# Chapter VI.
# Institutional mechanisms for gradual implementation of the recommended standards on weights, dimensions and emissions of pollutants for ESCAP member States

Harmonization of weights, dimensions and emission standards of heavy-duty vehicles amongst ESCAP Member States will certainly result in facilitation of international road transport along the Asian Highway, making it faster, cheaper, safer and greener. It also contributes in creating a level playing field for road transport operators.

It is important to assign the harmonization of weights, dimensions and emission standards at least to the Asian Highways but, if possible, also to the major national roads in the Member States, as most trucks should be permitted to reach its final destination with a certain load within the maximum set by the agreed standards on weights, for instance.

Once agreement has been reached in harmonizing such standards, an efficient and effective system for enforcement of these standards is very important. ESCAP Member States should agree how to organize enforcement of compliance with the standards on weights, dimensions and emissions applying uniform procedures.

In this report we have included case studies focusing on drafting and implementing regional vehicle load management strategies in Sub Saharan Africa and in the European Union. These case studies provide good examples of how to harmonize enforcement practices by applying similar procedures and methodologies. It also highlights the challenges for an efficient and effective implementation of national and regional vehicle load management strategies.

We have also included case studies focusing on the need for setting and enforcing national and international emission standards of heavy-duty vehicles, which may serve as an example for the Member States of ESCAP to set and harmonize and enforce these standards as well.

We will complete this report with a concise road map for establishing institutional mechanisms for defining, harmonizing and implementing standards of weight, dimensions and emissions of heavy-duty vehicles in the Member States of ESCAP.

## VI.1. Case studies

### VI.1.1. Case Study: Tripartite Vehicle Load Management Initiative COMESA-EAC-SADC

**INTRODUCTION**

In Eastern and Southern Africa the issue on weights and dimensions of road transport vehicles has been on the national and regional international political agenda since the early eighties. One of the main reasons for this attention were the problems that overloading of road freight vehicles were causing on the national and international roads in Eastern and Southern Africa in terms of damage to the road infrastructure and road safety. It was acknowledged that road transport was an essential link in the transport chain in Sub Saharan Africa holding the key to economic growth; without the means and capacity to move goods in an efficient, safe and secure way, the economies of the region would stagnate. The transport, trade and economic corridor concept was introduced to the Sub Saharan Africa to facilitate international movement of goods and services across the region. From the early beginning of this initiative almost 30 years ago the main factors affecting the corridor performance were identified as the quality of the physical transport infrastructure: the pavement and geometric standards; the regulations affecting the use of the infrastructure: overload control, road safety; and the effectiveness of procedures for enforcing regulations: weighbridge infrastructure and operations and

procedures[1]. It was felt that overloading was causing an accelerated deterioration of the road and bridge infrastructure, which also resulted in increased vehicle operation costs and very high transport costs. The transport costs for Eastern and Southern Africa are estimated to be four to five times higher than that of developed countries and for some landlocked countries as high as 30–40 per cent of the price of goods[2].

The Sub Saharan African region, however, has a number of regional cooperation agreements, which sometimes overlap, but sometimes also differ. We mention here COMESA, SADC and EAC. COMESA is the Common Market for Eastern and Southern Africa, which vision is to "be a fully integrated, internationally competitive regional economic community with high standards of living for all its people ready to merge into an African Economic Community"[3]. Its member states are Burundi, Comoros, Democratic Republic of Congo, Djibouti, the Arab Republic of Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia and Zimbabwe. SADC is the Southern African Development Community whose main objectives are to achieve development, peace and security, and economic growth, to alleviate poverty, enhance the standard and quality of life of the peoples of Southern Africa, and support the socially disadvantaged through regional integration, built on democratic principles and equitable and sustainable development[4]. Member states of SADC are Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. SADC is the successor of the SADCC, which was established in 1980 and is a more politically oriented regional cooperation organization. EAC is the East African Community, a regional intergovernmental organisation of 6 Partner States: Burundi, Kenya, Rwanda, South Sudan, the United Republic of Tanzania, and the Republic of Uganda, with its headquarters in Arusha, Tanzania. The regional integration process through EAC the regional integration process is reflected by the progress of the East African Customs Union, the establishment of the Common Market in 2010 and the implementation of the East African Monetary Union Protocol[5].

All three regional cooperation platforms, which are also called the Regional Economic Communities (RECs) – COMESA, SADC and EAC - have been addressing the issue of common standards for weights and dimensions of road transport vehicles as well as common approaches for enforcement of the regulations on weights and dimensions of road vehicles through attempts to harmonize axle load controls at regional level. A first step for harmonization amongst the three organizations was achieved in 2005 when the COMESA-EAC-SADC Tripartite was established. Three years later in 2008, the three regional cooperation platforms agreed to start a negotiation process of establishing a Tripartite Free Trade Area (TFTA). The TFTA was finally launched in 2015. Twenty four of the 26 member states have signed the Declaration; only Libya and Eritrea have yet to sign. The TFTA Agreement has been signed by 22 member countries, namely Angola, Botswana, Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Kenya, Libya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Sudan, Tanzania, Uganda, South Africa, Swaziland, Zambia and Zimbabwe. The Agreement requires 14 ratifications to enter into force. So far, only Egypt, Uganda and Kenya (Kenya in June 2018) have signed *and* ratified the Agreement.

The issue of vehicle load management (VLM[6]) has been under consideration by the Regional Economic Communities (RECs) of COMESA, EAC and SADC (the Tripartite) for almost three decades. During this period, numerous studies have been undertaken to try and determine how best to deal effectively with the many issues related to VLM on a regional basis (Box 3).

