to set the limits of any long term targets.

The basic strategy of a Safe System approach is to ensure that in the event of a crash, the impact energies remain below the threshold likely to produce either death or serious injury. This threshold will vary from crash scenario to crash scenario, depending upon the level of protection offered to the road users involved. For example, the chances of survival for an unprotected pedestrian hit by a vehicle diminish rapidly at speeds greater than 30km/h, whereas for a properly restrained motor vehicle occupant the critical impact speed is 50km/h (for side impact crashes) and 70 km/h (for head-on crashes).

Road safety in a complex multi-sectoral context
In practice is a shared responsibility at international, national, regional, state, and local levels. Achieving road safety results is a multi-disciplinary activity which takes place in a complex multi-sectoral context. Multi-sectoral activity provides both the opportunity for a holistic system-wide approach and the possibility that road safety interests will be submerged by competing interests. It thus requires careful management and leadership [5] [50]. Meaningful institutional collaboration within Government needs to take place to adopt a system-wide strategy and achieve programme integration of the development, environment, accessibility, equity and safety objectives of governments [5]. The management of shared responsibility for implementation within organizations, whether governmental or non-governmental, is also important ensure that decisions lead to the intended policy performance [30].

Leadership, ownership, accountability
Achieving road safety results requires long-term governmental ownership, leadership and political will. The first and crucial recommendation in the *World Report* concerned the identification of a lead agency in government to guide the national road safety effort, with the power to make decisions, control resources and coordinate the efforts of all participating sectors of government. New World Bank guidelines and good practice review indicate the importance of the lead agency/department, on a 'first amongst equals basis', orchestrating action across Government supported by effective coordination arrangements [5].

2. The road safety management system

2.1 The evolution of road safety management for results

As outlined in the *World Report on Road Traffic Injury Prevention* (WHO, 2004) and the follow up *World Bank Transport Note* [6]' progressive shifts in road safety management thinking and practices in high-income countries have been evident. Since the 1950s there have been four significant phases of development, which have become progressively more ambitious in terms of the results desired.

Phase 1 - Focus on driver interventions.
In the 1950s and 60s safety management was generally characterized by dispersed, uncoordinated, and insufficiently resourced institutional units performing isolated single functions (Koornstra et al, 2002). Road safety policies placed considerable emphasis on the driver by establishing legislative rules and penalties and expecting subsequent changes in behaviour, supported by information and publicity. It was argued that since human error contributed mostly to crash causation it could be addressed most effectively by educating and training the road user to behave better. Placing the onus of blame on the road traffic victim acted as a major impediment to the appropriate authorities fully embracing their responsibilities for a safer road traffic system (Rumar, 1999).

Phase 2 - Focus on system-wide interventions.
In the 1970s and 1980s, these earlier approaches gave way to strategies which recognized the need for a systems approach to intervention. Dr. William Haddon, an American epidemiologist, developed a systematic framework for road safety based on the disease model which encompassed infrastructure, vehicles and users in the pre-crash, in-crash and post crash stages (Haddon, 1968). Central to this framework was the emphasis on effectively managing the exchange of kinetic energy in a crash which leads to injury to ensure that the thresholds of human tolerances to injury were not exceeded. The focus of policy broadened from an emphasis on the driver in the pre-crash phase to also include in-crash protection (both for roadsides and vehicles) and post crash care. This broadened it to a system-wide approach to intervention and the complex interaction of factors which influence injury outcomes. It

underpinned a major shift in road safety practice which took several decades to evolve. However, the focus remained at the level of systematic intervention and did not directly address the institutional management functions producing these interventions or the results that were desired from them.

Phase 3 - **Focus on system-wide interventions, targeted results and institutional leadership.**

By the early 1990s good practice countries were using action focused plans with numerical outcome targets to be achieved with broad packages of system-wide measures based on monitoring and evaluation. On-going monitoring established that growing motorization need not inevitably lead to increases in death rates but could be reversed by continuous and planned investment in improving the quality of the traffic system. The United Kingdom, for example, halved its death rate (per 100,000 head of population) between 1972 and 1999 despite a doubling in motorised vehicles. Key institutional management functions were also becoming more effective. Institutional leadership roles were identified, inter-governmental coordination processes were established and funding and resource allocation mechanisms and processes were becoming better aligned with the results required. Developments in Australasian jurisdictions (e.g. Victoria and New Zealand) further enhanced institutional management functions concerning results focus, multi-sectoral coordination, delivery partnerships, and funding mechanisms (WHO, 2004; Bliss, 2004; Wegman *et al.,* 2006; Trinca *et al*., 1988). Accountability arrangements were enhanced by the use of target hierarchies linking institutional outputs with intermediate and final outcomes to coordinate and integrate multi-sectoral activities. This phase laid the foundation for today's best practice and reflects the state of development found in many higher performing countries today.

Phase 4 - Focus on system-wide interventions, long-term elimination of deaths and serious injuries and shared responsibility.

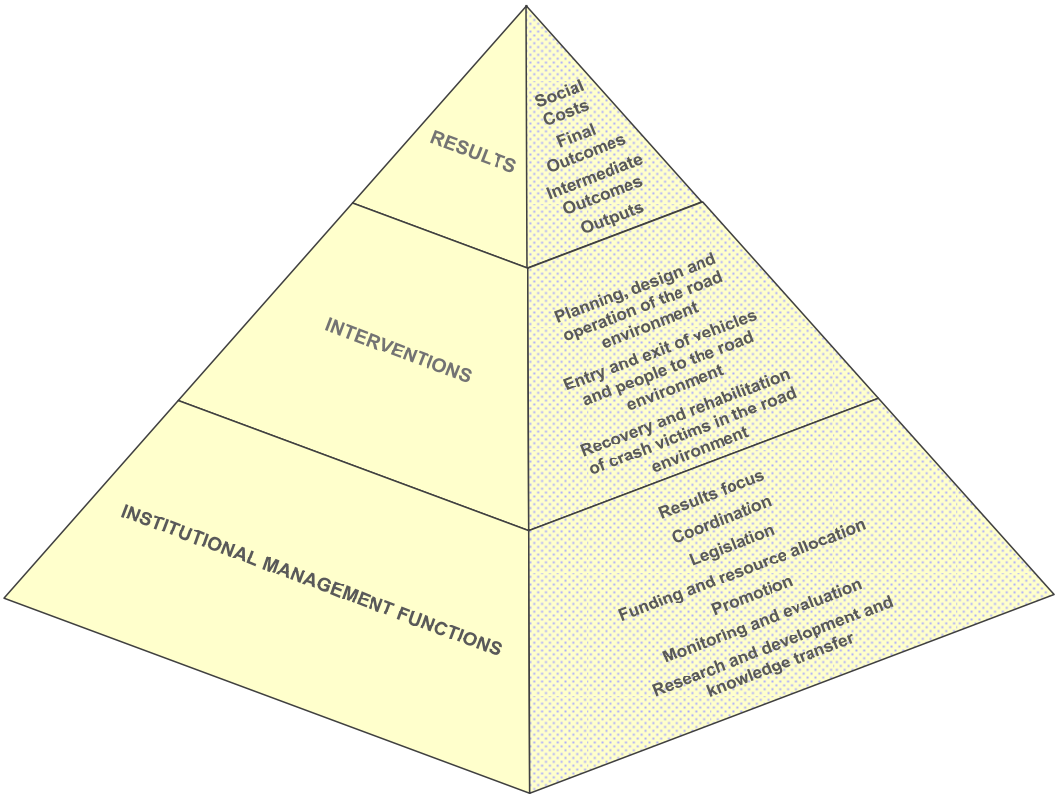
By the late 1990s, two of the best performing countries had determined that improving upon the ambitious targets that had already been set would require rethinking of interventions and institutional arrangements. The Dutch Sustainable Safety (Wegman *et al.,* 1997 and 2008) and Swedish Vision Zero (Tingvall, 1995; Committee of inquiry into road traffic responsibility, 2000) strategies re-defined the level of ambition and set a goal to make the road system intrinsically safe. The implications of this level of ambition are currently being worked through in the countries concerned and elsewhere. These strategies recognize that speed management is central and have re-focused attention on road and vehicle design and related protective features. The 'blame the victim' culture is superseded by 'blaming the traffic system' which throws the spotlight on operator accountability. These examples of *Safe System* approaches have influenced strategies in Norway, Finland, Denmark, Switzerland and Australia.

Today the growing view is that road safety is a system-wide and shared multi-sectoral responsibility which is becoming increasingly ambitious in terms of its results focus. Sustaining the level of ambition now evident in high-income countries requires a road safety management system based on effective institutional management functions that can deliver evidence-based interventions to achieve desired results. Achievement of the ultimate goal of eliminating death and serious injury will require continued application of good practice developed in the third phase of targeted programmes coupled with innovative solutions which are yet to be determined based on well-established safety principles.

Source: Bliss and Breen, 2008 [5] *reproduced by OECD, 2008* [52]

2.2 The road safety management system

The latest evolution of the road safety management system which is recommended for use by the World Bank and the OECD is shown below. Safety is produced just like other goods and services and the production process is viewed as a management system with three levels: *institutional management functions* which produce *interventions*, which in turn produce results.



This road safety management system model derives from New Zealand's comprehensive 2010 target setting framework which linked desired results with interventions and related institutional implementation arrangements (Land Transport Safety Authority, 2000).[1] The New Zealand framework was adopted by the European Transport Safety Council (Wegman, 2001)[2] which highlighted its results management framework, and it was further elaborated by the Sunflower Project (Koornstra *et al.,* 2002)[3] which located the institutional implementation arrangements in the broader context of country 'structure and culture'. The first World Bank guideline concerning the implementation of the *World Report* recommendations (Bliss, 2004)[4] used the framework to introduce prototype safety management capacity review tools. This updated guideline refines these tools and further defines the organizational manifestation of the Sunflower Project 'structure and culture' in terms of seven institutional management functions.

