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PROJECT REMOVE Final Report



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Abstract: The objective of the REMOVE project is to provide a framework within which both new and existing weigh in motion systems can be operated at a strategic and tactical level across the European Community, in order to reduce the danger and damage caused by overloaded vehicles, the goal being to achieve compliance in heavy goods vehicles legislation.

The transport of goods by overloaded trucks creates a number of serious problems on both Europe's main roads (TERN), bridges and other road networks.

These include safety, mobility and last but not least there are considerable extra costs for additional maintenance/repair of the roads, and bridges. As road transport by trucks increases these problems will become more and more serious.

This final report seeks to distil the key elements from the four work packages from the report

- Legal Issues
- Technical Issues
- Operational Issues
- Cost Benefit Analysis

The final report is a summary of the findings from the work packages of the REMOVE project. Comprehensive information will be found in the accompanying CD which describes the individual activities of the work packages, or by linking to the WiM web site which is located at http://wimusers.free.fr/index.php

Keywords: Overloading, Weigh-in-Motion, Road Safety, Pavement Damage, Fair Competition, Compliance, Enforcement, Prevention, Legal Issues, Technical Issues, Operational Issues, Cost Benefit Analysis, Conclusions and Recommendations.

Peer Review Summary

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1. Executive Summary

The formation of the Project REMOVE consortium was a unique group of interested agencies from across the EU, which included the EU enforcement community through TISPOL and ECR, the industry, the responsible Ministries and the technological knowledge of the University of Prague all of which have an interest in the carriage of goods by heavy goods vehicle.

The members represent the original 15 member states, and the findings were limited to those areas, as this was the limitation placed by the project contract. The project team are aware of the limitation that this may pose.

The Final Report focuses on issues surrounding enforcement, but also reflects on preventative measures that could be instigated by both the haulage industry and enforcement agencies in a partnership approach.

It is recognised that the transport industry cannot solve all of these issues alone, an example of this is the issue of the chain of liability for those involved in the haulage of goods with the increasingly complex transport and freight forwarding industry, the original concepts of liability are not judged to reflect current practices and responsibilities in this field.

The rational of the report is to achieve strategies that are



LEADING TO

COMPLIANCE

It should also be recognised that there is a singular lack in technical innovation to prevent vehicles from moving whilst overloaded.

The list of conclusions and recommendations from the final report are reproduced in a table format below.

As the final report is an amalgam of the products from all four work packages, reference points have been inserted into the final report to guide the reader to the corresponding complete article within a work package. This will be shown within the document in the following way.



Suggest order conclusions by importance

Concl	<u>usions</u>		
1.	Significant benefits could be achieved in terms of road safety with the introduction of effective strategies to reduce overloaded vehicles on the		
	roads of Europe		
2.	Overloaded goods vehicle would a	ppear to gain a significant fiscal	
	advantage when compared with the	nose operators who operate ethically	
3.	A disparity exists with how each n	nember state regards the issue of	
	overloaded vehicles		

4.	That the level of damage to the road infrastructure and bridges by
	overloaded vehicles is significant
5.	The lack of effective cross border enforcement is a significant issue
6.	The is a wide variety of tolerances and sanctions applied to overweight
	vehicles
7.	The issue of Liability is a complex issue and not satisfactorily addressed by
	existing rules.
8.	Member States do not regard overloaded vehicles as a high priority
9.	The Use Case stepwise approach and the resulting user requirements have
	drawn together a true representation of the requirements of the
	enforcement community. This provides a framework in which both new
	and existing weigh technology can be operated at a tactical and strategic
	level across Europe.
10	. The inventory of the current situation undertaken by the project has
	shown that there is a wide variance of fiscal penalties that could be
	imposed. However in reality the actual fines imposed are in practice very
	similar
11	WiM devices can be shown to be effective enforcement devices but this is
	dependant on the location of the station
12	. The road transport industry is generally in favour of a
	preventative/problem solving approach as a means to achieve compliance
13	. Existing methods of enforcement may involve additional cost to legitimate
	hauliers where they are un-necessarily screened by conventional weighing
	devices.

Recommendations	
Responsible	Action
European Commission	A detailed study to be undertaken on the impact of heavy goods vehicle on the European Road network
	A study to identify and quantify the potential benefits from the increased safe usage of heavy goods vehicles achieved through compliance with legislation
	Work should continue on producing a full version of the Virtual Annex for High speed axle weighing to ensure a common approach across the European Union
	Further work should be undertaken to identify and promote good practice in the field of prevention and detection of overloaded heavy goods vehicles.
	The development of detection and monitoring devices for heavy goods vehicles to prevent overloading should be undertaken, and operators should be encouraged to invest in such systems
	Member States should be encouraged to find effective solutions to cross border enforcement.
	A legally accepted standard for vehicle identification should be adopted across the Union, this should include Country identification markers

The UN classification of vehicles should be formally adopted, and then unified with the classification proposal from the "Top Trial" project.
Member State should look to existing legislation for suitability to deal with automated enforcement
The needs of the weigh enforcement community should taken into account when promoting the development and standardisation of weighing devices across Member States
Member States should be encouraged to harmonize the fine levels for offences concerning overloaded goods vehicles.
European Directive 96/53 should be promoted as the definitive constituent of an overloaded vehicle.
Sanctions should be imposed in a common fashion across the Union
Member State activity for overloaded vehicles should be co-ordinated
Research should be undertaken to define and promote the "Chain of Responsibility" as outlined in this project
Collaborative working should be explored with OIML and CEN working groups
Weigh in Motions system specifications should be harmonised
Harmonisations of accuracy testing for all weighing devices should encouraged
Understanding of the different possible applications of WiM technology as identified through the Use Cases and User Requirements in this project should be initiated through additional project work
Member states should be set targets to reduce road maintenance budgets in line with an effective compliance strategy for overloaded vehicles.

2. Introduction

From the commencement of the REMOVE project, it was recognised that the work which was to be undertaken was a continuum of established EC funded projects, in particular **WAVE**, **COST323 and Top Trial** all of these projects have provided a solid foundation upon which REMOVE is built, and it is hoped that the work from this project will continue as part of the drive to provide effective and balanced solutions to the issue of overloaded goods vehicles.

The objective of the REMOVE project is to provide a legal framework within which both new and existing weigh in motion systems and technologies can operate at both strategic and tactical levels across the European Community. The intention being to reduce the danger and damage caused by overloaded vehicles. The transport of goods by heavy goods vehicles creates a number of problems on the main roads of Europe, the Trans European Road Network (TERN), as well as other associated road networks.

The problems include risks to safety for all road users, the free flow of traffic and last but not least the additional costs generated for additional maintenance and repair of the roads, bridges and other infrastructure. These results in extra wear caused by the increased and increasing numbers of large goods vehicles moving across the European road network, this extra wear is significantly enhanced by the vehicles which are overloaded.

Overloading

The issue of overloading is principally identified in the domain of the road transport industry. This is for the most part caused by deliberate non-compliance by some transport operators within the industry, who choose not to comply with the rules and regulations set by legislation regarding maximum axle loads and total vehicle mass of heavy goods vehicles. As will be shown later in this report, the causes of overloading may be found further up the transport chain.

The main aim of the project in this instance is to reduce the negative consequences of overloading, whilst also appreciating that non-compliance in certain instances is unintentional.

An example of unintentional non compliance is where a goods vehicle is correctly loaded and within the weight limits, but in the process of transporting the goods, part of the load is removed, the rest of the load remains under the gross vehicle weight limits, but overloading of a single axle results due to the now poor distribution of weight across the vehicles axles. Another example would be sealed container that neither reflects its true weight nor is poorly loaded creating an imbalance.

Overloading also undermines the traditional concept of free market forces in terms of supply and demand and the consequential price charged for the service provided. This creates prejudicial competition within the EU, as it creates an illegal and unfair advantage for some operators, allowing them to charge lower prices for the same journey, with a resulting negative effect on price levels. This can lead to non compliance with legislation in many other areas associated with the operator, such as maintenance and drivers hours, as well as with the bona fide transport companies who are unable to compete with the haulage operators that operate illegally.

These issues will not diminish as the current forecasts for road traffic continue to show a significant increase, with road transport making up 44% of the goods transport market compared with 41% for short sea shipping, 8% for rail and 4% for inland waterways. Road's share of the goods transport market has been growing constantly since 1990 and is expected to reach 47% by 2010.

Risk to Safety WP4/FINAL REPORT/23

The problem of overloaded vehicles poses an additional risk to safety, particularly when an emergency situation occurs, as braking distances for overloaded vehicles are increased. These factors need to be considered along with other safety risks which can be identified, such as overloaded (and therefore slow) goods vehicles may tempt drivers of other vehicles to make dangerous manoeuvres on secondary roads.

It should also be recognised that an increase in the mass of the vehicle will also increase the potential impact in the event of a collision.



Figure 1 Heavy Goods Vehicle Roll Over

Handling WP4/FINAL REPORT/23

Overloaded or badly loaded goods vehicles have reduced handling capabilities, resulting in possible unusual manoeuvres such as veering from lanes, and in extreme cases may pose a greater risk of toppling over.

Pavement and Bridge Damage WP4/FINAL REPORT/21

A major concern of the project is to suggest strategies that will lead to a reduction in the unnecessary and premature road, bridge and infrastructure wear and tear, caused by overloaded goods vehicles. In particular the damage caused to the inside lanes (UK) outside lanes (Europe) of multi-lane roads which comprise much of the European road network, and are the main running lane for all larger goods vehicles, particularly those over 3.5 tonnes gross vehicle weight. Bridge lifetimes with respect to fatigue damage caused by overloaded goods vehicles may be significantly reduced also, these lifetimes and increased costs for repair, is seen as a key issue.

The additional damage to the road pavement and bridges not only requires the need for more maintenance, leading to consequently higher maintenance budgets, but also creates additional safety risks involved in carrying out the repairs or maintenance. For example the rutting caused by overloaded trucks may lead to more dangerous situations arising, such as in rainy conditions where aqua-planning may occur. Not least the road conditions surrounding the repairs needed due to the additional pavement damage create additional road works and these in turn may lead to more hazardous traffic conditions.



Figure 2 Pavement damage by Heavy Goods Vehicles

Given the above considerations, the project, sets out to provide an effective, efficient and impartial enforcement methods, which go beyond traditional methods which are often inefficient, ineffective discrimatory, and labour intensive.

Key Point:

The intention is to develop a framework in which a new type of enforcement strategy can be based, by the use of current and emerging Weigh in Motion technologies, and through enforcement create a climate where compliance to legislation pertaining to the carriage of goods by heavy goods vehicles is preferred.

In striving to achieve the objective of compliance, the project was set a number of contractual goals within each work package, which would all work towards the final objective.

The project team recognised that the ultimate technical achievement of fully automated direct enforcement by a WiM system could be some years ahead, but many of the issue identified by the project during research can be acted upon now and could have a direct impact on ensuring that any enforcement strategies can be seen as being **Fair**, **Proportionate and Effective**, which the project team believes leads to the objective of **Compliance**.

It should also be noted at this stage of the report the valuable work that can be achieved in terms of prevention. Both in technical terms around the vehicle itself but also in the training and competence of all of those involved in the chain.

To assist in the representation of this a time line has been produced to show the elements of the project and how and when their impact could be introduced.



Figure 3 Project Remove timeline

3. The Problem: Overloading

In order to provide a basis of information for the project as a whole, the consortium undertook a series of questionnaires to establish what the problems were in relation to the use of heavy goods vehicles on the roads of Europe insofar as the issue of overloading was concerned. This was from the perspective of a number of stakeholders, in particular the enforcement agencies, and the road hauliers. **WP1/FINAL REPORT APPENDICES/8**

From the outset it was clear to the project team that the success of this first element would be dependent on the co-operation of member state enforcement agencies and also the haulage industry.

Whilst the level of response was by no means complete across the original 15 member states, the spread of response was judged to be sufficient to provide the level of information that was required across all of the work packages.