These key studies provide a blue print for implementation of regionally agreed, harmonized approaches to VLM in the Tripartite region that take account not only of international best practice but, also, of the existing instruments and implementation experiences of each of the three RECs. As such they provide a source of inspiration and useful guidelines for the development and implementation of a similar VLM system in the ESCAP region along the Asian Highway network.

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[1] Mike Pinard, 'Axle Load Control: Case Studies, Lessons Learned, Guidelines' (presented at the European Commission Infrastructure Seminar, Addis-Ababa, 2013) <https://europa.eu/capacity4dev/file/16092/download?token=fwzJq2zj>; 'SSATP Africa Transport Policy Program' <https://www.ssatp.org/>.

[2] 'Draft Tripartite Vehicle Load Management Initiative (EAC, COMESA, SADC)', 2014 <https://www.works.go.ug/wp-content/uploads/2017/06/updated-2014-11-06-Draft-VML-Strategy-and-Implementaion-Plan-Version-7-UPLOADED.pdf> [accessed 7 August 2019].

[3] Common Market for Eastern and Southern Africa <http://www.comesa.int/comesa-vision-and-mission/>[accessed 7 August 2019].

[4] Southern African Development Community (SADC) <https://sadc.int/about-sadc/overview/> [accessed 7 August 2019].

[5] East African Community <https://www.eac.int/overview-of-eac> [accessed 7 August 2019].

[6] The concept "vehicle load management" includes not only measures for controlling vehicle overloading but, also, other related aspects of vehicle load management such as the institutional, legal, regulatory and operational ones.

### Box 3 Studies on vehicle load management and control in Eastern and Southern Africa

- Regional Workshop on Harmonization of Key Elements and Implementation of Best Practice in Overload Control, Nairobi, Kenya, July 2008 (Infra Africa et al, 2008);
- Overload Control Practices in Eastern and Southern Africa – Main Lessons Learned (World Bank Paper 91, April 2010);
- Study for the Harmonisation of Vehicle Overload Control in the East African Community (PADECO, September 2011);
- Preparation of a transport facilitation strategy for the East African Community (the BICO Report, October 2012);
- The East African Community Vehicle Load Control Bill; 2013.
- Study on Road Transport Market Liberalisation in the COMESA-EAC-SADC Tripartite Region: Lot 1: Vehicle Overload Controls (Aurecon, October 2013).
- A Harmonized Road Transport Regulatory System for the ESA Region (Porée & Associates, March 2014).

Source: EAC, COMESA, SADC, 'Draft Tripartite Vehicle Load Management Initiative', 2014; p. 2.

## TRIPARTITE VEHICLE LOAD MANAGEMENT INITIATIVE

Vehicle Load Management Initiative was initially shaped during a Tripartite COMESA-EAC-SADC Technical Workshop (November 2014, Botswana). Key strategic documents were discussed:

1. Development of a Tripartite Strategy and Implementation plan for the synchronized and coordinated implementation of agreed measures focused at supporting Member States to implement the legislative, policy, regulatory systems and standards at national and corridor level necessary for ensuring harmonised vehicle overload controls in the Tripartite region.
2. Identification of regional regulatory frameworks that need to be developed to underpin the proposed vehicle overload control strategy.
3. Identification and specification of the requirements for technical assistance, capacity building and institutional development to implement the strategy at both national and regional level.
4. Preparation of resolutions on the draft VLM Strategy and Implementation Plan.

The Workshop attendance showed the importance of the Vehicle Load Management Initiative for the region: COMESA, EAC and SADC Member/Partner States, such as Angola, Botswana, Burundi, Democratic Republic of Congo, Djibouti, Ethiopia, Kenya, Malawi, Mozambique, Namibia, Rwanda, South Africa, Sudan, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe as well as representatives from the various sub regional organisations and corridor management institutions joined the consultations.

It is important to note that COMESA, EAC and SADC had already agreed about standardized vehicle and axle/axle unit load limits in various regional meetings held since 20008 (Table 22). The permissible maximum combination mass is agreed to be set at 56,000 kg.

### Table 22 COMESA, EAC and SADC regional harmonized axle loads limits

| Type of axle | | Tyres | Maximum permissible load |
|---|---|---|---|
| Steering | Single | | 8,000 kg |
| Non-Steering | Single | Single tyres | 8,000 kg |
| | | Dual tyres | 10,000 kg |
| | Tandem | Single tyres | 16,000 kg |
| | | Dual tyres | 18,000 kg |
| | Tridem | Single tyres | 24,000 kg |
| | | Dual tyres | 24,000 kg |

Source: René Meeuws.

There were already other pre-agreed conditions and considerations:

- Weighbridge verification intervals should be no longer than 12 months with interim routine checks.

- Auditing of weighbridge operations should be carried out at least annually.
- Overloading offences should be decriminalized and replaced with an administrative system incorporating fees.
- Level of fees should be based on the recovery of road damage costs.

Having above issues decided, the agenda focused on the still-to-do list from earlier meetings:

*Weighbridge infrastructure and equipment*

- Development of a strategic regional network of overload control stations on the major transport corridors.
- Selection of appropriate weighbridge types based on traffic volumes.

*Enforcement and weighbridge operations*

- Involvement of the private sector in the operations and maintenance of weighbridges.
- Connection of the cross-border overload control system with customs to be introduced at all border posts along the regional corridors.
- Harmonisation of regional weighbridge clearance certificates.
- Adoption of a policy to promote self-regulation and accreditation and its introduction in the member states.