Source: Land Transport Safety Authority, 2000 [40] and Bliss & Breen, 2008 [5]

Institutional management functions: The seven identified institutional management functions are the foundation on which road safety management systems are built. They are essential for the production of interventions which, in turn, achieve road safety results and for this reason they must receive the highest priority in road safety planning and policy initiatives. The institutional management functions relate to all government, civil society and business entities that produce interventions and ultimately results [5].

Interventions: Broadly, these comprise system-wide strategies and programmes of interventions to address safety targets. Interventions cover the planning, design and operation of the road network, the entry and exit of vehicles, and users into the road network, and the recovery and rehabilitation of crash victims. They seek to manage exposure to the risk of crashes, prevent crashes, and reduce crash injury severity and the consequences of crash injury. They comprise safety designs, standards, and rules and well as a combination of activity to secure compliance with these such as information, publicity, enforcement and incentive [5] [6].

Results: In good practice management systems road safety results are expressed in the form of long term goals and interim quantitative targets. Targets specify the desired safety performance endorsed by governments at all levels, stakeholders and the community. To be credible, interim targets must be achievable with cost-effective interventions. Targets are usually set in terms of final outcomes. They can also include intermediate outcomes consistent with their achievement, and institutional output measures required to achieve the intermediate results [5] [6].

The road safety management system has a number of generic characteristics that allow for its universal application to all countries, irrespective of their development status or road safety performance.

Generic characteristics of the road safety management system [5]
It places an emphasis on the production of road safety, and recognizes that safety is produced just like other goods and services. The production process is viewed as a management system with three levels: institutional management functions which produce interventions, which in turn produce results. Much of the day to day road safety discussion is concerned with interventions alone, and use of the management system opens up the discussion to the important and often neglected issues of institutional ownership and accountability for results.

It is neutral to country structures and cultures which will shape the way institutions function and the goals to be set and achieved. Any country can use this framework and adapt their road safety initiatives to it.

It accommodates evolutionary development. This is illustrated by the evolving focus on results that has been evident in high-income countries through to its ultimate expression in the *Safe System* approach. In any particular period of development the system can be used to review road safety management capacity and prepare related strategies and programs.

It applies to any given land use/transportation system and takes as given the current and projected exposure to risk arising from that system. However, it can also manage the land use/transport trade-offs by considering these as options in the desired focus on results and addressing them with interventions concerning the planning, design, operation and use of the road network and the entry and exit of vehicles and road users to this network.

It takes the road network as its frame of reference and locates the deaths and injuries that are avoidable. The three broad categories of intervention are defined in terms of the road network and have strong spatial dimensions. This distinguishes the system from earlier frameworks that emphasized safer roads, safer vehicles, and safer people, without locating them specifically in the network contexts where deaths and serious injuries occur.

Consideration of all elements of the road safety management system and the linkages between them becomes critical for any country seeking to identify and improve its current performance levels [5] [52].

2.2.1 Institutional management functions

The seven *institutional management functions* provide the foundation on which road safety management systems are built: they produce the *interventions* to achieve the desired long and medium-term road safety *results* (expressed as visions and performance targets) which have been agreed across the road safety partnership at national, regional and local levels. These functions are delivered primarily by all the government agencies producing interventions, but they are also delivered in government partnerships with civil society and business entities to achieve the desired focus on results. Without effective institutional management a country has little chance of implementing successful road safety interventions and achieving desired results [5] .

Institutional management functions
Results focus in its ultimate expression concerns a strategic orientation that links all actual and potential interventions with results, analyses what can be achieved over time, and sets out a performance management framework for the delivery of interventions and their intermediate and final outcomes. It defines the level of safety which a country wishes to achieve expressed in terms of vision, goals, objectives and related targets.
Coordination concerns the orchestration and alignment of the interventions and other related institutional management functions delivered by government partners and related community and business partnerships to achieve the desired focus on results.
Legislation (where necessary) concerns the appropriate legal instruments which specify the legitimate bounds of institutions, their responsibilities and accountabilities, their interventions and their related institutional management functions to achieve the desired focus on results.
Funding and resource allocation concerns the financing of interventions and related institutional management functions on a sustainable basis using a rational evaluation and programming framework to allocate resources to achieve the desired focus on results.
Promotion concerns the countrywide and sustained communication of road safety as a core business for Government and society, emphasising the shared societal responsibility to support the delivery of the interventions required to achieve the desired results.
Monitoring and evaluation concerns the systematic and ongoing measurement and evaluation of interventions in terms of achieving the desired road safety outputs and outcomes (results).
Research and development and knowledge transfer concerns the systematic and ongoing creation, codification, transfer and application of knowledge that contributes to the improved efficiency and effectiveness of the road safety management system to achieve the desired focus on results.

Source: Bliss and Breen, 2008 [5]

2.2.1.1 The role of the lead agency

Function:
The lead agency plays a dominant role in most of the institutional management functions for road safety; in others it plays a guiding, encouraging or catalytic role [5]. The lead agency takes responsibility within Government for the development of the national road safety strategy and its results focus. It is engaged in the delivery of and supported by strong horizontal inter-governmental coordination arrangements; good vertical coordination of national, regional and local activity; coordination of the necessary delivery partnerships between government stakeholders, the professional, non-governmental and business sectors and Parliamentary groups and committees; a comprehensive legislative framework; sustainable sources of annual funding and a rational framework for resource allocation; high-level promotion of road safety strategy across Government and society; regular monitoring and evaluation and strong research and technical support [5] .

Structure:
As the *World Report on Road Traffic Injury Prevention* notes, a variety of lead agency models can be effective in road safety and each country needs to create a lead agency appropriate to its own circumstances. Successful practice underscores the need for the agency to be a governmental body and for its leadership role to be accepted and fully supported by the rest of government to ensure the development of appropriate capacity and funding. The agency might take the form of a designated, stand-alone bureau with a coordinating committee or cabinet representing several different government agencies. It might also be part of a larger transport organization or be part of the Premier's department. The agency might undertake much of the work itself or else it might delegate aspects of work to other organizations, including provincial and local governments, research institutes or professional associations [5].

Recent work by the World Bank has examined different types of governmental lead agency structure in several 'good practice' jurisdictions which have been active in road safety over a long period of time and have developed a role in the delivery of all seven institutional management functions [5]. They illustrate how governmental lead agencies and their coordination arrangement can vary in form and structure to achieve results. In some cases, the main institutional arrangements have evolved gradually over many years. In others, they are relatively recent. All agencies involve fairly complex organizational structures and processes and many players.

OECD [52] ***recommendation:***
Strengthen the road safety management system
All countries should commit to ensuring an effective road safety management system and in particular seek to achieve a strong results focus through their institutional management arrangements. This results focus requires clear identification of: a lead agency; the core group of government ministries and agencies to be involved; their roles and responsibilities; and the performance targets in terms of institutional outputs and intermediate and final outcomes to be achieved within a defined strategy.

In EU countries, the typical lead agency structure lead department is the Ministry of Transport or Road Authority (see the example of the Swedish Road Administration) which undertakes much of the work itself as well as delegating aspects of its work to other organizations, including provincial and local governments, research institutes or professional associations.

Swedish Road Administration delivery of institutional management functions

Results focus: The Swedish Road Administration (SRA) is the accountable lead agency for road safety in Sweden. SRA has the main responsibility in Sweden for managing the country results focus: reviewing performance and proposing goals and targets and carrying out intervention in the road network; SRA developed and leads *Vision Zero* and is responsible for the achievement of national targets was underpinned by a performance agreement with the Ministry of Industry, Employment and Communications.

Coordination*:* SRA established, chairs, manages and provides a dedicated secretariat in-house for each of the three consultative (rather than decision-making) bodies to engage all the main players with governmental responsibilities in road safety as well as other key players in addressing *Vision Zero* and national targets. These bodies, however, are designed more for sharing knowledge, discussing countermeasures and stimulating stakeholder contributions rather than decision-making bodies at national level. SRA also ensures that there is vertical coordination between governmental bodies and funds tools for use by regional and local authorities, as well as specific road safety outputs. In recent years, the SRA has expanded its external partnership capacity to deliver the challenging *Vision Zero* concept and has developed result-producing road safety partnerships individually and through its consultation bodies with a wide range of professional, research, non-governmental, user and industry groups. SRA tries to ensure stakeholder accountability through its OLA process which involves the use of Declarations of Intent.

Legislation: SRA has established a comprehensive legislative framework which has evolved over the years. SRA proposes vehicle, roads and user rules and standards, some of which are identified and agreed at EU level, with inspection and compliance carried out by Departmental agencies and the police. SRA has established in-house capacity to propose, ensure compliance with and monitor road safety standards for vehicles, roads and people as well as to provide policy advice. SRA establishes Commissions of Enquiry when developing and consolidating major primary legislation.

Funding and resource allocation: SRA ensures sustainable annual funding for road safety from general tax revenues which it allocates to its agencies through annual agreements and transport plans in support of *Vision Zero* intervention. SRA has used ring-fenced funding on a regional basis to encourage local road safety engineering activity and *Vision Zero* demonstration projects as well as directly funding some police outputs to achieve results. Procedures are established for benefit to cost analysis which is used to identify priorities for infrastructure road safety spending. Estimates of the value of preventing death and serious injury are not made annually, nor are cost-benefit analysis or cost-effectiveness analysis used widely in resource allocation for safety work in the public sector.

Promotion: SRA promotes the shared responsibility for road safety using *Vision Zero*. Lead agency Ministers and Parliamentarian played a key role in launching and promoting *Vision Zero.* SRA coordinates multi-sectoral promotion and contracts out targeted road safety information which, in recent years, has been directed to organizational stakeholders than the general public. SRA helped to set up, chairs and supports the European New Car Assessment Programme which promotes vehicle safety. The MoT promotes the need to achieve road safety results to local and regional levels of government.