The results of the questionnaire were gathered into one document, which formed the seminal document for the subsequent work of the project. The information gathered was presented as an overview of the current situation within the European Union as regards to the strategic, tactical, legal, technical and operational situation. In addition it also dealt with procedures in relation to the enforcement of overloaded goods vehicles travelling throughout the Trans-European Road Network (TERN).

Each of the work package areas of the project cover work within those 4 main headings and as such it was desirable to present some form of inventory of the current situation.

The key findings from the questionnaires are represented below.

Key Point:

ALL Member States and other responding countries,, use some form of axle /Vehicle weighing equipment which has legal acceptance for use as an enforcement tool against overweight vehicles in that particular member state.

Key Point:

At present there is **NO** legal acceptance of High speed Weigh in Motion (WiM) technology for any enforcement process any where in the European Union

In all cases there are issues relating to legal requirements which fall within the 'traditional' enforcement practices, these relate to tolerances, liabilities and technical specifications of the type of equipment. These issues can only be described currently as inconsistent across the Member States.

Key Point:

There is no standardisation of Tolerances Liabilities and technical specifications for enforcement activities across all member states.

It has been found that there are clear differences in the possible levels of fines or sanctions imposed on offenders for overloading offences, across member states

The questionnaire identified that what could be termed 'Traditional' enforcement methods which includes the Static weigh plate and the dynamic weigh plate, have shown the following.

- Each Member State has a different approach to Penalties and Liabilities
- There is no common approach to the technical specification for any enforcement equipment used.
- The current equipment used is labour intensive for the enforcement agencies.
- Each member state views the issue of overloaded heavy goods vehicles as a different level of priority.



Figure 4: Current diverse use of 'Traditional' enforcement in EU

It is clear from the response to the questionnaires that all 15 member states advocate the use of some form of static weigh bridge, or portable weighing scales.

For each individual member state there are requirements for the device to comply with standards of accuracy for that particular member state. However the standards are not uniform and there is a wide variance as to the tolerances employed and the requirements to ensure that the device is correctly calibrated, tested and operated.

What is clear is that the current modes of use for the various devices indicate that the activity is labour intensive; the level of detection is low. The result being

that very often it is viewed as an in-effective deterrent to overloading which is overly reliant on the skill of the operator.

3.1. Overview of Weigh -In- Motion (WiM) within Europe

KEY POINT:

It should be noted that there are **NO** countries currently identified where WIM technology is deployed, where it is being used for direct enforcement (other than some examples for a fixed weight site e.g. a 16 ton weight limit on a bridge).

The WiM systems currently deployed have only a semi-automatic function and are ONLY used for the pre-selection' of vehicles. There is still a requirement for the vehicle to be re-weighed for the evidence to be captured on a legally recognised weighing device to gain legal acceptance for prosecution purposes.

KEY POINT:

The main rationale for the support of WiM technology is through the advantages seen, over the 'traditional' static, or low speed 'dynamic' weighing, due to the large quantities of vehicles that can be weighed. It is perceived that the greater chance of detection will have the advantage of decreasing overloading, thereby also having added benefits in terms of road safety, road network and infrastructure maintenance, reduction in disruptions to traffic flow, as only specifically identified overloaded vehicles will be stopped and increasing fairer competition amongst goods vehicle operators.

KEY POINT:

In the area of specific planning and coordination of overload enforcement there is a real need for uniformity across the European Union. Currently there is total disparity as to how, and by whom this is coordinated.

3.2. Conclusions from the existing situation

Conclusion

Throughout the European Union there is a high level of disparity in how the issue of overloading is dealt with, both in terms of the legal basis, enforcement, and technical and functional applications employed.

Much of the disparity evolves from the fact that some member states are already using elements of high speed WiM technology whilst many others have only very basic static weighing capability. The use of Weigh in Motion (WiM) technology for enforcement is therefore shown to be inconsistent and varied throughout the European Union, although it has been shown to be beneficial in achieving decreases in overloaded vehicles in areas where it is deployed. The most significant point to consider is that currently there are no Member States identified where WiM technology has already been deployed. It is yet to be legally accepted to be used for full or direct enforcement. It should be noted that WiM technology is at a stage where it is prepared for use in a number of enforcement applications.

Conclusion

From the information provided in the Questionnaire there is a total lack of any harmonisation with regards to the use of weighing equipment across the European Union. This is most pertinent when looking at the use of WIM technology overall, the use of Low-Speed Dynamic weighing has achieved some acceptance, as an alternative for static weighing whilst the differences and disparity of WiM technology use increases greatly when considering High Speed WiM technology,

Conclusion

Assessment of the questionnaire responses has shown that in some member states little account has been taken of the expanding European Community, and with the expansion and consequent increased use of the European road network as a whole for the carriage of goods. Many states have failed to appreciate the impact that these additional goods vehicles will have on the Trans European Road Network (TERN) and other roads, bridges and roads infrastructure, especially when the vehicles are overloaded.

4. Vision

The inventory overview from the main report focuses heavily on the technology and equipment aspects of effectively dealing with heavy goods vehicle overloading. This must however still relate strongly to how the deployment of fully automatic WiM technology impacts on the other aspects of the project. It is necessary to recall the overall objective of this project and that is to provide a framework within which both new and existing weigh in motion systems can be operated at a strategic and tactical level throughout all member states of the European Union. The aim is to reduce the danger and damage caused by overloaded goods vehicles travelling on the Trans European Road Network.

The diagram overleaf is a representation of how the project visualises the move from the 'traditional' or current situation towards the future vision of the use of Weigh in Motion systems for the whole of the European Union.

It is the ultimate vision of the Remove project is to have fully deployed WiM technology across all the member states, which will be capable of succeeding in the full automated enforcement processes. The end goal is to achieve a situation utilizing an intelligent enforcement mix; in other words where Weigh-in-Motion technology is used for different enforcement applications in such a mix that is best fits the overloading problem. This enforcement mix will probably vary from one Member State to the next however the operational procedures would be internationally harmonised. In this ideal future situation in addition to direct automated enforcement other (technically less complicated) WIM-applications will be capable of being used, as each application has its own unique set of advantages and disadvantages which are best suited for specific parts of the overloading problem.

The other areas of the project which have an effect on the move to a fully automated and harmonised deployment of WiM technology for enforcement are also represented, but all cases point heavily towards harmonisation, and consistency.

One of the most relevant areas of this project is encompassed within the Future Enforcement Strategy **WP3/FUTURE ENFORCEMENT STRATEGY V0.5/18**, which aims to provide the lead to all countries in achieving a harmonised enforcement and operational process, regardless of the level of weighing technology available within a particular member state.

Importantly Remove does recognise that each country will still be required to deal with their own national overloading problem, and whilst higher levels of technology will remain available to them, their priorities and funding will continue to dictate the preferred and legally accepted equipment and technologies that are used for their own specific local and national circumstances.



Figure 5 The Future - Automated WiM Enforcement.

It has already been recognised by the project that for a number of enforcement applications WiM technologies offers a nucleus of a system which can be used, in stages as appropriate to the individual member state requirements and budgets. This modular approach has been likened to using the Childs "Lego" building system, where additional functionality can be added to the core WiM module.

The concept is that a WiM-system for a 'uncomplicated' enforcement application can be easily be 'upgraded' to a more advanced application by adding extra components as required to an existing system.

A simple example could be; by adding a camera to a system currently used only for Statistics and Planning, it enables an upgrade to a Pre-selection site.

It should be noted that in some countries it may be preferable to enable large numbers of enforcement officers to operate the task of overloading enforcement, and achieve success despite the labour intensiveness of the manual process. The project envisages that even these countries will start to see the benefits of the increasing use of more advanced levels of WiM technology, and will begin to upgrade their weighing technology which will be achieved more simply due to the applications, and process in place as revealed in the Future Enforcement Strategy of the REMOVE project. The project recognises the limitations placed on some enforcement agencies in their ability to stop and check heavy goods vehicles, relying instead on other agencies that do have the power to stop to enable them to carryout there enforcement function. The report recognises that this is not an efficient use of resources and recommends that all enforcement agencies engaged in heavy goods vehicle enforcement be given the power to stop vehicles.

The diagram below is an extract from the Future Enforcement Strategy document which gives a pictorial representation in the form of a sliding scale of the direction in which WiM technology can progress.

To the left of the broad central line between boxes 3 and 4 could reasonably accurately describe the current situation for most of the EU member states, with some using WiM technology up to the level of pre-selection, but moving into the realms of problem solving and intelligence gathering.





However it must be reiterated that there are currently **NO** member states where the higher levels of technology have been fully developed, tested and certified to use for direct (automatic) enforcement as envisaged by the Remove Vision.

The main advantage in advocating WiM is that the WiM-system weighs ALL passing vehicles, when an overloaded vehicle is detected, an image of the vehicle is taken by the WiM system and the target vehicle is then guided to the 'Static weighing area'. The use of WiM to weigh all passing vehicles means that the chance of detection has already increased from the 'traditional' manual or human selection which relies heavily on the skills of the enforcement officers.

KEY POINT:

In general terms where WiM technology has currently been in use in the Europe, there is general agreement that use of WiM shows decreases in the instances of overloaded vehicles and the overall perception is therefore that it is an effective tool, in the control of those vehicles.

For there to be any willingness to undertake change there is a need to show the relevance for undertaking such a task either on the grounds that the status quo is ineffectual or discrimatory. The project sought to satisfy these issues with a limited Cost Benefit analysis which used existing data to try and answer some of the questions that the inventory to the present situation had high-lighted.

4.1. Rational for Change

Introduction

The task of the project was to provide a cost benefit analysis focusing on two elements from within the scope of the overall project requirements, these being

- The negative effect that overloaded heavy goods vehicles have in terms of road safety and damage to the road infrastructure.
 WP4/FINAL REPORT V0.81/19
- A comparison of cost for the methods of enforcement currently employed and the use of High Speed WiM direct enforcement. WP4/FINAL REPORT V0.81/29

This work package did not undertake new research as the resources and time allocated precluded this level of detail. Instead it focused on existing information. However the project team have recognised that there is a great deal more work required in this area to effectively quantify the impact of overloaded heavy goods vehicles on the road network of Europe. This is both in terms of environmental impact and road safety, and the role that effective enforcement strategies could play in moving toward greater compliance.

As a result only a rough estimate was given of the costs which are involved in the problem of overloading, and the benefits that can be achieved when using Weigh-in-Motion technology for enforcement purposes.

In fact all the figures given originate from assumptions, due to the limited amount of research data available. These assumptions are based on general police and enforcement agency experiences discussed within the project, and therefore cannot necessarily be proved.

4.2. Costs and Efficiency of Enforcement

Recommendation

This report recommends that the European Commission undertake a study into the potential benefit that could be obtained by harnessing the benefits that could be brought to road safety in terms of the use of heavy goods vehicles on the road network of Europe. Accepting that the issue of overloaded goods vehicles is but one of number elements that could have a positive impact on road safety

In considering the effect of weight enforcement for heavy goods vehicles, the consortium considered the lack of information, and elected to study the scenarios that lead to direct enforcement of heavy goods vehicles. All of the scenarios considered the same conditions, as the manual selection of heavy goods vehicles is the current accepted practice, this formed the base line.

scenario	definition	description	Remarks
1	Manual Selection, no use of WIM.	Human, static overloading measurements, based on visual pre-selection	The current/traditional and most common way of overloading enforcement
2	WIM used for pre-selection controls	WIM is used to select the goods vehicles that then need to be measured with the traditional means	These WIM-systems can also be used for the applications 'Statistics & Planning' and 'Problem Solving'.
3	WIM used for automatic direct enforcement	An automated and certified WIM-system that generates fine notices for overloading directly based on the WIM-measurement.	This way of enforcement is not yet available.

Table 1 Enforcement scenarios considered for Cost-Benefit Analysis

In the calculation the following information was taken into account.