*Institutional arrangements*

- Member states will establish dedicated overload control enforcement units.

*Human resources*

- Establishment of a regional training centre for overload control.
- Adoption of a common syllabus for overload control training.
- Ensure that overload control personnel are adequately trained and accredited.
- Design and facilitate implementation of anti-corruption programmes.

*Public awareness*

- Publishing of brochures, leaflets and installing information signs and disseminate information through community and national radio stations and websites.

The four pillars on which the Tripartite Vehicle Load Management Strategy is based are:

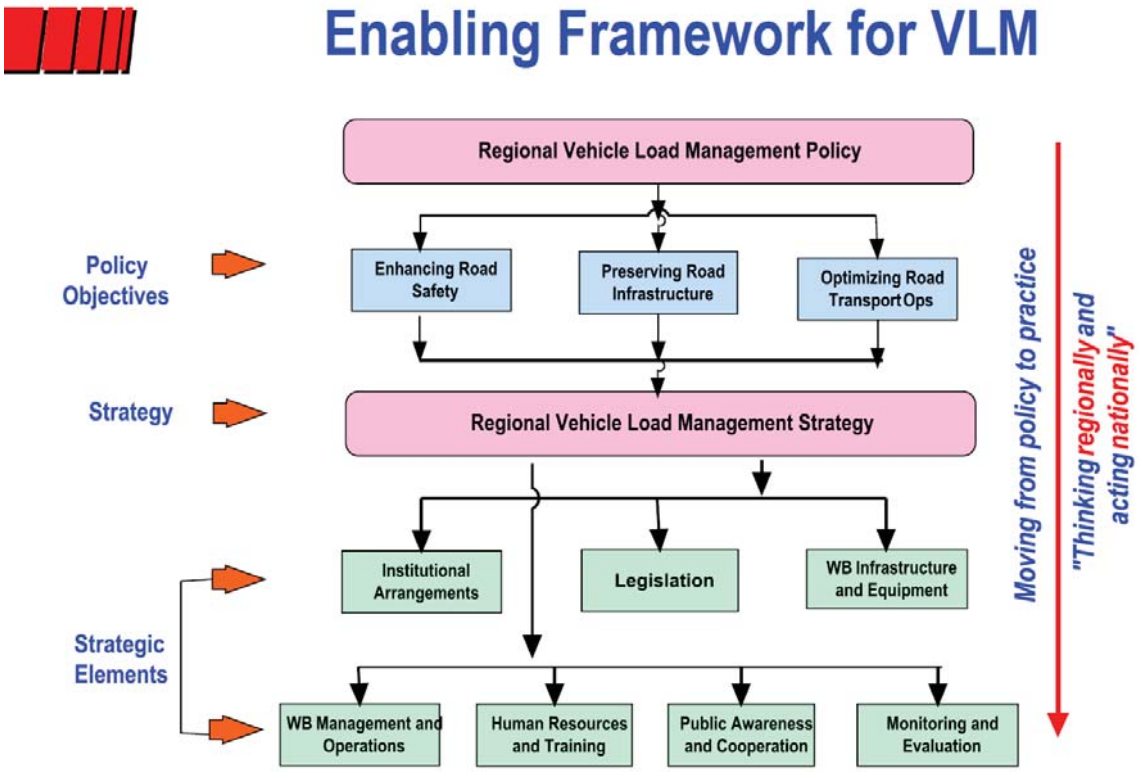
1. Integrated regional and national institutional Frameworks.
2. Harmonised legal instruments for Implementation of Vehicles Overload Control.
3. Joint planning of network of facilities.
4. Mutual recognition of weighbridge certificates and electronic linking of weigh stations.

The proposed Tripartite Vehicle Load Management initiative aims to:

- Preserve road infrastructure (roads and bridges).
- Enhance road safety.
- Optimise road transport operations taking into account the principles of fair competition between transport modes and creation of a level-playing field amongst road transport operators.

Figure 17 presents the Enabling Framework for Vehicle Load Management.

Figure 17 Enabling framework for vehicle load management




Source: Draft Tripartite Vehicle Load Management Initiative; COMESA- EAC-SADC; November 2014.

During the Tripartite COMESA-EAC-SADC Technical Workshop in 2014 it became clear that most member states were still lacking an appropriate enabling framework for Vehicle Load Management such as the one presented in Figure 17. Often there is no coherent Government policy on Vehicle Load Management in place involving the Ministries responsible for infrastructure, road transport, road safety and finance. The setting-up of such an enabling national and regional framework for VLM was considered as priority and as a core component of a Tripartite VLM Strategy. This should be achieved through a participatory approach involving stakeholders from both the public and private sector including the road transport associations.

For an effective and efficient implementation of a Tripartite VLM Strategy institutional arrangements have to be established. Figure 18 shows the proposed institutional arrangements for the COMESA-EAC-SADC vehicle load management strategy. The institutional arrangements have to be made at three different levels: regional, subregional and national.