Monitoring and evaluation: Sweden has a long tradition in monitoring and evaluation of road safety. This, in general, is carried out comprehensively by the lead agency (at national and regional level), the Swedish Institute for Transport and Communications Analysis (SIKA), the Road Traffic Inspectorate (since 2003), research organizations, the municipalities and independent national and international experts. SRA and its partners have established databases to identify and monitor final and intermediate outcomes against targets and the results are published annually. The SRA played a key role in the establishment of the European New Car Assessment Programme and European Road Assessment Programme,

both of which monitor vehicle fleet and aspects of road network safety. The SRA established the Road Traffic Inspectorate to help monitor road safety performance and the effectiveness of stakeholder activity.
Research and development and knowledge transfer: Sweden has a long and internationally recognised tradition in road safety research which has had a major impact on policy and results. SRA has ensured secured funding and capacity for road safety research and knowledge transfer. SRA supports attendance of its personnel at international road safety meetings, seminars, workshops and field visits. SRA and its partners have developed and disseminated best practice guidelines on road safety. SRA funds Vision Zero demonstration projects.

Source: Bliss and Breen 2008 [5]

2.2.1.2 Results focus

In good practice road safety management, 'results focus' is the overarching institutional management function [5]. It determines the country's level of ambition for road safety and takes into account the interventions and institutional arrangements which need to be put in place in order to realise it.

Results focus involves:
- Appraising current road safety performance through high-level strategic review
- Adopting a far-reaching road safety vision or goal for the longer term
- Analysing what could be achieved in the shorter term and proposing targets
- Agreeing targets across the road safety partnership and ensuring stakeholder accountability for results

All other management functions influence this activity. In the absence of a clear focus on results, all other institutional functions and related interventions can lack cohesion and direction and the efficiency and effectiveness of safety programmes can be undermined [5] .

Countries have become progressively more ambitious in terms of the results desired culminating in *safe system* approaches which today represents the new performance frontier for road safety management requiring ambitious long term goals and interim targets, exacting intervention strategies and strengthened institutional management systems.

Appraising current road safety performance through high-level strategic review

OECD [52] ***Recommendation*:**
Countries experiencing difficulty in improving their road safety performance should as a matter of urgency conduct high-level reviews of their safety management capacity and prepare long-term investment strategies and related programs and projects to overcome revealed capacity weaknesses.

The first recommended step when formulating new long term goals, interim targets, strategies and programmes is a systematic country capacity review of the road safety management system. The aim is to achieve a clear overview of country organizational needs to understand present road safety performance - what is working and where there is room for improvement - and to specify or better specify challenging but achievable road safety outcomes in the national road safety strategy.

The process of appraising current road safety performance involves high-level multi-sectoral strategic examination of a range of activity and involve senior management from the key governmental agencies - Transport, Police, Health, Justice and Education, who may not all be actively engaged as yet (the WHO called on the health sector to engage more actively) – as well as all other stakeholders who are able to contribute to the delivery of road safety results.

What public health can do

- Include road safety in health promotion and disease prevention activities
- Set goals for the elimination of unacceptable health losses arising from road traffic crashes
- Systematically collect health-related data on the magnitude, characteristics and consequences of road traffic crashes
- Support research on risk factors and on the development, implementation, monitoring and evaluation of effective interventions, including improved care
- Promote capacity building in all areas of road safety and the management of survivors of road traffic c crashes
- Translate effective science-based information into policies and practices that protect vehicle occupants and vulnerable road users.
- Strengthen pre-hospital and hospital care as well as rehabilitation services for all trauma victims
- Develop trauma care skills of medical personnel at the primary, district and tertiary health care levels
- Promote the further integration of health and safety concerns into transport policies and develop methods to facilitate this, such as integrated assessments
- Campaign for greater attention to road safety, based on the known health impact and costs

World Report on Road Traffic Injury Prevention, 2004 [56]

The World Bank has developed a 'state of the art framework' which its uses routinely for systematically assessing the performance of a country's road safety management system. The framework has been tested in low, middle and high income countries [5]. Checklists are used by safety management experts to assess country capacity across good practice dimensions of *institutional management functions*, *interventions* and *results* [5] [8].

A recent independent review of road safety in Sweden highlighted the highly advanced nature of its road safety management system when benchmarked internationally, but still found that it required considerable strengthening to ensure the achievement of its ambitious goal of death and serious injury elimination [8].

Overview – Independent review of road safety in Sweden

- Sweden is a world leader in road safety performance having achieved continuous improvement towards one of the lowest death rates globally. Sweden works to highly ambitious long term and interim road safety goals and has developed innovative strategies and solutions which have inspired and engaged national stakeholders as well as road safety professionals worldwide.
- The review acknowledged, at its outset, that Sweden's road safety management system is in a highly advanced phase of development when compared internationally. The higher the level of ambition, however, the more robust the road safety management system is required to be. Sweden has embarked upon a bold path and Vision Zero demands a new level of high performance and responsibility which needs to be shared by both the providers and the users of the system. Based on national and international good practice and information provided by senior management of stakeholders in Sweden, this independent review has identified some scope for future action.
- Achievement of the long term goal of death and serious injury elimination influences management functions and interventions in ways that differ profoundly from typical targeted approaches of the past. It requires both a shift to a more protective system (separating dangerous mixed road use as, for example, is being done with median barriers, better speed management, more crash protective roads and vehicles, good recovery and rehabilitation mechanisms) as well as achieving higher levels of user compliance with the design parameters set for the system in terms of speed and use of safety equipment.
- Sweden is in the 'establishment' phase of its journey towards Vision Zero. The next challenge, in view of Sweden's highly ambitious goal, is to achieve rapid 'growth' in the delivery of accountable, well-orchestrated, and effective Vision Zero activity. This is expected to include the continuation and deepening of essential long term work either underway or envisaged, as well as sharper multi-sectoral focus on interim goals to prevent death and disability in the short term. Short term gains can be expected from conventional interventions derived from national and international best practice, while improvement of the protective features of the network and the vehicle fleet will bring big benefits in the longer term. The new interim target(s) to 2020, and the related strategy and programme will establish the next phase of 'growth' for Vision Zero.

Source: Breen, Howard & Bliss, 2008 [8] .

Adopting a far-reaching road safety vision or goal

OECD [52] ***Recommendation*:**
Adopt a highly ambitious vision for road safety
All countries are advised to adopt and promote a level of ambition that seeks in the long term to eliminate death and serious injury arising from use of the road transport system. Adopting this ambition will alter the community's view of the inevitability of road trauma, alter institutional and societal responsibilities and accountability and change the way in which road safety interventions are shaped.
This is an aspirational vision in that achievement will require interventions that are some steps removed from prevailing best practice and will require the development of altogether new, more effective interventions. Part of its value lies in driving innovation. The long term vision needs to be complemented with interim targets for specific planning periods up to a decade or so.

European countries are increasingly adopting long term visions or goals for road safety e.g Vision Zero and Sustainable Safety. Experience indicates that complacency about death and injury in society can be shaken and sights raised by adopting a vision or philosophy for road safety which can relate to the general public [2]. Far reaching visions of total road safety promote a level of ambition that goes beyond incremental performance gains and the implicit acceptance of death and injury that will be determined by the rate of improvement shown by the best performing countries. These desired longer term results, together with interim targets, underpin the national road safety strategy and help to create a sympathetic climate for the introduction of effective interventions [5].

Vision Zero is presented as a long-term, objective for a traffic system where the amount of biomechanical energy to which people can be exposed without sustaining serious injury is the basic design parameter. Sweden has set a new performance frontier for road safety management and the adoption of a long term goal for eliminating death and serious injuries, supplemented by a range of interim casualty reduction targets, is strongly recommended by the OECD [52]. As with the Sustainable Safety strategy being implemented in the Netherlands which has a similar safe system strategy, Parliamentary scrutiny and approval stimulated public debate and prepared the way for future successful work [66]. The Nordic countries have all adopted a policy based on the Vision Zero strategy. Switzerland's *Via Secura* theme and the *Safe System* concept adopted in the Australia States are also derived from the Vision Zero philosophy.

These long-term goals and strategies for a *Safe System* require fundamental and wide-scale re-working of various aspects of the design and operation of the national traffic system, to achieve better interface between human, vehicle and road environment as outlined in OECD Towards Zero: Achieving Ambitious Road Safety Targets through a Safe System Approach [52].

Analyzing what could be achieved in the medium term

This entails analysis by a high-level expert group of the identification of the most important road casualty problems throughout the road traffic system on the basis of data analysis, survey and research. It involves survey of the current safety performance of different aspects of the traffic system, analysis of information on the effectiveness of different countermeasures in achieving road safety outcomes, socio-economic appraisals and the identification of useful implementation tools [53]. This analytical activity usually involves a high-level multi-sectoral group supported by advisory groups comprising in-house, external research expertise and sometimes technical experts from abroad.

- ***Use of a sound methodology***
  Effective national target-setting requires a sound statistically based methodology to set credible casualty reduction targets. Several countries have used models which provide a powerful means of organizing available knowledge and thinking systematically about the future development of road transport and its safety [9] [38] [39] [41] [42]. The model used for the development of the New Zealand 2010 targets can be used to determine what target is achievable with given amounts and types of interventions and to determine the amounts and types of intervention needed to achieve a given target [42].
- ***Forecasting future trends on the basis of past performance***
  The starting point is analysis of past and current safety performance and on the basis of this forecasting what may be realistically achieved in future with additional efforts. The first stage of the forecasting process consists of developing statistical models that explain past changes in the casualty numbers for different user groups with reference to measures of the changing exposure to risk of these groups, including the amount of motor traffic and

the average distances walked and cycled per person per year; and available information about the effectiveness at the national level of measures that have influenced casualty numbers substantially [9].