- The number of overloaded and non-overloaded vehicles;
- The distance between the location of the WIM-system, the location where an overloaded vehicle is selected and escorted to the static weighing area and the location for the static weighing itself;
- The cost of equipment and personnel (e.g. static scales used in different scenario's have the same cost, officers working in different scenario's have the same cost).

Not included are:

- The costs for the judicial chain, this is not included as it is seen as equal to all considered enforcement scenarios;
- The income from fines is not considered because the goal of enforcement is the reduction of overloading and not the collection of fines.

Manual Selection

Manual selection only consists of the costs for labour and a limited amount of equipment (static scales, car, weighing bus). Whilst this method is the cheapest, the number of vehicles capable of being checked is low.

Furthermore, only 50% of the vehicles that are checked are actually overloaded. See table 2 below:



Figure 7 – weighing with static scales

Scenario: manual selection	per year	per year per officer
Number of vehicles checked	2200	734
Number of overloaded vehicles	1100	367
Number of wrongly stopped vehicles	1100	367
Enforcement cost	€ 160,000	€ 53,333
Enforcement cost per overloaded vehicle	€ 145	€ 145

Table 2 – Enforcement cost using manual selection

Pre-Selection

With pre-selection, a WIM-system is added to any configuration for Manual selection costs. Therefore the costs will increase by about €100,000 per year; per WIM-system (cost for a WIM-system is about € 130,000 per year, but savings can be made in terms of the type of personnel used). The use of a WIM-system in

this instance hardly changes the number of vehicles that can be checked, but the detection success rate does become higher, reaching up to 95%. This potential success rate makes the use of pre-selection almost twice as effective as that of manual selection, and therefore could prove worthy of the extra cost of a WIM-system.

See table 3 below:



Figure 8 Example of a pre-selection site

Scenario: pre-selection	per year	per year per officer
Number of vehicles checked	5,940	990
Number of overloaded vehicles	5,643	940
Number of wrongly stopped vehicles	297	50
Enforcement cost	€ 422,500	€ 70,417
Enforcement cost per overloaded vehicle	€ 75	€ 75

Table 3 – Enforcement cost for pre-selection

Direct Enforcement

In the case of direct enforcement, there is no enforcement officers involved in the enforcement cost, thus the labour costs diminish as instead a system administrator only is used, and who monitors 10 direct enforcement WIM systems. The cost of a WIM system may increase up to twofold compared to the

pres-selection scenario due to the additional hardware needed for certifying the system as an autonomous enforcement system.

With direct enforcement, the advantage is that every overloaded vehicle is detected and a fine issued, as the system works 24 hours a day and 7 days a week. For approximately the same costs of a pre-selection system where 5% of vehicles can be effectively checked, direct enforcement allows 100% of vehicles to be checked.

See Table 4 below:

Scenario: direct enforcement	per year	
Number of vehicles checked	all passing vehicles	
Number of overloaded vehicles	105,120	
Number of wrongly fined vehicles	0	
Enforcement cost	€ 322,150	
Enforcement cost per overloaded vehicle	€ 3	

Table 4 – Enforcement cost for direct enforcement

In providing the above costing the consortium wished two comments to be noted.

- 1. A starting point of the above mentioned enforcement cost per vehicle is that the number of overloaded vehicles remains the same despite the hit rate of the enforcement scenario. The higher the hit rate, the less this assumption will be true in real life. It would be better to compare the different scenarios by estimating the effect on overloading behaviour for each scenario, for instance by estimating the number of overloaded vehicles passing after applying a certain enforcement scenario. As discussed in the main report there is not enough research data available to estimate efficiency, therefore an indication of effectiveness can only be given by estimating the enforcement cost per overloaded vehicle.
- 2. A WIM system used for direct enforcement places a higher demand on that system for accuracy than pre-selection system. A pre-selecting WIM system has an allowance for a certain number of errors, as the static weigh system is the legal determination as to whether an offence has been committed. It should be noted that any current static weighing also involves a tolerance margin.

A direct enforcement WIM system cannot be allowed to select vehicles that are not overloaded. Technically this is solved by not giving a penalty to vehicles in the lowest part of the overloading spectrum. In this case a vehicle that is not overloaded, but falls within the lower part is not automatically fined. At this time it is estimated that future WIM-systems will need 10% tolerance set within the overloading spectrum to be sure that a vehicle is not wrongly fined. This will correspond to about 25% of the total number of overloaded vehicles checked.

Conclusion

From the limited study carried out it is clear that once the initial capital outlay of a WiM system is removed from the equation then the ability to provide effective enforcement, to realise the goal of compliance becomes achievable. However it must be stressed that the location of the system is critical. This technology should be commended by the European Commission to member states as the most effective form of enforcement.

4.3. Damage to Infrastructure WP4/FINAL REPORT V0.81/19

Traffic that uses the roads infrastructure unavoidably causes wear and tear of that infrastructure. However, it is important to realise that with increasing axle load(s) on heavy goods vehicles the damage to the infrastructure increases exponentially by at least a factor of 4.

Heavy goods vehicles are known to cause the most of the damage to the road infrastructure, and it is believed that overloaded goods vehicles take an even greater share in causing this damage.

This chapter can only give an approximation of the damage to infrastructure caused by overloaded goods vehicles.

At the start of the project it was very quickly realised the limited nature of the existing research on the damage to pavement caused by overloaded heavy goods vehicles, and it was considered outside of the scope of the project to undertake detailed research on this. Therefore it is only possible to show the costs for road maintenance and the corresponding cost of traffic delays as a result of the maintenance. Any damage to bridges has not been considered at this stage though this is clearly an issue. The difficulty experienced by the consortium in reaching these conclusions is shown by the number of differing types of surfaces used for road construction.



Figure 9 – Damage to road pavement (rutting)

The project found that there was very little information concerning damage to the infrastructure, however the consortium have utilized existing working carried out by COST 334, and work carried out in the Netherlands. The information obtained from this formed a basis for the extrapolation to give a view on the impact of damage caused to pavement on a European level. As has already been identified the construction of the road surface is critical in this assessment as is the type of vehicle causing the damage

	Cost	
Damage to road pavement on national	€ 11.6 million - € 21.2 million	
roads		
Damage to road pavement on	\in 4.9 million - \in 18.1 million	
secondary roads		
Social cost of related traffic jams	\in 1.6 million - \in 3.0 million	
Total cost of damage to road	€ 18.1 million - € 42.3 million	
pavement		

Table 5 – Road damage cost caused by overloaded vehicles in the Netherlands

It is shown that the budget for road maintenance in the Netherlands is around \in 800 million. Therefore the pavement damage caused by overloaded vehicles amounts to 2.3% - 5.3% of the budget. The total road maintenance budget of the 15 EU countries is around \in 10,500 million. Assuming the same percentages for the 15 EU countries, is the same as the Netherlands then \in 239 million to \in 557 million is being spent yearly on repairing road damage caused by overloaded vehicles.

If only the national road network is considered then the figures are likely to be \in 153 millions to \in 227 millions being spent each year.



Table 6 Investment in road maintenance for EU-15 countries in 1999

The estimated costs presented which relate to the damage of road pavement on a European scale should be treated with some care. These figures are only a rough extrapolation, and for instance does not take into account the following:

- Different member states have different weight limits, therefore they build roads with different maximum load limits;
- Different member states have different road traffic densities, these relate to differing HGV fleet, and the location of the member state within the TERN.
- Bridges are not considered;

Conclusion

This report concludes that the possible level of damage to the infrastructure caused by overloaded vehicles is significant. The potential savings by the reduction in pavement damage by the use of correctly loaded heavy goods vehicles is significant. The report recommends

Recommendation

That each member state be set targets to reduce road maintenance budgets by effective compliance strategies for overloaded vehicles

4.4. Road Safety WP4/FINAL REPORT V0.81/23

In considering the issue of road safety insofar as it is affected by the overloading of heavy goods vehicles, the project team makes the following observations.

- Incorrectly loaded goods vehicles have decreased vehicle handling characteristics, which increases the possibility for collisions.
- Frequent overloading also gives an indication that other safety or legal regulations may not be complied with.
- Overloading does cause pavement damage and this may directly lead to dangerous driving conditions caused by that road pavement damage.

In the study the following observations were made in relation to the effectiveness of the information obtained from around the world

- Generally a collision is a result of a random combination of events. Often it is difficult to determine all causation factors of an collision and only the most obvious ones are reported and included in the statistics
- The experience and personal 'preferences' of the person reporting the collision tend to determine which cause will be chosen. As knowledge about overloading is less widespread than other possible causes like speeding, overloading may often be overlooked as a cause for a collision.
- There is a drawback of using general collision statistics in that there is only a general category called "load". Even when the statistics show the main cause is ascribed to load, it might mean that the truck was overloaded, but equally it may relate to instances of insecure loads being the cause.
- When overloaded vehicles are involved in collisions the potential for damage is increased.

4.5. Conclusions

Conclusion

This report concludes that potentially significant savings could be made in terms of Road Safety applications by the introduction to all member states of effective strategies to reduce overloaded heavy goods vehicles on the European Road Network. However significant research would be required to quantify this assertion on behalf of the European Commission.

Conclusion

There is very little authoritative work in existence in relation to the fiscal analysis of compliance. However the work produced has indicated that potentially a great deal of revenue, lives and increased ethical competition could be gained by a greater understanding of the true structure of a cost benefit analysis of the issue of overloaded heavy goods vehicles.

5. The Future

At the present time throughout the European Union the transport of goods by road using overloaded goods vehicles create a number of serious problems, not only on the Trans European Road Network (TERN) which forms Europe's strategic road system, but on Europe's other secondary road networks too. These problems include issues of road safety, mobility and the creation of considerable extra costs in maintenance and repair of the resulting wear and tear to the roads, bridges and other road infrastructure.

The inventory of the present situation indicated that most member states regard this as an issue; however the level of priority varies from member state to member state.

Conclusion

It was found that throughout the European Union there is a great disparity in how the problem of overloading is dealt with, in terms of the legal basis, enforcement, and technical and functional applications.

- Each member state had its own legislation governing the loading of goods vehicles for road transport,
- Each Member State has its own defined legal liability for contraventions of the legislation.
- The level and application of enforcement for contraventions of the legislation is not uniformly applied,
- It is generally accepted that enforcement is a recognised tool to achieve compliance within existing legislation for Member States.

The use of **weighing technology** including Weigh in Motion (**WiM**) for enforcement is shown to be inconsistent and varied throughout the European Union.

- All member states use some form of static weighing device, which comply with the standards of accuracy for each individual member state,
- Each has sought recognition by standardisation bodies such as the International Organisation for Legal Metrology- (OIML).
- Only a few countries have access to or have begun using some form of WiM technology.
- There are no member states identified where WiM technology is being deployed where it is being used for direct or fully automated enforcement.

Automated WiM Systems WP2/FINAL REPORT V0.7/23

One of the requirements for the project was to explore the feasibility for a fully automated WIM system for direct enforcement.

Key Point:

For full legal acceptance of an Automatic Weigh-in- Motion (WiM) system for direct enforcement across the EU to include cross border enforcement, the issues raised in relation to current legal requirements indicate that the standards for legal acceptance must become standardised across the European Union.

This will become increasingly essential, particularly when considering that Automated WiM could ultimately be used for cross-border enforcement, across the Trans- European Road Network (TERN)

Key Point

At this present time there is no standardised legal acceptance for high speed WiM systems across Europe; this is vital consideration if WiM systems are to be effective across Europe.

The responses from the enforcement agencies have shown that the use of static weighing devices, are not the most effective deterrent against potential offenders. Though one member state (The Netherlands) felt that the effectiveness could be maximized with the effective use of intelligence and trained officers. This view point was also borne out by the responses from IRU members who indicated that the levels of effective detection of overweight vehicles in traditional enforcement activities is heavily reliant on the skills of the enforcement officers to make the correct selection.

The current application of weighing technology, at its most basic is labour intensive, and relies heavily on the enforcement officer's skill; this includes aspects of vehicle identification as well as actually being competent in weighing vehicles. There is also the issue of proportionality where enforcement agencies often fail to enforce equitably in relation to home v foreign registered vehicles.