Figure 18 Institutional Arrangements for the Tripartite Vehicle Load Management

# Strategic Element 1 – Institutional Arrangements

| Level | Function | Organizational Body | Organizational Entity |
|---|---|---|---|
| 1. Regional | Policy Formulation | Various Tripartite | • Heads of State<br>• Council of Ministers<br>• Sectoral Ministerial Committees |
| | Strategy Formulation | | • Standing Committee of officials<br>• Member states<br>• Secretariat<br>○ **Tripartite Task Force on VLM** |
| 2. Sub-regional | Programme Formulation | Various Sub-regional | • ASANRA<br>• ARMFA<br>• FESARTA<br>• FCFASA, FEAFAA<br>• Corridor Management Institutions<br>• Other regional bodies (e.g PMAESA) |
| 3. National | Project Implementation | Various National | • Member states<br>○ Gov't ministries/departments responsible for policy<br>○ Gov't ministries/departments responsible for road infrastructure<br>○ Gov't ministries/departments responsible for law enforcement |


Source: Draft Tripartite Vehicle Load Management Initiative; COMESA- EAC-SADC; November 2014.

The establishment of a Tripartite Task Force on Vehicle Load Management (TTF-VLM, first level of the institutional arrangements, Figure 18) is an essential element in the institutional arrangements for the implementation of the regional VLM Strategy.

The functions of TTF-VLM are the following:

- Develop, monitor and continuously review the effective implementation of harmonised vehicle load control policies, standards and measures.
- Develop model legislative provisions for promulgation by individual member states, including model regulations, schedules and annexes that are required to be implemented in terms of the model legislative provisions.
- Develop programmes for training, capacity building and awareness creation amongst stakeholders.
- Initiate policies to improve the efficiency of the regional network of weighing stations and any related trade facilitation matters.

The composition of TTF-VLM is as follows: ministries responsible for roads and transport; transport regulatory agencies or departments; national road authorities; ministries or authorities responsible for customs; representatives from the private sector such as regional and/or national transport, clearing and freight forwarding associations; and corridor management groups and committees.

In terms of the legislation, a draft Memorandum of Understanding (MOU) was elaborated to provide the COMESA-EAC-SADC region with a regionally harmonized act and regulations on Vehicle Load Management. This MOU is supposed to become legally binding. It is based on The East African Community Vehicle Load Control Act, 2013, but customized to suit the legal environment in each country of the Tripartite cooperation. This draft MOU states that "the Parties wish to strengthen their co-operation and to endorse the objective of a

continental economic zone by 2028, with specific reference to the control of vehicle loads, harmonization of enforcement and institutional arrangements for regional co-operation in vehicle load management"[1].

Prior commitments are reinstated in the MOU's Article 2 on Policy Reform (Box 4)..

**Box 4 Tripartite prior agreements on VLM**

**ARTICLE 2: POLICY REFORM**

The Parties confirm their prior agreement to-

2.1 decriminalise the offence of carriage of loads in excess of legal load limits and to introduce a system of administrative control of vehicle loading;

2.2 combat non-compliance with legal load limits by imposing financial sanctions, mobility restrictions, administrative sanctions and points demerit systems in response to such non-compliance;

2.3 vest primary responsibility for the management of vehicle loading in appropriate road authorities and to ensure that such road authorities are vested with adequate powers to undertake vehicle load management comprehensively and effectively;

2.4 recover overloading fees which are punitive in respect to the levels of overloading and cover additional road pavement consumption, enforcement and administration costs and to dedicate income obtained from overloading fees to road maintenance and rehabilitation;

2.5 encourage voluntary compliance with legal load limits and, to this end, agree to facilitate regional partnerships between the public and private sector;

2.6 take all necessary steps to implement appropriate control measures to combat corrupt practices in the management of vehicle loading;

2.7 encourage broad-based private sector investment, including, but not limited to public-private – partnerships in the provision and operation of weighing stations: Provided that private investment may not be undertaken by an entity that has a direct or indirect interest in the consequences of the operation of the weighing station;

2.8 monitor the adequacy of overload management and the regional network of weighing stations; and

2.9 ensure the implementation of an asset management system in relation to weighing stations.

The MOU clearly states the aspects of harmonization of the regulations and procedures concerning VLM in the Article 3 (Box 5).

[1] COMESA, EAC, and SADC, 'Memorandum of Understanding on Vehicle Load Management', p. 4 <https://www.works.go.ug/wp-content/uploads/2017/06/VLM-MOU-sadc-eac-comesa-Final-Feb2017.pdf>.

**Box 5 Agreements on harmonization VLM**

**ARTICLE 3: HARMONISATION**

3.1 The Parties agree to the harmonised legal load limits contained in Schedule A.

3.2 The Parties agree that no revisions of legal load limits will be undertaken without comprehensive stakeholder consultation.

3.3 The Parties agree to harmonise vehicle dimensions insofar as it relates to vehicle load management.

3.4 The Parties agree to ensure the harmonisation of legal definitions of vehicles in accordance with the technical definitions as contained in Schedule A.

3.5 The Parties agree to ensure that financial sanctions, mobility restrictions, administrative sanctions, offences and points demerit systems related to non-compliance with load limits, are harmonised as provided for in this MOU.

3.6 The Parties agree to introduce a system for the electronic payment of a security bond equal to the overload fee imposed in terms of the relevant legislation in relation to an overload offence, which security bond must be refunded if the operator is found not liable for that offence in terms of due process.

3.7 The Parties agree to ensure that they calculate the security bond or fee to be paid by an operator found to be overloaded at the currency exchange rate of the day on which the vehicle was weighed.

3.8 The Parties agree to ensure that they calculate overload fees taking into account the cost of additional road pavement consumption by a vehicle or combination of vehicles that exceeds the prescribed permissible mass load as well as the distance over which that vehicle or combination of vehicles travelled and an apprehension level and punitive factor that includes an administrative cost recovery factor:

**Overload Fee = [Additional ESA (due to overload)] x [Cost of ESA/km] x [Distance Travelled] x [Level of Apprehension Factor] x [Punitive Factor]**

3.9 The Parties agree to amend their legislation to require, where possible that vehicles are, subject to article 6, not be processed by Customs unless in possession of a weighbridge certificate,.