- ***Identifying the potential for further improvements***
  The forecasting process produces a wide range of results reflecting different scenarios about the future development of road transport and road safety measures. Scenario planning and computer modelling is often used to predict possible outcomes. Assessment of future long-term casualty, traffic and demographic trends is also necessary to understand underlying factors which may influence achievement of future results.

Working papers analysing a range of countermeasures in terms of their cost-effectiveness and public acceptability are developed to inform target-setting and strategy development (e.g. [9] [38] [39]. These working papers are typically published at the same time of the road safety strategy. Information is derived from surveys, practical trials or from national or overseas experience of successful implementation effectiveness of policies. During the last forty years a substantial international knowledge base of effective interventions has grown up to inform national policymaking and road safety planning [18] [56]. At the same time, exacting *safe system* strategies and innovative intervention which take better account of human limitations are being used increasingly and with some good results [5] [52].

Socio-economic appraisals need to be carried out to determine the best use of public resource to meet the objectives. Selecting measures and ensuring that maximum returns are realized entails the benefits of road safety measures needed to reach safety targets to be quantified and ranked, using cost-effectiveness, multi-criteria analysis and cost-benefit analysis or a combination of these methods.

Cost-effectiveness analysis In cost-effectiveness analyses the costs of a measure are set against its effects. The measure's effects are not expressed in monetary terms. Starting from a given safety target and budget, this method identifies the path which will produce the highest casualty savings. Policy measures are ranked according to their estimated cost-effectiveness ratios. Cost-effectiveness analysis is widespread in OECD countries (e.g. Finland, the Netherlands, and the United States). An ETSC review in 2003 identified a variety of cost-effective measures which could be adopted by the European Union [58].
Multi-criteria analysis is a qualitative method which is more complex than other appraisal options. It assesses the impact of a measure against a wide range of general objectives. Value scales and weighting schemes are used to indicate a value trade-off between criteria and objectives. Such analyses are also commonly used in OECD countries.
Cost-benefit analysis in an essential road safety resource allocation tool in best practice countries. The result is obtained by comparing crash and injury costs with benefits of avoiding the crash and injury. Avoiding such crash and injury costs represents the economic benefit of road safety measures. The benefit-cost ratio represents the economic advantage of the safety measures [24]. Cost-benefit analysis requires the valuation of lives saved and injuries avoided. Some best practice countries adopt values of statistical life, based on estimates of peoples' "willingness to pay" for small reductions in risk. Others adopt a "gross output" or "human capital" approach which values the loss of current resources and losses in future output, and sometimes adds a significant sum to account for related "pain, grief and suffering". Other measures can also be used, such as those based on the values revealed in "court awards" to surviving dependents. Given the limited availability of robust data, cost benefit analysis is not yet used widely, but it is the preferred tool of road safety professionals. In the absence of such data, cost-effectiveness can be used to select and rank the most effective measures, once a target has been set.

The ERSO Cost benefit analysis web text together with the EU funded thematic network ROSEBUD report provides further information on these issues [58].

Public opinion survey data Covering representative samples of road user opinion are helpful in establishing levels of understanding and support for different interventions. These can often be used to place the contributions of narrowly focused lobbies into an appropriate context [70] [53]. Most road safety lead agencies put in place public opinion tracking, usually with an outside agency to monitor the public acceptability of different measures. The European Social Attitudes to Road Risk in Europe (SARTRE) survey is a cross national study of attitudes to road safety. In it, about 1000 driving license holders per country are questioned about their opinions on road safety measures, danger perception in traffic, about road accident causes, their own behaviour and that of other road users, and about their experiences with police surveillance [64] [31].

Setting targets by mutual consent across the road safety partnership

OECD Recommendations

Set interim targets to move systematically towards the vision

Ambitious, achievable and empirically-derived road safety targets should be adopted by all countries to drive improved performance and accountability. These targets should be developed by using a methodology that links interventions and institutional outputs with intermediate and final outcomes to develop achievable targets for different intervention options.

Exceptional efforts will be required in most OECD and ITF countries to achieve the road safety targets set by Transport Ministers in 2002 - 50% reduction in deaths between 2000 and 2012, or similar ambitious targets. Accordingly, it is recommended that targets based on expected outcomes from specified interventions now be established, as a means to move more systematically towards the level of ambition established by the targets set in 2002.

An effective process depends upon effective governmental lead agency direction and coordination, good in-house support, technical support from independent experts and consultation with a wide range of stakeholders to identify a system-wide programme of effective and implementable intervention [52].

Responsibility

In good practice, target-setting is the responsibility of the lead agency and the coordinating body since the realization of outcome targets is a multi-sectoral shared responsibility across Government.

Long term goals and challenging but achievable interim targets

It is recognized good practice that national road safety strategies include achievable performance targets for the interim, with their achievability being determined by both the country's institutional management capacity and the technical performance boundaries of the interventions implemented. However, longer-term ambition can go beyond what can be achieved with current and projected means, and in leading countries the goal of eliminating deaths and serious injuries has been set and requires a shift to the *safe system* approach to bring the road system into line with the safety performance expectations for other modes of transport.[5] [52].

Empirically derived targets

In good practice, the interim targets proposed by the lead agency and/or the coordination body are based on research and analysis of how targets can be reached. These are then submitted for Ministerial/Cabinet approval and Parliament. The activity is driven by the lead agency

which reviews safety performance, identifies priorities, and organizes the other key government stakeholders to consider and approve proposed outcomes. An achievable but challenging target requires a sound relationship to be established between targets and measures and the ownership and commitment of all the affected stakeholders. A strong alliance between political leadership and professional management is crucial.
The different types of targets which can be set for road safety outcomes and outputs are shown in Results and on the ERSO text Quantitative road safety targets.

Establishing mechanisms to ensure stakeholder accountability for results
Public service targets and agreements are typically the means by which governments and agencies demonstrate their role and accountability for road safety responsibilities.

Examples of lead agency annual performance agreements
Victoria: The roles and responsibilities of VicRoads, Victoria Police and the Transport Accidents Commission are set out in the road safety strategy, annual plans and performance agreements. The Chief Executive of VicRoads has reducing road crash death and injury as a formal criterion in the performance-driven employment remuneration package. Reducing road casualties by 20% by 2007 as targeted in the national strategy *Arrive Alive!* is one of four policing performance targets in Victoria Police's published plan for 2003/4. Accountability for local road safety activity is established through a combination of funding mechanisms and performance indicators. Specifically allocated funding is made available to Community Road Safety Councils for targeted road safety activity and VicRoads works to specific performance targets associated with this program, the results of which are published annually.
New Zealand: Since 1989, public finance law in New Zealand has required all government agencies to prepare annual corporate management information, which includes performance targets, objectives and scope of activities[17]. The road safety targets which each National Road Safety Committee member has signed up to and the systematic follow through which is conducted to determine the success or failure of specific actions are the cornerstone of New Zealand's road safety performance assessment regime. The lead agency for road safety has to submit an Annual Performance Agreement with the Ministry of Transport covering road safety activity for the next twelve months[18].
Sweden: The Swedish Road Administration's (the lead agency) responsibilities for road safety are set out every year in performance agreements in its Annual Report. The SRA target is to contribute to a reduction in the number of deaths and serious injuries and the number of deaths in road traffic is to be no more than 270 in 2007. Annual goals are specified in performance agreements. For example in 2003, the specified goal was to implement cost-effective road safety measures on the state road network so that the number of deaths is reduced. Measures that aim to improve traffic safety of children are to be prioritized. The outputs and contributions of other key stakeholders are based on formal Declarations of Intent.
Britain: The Department for Transport's Public Service Agreement target is to reduce the number of people killed or seriously injured in Great Britain in road accidents by 40%, and the number of children killed or seriously injured by 50% by 2010 compared with 1994-98, tackling, at the same time, the significantly higher incidence in disadvantaged communities. The Department's Highways Agency also has a specific Public Service Agreement target to reduce casualties on national roads and has produced a 5 year road safety plan

Bliss and Breen, 2008 [5]

Police performance management framework in New Zealand
To encourage and promote good quality service delivery and to maximise the effect of enforcement on meeting the 2010 road safety targets New Zealand Police work within a performance management framework.
The performance framework considers both outcomes (aims and objectives) and outputs (enforcement) and has been put in place to promote the effectiveness and efficiency of the enforcement delivered in order to maximise the effect on the desired outcomes.
Outcomes include road deaths, serious injuries and crashes as well as other intermediate outcomes relating to driver behaviour. Some examples of the behavioural outcomes that might be influenced by enforcement include mean speeds and the percentage of offenders driving in excess of 10 kph above the limit. These outcomes often relate to 2010 road safety targets.
Outputs include strategic offences per hour delivered (for speed, drink driving, restraints and visible road safety) and these are generally referred to as productivity measures and intended to maximise the efficiency of enforcement. Other quality-focused outputs are intended to maximise the effectiveness of Police enforcement by targeting particular behaviours. These outputs include the percentage of tickets issued in the lowest speed band above the 10 kph tolerance and the percentage of visible road safety offences that relate to manner of driving and driver duties and obligations (eg crossing the centre line, failing to give way).

Bliss and Breen 2008 [5]*, Source: Jones [35]*

2.2.1.3 Multi-sectoral co-ordination

Many government departments share responsibility for road safety – Transport, Health, Justice, Education, Employment, Finance - but unless special arrangements are put in place, achieving accountability, appropriate co-ordination and realizing the full potential of individual sectoral responsibilities is difficult [56]. The component problems of road traffic injury are diverse and meaningful institutional collaboration within Government needs to take place to adopt a system-wide strategy and achieve programme integration of the (sometimes competing) development, environment, accessibility, equity and safety objectives of national/regional governments. The rationale for coordination is always the country results focus [5].