There has also been little account taken of the expanding European Community, and the expansion and consequent increased use of the road network as a whole, and the impact that these additional vehicles will have.

One of the aims of project REMOVE is to encourage the use of Weigh in Motion technology across all member states to improve compliance with vehicle weight legislation. Should this be achieved, it would significantly enhance the efficiency and effectiveness of overloading enforcement, throughout the European Community, in a way acceptable to both member states governments and the road transport industry.



This can best be illustrated by the below diagram.

Figure 10 Project Remove Vision

The ultimate aim is to achieve full compliance with the vehicle weight laws and regulations, relating to the transport of goods by road. This in turn would lead to improved road safety, reduced costs for road repair and provides a level playing field in terms of open and fair competition for the road transport industry.

In terms of legal issues it is absolutely necessary to identify and recommend a legal framework to achieve this vision of a harmonised and interoperable deployment of WiM systems:

- Firstly by building on those standards already in place for the legal exchange of data and enforcement information across member states borders throughout the European Union, and
- For this to be a fully automated and legally accepted process linked with enforcement using WiM technology.

The Remove future vision promotes a harmonised approach to enforcement itself, where all member states are able within their own national legislation to apply sanctions, which will in the main be compatible across the whole of Europe.

It was recognised that a unified method of vehicle identification that was acceptable to all member states would be essential. The project team in this report has identified, along with other recent studies that the use if the VIN number for each vehicle would be most pragmatic solution. A number of studies have been undertaken in this field that indicate potential solutions, such as the EVI report which can be found in REMOVE work package 1 appendices.

Most essential to achieving 'state of the art' will be obtaining 'Type Approval' for every aspect of the WiM system this will have to be obtained through a recognised international standards agency, such as the International Organisation of Legal Metrology (OIML) European Committee for Standardization (CEN) or other recognised international standards bodies.¹ WP2/FINAL REPORT V0.7/23 by meeting these International recommendations there is assurance that the WiM technology will meet international specifications for metrological performance and testing. Work was carried out in VERA2 on a possible way forward for this issue around the subject of type approval; this can be found in REMOVE work package 1 appendices. WP1/FINAL REPORT APPENDICES/8

The regulation of construction and certification of every aspect of the WiM technology will be required to be contained within a European Directive in relation to measuring instruments, and this will specifically provide a harmonised implementation of the requirements for weight enforcement systems.

It is essential that any Weigh in Motion specification will be designed to be acceptable to all European member states to what level they choose to use it, and that those with lower levels of weighing technology are still able to work through the harmonised approach being put forward by the project. It is envisaged by the project that a sliding scale methodology **WP3/FUTURE ENFORCEMENT STRATEGY V0.5/18** will assist those countries where WiM technology is less available, but man power is not an issue, to still comply with harmonised enforcement procedures recognised across the EU.

5.1. Type Approval for enforcement equipment

Type approval is the confirmation that production samples of a design will meet specified performance standards. The specification of the product is recorded and only that specification is approved. The test procedure to get a type approval can only be done once, until any modification is made to the system. Type Approval is aimed at providing a climate of mutual confidence and recognition of test results relating to a product.

Key Point:

Any system employed for future direct enforcement activity must be type approved to a common agreed standard

This is a key point for the project in achieving the assurance and confidence necessary between Member States that an offence detected and processed in one member state has had the same rigors applied to it as it would be in the country receiving the penalty.

This Type Approval is achieved through the International Organization of Legal Metrology (OIML).

When looking at the measurement-technology related aspect of cross-border enforcement the key issue is confidence. This confidence is built on the following points:

- Any record produced by an enforcement system should contain all relevant data that describes fully the offence which is the subject under consideration for enforcement. This issue can be covered by a standard data set this will describe all the quantities or other items that are required for the enforcement of overloading offences.
- All equipment used to enforce road traffic laws should have type approval, achieved through national organisations for legal metrology or other notified bodies, and must be subject to periodic checks which may occur whilst the instrument is in service.
- The Measuring Instrument Directive is a European Union directive which regulates the construction and certification procedures of several measuring instruments, among other measuring devices it applies to automatic weighing instruments, which were added in May 2004. Although the MID comprises of several parts, containing a number of annexes, the specific details relative to automatic weighing instruments are shown in Annex MI-006. This Directive establishes the requirements the devices have to satisfy in order to be sold or used for "measuring tasks for reasons of public interest, public health, public safety, public order, and protection of the environment, protection of consumers, levying of taxes and duties and fair trading".

Key Point: WP2/FINAL REPORT V0.7/12

The REMOVE project proposes to use the Measuring Instruments Directive (MID) as a common starting point for setting national type approval requirements for high speed automatic weighing instruments used for weight enforcement.

Project REMOVE has already prepared a first draft version of this 'virtual' annex on weight enforcement systems type approval. This is located in Work Package 2 Technical Issues Annex A WP2/FINAL REPORT V0.7/31

5.2. Promoting Compliance WP1/FINAL REPORT/168

The issue of overloading is mainly identified within the transport industry, this is especially the case where the gross vehicle mass is concerned. This overloading is most often first identified in the road transport chain when the vehicle is weighed, but as this report will show, the causes and liability may be elsewhere in the process.

Key Point:

Remove would look to create an atmosphere through legislation and the provision of an effective deterrent through enforcement problem solving, intelligence and EU wide strategic deployment, with a view to achieving full compliance of goods vehicle legislation. This would be achieved by the enforcement agencies and the transport industry working together to find effective solutions to overweight vehicles and axles.

Key Point:

Compliance can be achieved by way of enforcement or by prevention but in any case, neither is likely to achieve it singularly.

Transport ministries and enforcement agencies should look to organise their enforcement in the most effective way, and should also be working on problem solving, sharing intelligence, company visits, stimulating quality control within transport companies, and in developing incentives that make compliance more attractive than non-compliance.

Key Point:

This report concludes that a great deal more could be done to explore the technological innovations that are already available across the world to address the issue of increased compliance with all heavy goods vehicle legislation. This could include technology to warn the driver that the vehicle is overloaded, or in extreme cases the immobilization of the vehicle until the load is reduced. Greater use could be made of 3 axle Tractive units, the report recognises that there is a significant investment in a vehicle fleet and incentives to move towards three axle Tractive units is to recommended.

The report concludes that the EU should actively support technical innovation to prevent overloading.

The example below highlights the recent introduction of this technology in Australia where the key benefits to be delivered is consistent with those of project Remove. This represents an example of Good Practice that could be considered.

WP1/FINAL REPORT/168

In Australia the monitoring of compliance was introduced in the Intelligent Access Programme (IAP)2. The IAP objective was the implementation of a voluntary system that will monitor freight vehicles remotely using satellite based telematic services to ensure compliance with their agreed conditions of operation, that is, ensuring they operate how, where and when they should. The IAP feasibility study showed benefits in:

- Improved road safety,

- Reduction of damage to the road infrastructure,

- Reduction of environmental effects better management of public perceptions and expectations of large goods vehicle movements

- Optimisation of road freight policies and operational tasks which included optimisation of on-road enforcement activities

5.2.1. Conclusions

Conclusion

That currently there is a total lack of any harmonisation with regards to the use of WiM technology, the general conclusion was that throughout the European Union there is a great disparity in how the problem of overloading is dealt with, in terms of legal basis, enforcement, and technical and functional applications.

Conclusion

The project concludes that the lack of cross-border enforcement continues to be a major issue and blockage in the need to improve compliance with road traffic laws including overweight vehicles and axles. The resolution of this issue will increasingly become a priority with the move to automated detection and enforcement

² Australian Intelligent Access Programme (IAP)-Feasibility Project 2003, www.austroads.com.au/ pdf/IntelAccess/AP-R223.pdf

Conclusion

The project recognised that compliance with vehicle weight legislation in order to achieve road safety benefits and reduce premature pavement wear is the prime aim of this project and of this technology.

Conclusion

WP3/FUTURE ENFORCEMENT STRATEGY V0.5/18

WiM technology will be used to detect violating vehicles so that the

appropriate response can be considered through either;

- Enforcement
- Problem Solving
- Intelligence
- Information Gathering

Throughout the EU in order to reduce the risks of the danger and damage caused by overloaded goods vehicles.

Conclusion

It was concluded that currently throughout the European Union there is a wide variance in the tolerances and sanctions applied for contraventions.

Conclusion

There is an absolute necessity to create a legally accepted European standard for vehicle identification to provide a synchronised and authoritative approach to Vehicle Identification Numbers (VIN), definitive vehicle characteristics, and standardised vehicle number plates including country of origin markers. EVI report REMOVE work package 1 appendices. WP1/FINAL REPORT APPENDICES/20

5.3. Use Cases and User Requirements WP1/FINAL REPORT/78

The provision of effective weighing devices which can be employed in the screening and detection of overloaded vehicles is fundamental to this project.

The project has sought to bring together the requirements of the user in defining what such future weighing devices should look and operate like from the perspective of the "User". In this particular instance this term is applied to enforcement agencies.

The requirements expressed by a broad spectrum of users cover all types of weighing devices and should be regarded as the ideal requirements. It is recognised by the project team that there are a number of obstacles to the fulfilment of these requirements, which include fiscal technical and legal. However, the requirements contained within Work Package 1 have been evaluated by the wider "Weigh-in-motion" community and found to be the most advanced and comprehensive compilation of requirements for the user community any where in the world.

The project adopted and extended the "Converge Methodology" by selecting the levels of user needs as an important level to be defined in the project and by adding the intermediary level of use cases. This additional layer is considered useful to link user needs to specific use cases; also the additional level of use cases provides a more concrete basis for the identification of related system requirements.

User needs, use cases and system requirements are defined as follows:

Use cases define a subset of the functionality of a system. They are primarily used to define the behaviour of a system without specifying its internal structure.

User requirements emanate from the users and are entirely user-oriented. They will not necessarily be consistent, and are likely to be expressed in plain text, with informal diagrams if necessary.

Use cases basically tell coherent stories about how a system will behave in use.

The project has defined the use cases in a pictorial manner to assist in the flow of the cases. Broadly speaking the project defined the Use Cases into six defined applications

PROJECT REMOVE/APPLICATION DESCRIPTION V0.8/4

- 1. Human Selection
- 2. Statistics and Planning
- 3. Pre-Selection
- 4. Problem Solving
- 5. Direct Enforcement
- 6. Intelligence.

Each of the defined applications can be applied across any form of weighing device, and the order indicated the level of technical difficulty or technical integration with other existing systems or data bases.

The project team also considered the outcomes of information collected by any weighing system. These were defined as:

- No action
- Enforcement
- Problem Solving
- Statistics and Planning
- Intelligence

Applications

Human selection

Traditionally heavy vehicles were selected from the traffic by an enforcement officer. Here the officer uses his/her field experience to select vehicles based on external characteristics. The selected vehicle is then escorted to a location for static (in some countries Low Speed) weighing which is currently the only legally accepted method for enforcement. The disadvantage of this method is that not all selected vehicles are overloaded and, worse, that (groups) of overloaded vehicles are never selected and therefore never checked. Human selection is a way of overload enforcement without the use of Weigh-in-Motion technology.

Statistics and Planning

In this case the data measured by a WIM system is used to generate statistical overviews on the overloading on a specific road. Such overviews from different WIM-systems can be used in the planning of enforcement activities, e.g. based on the distribution of overloading by time of day on a certain location. Also they can be used for non-enforcement applications like the calculation of the damage to the infrastructure. For the Statistics and planning application a WIM-system does not require a digital camera.

Pre-selection

In this case the WIM-system is used to select potential offenders. The WIMsystem 'only' gives an indication that a vehicle is probably overloaded, the measurement that is legally valid for enforcement is done by a second system. This second system is either a static weighing system or a Low Speed WIMsystem depending on national regulations. The WIM-system weighs all passing (heavy) vehicles, when it detects an overloaded vehicle, an image of the vehicle is taken and this vehicle is guided to the static weighing area. There are two possibilities for the escort of the vehicle from the traffic to the static weighing area; human escort and automatic escort.