Schedule A of the MOU on Vehicle Load Management contains the minimum requirements to be incorporated into legislation for VLM.

In 2014 the Tripartite VLM Initiative observed that a uniform effective and efficient system for vehicle weight control in the Tripartite region was still lacking. The adequacy of **weighbridge infrastructure** deployed on national road networks in the Tripartite region varied significantly amongst the member states. Some countries do not succeed in covering the entire national road network or are inadequate in providing reliable and accurate measurements. The lack of a regional weighbridge location plan also might result in the installation of expensive weighbridges in non-strategic locations along regional corridors[1]. Therefore, the Tripartite VLM Strategy formulates as one of its policy objectives to use appropriate weighbridge infrastructure and equipment for overload control that is deployed at strategic locations on transit and national routes.

The Tripartite VLM Strategy comes up with the following recommendations:

[1] 'Minutes of a Meeting of the Tripartite (COMESA-EAC-SADC) Senior Officials on the Tripartite Vehicle Load Management Initiative', 2014.

- "Any future planned investment in weighbridge infrastructure should be undertaken in the context of a regional weighbridge location plan covering all strategic points on regional corridor routes from the gateway port to origin/destination on the regional trunk network. The development of such a plan is an urgent priority.
- When new border facilities are being planned, provision should be made for not only locating the weighbridge within the customs area but, also, for sharing the weighbridge facility between the adjacent countries in a one-stop border post (OSBP) arrangement.
- Location of weighbridges in ports, inland container depots and freight stations and the role of authorities managing ports, inland container depots and freight stations in Vehicle Load Management should defined and enhanced as these are critical nodes for the enforcement of VLM standards and regulations.
- Careful consideration should be given to selecting the most appropriate type of equipment and choice of weighbridge facilities in relation to such factors as the volume of commercial traffic to be weighed.
- As far as possible, weighbridge equipment should be standardised, or at least harmonised, on the main corridors of the region in order to facilitate training activities.
- Each country should undertake an inventory of its weighbridge stock in order to determine its future requirements in relation to the regional weighbridge location plan." [1]

The Draft Tripartite Vehicle Load Management Strategy and Implementation Plan also identified the requirements to undertake **weighbridge operations and management** in a proper way:

- Accreditation, auditing and random inspections of weighbridge stations.
- Execution of harmonised weighbridge operations and maintenance manuals.
- Issuance of a regionally recognized weighbridge clearance certificates.
- Promotion of self-regulation arrangements with certain transporters.
- Electronic linking of weighbridges to each other and to a central control facility.
- Verification and calibration of weighbridges at least every 12 months depending on traffic.
- Application of regionally agreed weighing tolerances for axles and Gross Vehicle Mass.
- Implementation of a Weighbridge Information Management System for national and possible regional sharing of information.

The VLM Strategy and Implementation Plan distinguishes various options for involvement of the private sector in Vehicle Load Management without making a recommendation for one specific option (Table 23).

**Table 23 Options for private sector involvement in VLM**

| Item | Service Contract | Management Contract | Lease Contract | Concession Contract | Full Privatization |
|---|---|---|---|---|---|
| **Ownership** | Public Sector | Public Sector | Public Sector | Public Sector | Private Sector |
| **Financing Fixed Assets** | Public Sector | Public Sector | Public Sector | Private Sector | Private Sector |
| **Financing Working Capital** | Public Sector | Public Sector | Private Sector | Private Sector | Private Sector |
| **Duration** | Short (1–3 yrs) | Short (5 yrs) | Medium (6–10 yrs) | Long (20–30 yrs) | Indefinite |
| **Risk** | Public Sector | Public Sector | Public Sector | Shared | Private Sector |

1 'Draft Tripartite Vehicle Load Management Initiative (EAC, COMESA, SADC)', pp. 17–18.

| Item | Service Contract | Management Contract | Lease Contract | Concession Contract | Full Privatization |
|---|---|---|---|---|---|
| **Remuneration of Private Sector** | Operation and management (O&M) costs | O&M costs | O&M costs and working capital | O&M costs, working capital and financing of fixed assets | |

Source: Draft Tripartite Vehicle Load Management Strategy and Implementation Plan; p. 19.

Another strategic element in the Draft Tripartite Vehicle Load Management Strategy and Implementation Plan is '**Human Resources & Training'**. Weighbridge equipment and operations become increasingly sophisticated and requires well-trained and experienced staff with a wide range of knowledge and expertise: transport environment; legislation; weighbridge equipment; weighing operations; software operation; data management; management reporting; staff management; operations management; maintenance management; safety. There is still little formalized training carried out in the East and Southern African countries; most training is provided in-house in an ad hoc manner by the authority concerned. The overall recommendation is that training is mandatory for all weighbridge staff following a prescribed, harmonized training course. The categories of staff to be trained are law enforcement; operational; administrative; maintenance; management.

**Public awareness and cooperation** is also being addressed in the Draft Tripartite Vehicle Load Management Strategy and Implementation Plan as support and cooperation of all stakeholders are important for the proper implementation of the VLM system. It was noted that there was still a general lack of awareness amongst the public at large, transport operators and other stakeholders about the negative effects of overloading on the national and regional economy and the need for VLM. Amongst the target audience belong local courts and public prosecutors, transport operators, consigners and consignees, drivers and last but not least weighbridge staff.