The coordination function is addressed across four key dimensions and the lead agency plays the main management role [5] :

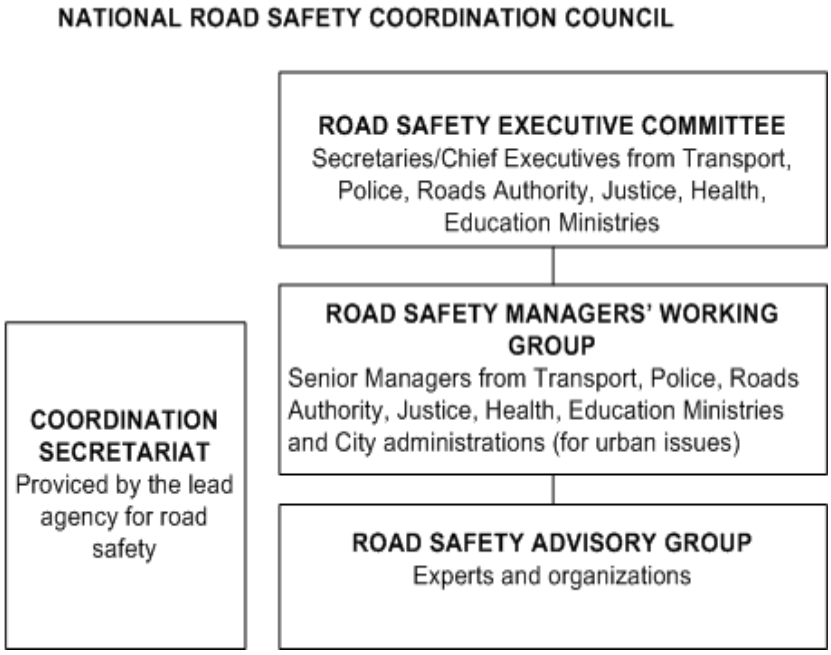
- Horizontal coordination across central government
- Vertical coordination from central to regional and local levels of government
- Robust delivery partnerships between government, non government, community and business at the central, regional and local levels
- Parliamentary relations at central, regional and local levels

Horizontal coordination
In good practice, horizontal coordination to achieve results is carried out across government by government [5]. High-level committees, working groups and bi-lateral partnerships are established to deliver coordination.

New Zealand's National Road Safety Committee (NSRC) Co-ordination: Chaired by the Chief Executive of the lead agency, it brings together the Chief Executives of seven key Government agencies concerned with road safety including local government. Accountability: The terms of reference for the NRSC are set out in a Memorandum of Understanding. Road safety is clearly identified as core business for each of the partners in their documentation and in the adopted national road safety strategy giving potential for wider implementation of specific proven measures and increased resource. Technical support: The NRSC has a National Road Safety Working Group made up of representatives of the NRSC organizations which sets the agenda and prepares papers for quarterly NRSC meetings as well as setting up working groups on specific issues.		**Interministerial Committee for Road Safety (CISR) in France** Chaired by the Prime Minister, the coordinating committee brings together Ministers of the following Government Departments: • Transport • Interior • Defence • Justice • Health • Education • Research • Finance The Committee meets twice a year and the Secretary is the Director of Road Safety and Traffic within the Ministry of Transport The National Road Safety Council has a consultative role and comprises all stakeholders. Including representatives of local authorities

In best practice coordination, the national coordinating arrangements and structures are an extension of the accountable lead agency that manages them and are used as platforms for agreeing and reviewing national road safety targets; mobilizing resources; coordinating multi-sectoral partnerships in pursuit of agreed results and consulting with a wider group of stakeholders. Formal specification of the leadership and decision-making role of coordination bodies are set out in legislation and/or a Memorandum of Understanding (MoU) and in the safety strategy. A MoU is established with each participating member agency and used to encourage their delivery of concrete results; establish their accountability; and work collectively to achieve shared objectives. The arrangements are usually established, serviced, supported by the lead agency with a clearly defined secretariat and appropriate funding [5]. A best practice model is recommended by the World Bank and OECD [5] [52].

Best practice coordination model recommended by the World Bank and the OECD [5] [52]



The National Road Safety Coordination Council comprises a decision-making hierarchy and partnership for achieving road safety results through the development and implementation of a well-developed and coordinated road safety strategy and targets which have been agreed across Government. The hierarchy comprises three main levels:
The Road Safety Executive Committee comprises the Chief Executives (Secretaries/Assistant Ministers) of the key governmental stakeholders and reports to, supports and receives direction from Ministers. Its role is in communicating, coordinating and agreeing on top-level strategy between agencies on road safety issues. It monitors and reports progress to the Government through its Ministers, who sign off the national road safety strategy based on detailed plans for the outputs of the key stakeholders to achieve results. The Group meets approximately 4 times each year and the Chair is occupied by the lead agency for road safety
The Road Safety Managers' Working Group is the hub of the road safety co-ordination meeting monthly and comprises senior managers from Government departments with responsibilities for day to day road safety management. The Chair is occupied by the lead agency for road safety. With the lead agency as the key link, the group coordinates implementation of the road safety strategy, develops and implements programmes and interventions, reviews identified programmes, identifies research priorities, and promotes and monitors a coordinated country-wide programme of activities. The Group can set up Technical Working Groups to assist its activity.
The Road Safety Advisory Group is a consultative body comprising all the main road safety stakeholders, including the non-governmental sector, business and professional sector which meets quarterly and is chaired by the lead agency head of road safety.
The Coordination Secretariat is a dedicated, funded unit which sits within the road safety strategy unit of the safety department of the lead agency.

EU level Coordination

The EU has broad scope to act on road safety and the lead responsibility for the development of road safety strategy within the European Commission rests with DG Energy and Transport. In June 2003, the European Commission presented a European Road Safety Action Programme Halving the number of road accident victims in the European Union by 2010: A shared responsibility [10]. In addition the EU has a legislative role in accordance with Articles 71 and 95 of the EU Treaty, it funds road safety activity and is active in research and development and knowledge transfer [2]. EU level intervention ion road safety s coordinated between Member States through the High Level Group on Road Safety and the eSafety Forum. A European Road Safety Charter was established in 2004 to allow engage with a wide variety of road safety stakeholders.[21]

The European Union has financial means which enable it, through targeted calls for proposals, to support initiatives to generate a higher sense of awareness among policymakers, professionals and the public at large about the main safety issues and the solutions required.

Vertical coordination

Over the last thirty years, there has been a trend in many high-income countries for less central governance with more local and regional decision-making in public policy. Some countries, such as Belgium and Germany have a long tradition in regional road safety activity. Others have decentralized over a period of time. In many countries therefore, major responsibility for road safety is shared also with regional, State, provincial government as well as local authorities and districts. In most countries, local highway authorities have responsibility for their own roads. National targets are being translated increasingly into regional and local targets. Decentralised responsibilities for road traffic policing are also present in some countries [5].

Strong coordination between central, regional and local government is therefore important to achieve national results. This is generally achieved through involving lower tiers of government in the coordination hierarchy or creating regional road safety coordination bodies, by use of funding mechanisms, contractual agreements, Codes of Good Safety Practice and performance monitoring [5].

In the United Kingdom, the Netherlands and Sweden, responsibilities for road safety at regional/local level are defined in legislation which can facilitate interaction and contractual arrangements for positive road safety outcomes, while still leaving local authorities free to decide how to carry out that duty in all their local circumstances. For example, in the UK, the road safety functions of local highway authorities were set out in legislation in the 1970s. The UK also had a specific annual allocation in transport grants to local government for high risk site treatments or local safety schemes which required formal justification in road casualty reduction terms, as opposed to that required for minor works [36]. Budgets are now assigned against local transport plans. In the Netherlands, responsibilities for the financing and implementation of *Sustainable Safety* within the National Traffic and Transport Plan 2001-2020 are largely decentralized. The Decentralization Agreement in 1994 specified that each of the 19 regions should have a Provincial Safety Board (ROV), funded by central government (which has since been discontinued), in which all parties involved in traffic safety should co-ordinate their individual activities at provincial and local level [36].

Robust delivery partnerships between government, non-government, community and business at the central, regional and local levels

Good practice delivery involves the development of a range of close working partnerships to achieve national goals, often using direct funding mechanisms and other implementation tools. These include bi-lateral and multi-sectoral partnerships amongst the roads/transport, health, justice/police and transport sectors at national, regional and local levels. Many other organisations also work actively on road safety. Consultation and coordination with all is necessary to achieve societal ownership of the road safety problem and the championing of solutions.

Police and highway authorities

Partnerships between highway authorities and the police are particularly important for the efficient use of crash data systems and coordinated enforcement and publicity. Good practice countries set up highly effective partnerships between the police and roads authorities resulting in the coordination of high profile advertising and high visibility traffic policing leading to significant casualty reduction. Police and highway authorities work together to produce road safety action plans that promote local ownership of road safety, and the appropriate use of police and other resources across boundaries as well as calendars of coordinated activity through the year.

Multi-stakeholder local partnerships

The EU-funded DUMAS project and the OECD have highlighted many examples of how local road safety planning and local delivery partnerships can contribute sustained improvements in road safety [36] [15] [45].

Engaging the NGO sector

The scope of non-governmental organization road safety activity is broad, contributing to a variety of country institutional road safety management functions as well as carrying out interventions in support of national visions, targets and strategies. NGOs are most effective when they measure their success by their ability to influence road safety results [7].

Professional institutes such as those representing the road engineering or health professions can make an important contribution to road safety. These organizations are usually funded by professional membership subscriptions, which assure their independent voice. They can provide an authoritative voice in helping to stimulate awareness and action on road safety amongst their profession; helping to identify best practice as well as embarking on training activity and professional capacity development (e.g. the Institution of Highways and Transportation in the UK [33] or the Dutch highway engineering organization, CROW [12]. Such organizations have been in the forefront of advances in Europe in urban and rural safety management.