The advantage of the pre-selection method compared to human selection is that almost (more than 95%) every selected vehicle is also actually overloaded and no groups/types of overloaded vehicles are missed. The disadvantage is that this method is still labour-intensive due to the fact that the static after-weighing remains necessary.

Problem Solving

The aim of Problem Solving is not to achieve compliance through the enforcement of the regulations by the imposition of penalties, but to resolve the problems that underlie offences. An increase in compliance is achieved by removing one of more of the obstacles to compliance with the regulations. Within the application of Problem Solving two of many different forms have been considered "Direct Feedback" and "Company Profiling"

Direct Feedback: in this case the WIM-system is used to warn passing trucks when they are overloaded. The system set up consists of a WIM-system, a traffic sign (variable message sign) and locations were the target vehicle can remove some of the load to reduce the weight of the vehicle.

Company profiling: in this case the WIM-system stores all measured data, including the pictures of the vehicle, of all overloaded vehicles. Again the WIM-system 'only' gives an indication that a vehicle is probably overloaded the data can still not be used as evidence for direct legal action. The data from the WIM-systems is stored in a data base. Using the licence plate information the overloaded trucks are sorted per company. Based on this information companies are selected that qualify for further action. This action may consist of

a warning letter, a company visit or inspection. The company is advised to check its loading regime and that the progress will be monitored.

There are many other forms that WiM technology would support in the future.

Direct Enforcement

Direct Enforcement means that the evidence for the penalty for an overloaded vehicle is directly based on the measurement by a weighing system. Within the procedure of Direct Enforcement both "Automatic enforcement" and "Manual Enforcement" are possible.

For Automatic Enforcement the procedure from the measurement to the sending of the penalty can be completely automated and is similar to that of automatic speed enforcement. The defined level of inaccuracy of the weigh-system is deducted from the measured value in order to make sure that the offender always has reached at least the corrected value. This corrected value is used to determine the violation and for the possible further prosecution. The enforcement margin means that only violations larger than that margin e.g. (10%) are actually prosecuted. In this way, the enforcement is focussed on the more severe cases of overloading and cases of small accidental overloading do not immediately result in a citation. It should be made clear the where vehicles are in excess of their weight limits which are > 5% but < 10% then these issues could be dealt with by way of a caution either formal or informal or subject to a problem solving approach.

For Manual Enforcement the procedure differs from 'Automatic Enforcement' as it incorporates either the 'Human Selection' or 'Pre-Selection' procedures previously described. Manual enforcement will always require some element of 'human interaction'. If an overload is detected the information regarding that vehicle, and offence are conveyed to a human operator who will manually stop the vehicle, and then deal directly with the driver in relation to the overload offences detected. A manual prosecution process is activated, relevant to the particular countries' laws, rules, regulations and tolerances.

Intelligence

Intelligence is a collection of applications using the power of modern ICT to combine all possible forms of collaborative data and aggregate the information into intelligence for policing or enforcement application. These may not be aimed exclusively at the problem of overloading. Here the data recorded by a network of WiM-systems distributed over the TERN is stored in a number of data bases. This way the behaviour of specific vehicles can be monitored as they move over the TERN. Possible applications are; average speed enforcement, driving and resting times, the monitoring of transport of dangerous or illegal goods, the control of various transport documents and permits or issues of national security.

The six applications offer to enforcement agencies new and innovative ways of utilizing both WiM and conventional weigh stations. Following the results of the inventory of current situation provided in Work Package 1 it was clear that many member states had the will to undertake enforcement activities, but lacked the technical expertise of other states that had undertaken these activities for a number of years and had acted as 'Beacon' Countries in this form of enforcement. The six applications developed will work equally well with conventional weigh stations as they will with the most advanced WiM station. It is the principle behind each tactic that acts as the key.

These have now been reproduced in the diagram below which encapsulates the project view on the direction of any enforcement system



Figure 11 Project Use Case Visualisation

5.3.1. Conclusions

Conclusion

The Use Case step wise approach and the resulting user requirements have drawn together a true representation of the requirements for Enforcement agencies to satisfy the requirements of the project that being: "To provide a framework within which both new and existing weigh in motion systems can be operated at a strategic and tactical level across European Community."

5.4. Sanctions WP1/FINAL REPORT/148

The imposition of sanctions varies greatly, as does the execution of the legislation that fixes the point from which the sanction is delivered

The fundamental aspects of the imposition of a penalty are the following:

- Must be effective in relation to the offence
- Administration of the penalty must be transparent to those affected
- It must be commensurate with the offence committed
- The application should be uniform across Europe
- The imposition of the penalty for the offence should be seen as being fair by the majority of the population

In principle a sanction can follow two routes, when discussing the issue in the context of this project. Broadly speaking there are two main types of sanctions:

• Financial

5.4.1. Penalties WP1/FINAL REPORT/156 Financial Penalty

The imposition of a financial penalty is a concept that is used throughout the world in providing an easy to administer punitive measure to ensure compliance with legislation. Should a person transgress a statute or regulation, they would be liable to the imposition of a penalty on the finding of guilt for breaking a law.

Non Financial Penalty

The concept of the imposition of non-financial penalty is relatively new in terms of a concept in legal terms to achieve compliance. The range of options available in terms of non-financial penalties can be as innovative as the member state or enforcement agency feel able, however again the principle of the concept is to achieve compliance. It is the identification of the problem that is to be addressed, and the formulation of the non-financial penalty that is the key. What ever type of penalty that a member state should decide to use as part of the tool box on the road to achieving compliance they must in all cases be:



Cross Border Enforcement

In the inventory of the current situation the road haulage industry pointed to the inequality experienced by drivers and hauliers when offences of overloading are detected. This is at its most noticeable when two offenders, caught in the same check are from two different member states. The project team identified that very often it is the process of exchanging and enforcing penalties with other member states which was the key issue. This issue of in-equality in the view of the project team may breach fundamental human rights, namely to be dealt with fairly and equitably in all cases and also has an adverse effect on what could be described as the accepted model for supply and demand in relation to determination of a fee for the carriage of goods. It has been found that where drivers from other countries know that they will not be stopped or fined then this tends to encourage illegal acts. Conversely there is anecdotal evidence of increased on the spot fines for foreign drivers

It is for these reasons that the Remove Project Team supports and embraces the concept of cross border enforcement, and endorses the research carried out in the VERA series of projects and Project Captive. Clearly equitable treatment for all is fundamental to the principle of Fair Proportionate and Effective application of legislation which will lead to Compliance.

Key Point

The Remove Project Team supports and embraces the concept of cross border enforcement, and endorses the research carried out in the VERA series of projects and Project Captive

Conclusion

It is the conclusion of the project team that in the light of the known travel patterns for heavy goods vehicles the issue of cross border enforcement is vital to the project goal of achieving compliance with vehicle weight regulations. At this time project Captive is assessing the known blockages to the ability to enforce offences cross border.

5.4.2. Problem Solving WP1/FINAL REPORT/161 & WP3/GOOD PRACTICE GUIDE/23

The term problem solving is not an entirely new concept to enforcement agencies across Europe. There are a number of good projects now being carried out, but these tend to be one dimensional rather than the multi-dimensional approach advocated by the originators of the concept.

Problem Solving is defined as 'Transforming one set of circumstances to another preferred state'3.

Clearly what could potentially be offered by the application of "Problem Solving" methodology to enforcement agencies across Europe is significant. The skills are not difficult to acquire, however what is more fundamental is the approach of the enforcement agency involved as this solution requires new and innovative approaches, and a willingness to engage other agencies and bodies previously not regarded as natural partners in enforcement issues.

The results achieved can be dramatic and in most cases last far longer that the imposition of just a financial penalty, as the goal is to achieve a change in state, by removing the problem.

³ How to be a better problem solver, Michael Stevens. London: Kogan Page, 1996.



Figure 12 Problem Analysis Triangle

Were this to be applied to the realm of overweight goods vehicles then the three sides of the triangle identified as:

VICTIM OFFENDERS ENVIRONMENT

Each are analysed to bring out the components of each of those categories. The process is then to significantly affect one side of the triangle to bring about change.

Key point

Problem Solving when linked to intelligence is becomes an extremely effective preventative tool for enforcement agencies, for instances of overloading.

5.4.3. Intelligence WP1/FINAL REPORT/163 & WP3/GOOD PRACTICE GUIDE/15

In this report, the project team recognises the true issue of cross border traffic and the implications that this posses for each member state and the Union as a whole. Many persistent offenders who travel across member state borders escape identification and detection merely because they are mobile. Whilst there is a number of enforcement agencies and associations dedicated to European Cooperation and cross border enforcement such as European Control Route (ECR) and TISPOL. The exchange of intelligence on offenders is not yet an every day occurrence and there are significant technical and political issues that still need to be resolved.

But it is the conclusion of the Project Team that there is a need to ensure that intelligence between member states is increased, that the technical issues need to be addressed and that the existing work carried out by ECR and TISPOL should

be recognised and expanded. This e project team also recognises the initial work carried out by the TISPOL funded TIDE project in attempting to find language independent solutions to the exchange of intelligence.

Key Point

There is a need to ensure that intelligence sharing between member states is increased, the quality of the information/intelligence should be certified to the highest level.

Key Point

Technical issues need to be addressed and that the existing work carried out by ECR and TISPOL should be recognised and expanded, this report also recognises the initial work carried out by the TIDE project in attempting to find language independent solutions to the exchange of intelligence.

5.4.4. Conclusions

Conclusion

From questionnaire responses from member states where there is reliable information on sanctions relating to overloading, it is clear that there are large differences between the potential maximum sanctions that can be imposed. However the indications from this survey suggest that in reality the differences in level of sanctions are not so great, as the maximum penalties are seldom imposed. However further research is required to complete the picture as this description could not be applied across all member states. **WP1/FINAL**

This conclusion is significant as it means that the process of harmonising sanctions in the future may not be as complex as first thought.

Conclusion

The Remove project identified that some member states do not appear to regard the issue of overloaded vehicles as a high priority.

Few member states make effective use of non financial penalties, even though when linked to a problem solving approach, are regarded by many as the most effective solution to this problem. This can also be linked issue of liability and culpability where more innovative solutions such as indicated by the Australian example earlier in the report have yet to be taken up, and are now outlined more fully in the next chapter.

5.5. The Responsibility and Liability for overloading

5.5.1. Introduction WP1/FINAL REPORT/168

As part of work package 1 for the REMOVE project, one of the major elements was the inventory of the present situation, the purpose of which was to try and assess the situation across Europe from the perspectives of the significant actors in the issue of overloaded heavy goods vehicles.

One of the major concerns high lighted by the haulage industry was the issue of who has responsibility for a vehicle being overloaded, and who should accept liability in these circumstances?

It was very clear from the questionnaires submitted by the International Road Transport Union (IRU) that this was a significant issue, as the current accepted rules of responsibility and liability in its various forms across the member states did not truly represent all of those who could and should be held accountable for the instance of an overloaded heavy goods vehicle being allowed onto the roads of Europe.

In general terms the issue of liability for and overloaded heavy goods vehicle has traditionally rested with two main actors in the chain in which goods are moved by road.

The main actors are:

- Driver
- Transport Operator/Owner of the haulage company.

However on examination a complete set of actors are currently omitted from any responsibility for the goods carried, it is these actors that the project team proposes to examine to establish a level of responsibility.

Conclusion

The Remove Project team concludes that the existing situation in terms of issues of liability should not be laid solely on the transport operator and/or the drivers, but should be shared among all actors involved in the transportation of goods chain – i.e. consigners, shippers, loaders, container handlers and consignees.

5.5.2. Stakeholders WP1/FINAL REPORT/169

From the original work carried out in the chapter "Requirement for Legal Acceptance", a large number of stakeholders were identified for the entire end to end process of the transport of goods by road. From that, a defined list of

stakeholder who the project team feels should bear responsibility for the carriage of goods by an overloaded vehicle have been identified.