VLM also should include a Monitoring and Evaluation system. The status of implementation of the Vehicle Load Management system needs to be monitored periodically and evaluated at certain intervals. Therefore, it is important to identify and select performance indicators at national and regional level. Also a national axle load baseline survey had to be established to determine the existing situation prior to the introduction of new acts and regulations concerning VLM; these surveys would provide historical data for identifying trends in overloading.

The Tripartite Vehicle Load Management Strategy and Implementation Plan 2015-2020 identified the following prioritized strategies for its implementation:

- Domestication of the Tripartite VLM MOU.
- Develop national VLM strategies and plans.
- Capacity development at the level of the Member States through strengthening the government agencies responsible for VLM.
- Improve the alignment between regional and national VLM priorities.
- Develop legal/policy framework/guidelines to improve Member States' implementation of VLM programmes and projects.

## DEVELOPMENT OF A NATIONAL VEHICLE LOAD CONTROL STRATEGY FOR MALAWI[1]

This section provides an example of the elaboration and implementation of a national vehicle load control strategy, which in fact can be considered as implementation of the Tripartite Vehicle Load Management Strategy and Implementation Plan at national level.

The Strategy defines a comprehensive set of strategic outcomes and targets as well as outputs and outputs targets for the implementation of the national Vehicle Load Control strategy for Malawi 2016-2020. Box 6 shows the complete set of the performance indicators, which can be a source of inspiration for other countries, which are willing to follow a similar path for the development and implementation of a national vehicle load control strategy.

[1] MP Roux, S Lötter, and PA Nordengen, 'Development of a Vehicle Load Control Strategy for Malawi for the Period 2016 to 2020' (presented at the Proceedings of the 35th Southern African Transport Conference 2016, CSIR), pp. 583–96 <https://repository.up.ac.za/bitstream/handle/2263/57994/Roux_Development_2016.pdf?sequence=1&isAllowed=y>.

The paper highlights an important issue: the need to **carry out national baseline axle load surveys**. In Malawi such a baseline axle load survey was undertaken in 2013-2014 by staff members of the Malawi Directorate of Road Transport and Safety Services (DRTSS) using three sets of portable scales. Road transport vehicles were weighed on 17 sites in Malawi. The sites were selected in such a way that the most important road links carrying the highest number of trucks were included and at the same time ensuring a widespread coverage of the Malawi main road network. In total 2,691 trucks were weighed on 68 weigh days at an average of 39 vehicles per day. The result was rather unexpected: of the 2,691 vehicles weighed, 1,356 were found to be overloaded, which presents a percentage of 50.4 per cent. The average overloaded mass was 4,264 kg per vehicle, representing an average degree of overloading of 26.1 per cent. This percentage of 50.4 per cent of overloaded is in stark contrast with the incidence of vehicle overloading as measured at the permanent weighbridges in Malawi, which showed an extent of overloading of merely 3 per cent and an average degree of overloading of 5 per cent. One can speculate about the reasons for this enormous difference, fact is that axle load surveys proof to be an important tool to monitor implementation of any national vehicle load control strategy. This example also shows that one can still find many challenges on the road regarding reduction and diminishing of overloading of trucks taking into account that the issue of overloading already has been on the political agenda in Eastern and Southern Africa for more than thirty years.

### Box 6 Implementation of the National Load Control Strategy for Malawi 2016-2020[1]

***Strategic Outcomes and Targets***

Through the implementation of the Strategy, the Malawi Directorate of Road transport and Safety Services (DRTSS) aims to accomplish the following two Strategic Outcomes:

**Strategic Outcome 1**:
Road infrastructure protected against damage caused by overloaded vehicles.

**Strategic Outcome 2**:
Reduced number of unsafe vehicles on the roads of Malawi.

To enable the Directorate to measure its progress towards achieving these Strategic Outcomes, a number of output targets with both a quantity and a time element have been set. Monitoring of progress with the implementation of these output targets will also allow the Directorate to revise its goals as circumstances change without changing the Strategic Outcomes that are most important.

Outcome Targets for Strategic Outcome 1

- 70% of the main road network covered by a weighing facility by2020.
- 100% of permanent weighbridges operating 24 hours per day by2020.
- Downtime at weighbridges reduced to under 10% by 2020.
- Human resource capacity and effectiveness improved by 80% by 2020.
- 15% of other recurrent transactions (ORT) funding is channelled to vehicle load control operations by 2018.
- 100% of load control operations monitored by 2020.
- Enhanced regulatory framework for axle load control by 2017.
- 90% of hauliers aware of load control regulations by 2020.

Outcome Target for Strategic Outcome 2

- Key safety checks conducted on 70% of drivers and their weighed vehicles by 2020.

***Outputs and Output Targets***

The Outputs – the tangible goods and services – that have to be produced by the DRTSS in order to achieve its Strategic Outcomes were identified during Step 3. Outputs are set against each Outcome Target and for each Output an annual Target is set. Detailed implementation plans have been drawn up for the 2016 financial year's list of Output Targets.

**Outputs for the Outcome Targets of Strategic Outcome 1**

Strategic Outcome 1 deals with the protection of road infrastructure against damage caused by overloaded vehicles and has 8 outcome targets.