Safety organizations The leadership and advocacy of public health and safety professionals, pro-active in building effective coalitions, has often provided the stimulus for successful evidence-based interventions [56]. Aided by the scientific community, the medical profession, victims groups, user groups and the media, safety organizations can play a major role in road casualty reduction [65]. At European level, the Brussels-based European Transport Safety Council (ETSC) provides an international example of successful coalition building to achieve specific aims and professional support. Successful campaigns include an EU-wide road fatality reduction target and new vehicle safety standards legislation. Supported by a wide range of professional experts and organizations, ETSC aims to provide impartial advice on transport safety to European policymakers and to identify and promote measures with high safety potential and with due consideration to cost and public acceptability [25]. The National Society for Road Safety in Sweden is the umbrella organization for the non-governmental

sector comprising a wide range of organizations [51]. It plays a key role in promoting Vision Zero.

Motoring, road user and consumer organizations User organizations typically mount strong national campaigns to improve mobility and safety. In recent years, together with safety organizations, motoring and consumer organizations have played a key role in improving car occupant safety standards. International Testing representing consumer and FIA/AIT representing motorists has played an important role in European New Car Assessment Programme [20] which was initiated by the British and Swedish governments.

Engaging with the business sector

The business sector shares responsibility for road safety and can make an important contribution to road safety when input which is in line with national road safety strategy goals. Industry shares responsibility for road injury prevention, in the design and use of its products and as an employer whose staff and transport services are often major road users. Vehicle manufacturers are a key provider of road safety and Volvo has recently announced that no one will be killed or seriously injured in or by a Volvo car by 2020.

What vehicle manufacturers can do:

- Ensure that all motor vehicles meet safety standards set for high-income countries – regardless of where the vehicles are made, sold or used – including the provision of seat-belts and other basic safety equipment.
- Begin manufacturing vehicles with safer vehicle fronts, so as to reduce injury to vulnerable road users.
- Continue to improve vehicle safety by ongoing research and development.
- Advertise and market vehicles responsibly by emphasizing safety.

World Report on Road Traffic Injury Prevention (2004)

The business sector often contributes financial support to road safety activity. For example, organizations funded by the insurance industry make a valuable contribution to road safety. Folksam Research, Sweden [11] and the Insurance Institute for Highway Safety [34] in the United States play a key role in providing objective information about the crash performance of new car and other safety issues. Data collection managed by the Motor Traffic Insurers Bureau (VALT) [68], in Finland which investigates every fatal crash occurring nationally and carries out safety studies, feeds directly into national public information and policy. The insurance industry in Austria contributes a large share of the funding of the Austrian Road Safety Board [4].

In view of the fact that a large proportion of road traffic injuries are occupational in nature, companies can play a role in improving road safety through in-house safety policies and fleet policies. The Swedish Road Administration and the Swedish Work Authority have been particularly active in engaging employers in work-related road safety.

Examples of lead agency initiatives to engage the business sector in Sweden [5]

- Helping to establish the European New Car Assessment Programme (Euro NCAP) which publishing ratings on the crash performance of new cars which has led to significant improvements in safer car design for car occupants
- Using Euro NCAP safety ratings in performance monitoring in SRA travel policies to encourage demand for improvements in vehicle safety
- Encouraging local car industry to fast track the fitment of alcohol interlocks, seat belt reminders, electronic stability control systems
- Encouraging road haulage and taxi companies to adopt a range of safer practices e.g. the fitment of alcohol-lock devices to detect excess alcohol and the fitment of seat belt reminders by stipulating safety demands such as these in transport contracts.
- Supporting the non-governmental organization National Society for Road Safety to develop performance ratings for the road safety activities of road haulage companies;
- Engaging the business sector and other organizations through establishing the National Coalition for Road Safety. This consultative and coordinating body encourages traffic stakeholders to make far-reaching promises to improve road safety. The taxi and road haulage sectors, for example, made commitments regarding the increased use of seat belts, better observance of speed limits and driving without alcohol.

Parliamentary relations at central, regional and local levels

In European Union countries both the European Parliament and national Parliaments play a key role in road safety.

Well-informed all-party Parliamentary committees and groups on road safety have been associated with major developments in road safety policy in Australia and Europe [65] [56]

- Parliamentary Committees are appointed by the Parliament and have a formal remit within the Parliamentary process. These can be stand-alone road safety committees, or transport committees which give high priority to road safety. They usually comprise around 8-10 Parliamentarians from all parties. E.g. the Joint Standing Committee on Road Safety in Victoria, Australia and the Swedish Parliament's Transport Committee.
- Parliamentary Groups are usually registered with Parliament, have to conform to certain rules, but they are not formally part of Parliament. They comprise Parliamentarians from all parties, road safety experts and representatives from a range of organizations. E.g. the British Parliamentary Advisory Council for Transport Safety (PACTS)

These bodies have several functions:

- Champion road safety within Parliament, the media and the community
- Promote effective action to Government
- Consider a broad spectrum of issues and views and seek expert and community opinion
- Parliamentary Committees can conduct hearings and publish recommendations to which Governments must respond within a specific timescale
- Legislate for road safety using Private Members' procedures and Parliamentary time
- Approve casualty reduction targets.

Parliamentary initiatives on road safety [5]
Sweden's Parliamentary Transport Committee played a key role in enshrining the Vision Zero policy in legislation and introducing numerical fatality reduction targets to 2007 to encourage fast action.

In the Netherlands, the Standing Committee on Transport, Public Works and Water Management played a similar role in ensuring that Sustainable Safety and casualty reduction targets were covered by legislation.

The all-party British Parliamentary Advisory Council for Transport Safety played a national co-ordinating role in the introduction of compulsory front seat belt wearing in the early 1980s through Private Members' legislation.

2.2.1.4 Legislation

All countries active in road safety aim to ensure that appropriate legislation is in place to meet the road safety task set out and agreed within the national road safety strategy. Typically, a comprehensive framework for the road traffic system safety will have evolved over many years. The 'legislation' function involves:

- Reviewing the scope of the legislative framework periodically
- Developing legislation needed for the road safety strategy with due consideration to cost-effectiveness, practicality and public acceptability
- Consolidating legislation
- Securing legislative time for road safety

This function ensures that legislative instruments for road safety are well-matched to the road safety task. Road safety legislation typically addresses land use, road, vehicle, and user safety standards and rules and their compliance, as well as post impact medical care. A mixture of specialist legislative and technical expertise is needed within government to develop and consult on enforceable standards and rules with due consideration to cost, effectiveness, practicality and public acceptability [5].

2.2.1.5 Funding and resource allocation

This function seeks to ensure that road safety funding mechanisms are established, sufficient and sustainable. At the same time, a rational framework for resource allocation allows the making of a strong business case for road safety investments based on cost-effectiveness and cost benefit analyses. To achieve more ambitious performance targets, new funding sources and mechanisms may need to be established [5].

OECD [52] ***Recommendation***
Invest in road safety
Most countries need to improve their knowledge of expenditure on the consequences of road crashes, both by government and injury insurance companies, and investment in road safety improvement and trauma prevention. Road safety authorities need this information to prepare financial and economic evidence on the costs and effectiveness of proposed interventions in order to win whole-of-government support for funding innovative programmes and for transparency in resource allocation for crash prevention and treatment. There are opportunities for targeted road safety investments that provide competitive returns. Road safety practitioners and authorities should develop business cases for this investment. A step change in resources invested in road safety management and in safer transport systems is required to realize the achievement of ambitious road safety targets in most of the world.

Funding and mechanisms
The socio-economic costs of road crashes usually represent between 1% and 3% of a country's GDP (depending on whether a human capital or willingness to pay approach is used (the latter method is considered to be better practice). Many countries are unable to estimate the annual costs of road trauma to government and injury insurers, but the available evidence suggests that costs substantially outweigh the funds put into road injury prevention programmes [52].
Levels of public sector road safety investment in different countries are not readily identifiable, because many safety related expenditures are embedded in broader categories of expenditure across the transport, health, justice and education sectors.

General tax revenues:
Many best practice countries fund large components of their road safety programmes from general tax revenues, as part of the national budgeting processes. Often the specific road safety components are embedded within larger engineering, enforcement and education programmes and are difficult to identify as individual budget items. This approach to road safety funding is relatively simple to administer, but it lacks transparency in terms of determining equitable cost sharing across road user groups and in monitoring the financial performance of investments. Earmarked resources, wherever possible, can assist transparency of road safety investment and its value.
Road funds: Revenue sources for road funds typically come from fuel taxes, vehicle registration and licensing fees, and road user charges for heavy vehicles. There are few examples of road funds being used to finance road safety investments. In some countries like South Africa a small proportion of road fund income is dedicated to road safety activities, whereas in the New Zealand *Road Safety to 2010* strategy, the road fund finances the national road safety enforcement programme, national road safety education, national publicity and awareness campaigns, national strategy management and coordination processes, national and local low-cost safety engineering measures, and general road network investments that contribute to improved road safety outcomes.

Examples of earmarked funding for road safety engineering in Sweden and Great Britain

Sweden: Road safety in Sweden is mostly funded by government and general revenue which is then distributed to the lead agency – the Swedish Roads Administration (SRA) and other sectors. In 1999, funding to the SRA was doubled with a total of SEK 8.5 billion ($US 1.25 billion) allocated to road safety over 10 years. An increased and earmarked allocation was made to allow resource for physical road safety measures such as roads with median guardrails, safer intersections and road shoulders. It has been estimated that approximately SEK 75 million (just under $US 11 million) per year of the SRA budget are spent on road safety projects.