Stakeholder involved in the Carriage of goods

- The Heavy goods vehicle **Driver**, responsible for the carriage of the goods in the vehicle.
- The Transport **Operator/Manager/Haulier** operates and or manages the business dispatching the goods.
- The **Packer**, Packs the goods to be loaded onto the vehicle.
- The Loader loads the goods into the vehicle.
- The Consigner/Dispatcher, Dispatches the goods for delivery
- The **Consignee/Receiver**, Orders and or accepts the goods being delivered
- The **Agent**, responsible for brokering the carriage of goods between the owner/manager and a consigner, in another member state
- The **Container Handling Agent** responsible for the co-ordination and movement of containers from the dockside to the container storage and the allocation of hauliers.

The project team also recognised the interaction of another group of stakeholders who were defined as the authority stakeholders, who were represented by the European Union, Member State Governments and Enforcement Agencies.

5.5.2.1. Stakeholder Interaction

Having identified the stakeholders the process of establishing the existing interaction between them was established. This is best represented by the below diagram.



Figure 13 Diagram showing existing relationship between main chains of actors involved in the transportation of goods.

The interaction of the actors from the perspective of the hauliers:

The project's perspective is that enforcement agencies should adopt common harmonised methods of dealing with the issue of overloaded goods vehicles throughout the European Union. An offender in Poland should be treated in exactly the same way as he would be in Greece or in the Irish Republic this is referred to as proportionality, and should take place throughout the Union. The project's view is that enforcement agencies should recognise that the additional costs imposed on operators caused by time loss and extra mileage to comply with enforcement activities.

The project's view is that enforcement agencies should recognise that the issue of liability in respect of the interaction between the defined actors in the chain should be born in mind when detecting offences, as it is often the case that the driver and or the operator are not able to deal effectively with the issue of the weight of the goods that they haul or the issue of the redistribution of load in so far as it relates to axle loadings

The interaction of the actors from the perspective of the enforcement agency:

It should be recognised that enforcement agencies when carrying out enforcement action, may well be operating under defined parameters set by member state governments.

Enforcement Agencies when carrying out enforcement action should always act in a fair and ethical manner, when dealing with offenders irrespective of their Country of Origin.

The interaction of the actors from the perspective of the road authority:

The issue of overloaded goods vehicles has a significant impact on the ability of the road authorities to main national road infrastructure systems. The work identified in Cost Benefit Analysis Work Package 4, quite clearly identified the potential additional cost that overloaded goods vehicles could bring to the roads and to the bridges on the network.

The carriage of goods on the road network is seen as a positive issue on the broader scale as being seen as vital in ensuring that a member states gross domestic product remains positive. On a more practical level it is ensuring that what is regarded as items for every day living are delivered to where they are required at the right time and in the right condition.

But it should be recognised that to achieve the above two aims is not without significant costs to either Central or Local Government. In the current global economy the issue of the availability of funds for the public purse does raise questions as to the most effective way of spending a finite fiscal resource. Road Authorities should regard the compliance of all vehicles using the road network as

a priority in both achieving casualty reduction targets for 2010 and beyond, and also making the most effective use of public money by not having to undertake extensive and unscheduled repair programmes for prematurely worn roads.

5.5.3. Legal Co-Liability WP1/FINAL REPORT/175

The inventory carried out in work package 1 indicated that for most member states those held co-liable for the offence of using a heavy goods vehicle whilst overweight were the driver and the operator. No account was taken of the other stakeholders, despite the considerable element of responsibility for the offence that they may individually or collectively bear.

The inventory of the present situation has indicated that the level of responsibility at this present time is set in the main across Europe at far to narrow a focus. The majority hold either or both the driver/operator as being liable.

Research within this project has identified that there are a number of steps that need to be taken to assist in achieving liability for all stakeholders in the chain which is commensurate with the tasks that they undertake.

- Concepts for harmonised enforcement must therefore address the liability aspects.
- In those Member States were co-liability is legally established (Belgium, France), enforcers should apply the regulation to ensure co-liability in practice
- Other elements of this project address technical and enforcement issue relating to providing effective enforcement tools to ensure that the overall target concept of this project being COMPLIANCE is achieved.

Before any technical innovations or other measures are employed the issue of liability must be addressed

Research from this report has shown that an effective model for determining liability for all actors in the chain has been developed by the Road Transport Authority of New South Wales Australia. This model seeks to identify all stakeholders and their role within the term expresses by the model for the carriage of goods <u>'The Chain of Responsibility'</u>

The project team also notes that without the introduction of the direct enforcement WiM system the casual infringement of heavy goods vehicle legislation will not be addressed. It is accepted that the distance heavy goods vehicles now travel stretches far beyond the confines of the European Union. The ability to track record and exchange information on vehicles as they travel throughout Europe and beyond is vital. The ability to capture and share information will form a key element of future enforcement strategies where the significance of this requirement is full articulated. The inventory of the present situation has identified that the road transport industry is generally in favour of establishing such patterns of intelligence as operators breaching the law on a regular basis by not respecting the total gross weight of their vehicle and generally will not respect other regulations too and therefore should be targeted by the enforcement agencies.⁴ By developing such patterns one may also expect and accept that bona fide operators would be less controlled. An example would the grading of operators as Green (Correct) Amber (In need of Assistance) Red (Offender)

5.5.4. Harmonisation Issues WP1/FINAL REPORT/180

Non WiM

If WIM systems cannot be used, liability questions arise solely in the case of prosecution for a breach of weight limits. The driver receives the notification, even if it is only made out in the name of the transport company, as the driver would be acting as agent on behalf of the operator.

In order to achieve a harmonized approach to liability the following observations have been made.

- Harmonisation in respect of tolerances for the vehicle gross weight and the axle weight
- Party or parties held liable, depending on the type of infringement (axle weight, gross weight, full load, part load, container, open bulk vehicle, etc.).
- Even in cases where no WIM is used, the general introduction of the principle of co-liability should be explored.

Co-liability of principals would help to mitigate the pressure on operators and drivers. In order to make it operational for enforcement purposes, formal requirements with regard to transport orders and transport documents need to be laid down.

National laws in the countries that presently apply co-responsibility provide the best starting point for developing fair and enforceable rules at EU level.

Finally, the introduction of co-liability is worthwhile because "traditional" enforcement of weight limits will continue on parts of the road network, even if WiM is used on other parts. If the objective is to find patterns rather than individual infringements, it would be useful to combine information from WiM and non-WiM enforcement and in having the same rules in respect of liability for all enforcement methods.

⁴ ILLEGAL PARKING IN DISABLED BAYS: A MEANS OF OFFENDER TARGETING Sylvia Chenery, Chris Henshaw and Ken Pease HMSO UK May 1999

5.5.5. Conclusions

Conclusion

That the issue of liability in so far as it applies to the overloading of heavy goods vehicles is a complex issues with a multi-dimensional view points on the term liability as it is applied in both a penal and civil context to the same scenario.

Conclusion

The current practice common across the majority of the 15 original European member states of applying strict liability to the driver and or the operator is not compatible with achieving the project goal of Compliance across the haulage industry.

Conclusion

The inventory of the present situation has identified that the road transport industry is generally in favour of establishing a problem solving/company profile approach.

Conclusion

In the detection of offenders for vehicle overweight offences current methods can result in legitimate owners and drivers incurring additional cost in order for enforcement agencies to screen vehicles.

5.6. Technical Issues WP2/FINAL REPORT/8

Introduction

Work package 2, is defined as the technical element to the project. The requirement was to provide three products at the conclusion of the report, these being:

- 1. An Inventory of WiM technology as it exists now across the European Union.
- 2. Specification both functional and some technical.
- 3. Test Procedures for the legal acceptance of WiM

From the very outset it was recognised that the scope of the project had been set at a very ambitious level, certainly in terms of some of the proposed work in the technical fields, in particular proposed work in terms of Regulation both legal and technical and the issue of legal Metrology was a significant issue, as at the present moment it does not exist for advanced WiM systems such as those described in this project inventory of WiM Technology

What is Weigh in Motion (WiM)

Weigh in Motion (High-Speed WiM, with speeds over 10km/h) equipment is installed directly in the road where the vehicles drive over the equipment without being stopped. The sensors in the road determine the forces (mass) being exerted by each axle of a vehicle as it passes over the sensor. The vehicle is then identified by a number of means, which range from an enforcement officer noting the visible identification mark and country marker for the vehicle, to an automated process which reads the identification mark to identify the registered keeper of the vehicle.

One of the crucial elements for any WiM system is to correctly identify the number of axles that the vehicle being weighed has. This can be achieved by a number of means, again from an enforcement officer counting the number of axles, to photographic reference of the number of axles or a laser scanning the vehicle to identify where and how many axles the vehicle being weighed has.

5.6.1. The Road to Acceptance

The main goal of the REMOVE project is to provide the requirements for the harmonised and interoperable deployment of Weigh in Motion (WiM) systems throughout the European Union. The objective being to provide effective enforcement capabilities that would transcend traditional borders within the European Union, with a view to ensuring that effective enforcement measures would encourage compliance of existing legislation dealing with the weights that heavy goods vehicles can legally carry.

Measuring Instrument Directive

This report recognises the work already carried out by the European Union in the formulation of a Measuring Instrument Directive (MID 2004)

The MID was devised to allow the sale of WiM stations across Europe by the regularising the construction and certification procedures for a number of WiM devices.

At this present time the MID does not recognise any WiM device, however the existing structure of the MID will permit additional devices to be added in the appendices

To assist in this process the project team have produced a first draft version of a virtual annex on Weight enforcement systems.

5.6.2. Specification

This is a significant piece of work and currently outside of the scope of the project the Consortium felt that it was vital to commence this work, with a view that it could be entered into the MID at a later date following more consultation.

Existing Specifications

At this moment there are three existing international sets of specifications in the field of Weighing (Weigh–in-Motion) of road vehicles: COST 323, ASTM E-1318 and OIML R-134.

The main difference between the COST323 or ASTM E1318 and the OIML R-134 requirements for accuracy assessment comes from the fact that the OIML is a Legal Metrology Organisation, whilst the other two are acceptance criteria in assisting the vendor in the process of accepting new WiM systems.

None of the specifications that currently exist were capable or suitable for testing high speed WiM systems for direct enforcement of overloading. In defining this specification, it was lead by the end user (Enforcement Agencies); the consortium identified two high level applications for the WiM device.

- Enforcement without using WIM, so no specifications necessary;
- WIM for direct enforcement applications, a penalty is directly based on the measurement by the WIM-system;

• WIM for other enforcement applications, e.g. Pre-selection and Problem Solving.

5.6.3. Test Procedure

As already out lined the availability of defined test procedures for WiM is very limited, the test procedure defined and outlined below

Technology Independent the tests must not hinder any existing or future technology. During the acceptance test, the environmental conditions both physical and atmospheric at the site would be recorded and a system can be accepted for these conditions or better.

Static Reference the limits for the axle loads are interpreted as the maximum value for the static axle loads. For that reason, the static axle load measurements are accepted as reference value for the test procedure. The static reference measurement will consist of two parts:

- Measuring the total vehicle mass using a weighbridge.
- Measuring an accepted reference value for the individual axle loads on a test vehicle.

Quality assurance in order to be able to be used for direct enforcement, a WIMsystem must be certified by a Member State notified body. This certificate guarantees that the system will always be operating within the defined specifications. In daily practice the only specification to be considered is the accuracy, since the accuracy will be subtracted from the measured value. A certificate will be issued by the notified body and is based on the results of one or more acceptance tests.

The acceptance test and the necessary accreditations and quality assurance will be covered in an International standard. In the case of Weigh-in-Motion this could be the OIML or The CEN (or both); however it is recognised by the project team that this work is yet to be carried out.