**Outcome Target 1: 70% of the main road network covered by a weighing facility by 2020**

| | |
|---|---|
| Output 1: | Two fixed inland weighbridges constructed by 2020 |
| Output 2 | Ten semi-permanent stations constructed by 2020. |
| Output 3 | Five new fixed weighbridges established at border posts by 2020. |
| Output 4 | Patrols to restrict the use of by-pass roads at current fixed weighbridges by heavy vehicles implemented by 2017. |
| Output 5 | Commencing in 2017, weigh teams, using portable scales, to operate at least 15 days per month. |
| Output 6 | One pilot high-speed Weigh-in-Motion facility constructed by 2017. |

[1] Roux, Lötter, and Nordengen.

**Outcome Target 2: 100% of permanent weighbridges operating 24 hours per day by 2020**

Output 1 100% of bilateral border post agreements reviewed and implemented by 2017.

Output 2 100% of fixed weighbridges are fully equipped with night enforcement equipment by 2017.

**Outcome Target 3: Downtime at weighbridges reduced to less than 10% by 2020**

Output 1 Commencing in 2016, the generators at all fixed weighbridges must be regularly maintained and supplied with fuel.

Output 2 Continue with the annual verification of scales at all fixed weighbridges.

Output 3 100% of computers at fixed weighbridges replaced by 2020.

Output 4 Commencing in 2016, adequate stationery provided to all weighbridge stations on a monthly basis.

Output 5 Down time of equipment due to breakages reduced to less than 5% of operational hours by 2020.

Output 6 5 existing portable scales replaced by 2020.

Output 7 5 generators to be procured for use with portable scales in 2016.

Output 8 9 vehicles procured by 2020.

Output 9 2 Stand-by generators procured for existing fixed weighbridges by 2017.

**Outcome Target 4: Human resource capacity and effectiveness improved by 80% by 2020**

Output 1 100% of current vacant positions filled by 2020.

Output 2 15 persons for new weighbridges recruited and deployed per weighbridge prior to completion of weighbridge.

Output 3 (Technical) Training Needs Assessment conducted for 100% of staff by 2016.

Output 4 Commencing in 2016, 100% of Road Transport Officers trained annually in all aspects of vehicle load control.

Output 5 Commencing in 2016, Road Transport Officers performing exceptionally to be recognised.

**Outcome Target 5: 15% of ORT is channelled to vehicle load control operations by 2018**

Output 1 Commencing in 2016, 15% of ORT allocated to Vehicle Load Control Section and adhered to.

**Outcome Target 6: 100% of load control operations monitored by 2020**

Output 1 Weighbridge module of Trafman procured and integrated with MALTIS at all weighbridges by 2017.

Output 2 Central weighbridge database established by 2017.

Output 3 Commencing in 2016, regular weigh activities reports for permanent weighbridges and portable scales to be enhanced.

Output 4 Commencing in 2016, performance audits of weighbridge stations to be conducted annually at 100% of stations.

Output 5 Commencing in 2016, weigh certificates are issued to 100% of vehicles weighed.

Output 6 Commencing in 2016, annual monitoring overload surveys are undertaken.

**Outcome Target 7: Enhanced regulatory framework for axle load control by 2017**

Output 1 Roles and responsibilities of officers expanded to include key vehicle safety and driver fitness checks.

Output 2 Legislation aligned with the tripartite Memorandum of Understanding on Vehicle Load Management by 2017.

Output 3 100% of mass load regulations enforced on the designated road network by 2017.

**Outcome Target 8: 90% of operators aware of load control regulations by 2020**

Output 1 Information booklet and posters on load control regulations issued to 100% of registered operators by 2017.

Output 2 Commencing in 2016, 4 press statements on vehicle load control issued annually.

Output 3 Commencing in 2016, 2 vehicle load management and courses presented annually for registered operators.

Output 4 Commencing in 2016, 80% of registered operators sensitized on vehicle load control through sensitization campaigns conducted annually.

Output 5 Promotion of self-regulation by transport operators from 2017 onwards.

**<u>Outputs for the Outcome Targets of Strategic Outcome 2</u>**

Strategic Outcome 2 aims to reduce the number of unsafe vehicles on the roads of Malawi and has 1 outcome target.

**Outcome Target 1: Key safety checks conducted on 70% of drivers and their weighed vehicles by 2020**

Output 1: Update Weighbridge Operators Manuals to include key vehicle safety and driver fitness checks developed by 2016

Output 2: Weighbridge software at 100% of fixed weighbridges updated to capture key vehicle safety and driver fitness checks by 2017

Output 3: 100% of Road Transport Officers trained on key vehicle safety and driver fitness checks by 2017

Output 4: 100% of fixed weighbridges equipped for enforcement of key vehicle safety and driver fitness by 2017

## VI.1.2. Case Study: Policy, Legislation and Enforcement of Weights and Dimensions of Heavy-Duty Vehicles in the European Union (EU)

### INTRODUCTION

In this case study we will present some information on the development of policy, legislation and enforcement concerning weights and dimensions of heavy-duty vehicles in the European Union. The core of the European legislation regulating weights and dimensions of heavy-duty vehicles in the EU is Council Directive 96/53/EC laying down the maximum authorised dimensions in national and international traffic and the maximum authorised weights in international traffic for certain road vehicles circulating within the Community, amended by Directive (EU) 2015/719 of the European Parliament and of the Council[1].

### EU LEGISLATION ON WEIGHT AND DIMENSIONS OF HEAVY-DUTY VEHICLES

Heavy-duty vehicles in the EU have to comply with the rules on weights and dimensions set-out in Council Directive 96/53/EC, amended by Directive (EU) 2015/719. This Directive establishes the common maximum measures to ensure that road safety is not jeopardized and that degradation to roads, bridges and tunnels is minimal. It ensures at the same time that the Member States of the EU cannot restrict the circulation of vehicles which comply with these limits from performing international road transport operators within their territories. It also allows for fair competition amongst national road transport operators and operators from other EU Member States, when performing national transport.