Britain: In 1974 a legal duty was place on local authorities to establish systematic programmes for identifying high risk crash sites and developing remedial measures. The legislation also required local authorities to appoint road safety officers who were responsible for developing education and publicity programmes for the local authority. Aided by the development of national road safety guidelines, multi-disciplinary specialist safety teams grew up in many local authorities to carry out road safety engineering programmes and information work. Road safety engineering on local roads is financed by Central Government Capital Funds that are bid for by local authorities. In the 1980s, the Department of Transport and local government agreed that scheme funding should be ring-fenced such that it was used only for safety schemes which proved to be highly successful over its years of its operation. Annual funding rose rapidly and by 1997, comprised 6 times the amounts recorded in 1982

Source: Bliss and Breen, 2008 [5]

User fees: Many entry and exit services concerning measures such as driver licensing, vehicle inspection and operator licensing are directly funded from road user fees, paid either to the government agencies responsible or private sector agencies working on their behalf. These fees borne by users represent a substantial proportion of a country's total road safety investment.
Insurance levies: Some countries levy a fee on vehicle insurance premiums to help fund road safety programmes, but the amount of funding raised is generally small and is often used to fund education and publicity initiatives to improve road user awareness of road safety risks. Finland provides the best-known example of this approach.
Earmarked taxes: As well as various taxes and user charges being channelled to road funds for a variety of purposes, some taxes can be earmarked (or hypothecated) for a specific purpose. For example, revenue from traffic fines is used to finance road safety activities in some countries. The most recent example of this is the United Kingdom, where fines revenue from speed cameras is earmarked for road safety intervention at hazardous locations [1].

Resource allocation: Good practice countries establish a clear understanding of the total socio-economic cost of road crashes and the true value nationally of preventing deaths and serious injuries. Identifying this cost elevates the case for investment in road safety where identifiable savings can be made. In some countries the socio-economic cost of preventing a fatality is highly underestimated which can inhibit cost-benefit analysis. A nationally recognised basis for project evaluation enables road safety programmes and projects to compete successfully with projects serving other policy aims. See Cost benefit analysis web text for further information.

2.2.1.6 Promotion

OECD [52] ***recommendation***
Foster commitment at the highest levels of government
Sustained government commitment at the highest level is essential for improving road safety. To secure this, road safety managers not only need to develop evidence-based road safety programmes but need to advocate strategies that reflect an understanding of political constraints such as the electoral cycle.
Significant effort needs to be directed at informing the public about the Safe System approach. Public consultation should be comprehensive and should precede final political consideration of new policies.
Road safety practitioners and stakeholders have a responsibility to influence the political process of policy assessment through: competent and persistent advocacy of programmes within government, provision of annual estimates of the socio-economic costs of road trauma and development of an extensive armoury of effective road safety interventions.

The road safety 'promotion' function has, traditionally, comprised Government-backed publicity campaigns aimed at road users to create awareness of road safety problems and to influence attitudes. Road safety promotion today has a much broader role within the road safety management system. It aims to create a supportive climate for achieving results and implementing effective intervention by all those with responsibilities for traffic system safety, across many sectors of Government and society. It promotes the need for results, the means by which they can be achieved and the core business responsibilities of the key stakeholders at a high level [5].

In good practice, the 'promotion' function is addressed by the following:

- Promoting a far-reaching road safety vision
- Championing and promotion at a high level
- Multi-sectoral promotion of effective intervention and shared responsibility
- Leading by example with in-house road safety policies - see Work-related Road Safety text for further information
- Developing and supporting safety rating programmes - see Safety Ratings text for further information
- Carrying out national advertising
- Encouraging promotion at local level [5].

High-level Ministerial promotion in several EU countries [5]***.***
In several countries Government Ministers have engaged in road safety promotion at the highest level. For example, the President of France cited road safety as one of the main national priorities for his term of office and established high level committees to oversee developments. The Prime Minister of Britain launched the country's current national road safety strategy and targets and the promotion of anti-drink driving by a high-profile Transport Minister in the 1980s contributed to a hardening of public attitudes to excess alcohol and calls for further measures. Swedish Ministers engaged fully in the promotion of the *Vision Zero* road safety concept and in Britain, the promotion of anti-drink driving by a high-profile Transport Minister contributed to a hardening of public attitudes to excess alcohol and calls for further measures. In Poland, a leading academic in road safety became a Transport Minister and, in his term, introduced a major new national road safety strategy.

The role of representatives of independent research organisations, the non governmental sector and Parliament is vital in high-level championing where government is seen to be slow to act.

2.2.1.7 Monitoring and evaluation

Monitoring and evaluation completes the management loop in a country results-based management system and comprises systematic performance of all the elements of the road safety management system.

Monitoring and evaluation' function is addressed by 3 main functions [5]:

- Establishing and/or supporting a range of data systems to set and monitor final and intermediate outcome and output targets.
- Transparent review of the national road safety strategy and its performance along the dimensions of results, interventions and institutional management functions.
- Making any necessary adjustments to interventions and institutional outputs needed to achieve the desired results.

Periodic monitoring and evaluation of road safety targets and programs is essential to assess performance and to allow adjustments to be made. The establishment and sustainable funding of transport registries for drivers and vehicles, crash injury databases and periodic survey work to establish performance and exposure data is typically the responsibility of several different Government agencies - transport, police, and health. In some countries, Government insurance departments or organizations and university departments also share responsibility. The organization of independent inspection, audit and review are also part of this function [5].

OECD [52] ***recommendation***
Conduct sufficient data collection and analysis to understand crash risks and current performance
All countries are encouraged to develop data collection procedures to cover: final outcomes (including at least deaths and serious injuries by road user); exposure measures (for example, relating
outcomes to population levels, licensed driver numbers, distances travelled); intermediate outcomes (also called safety performance indicators and including levels of mean traffic speeds, seat belt wearing, drink driving and vehicle and infrastructure safety ratings); institutional delivery outputs (including different categories of enforcement effort); socio-economic costs associated with road trauma; and underlying economic factors (including new vehicle sales).
Careful data analysis should be conducted to improve understanding of crash and other trends to allow different intervention mixes and intensities to be modelled and ambitious but achievable targets to be set.

For example intermediate outcome data (or safety performance indicators) are collected for target setting purposes, to monitoring the impact of a measure or programme, enable early, target-oriented adjustments of specific interventions and allow for a more detailed understanding of the reasons for safety problems than is possible by looking at crash frequency alone [27] [60].

Intermediate outcome data systems
Intermediate outcomes are not desired for themselves but for what they entail – better final outcomes. They include average traffic speeds, the proportion of drunk drivers, seatbelt-wearing rates, helmet-wearing rates, and the physical condition of the road network and the standard of the vehicle fleet. Along with final outcome data, they provide a firm basis for multi-sectoral working to achieve road safety results. Where fragmentary arrangements exist for the collection and analysis of country-wide data on road traffic deaths and injuries, intermediate outcome data can provide, in the interim, a useful starting point for the measurement of country safety performance in the development to inform the national road safety strategy. Most intermediate outcome data comprises the carrying out of periodic national surveys of key safety indicators in normal traffic. Typical indicators in use include:

- Average travel speed on urban and rural roads
- Percentage of front seat belt use in cars
- Percentage of rear seat belt use in cars
- Percentage of child restraint use in cars
- Percentage of excess alcohol amongst drivers
- Percentage of motorized two wheeler users wearing crash helmets
- Percentage of cyclists wearing crash helmets
- Percentage of motor vehicles using daytime running lights
- Ambulance response times within the emergency medical system
- Percentage of cars in the national fleet with NCAP four star safety ratings

Source Bliss and Breen, 2008 [5].

Transparent review by independent experts and research organizations: In Sweden and Britain, in-house reviews of progress are supplemented by published review of national road safety performance usually carried out by an independent organization. Additionally, In Sweden, a road traffic inspectorate was set up to monitor the rate and quality of implementation of the *Vision Zero* strategy. From 1st January 2009 the a new Transport Inspectorate will be created covering road, rail, air and water modes. In 2008, an independent review of road safety management in Sweden was carried out for the Swedish Road Administration using the World Bank assessment framework [8].

SafetyNet has produced Recommendations for independent accident investigation (WP 4) coordinated European road accident investigation activities based on common methodology.

2.2.1.8 Research and development and knowledge transfer

This vital institutional management function has guided the design and implementation of national strategies that have sustained reductions in road deaths and injuries, in the face of growing mobility and exposure to risk [56] [5]. It aims to produce a cadre of international, national and local professionals who can contribute research-based approaches and knowledge to road safety policy, programs and public debate. Knowledge transfer must be grounded in actual practice in a 'learning by doing' model, backed with sufficient targeted investment to overcome the barriers presented by the evident capacity weaknesses at the global, regional and country levels. Strong and sustained international cooperation will be required to mobilize knowledge transfer resources and support services commensurate with

the sheer scale of the global losses arising from escalating road deaths and serious injuries [5].

Good practice countries believe that research, technical support and knowledge transfer underpin their road safety performance and ensure that this sector is well-supported. Key activities include:

- Developing capacity for multi-disciplinary research and knowledge transfer
- Creating a national road safety research strategy and annual programme
- Securing sources of sustainable funding for road safety research
- Training and professional exchange
- Establishing best practice guidelines
- Setting up demonstration projects [5].

In some good practice countries, multi-disciplinary road safety research forms part of a national research strategy with a dedicated government budget. This includes behavioural studies; road crash injury research, biomechanics and vehicle design; road safety engineering; post-impact care; demonstration projects; and the development of standards for national and international legislation. Some countries have set up external advisory panels to help define the national programme. Appropriate levels of human and public financial resource need to be invested in a national road safety research programme. National and community research – as opposed to relying solely on international research – is important for identifying local problems and localized groups at increased risk of road injury. Separation of the research and evaluation functions from the operational aspects of road safety management gives independence and credibility to public policy research [5].