Test design

The purpose of the tests as outlined above is to enable a valid decision as to whether a measurement system performs within the specifications defined. Acceptance tests for enforcement systems are generally based on many years of enforcement activities; however in the instance of High Speed WiM for direct enforcement there is no experience to draw from. Whilst the project team in this report recognises that some parts of the chain exist at the moment there are large parts of the system which to date are untried and tested. The result of this knowledge gap is that the first instances of testing will be a process of gaining experience, whilst the second test will allow a review of the established procedures and may allow a reduction in the size of later tests.

5.6.4. Conclusions

Conclusions:

• Weigh-in-Motion is a new technology to most of the enforcement world, offering a range of new applications for the enforcement of overloading.

- Instead of delivering a complete and internationally accepted set of technical specifications REMOVE work package 2 concentrated on the setting up of a structure of these specifications in line with the operational requirements that came out of WP-1 and 3.
- A standard data set for Weigh-in-Motion systems for the various enforcement applications, including a universal and flexible method for vehicle classification, has been devised. This data set is a corner stone for the future international exchange of WIM-data for enforcement.
- For the direct automatic enforcement, which is technically the ultimate application of WIM for enforcement, the structure of an acceptance test has been set up;
- A scientific base has been given for the test procedure necessary for the acceptance of WIM-systems for direct (automatic) enforcement which is required for a legally accepted certification of the WIM-system.
- The acceptance and quality control of WIM-systems for the other enforcement applications is less strict and depend on national procedures.
- The external influences relevant for the proper functioning of a WIMsystem for enforcement have been listed.
- The technical and operational criteria for the selection of a location suitable for a WIM-system for enforcement have been listed.

All of these conclusions are dealt with in full in REMOVE work package 2.

6. What are we trying to achieve?

The task of the project was to bring together issues identified from the inventory of the current situation in work package 1 and to transform them into usable products for the enforcement community, as the prime beneficiaries of the information from within this work package. In addition the project sought to obtain evidence of existing good practice from member states which had already been included in a documentary form.

Work package 3 was to produce three elements

- Good Practice Guide
- Code of Practice
- Future Enforcement Strategy

The responses from the inventory of the current situation gleaned a number of responses to specific questions:

- To obtain an overview of current practices for enforcement of overloaded goods vehicles in each member state.
- The type and level of weighing equipment currently in use, particularly in relation to the use of WiM technology.
- The laws and regulations surrounding the use of the equipment.
- The effectiveness of the current strategies used to combat the problem of overloading.

It was clear from the responses received from the questionnaires, that there was a need for a common approach to enforcement measures for the agencies engaged in activities to try and detect overloaded heavy goods vehicles.

In light of the information received it was clear to the project team that the levels of understanding about the techniques and terms used varied greatly across the European Union. This underlines the need for a harmonised set of definitions for the applications of WIM for enforcement (the Use Cases). With this in mind the project team formulated an additional document from the information provided in work package one, the inventory of the present situation and the other elements from that work package. This product Application Description assists in providing understanding and clarity of terms to all enforcement agencies engaged in enforcement activities.

The inventory of the present situation has shown a need for a common approach to enforcement strategies across Europe.

By adopting the common approach a number of products will be come evident.

- 1. Common Levels of Offence Detection across Europe
- 2. Ethical methods of offence detection
- 3. Offenders dealt with in a transparent manner
- 4. Cross Border enforcement now more effective.
- 5. Assistance for enforcement agencies in prioritization of work streams
- 6. Measurable defined outcomes for performance measurement.

The levels of technology currently utilized across the European Union vary greatly. Most member states are able to use conventional static weighing

bridges, these devices have been in existence for some considerable time, and can be found at a number of locations. In some cases the enforcement agencies utilize privately owned weigh bridges that are subject to the accepted certification for accuracy.



Figure 14 Conventional Weigh Bridge Station

One of the issues identified with WiM systems is its initial cost of purchase and installation. However experience with those Member States using this type of equipment has shown the following benefits

- 1. High expectation of offence detection the balance of probability for the correct detection of an offence on the UK Pre-Selection WiM now stands at $92\%^5$
- 2. Requirement for specially trained enforcement officers to operate devices and detect offences now reduced
- 3. High level of vehicles screened
- 4. Increased Deterrent effect
- 5. Less disruption to legitimate hauliers

This report commends the usage of WiM systems as the most effective enforcement tools currently available.

The project team has recognised that each member state has varying levels of experience in dealing with overloaded heavy goods vehicles, and the level of funding available for the introduction of new WiM technology may be limited. In recognition of this fact, the project team have developed six defined ways of using weight enforcement detection devices. In developing these usages, the project team were mindful that a significant number of member states may be short on the level of investment and technology that is available to carry out enforcement activities, BUT have significant levels of staff available. It was with

⁵ Source Highways Agency and Vehicle and Operating Standards Agency UK

this in mind that the six usages were developed to allow all member state to participate in enforcement activities as suggested in the good practice guide, which all leads toward the project objective of **compliance**.

The level of prioritisation across all member states is not uniform. Whilst this is to be expected, the project team feels that a unified response would be beneficial in providing a common approach so that citizens in all member states know exactly how this issue would be enforced.

The project team recognised that funding both for enforcement personnel and equipment remains an issue. The project team has concluded that the diversion of fines and penalties to fund these activities is felt to be a pragmatic solution, whilst recognising that this brings an implicit need for the enforcement agencies to operate at the highest possible ethical levels. Adoption of the future enforcement strategy and good practice guide will assist in this.

In its findings from the inventory of the present situation, the project team concluded that there was very little co-ordination of activities between enforcement agencies in different member states; this included the sharing of intelligence relating to the activities of known offenders, and the co-ordination of enforcement activities. With the common approach advocated by the project team and the utilization of bodies such as TISPOL and ECR this could and should become common practice.

The project team recognises the good work carried out by TISPOL and ECR in this area and the valuable work being carried out in the TISPOL funded project TIDE which is directed at providing a language independent gateway for enforcement agencies to share intelligence.

With any activity it must follow that there should be an evaluation of the activities undertaken. A common approach would allow this for direct comparison between member states.

The Code of Practice has been developed to assist member states to have access to a defined code of practice in the selection preparation and operation of weigh control sites. This has been achieved by taking the very best from the existing published codes of practice and distilling it into one document. The provision of the code of practice is a significant step on the road towards compliance as it will allow member states to ensure that they are now operating in a common way and from an ethical stand point for the detection and prosecution of offenders

Throughout the life of the project, consortium members have explored alternative options to traditional enforcement activities, which the project team feel offer a more effective options for enforcement agencies in the detection of persistent offenders and the measure taken to prevent them from re-offending.

It should, be stressed that the imposition of a fiscal penalty has its place, but there are alternative options which could offer more permanent resolutions, and which would make effective inroads into achieving compliance with heavy goods vehicle legislation.

The project has identified that Problem Solving Analysis would appear to be the most favourable for this task, it is applied by a number of enforcement agencies world wide and seeks to address the root of the problem not just the symptom. The details for this can be found in a number of the project documents as it is a recurring theme throughout the project report.

The Future Enforcement strategy has been constructed from information provided by other elements from within this work package and of course from the remaining work packages. It very much recognises the differentials between member states and concludes that a path way to progression should be identified. This has been graphically represented in the below diagram.



Figure 15 the Enforcement Path

This clearly shows how the project visualises the migration path toward the future situation being **Compliance**. Whilst much of the focus of this report has been concerned with the Trans-European Road Network (TERN). It should not be forgotten that enforcement is required on secondary roads. These roadways are often used by vehicles trying to avoid Weight Control Checks. The use of the Code of Practice in the identification of sites could reduce this possibility.

The ability to mix enforcement activity between sites is seen as vital in providing effective enforcement profile for each member state, this can best be shown in the below intelligent enforcement mix diagram.



Figure 16 Intelligent Enforcement Mix.

The problem of overloading may occur in many varying forms: from a local problem (e.g. around a building site) or over a specific period (e.g. the harvest season) The variation occurs due to numbers of goods vehicles required to be controlled in either case. There may be a relatively low number of trucks to be controlled in relation to the international transport on the TERN where there are a very high number of trucks to be controlled. In order to match this diverse problem the enforcement needs to be equally diverse. To achieve this optimal mix of possible enforcement operations should be combined into one intelligent enforcement mix.

Key Point.

The different applications of WIM-technology for enforcement (use cases) should be combined in an intelligent enforcement mix in order to match the varying occurrences of overloading.

Whilst the project team recognises the significant advantage that enforcement using WiM technology offers, the team also recognises that a structured approach to the introduction of such technology would be required. This WiM systems designed by the project team has a modular approach and can therefore deal with enforcement tactics on a sliding scale.



Figure 17 The Lego approach

Throughout this part of the final report the project team have sought to promote an integrated and ethical approach to enforcement activity which is **Fair**, **Proportionate and Effective**, leading to the project objective of **Compliance**. The team believe that this is an essential operational element for achieving compliance by all agencies and this principle can be found throughout the REMOVE reports.

7. How do we get there?

The project team in the final report has shown a clear migratory path which if chosen could lead the European Union from a fragmented, and in some cases discrimatory attitude to the enforcement of overloaded heavy goods vehicles to a state where the preferred option for those involved in the haulage industry is compliance.

There are a number of elements contained within the project documentation which will assist in the migration along this path.

- Prevention, in this report, the project team recognises that enforcement is not the sole answer to this complex and multi-layer problem. The project team have suggested strategies that should be followed in the first instance prior to the imposition of enforcement. It is recognised that this may be a new concept for some member states, but those member states who have and are following this path have found it highly effective.
 WP3/GOOD PRACTICE FINAL/7 & PROJECT REMOVE/APPLICATION DESCRIPTION V0.8/4
- User Requirements. For the first time a comprehensive list of user requirements and Use Cases has been defined by the user community giving a clear indication to the industrial and technical community what would be required from the Enforcement Community to achieve the goal of compliance in terms of enforcement equipment.
 WP1/FINAL REPORT/78
- Legislation the inventory of the current situation provided a clear indication of how fragmented the legal approach to overweight vehicles is this includes the imposition of penalties to offenders. The project team have reached conclusions on this issue.
 WP1/FINAL REPORT/33
- Liability one of the main issues was how those responsible for the offence were regarded by each member state. It is clear that at this present time many of those who potentially could bear some of the responsibility for overloaded vehicles on the roads of Europe do not do so.
 WP1/FINAL REPORT/168
- Standards, as already stated there are no automated direct enforcement systems, which have been subject to type approval in existence in Europe at this time. The project has sought to bring together technical innovation and the required legal standards to provide a path to be followed for the development and introduction of fully automated WiM systems.
 WP2/FINAL REPORT/23
- The project team in the report has identified many areas of good work already being carried on throughout Europe, and has sought to bring forward the two dimensional approach to the element of enforcement required to achieve compliance.
 WP3/GOOD PRACTICE FINAL/9 & FUTURE ENFORCEMENT STRATEGY V0.5/7

The full documentation for each of the above products can be located on the REMOVE CD ROM which accompanies this final report.

Clearly the future situation is some distance away, and the project team in this report recognises that there are both technical and legal obstacles to be overcome, but it is clear that if the recommendations are followed, what will follow will be an all encompassing and patently fairer system of enforcement, with the main goal of the project compliance as the focal point.

8. What needs to happen?

8.1. Road Map

This final report has sought to provide a summary of the findings of the entire project. Clearly for the most comprehensive view an examination of the areas within the project would be required to bring forward the true implications of all of the findings.

In this report, the Remove project team has sought to high-light a number of significant areas, where issues need to be addressed to work towards the goal of compliance with all heavy goods vehicle legislation.

Key Point

The project has used this broad term deliberately as it is quite clear from the research carried out, that those who deliberately choose to ignore the legislation on weight limits for heavy goods vehicles are more often than not involved in other illegal activities. This can be found throughout the entire chain for the carriage of goods and NOT confined solely to the haulier.

The project team recognises that the goal of fully integrated WiM systems may be some distance off, and in order to achieve this there are a number of significant hurdles that need to be crossed on the standard and legislative fronts. However the team believes that in-line with the future strategy diagrams there is a clear path that the project has now high-lighted to allow for the migration to automated WiM which is identified as one of the major goals in achieving compliance.



Figure 18 Project Remove Vision

The vision indicates what could be possible with the use of WiM throughout the TERN, but this clearly cannot happen within a short time frame.

The project estimates that in order for all technical legal and standardization issues to be resolved another 12 years of work would be required.

Whilst the project fully recognises that technology is evolving all the time, it is the legislation and standardization issues that are at the core of the time scale. The project noted that it took 10 years for the Measuring Instrument Directive to be completed. **WP2/FINAL REPORT/23**



Figure 19 Project Time line

The Project Team would recommend there are areas of work that have been completed by the project that would lend themselves to improving the existing situation, and would not detract from the overall goal of the project.

- The issue of harmonised enforcement should be examined. The team has identified a series of steps to achieve harmony in the way that offences are detected, and enforcement equipment maintained and used. WP1/FINAL REPORT/148
- There is a requirement to examine the level of penalties levied against offenders. Initially this was thought to be a major issue. Whilst it is true that most member states have a huge variance in the scale of the fine, in practice the fines tend to be at the lower end of the range and all within a very close tolerance. But this does not resolve the issue as harmonization should mean that all member state are operating as one with close fine parameters rather than relying on the judgement of an enforcement officer to decide on the fine level.
 WP1/FINAL REPORT/148
- 3. The issue of liability. The project team has found that this is a major area of imbalance. The project has identified internationally systems where co-liability has been established against of those who are involved in the loading carriage and haulage of goods. Where these measures have been introduced it has been shown to have an extremely positive effect on the levels of compliance within the haulage industry. This element is seen as a very positive exercise as the path to automated WiM will take a number of years. Where these has been introduced even with traditional weighing techniques this has had a positive effect.

- 4. The enforcement strategy provides a clear harmonised path for enforcement agencies to work toward a more unified approach. The different applications of WIM-technology for enforcement (use cases) should be combined in an intelligent enforcement mix in order to match the national/regional/local occurrences of overloading. WP3/FUTURE ENFORCEMENT STRATEGY V0.5/18
- Enforcement Agencies should be encouraged to look at Problem Solving methodology (prevention), and the introduction of secondary penalties. The project team in this report has concluded that the effect of both of these measures can outweigh the imposition of a fiscal penalty.
 WP3/GOOD PRACTICE FINAL/27
- The Good practice guide will assist member state enforcement agencies in promulgating good practice in a unified fashion. (This term is used rather than best practice, as the project regards this as an evolutionary process rather than definitive.)
 WP3/GOOD PRACTICE FINAL/9
- 7. Intelligence, the project team has established that the cross border use of heavy goods vehicles for the carriage of goods is increasing. The need for enforcement agencies in different member states to be able to collect evaluate and share intelligence with their neighbours is VITAL in combating cross border crime. Significant work has already commenced in this field with TISPOL and ECR and the TIDE project but this needs to be continued.

WP3/GOOD PRACTICE FINAL/15

- This project has produced the most advanced user requirements for enforcement agencies engaged in the detection of over weight vehicles, and use case functions for the most effective use. The project team would see these being presented to enforcement agencies as the most effective way to proceed, as it both maximizes the use of existing technology and is compatible with advanced WiM technology.
 WP1/FINAL REPORT/78
- 9. Shared liability this is an area of great concern for the haulage industry as a whole. Clear the advances in the carriage and haulage of goods have out stripped current legislation in member states. The result being that the complex chain that now represents the contract for the transportation of goods needs to be represented to ensure that all of the actors involved effectively share liability. WP1/FINAL REPORT/168

These measures can be instigated within a short to medium time span, whilst the technological and legislative issues for fully automated WiM are continued to be worked upon. This can best be shown in the below diagram.



Figure 20 Combined Preventative and Enforcement Model

The above diagram and measure show a clear path towards the introduction of future technology and the steps required to be taken by both the European Union and Member State government.



Figure 21 Directional Progress for Technical Development

In the interim the steps shown above if acted upon could have a significant on the issue of over weight heavy goods vehicles using the roads of Europe and the detection of offenders in a Fair, Proportionate and effective manner leading to COMPLIANCE.

8.2. Recommendations

Recommendation 1: WP2/FINAL REPORT V0.7/23

The European Commission should promote further work to prepare a more comprehensive and finalised version of the 'virtual' annex' on weight enforcement systems, with particular attention being paid to the use of WiM technology for 'high-speed' axle weighing , for inclusion as an Annexe within the Measuring Instruments Directive.

The project has already identified that a consistent approach to enforcement of overloaded heavy goods vehicles is desirable. For this to be effective a common approach to the proposed WiM systems and its certification is necessary. The work needed to produce this Annexe is currently beyond the scope of this REMOVE project, and as such the recommendation is to continue this work with an extension of the work already carried out in Project Remove. However a significant element of preparatory work has been carried out to allow this process to proceed.

Recommendation 2: WP3/GOOD PRACTICE FINAL/9

The European Commission should promote further work to identify an EU Framework and Good Practice guide for the introduction of common Performance based Standards linked to the use of vehicle technology to remotely monitor vehicles.

The REMOVE project would look to recommend the work conducted in Australia and other countries on the use of in vehicle technologies to remotely monitor vehicles, to include conditions of vehicle weight and usage. Whilst this could be managed at a Member State level, the Project Team believes that some degree of coordination and standardisation across the EU would be required to ensure the fair and equal treatment of all citizens and not to provide barriers to trade and free movement.

Recommendation 3: WP1/FINAL REPORT/66

The European Commission should encourage the development of in vehicle monitoring technology such as load indicator systems, and encourage operators to invest in such systems.

Vehicle manufacturers should be encouraged to develop technical innovation to allow the driver and other person's to check the total and axle weight. This should be provided in a clear and unambiguous manner, and could include the

technical ability for a truck to be immobilized when overloaded. Clearly if this were used protocols and safeguards would be required. This would remove the issue of doubt as to whether a vehicle driver or operator knew a vehicle was overloaded. More importantly is allows the bona fide operator/driver to take remedial action, before being identified and potentially prosecuted by the authorities.

Vehicle design also has a part to play the increased usage of 3 axle Tractive units could have an impact on solving part of the problem for heavy goods vehicle operators and drivers.

Recommendation 4: WP1/FINAL REPORT/148

The European Commission should encourage Member States to find effective solutions to cross border enforcement, and establish a single consistent legal basis which is effective and supports the transition from manual to automated enforcement methods.

It is clear from the discussion in the legislation chapter of in Work package 1 that to provide an effective deterrent to overloaded vehicles, the issues preventing the effective implementation of cross border enforcement need to be resolved. This is of particular relevance to the transport industry on the TERN, where a vehicle may operate in many countries within the European Union, taking on and off loading cargo.

To satisfy the requirement for harmonisation in particular in relation to crossborder enforcement, Remove recommends adoption of the principles and operational models presented in VERA2 and CAPTIVE. A common and mutual approach to cross border enforcement legislation should include the eNFORCE operational concept, and agree that COPEN 24, the European Council Framework Decision 2005/214/JHA:

Application of the Principle of Mutual Recognition to Financial Penalties is the legal basis to support cross-border enforcement. It is a recommendation that this should be addressed as an issue of fundamental importance in achieving the objective of this project to achieve overall compliance.

Recommendation 5: WP1/FINAL REPORT/36

That the European Commission should take action to create a legally accepted European standard for vehicle identification to provide a synchronised and authoritative approach to Vehicle Identification Numbers (VIN), definitive vehicle characteristics, and standardized vehicle number plates including country of origin markers.

The recommendation in relation to VEHICLE Classification will follow the suggestion from within that specific chapter, that is to create a legally accepted European standard for vehicle identification to provide a synchronised and authoritative approach to Vehicle Identification Numbers (VIN), definitive vehicle characteristics, and standardised vehicle number plates including country of origin markers. This is regarded as fundamental as the move to direct

automated enforcement progresses and the requirement for common standards for identification of vehicles across borders. The work already carried out in the EVI study addresses these issues this can be found in REMOVE work package 1.

Recommendation 6: WP1/FINAL REPORT/64

That the European Commission adopts the UN classification which was used by the EVI project, and is then unified with the ideas formulated within the Top Trial work, a system of classification which has been specifically designed to work in combination with a WiM system.

This recommendation is that the already legally accepted UN classification which was used by the EVI project, is unified with the ideas formulated within the Top Trial work, a system of classification which has been specifically designed to work in combination with a WiM system.

It is essential to put forward that these means of vehicle classification should be synchronised in order to further the harmonisation aspects of legal acceptance across the EU, and the main aim of this project.

Recommendation 7: WP1/FINAL REPORT/33

The European Commission should coordinate and encourage member states to adapt existing WiM legislation to support the use automated processes used by WiM systems within and across borders, in relation to accepting the data produced by such technology as proof of offence and identity, particularly due to the increasing number of (less-serious) road traffic offences now being handled under civil (or administrative) law rather than criminal law.

Remove recommends that existing legislation needs to move to support the use automated processes such those used by WiM systems, in relation to accepting the data produced by such technology as proof of offence and identity, particularly due to the increasing number of (less-serious) road traffic offences now being handled under civil (or administrative) law rather than criminal law. This indicates the real need for existing legislative instruments to support cases brought under both criminal and civil law, and to standardise the matters in relation to burden of proof.

Recommendation 8: WP1/FINAL REPORT/78

The European Commission should recognise and accept the views, needs and requirements of the weigh enforcement community. To promote the development, standardisation and use of Weigh in Motion systems and technology to the most advanced level, capable of being achieved throughout the European Union member states at this present time. The user needs and requirements identified at this time are already a significant move towards achieving this goal.

Recommendation 9: WP1/FINAL REPORT/148

The European Commission should encourage the harmonisation of sanctions across member states, both in terms of the level of sanction and the approach to imposing the sanction. An example of this is the Directive on Dangerous Goods which underlines that this harmonisation can be achieved.

Recommendation 10: PROJECT REMOVE FINAL REPORT/8

The European Commission should promote the one definition of what constitutes an overloaded vehicle, as defined in Directive 96/53.

Recommendation 11: WP1/FINAL REPORT/148

The European Commission should identify and promote a common approach to the imposition of sanctions across the EU. This approach should include identifying and promoting best practice in the use of secondary penalties and a problem solving approach.

Recommendation 12: WP1/FINAL REPORT/33

The European Commission should as a matter of urgency coordinate the activity of member states to provide an effective operational solution to the issue of cross border enforcement.

Recommendation 13: WP1/FINAL REPORT/163 & WP3/GOOD PRACTICE FINAL/15

The European Commission should conduct research and establish and institute an effective mechanism for and promote the sharing of intelligence between enforcement agencies on overweight vehicles and for other traffic offenders who travel across member state borders.

Recommendation 14: WP1/FINAL REPORT/168

The European Commission should undertake research to establish and promote a process whereby the liability and chain of responsibility for stakeholders for overweight vehicles is expanded beyond the driver and haulier in a common way across all member states.

Recommendations 15: WP2/FINAL REPORT/23

The European Commission should examine the initiation of a workgroup/project in cooperation with the OIML/CEN on the technical standard (specifications and test procedure) for Weigh-in-Motion systems for direct (automatic) enforcement of overloading. The work carried out in REMOVE work package 2 is the basis for this work.

Recommendation 16: WP2/FINAL REPORT/23

The European Union should explore the harmonisation of the specifications and quality control of Weigh-in-Motion systems for all applications except direct enforcement in the form of an EU-code of practice including international data exchange.

Recommendation 17: WP2/FINAL REPORT/31 & WP3/CODE OF PRACTICE FINAL/20

The wide variance of tolerances and tests for accuracy must be harmonised across the European Union. These must be harmonised by the European Union Member States

Recommendation 18: WP1/FINAL REPORT/78

The European Commission should promote the understanding and implementation of the different applications of WIM-technology for the enforcement of overloading (Use Cases) through active education of enforcement agencies and the initiation of pilot projects.