In Europe, the Forum of European Road Safety Research Institutes [29], the Passive Safety Network [67] and the European Enhanced Vehicle Safety Committee (EEVC), have comprised the principal road safety research networks over the last decade and new networks are emerging with the assistance of the EU Framework Programme. FERSI'S mission is to :

- Provide a forum for developing collaborative research projects aimed at producing solutions to common road safety problems within European countries
- Provide support to the European Commission in defining research needs within Europe
- Encourage the exchange of good practice and research knowledge between countries and
- Encourage closer co-operation and, where appropriate, the exchange of researchers between countries

Knowledge transfer in road safety is promoted and supported by a wide range of international and national agencies e.g. the *World Bank* and its *Global Road Safety Facility and World Health Organization, the FIA Foundation for the Automobile and Society* and the *Global Road Safety Partnership* are currently preparing a series of good practice intervention guides on road safety to assist country implementation of the recommendations of the *World Report on Road Traffic Injury Prevention*. The *World Health Organization* has produced a training programme (TEACH VIP) with a road traffic injury prevention component as well as a recent training manual (www.who.int). The *OECD* has carried out international reviews of road safety best practice for many years (www.oecd.org). Not least *the European Union* CARDS programme has supported twinning and professional exchange programmes in road safety management and has created the European Road Safety Observatory to enhance knowledge transfer on best practice (www.erso.eu.int) [5]

2.2.2 Interventions

Interventions are shaped to achieve the desired focus on results. As outlined the *World Report* these seek to manage exposure to the risk of crashes, prevent crashes, and reduce crash injury severity and the consequences of crash injury.
Interventions as depicted in *Box 1* [6] address the safe planning, design and operation and use of the road network, and the conditions under which vehicles and road users can safely use it; and they set specific standards and rules for this safety and aim to secure compliance with them.

Box 1: Classification of interventions Bliss, 2004 [6]

Intervention types	***Standards and rules***	***Compliance***
Planning, design, operation and use of the road network. Conditions of entry and exit of vehicles and road users to the road network. Recovery and rehabilitation of crash victims from the road network.	Standards and rules cover safe road planning, design, construction, operation and maintenance. Standards and rules also govern how the road network is to be used safely by setting speed and alcohol limits, occupant restraint and helmet requirements, vehicle standards and vehicle and driver licensing requirements. Standards and rules also govern the delivery of appropriate emergency medical and rehabilitation services to crash victims.	Compliance aims to make road builders and operators, the vehicle and transport industry, road users and emergency medical and rehabilitation services adhere to safety standards and rules, using a combination of education, enforcement and incentives.

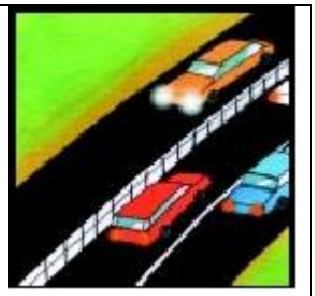
In addition the texts in the Knowledge Base of ERSO, a wide body of international literature is available to inform knowledge on road safety interventions. For relatively recent overviews see

- World Report of Road Traffic Injury Prevention (2004)
- Towards Zero: Achieving Ambitious Safety Targets - Summary, Full Report (2008)
- Implementing the Recommendations of The World Report on Road Traffic Injury Prevention Country guidelines for the conduct of road safety management capacity reviews and the related specification of lead agency reforms, investment strategies and safety programs and projects. See Global Road Safety Facility (2008)
- The Road Safety Handbook, Elsevier (2004)

Re-classifying the urban network in the Netherlands A Dutch study estimated that two-thirds of the urban network in the Netherlands could be re-classified into "residential roads" with a 30 km/h speed limit to lessen the risk faced by vulnerable road users from motorized traffic. To a timetable agreed between national government and the road controlling authorities, a re-classification system was put in place within two years. The Dutch functional road hierarchy sets out appropriate speed limits, geometric design, road layout standards and operating conditions for roads with flow, distributor and access functions. For urban areas, a distinction is made between residential access roads (where low area-wide speed limits could apply) and other access roads.	**% of urban roads treated with 30km/h** 5% in 1986 9.5% in 1990 16% in 1996 30% by 2000 50% by 2002 

2.2.2.1 Planning, design, operation and use of the road network

Safety conscious network planning involves classifying roads and setting speed limits to match road function and separating out motorized from non-motorized traffic, wherever possible.

Median barrier implementation in Sweden Some 38% of traffic flow on rural roads with a speed limit of 70km/h or greater is separated by median barrier. More than 3,500 kms of roads have separated traffic flows and 1,500 kms of these have 2+1 barriers.	

Proactive design involves adjusting the design and layout of the road and road networks such that they are 'self explanatory' to minimize error and to provide crash protection if an error is made. This includes self-explanatory road layouts, provision for pedestrians and cyclists, area-wide speed reduction and traffic calming, provision of crash-protective roadside objects and introducing safety impact assessment, audit and inspection (See iRAP and EuroRAP). Low-cost/high-return measures provide remedial action at specific sites, along stretches of road or on an area-wide basis. European countries report high benefits to cost of implementing road safety engineering. See Roads, Safety Ratings, Speeding, Pedestrians and Cyclists ERSO web texts for further information

2.2.2.2 Conditions of entry and exit of vehicles and road users to the road network

Interventions comprise standards and rules specifying how the road network is to be used safely by setting speed and alcohol limits, occupant restraint and helmet requirements, vehicle standards and vehicle and driver licensing requirements. They also comprise systems for ensuring compliance with standards and rules using a combination of education, enforcement and incentives. These issues are given extensive treatment in the ERSO knowledge base – See Novice Drivers, Older Drivers, Vehicle Safety, eSafety, Powered Two Wheelers, Alcohol, Speeding, Speed Enforcement, Fatigue, Pedestrians and Cyclists ERSO web texts for further information.

2.2.2.3 Recovery and rehabilitation of crash victims from the road network

Post-impact care is a strategy which aims to reduce the severity of injury consequences once a road traffic crash has occurred. Minor injury patients will often need the help of a general practitioner and optimal medical and psychological follow up care is important to alleviate pain and distress. For major injuries, clinical experts define the post-impact care needed as the chain of help starting with action taken by the victims themselves or more commonly by lay bystanders at the scene of the crash, emergency rescue, access to the pre-hospital medical care system, and trauma care and helping road crash victims who have suffered debilitating injury re-integrate into work and family life. The effectiveness of such a chain depends upon the strength of each of its links. For a review of the current state of the art and links to key sources of information, see Post-impact care ERSO web text.

2.2.3 Results

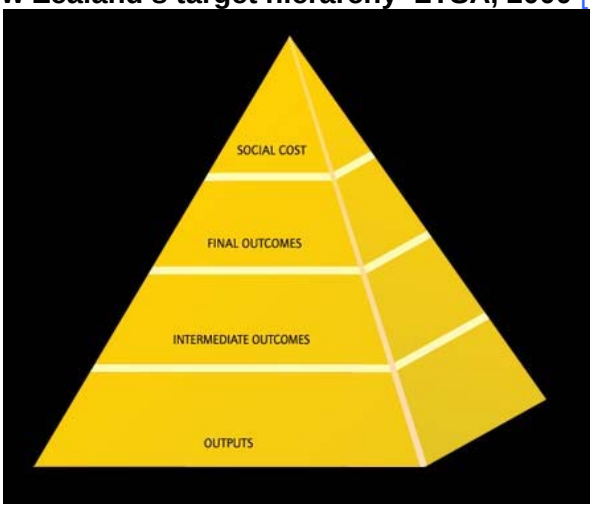
The final element of the road safety management system concerns the measurement of the desired results and their expression as targets in terms of final outcomes, intermediate outcomes, and outputs, as shown in Box 2 [6]. Targets specify the desired safety performance endorsed by governments at all levels, stakeholders and the community. The level of safety is ultimately determined by the quality of the delivered interventions, which in turn are determined by the quality of the country's institutional management functions.

Box 2: Safety Targets Bliss, 2004 [6]	
Final outcomes	Final outcomes can be expressed as a long term vision of the future safety of the road traffic system (e.g. *Vision Zero* and *Sustainable Safety*) and as more short to medium term targets expressed in terms of social costs, fatalities and serious injuries presented in absolute terms and also in terms of rates per capita, vehicle and volume of travel.
Intermediate outcomes	Intermediate outcomes are of value for their contribution to improved final outcomes and they include average traffic speeds, the proportion of drunk drivers in fatal and serious injury crashes, seatbelt-wearing rates, helmet-wearing rates, the physical condition or safety ratings of the road network, and the standard or safety ratings of the vehicle fleet.

Outputs	Outputs represent physical deliverables, for instance the number of police enforcement operations required to reduce average traffic speeds, or alternatively they can correspond to milestones showing a specific task has been completed.

Good practice countries set quantitative outcome and intermediate outcome targets to achieve their desired results focus. They can also set related quantitative output targets in line with the targeted outcomes as in the New Zealand example.

New Zealand's target hierarchy LTSA, 2000 [40]



- The overall target is to reduce the socio-economic costs of road crashes
- To be achieved by meeting the second level of targets, requiring specific reductions in the numbers of fatalities and serious injuries
- A third level of targets consists of intermediate outcomes (including those related to speed, drink driving and rates of seat-belt wearing) that are consistent with the targeted reductions in final outcomes;
- A fourth level of targeting is concerned with institutional delivery outputs such as the enforcement outputs that are required to achieve the third-level targets

European targets

The WHO Health for All policy in Europe sets international targets for reducing road deaths and injuries, calling for reducing mortality and disability from road crashes by at least 30% by 2020.
The European Union has adopted the goal of reducing fatalities by 50% by 2010. This target represents an ambition to reduce the number of deaths more quickly than continuation of past trends would imply
The European Conference of Ministers of Transport adopted a target of reducing road deaths by 50% by 2012, to serve as a benchmark for its 43 Member States.

See Quantitative road safety targets and Safety Ratings ERSO web text for further information.

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