The fact that Council Directive 96/53/EC was amended by Directive (EU) 2015/719 shows that the standards for weight and dimensions for vehicles are not absolute figures, but may need to change in time taking into account new policies, technological developments and other developments in society. Since 1996 changes took place in EU transport policy such as the need to reduce greenhouse gas emissions, in particular carbon dioxide (CO2) emissions, to improve road safety, to promote intermodal transport operations. Technological developments made it possible to attach retractable of foldable aerodynamic devices to the rear of vehicles, which would result in the maximum lengths permitted under Council Directive 96/53/EC being exceeded. New cab profiles with an improved aerodynamic performance and improving road safety by reducing blind spots in the driver's vision would also exceed the maximum dimensions under Council Directive 96/53/EC. The use of 45-foot containers by road also required an adaption of the dimensions of the heavy-duty vehicle as laid down in Council Directive 96/53/EC. Recently, the first electric heavy-duty vehicle was launched by DAF Trucks. It is expected that in the long run, heavy-duty vehicles running on electricity stored in heavy batteries will conquest the market, in particular in urban distribution to start with. Given the improved state of infrastructure on most European international highways, a relaxation of the maximum weights would also become possible. Because of all these developments, Council Directive 96/53/EC was amended by Directive (EU) 2015/719.

The Member States of the EU had to bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 7 May 2017. To enforce Directive (EU) 2015/719 Member states are supposed to efficiently control traffic loading and perform a minimum number of vehicle checks using weighbridges, weigh-in-motion (WIM) systems and/or on-board weighing (OBW) sensors in vehicles which communicate remotely with roadside inspectors. Directive (EU) 2015/719 stipulates that by 27 May 20121 Member states shall take specific measures to identify vehicles or vehicle combinations in circulation that are likely to have exceeded the maximum authorised weight and that should therefore be checked by their competent authorities in order to ensure compliance with the requirements of this Directive. Those measures may be taken with the aid of automatic systems set up on the road infrastructure, or by means of on-board weighing equipment installed in vehicles. Member States shall also carry out each calendar year an appropriate number of checks on the weight of vehicles of vehicle combinations in circulation, proportionate to the total number of vehicles inspected each year in its territory.

Directive (EU) 2015/719 prescribes that the EU Member States have to send to the European commission every two years the necessary information concerning: a) the number of checks carried out in the previous 2 calendar years; and b) the number of overloaded vehicles or vehicle combinations detected. The European Commission shall analyse the information received and shall include such analysis in the report to be forwarded to the European Parliament and the Council.

### ENFORCEMENT OF OVERLOADED VEHICLES IN THE EU

Heavily overloaded vehicles on the European road transport network are causing multiple problems: deterioration of the road, bridge and tunnel infrastructure; endangering road safety; affecting fair competition

[1] A Directive (EU), formerly Council Directive, is a legal act of the European Union which requires member states to achieve a particular result without dictating the means of achieving that result. It can be distinguished from regulations, which are self-executing and do not require any implementing measures.

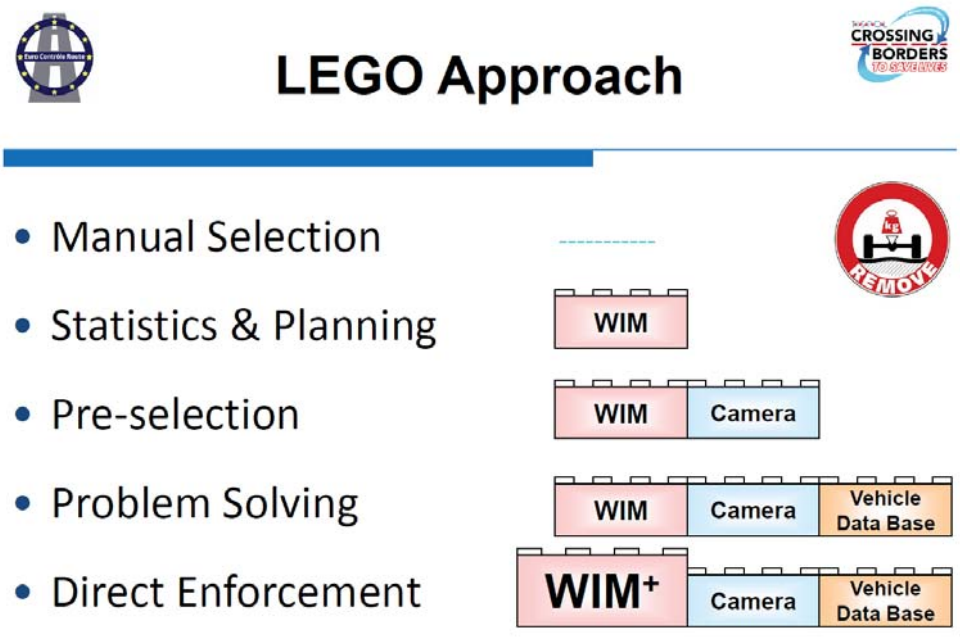
amongst road transport operators; etc. In the Member States of the EU a certain level of enforcement is prescribed by law. However, enforcement of overloaded vehicles is often an enormous challenge for most of the regional and national authorities.

Weight compliance checking in the EU is organized on a national basis according EU and national legislation. What makes this task challenging is that, as a basic principle, fining of the offenders can only take place if the evidence for overloading is court proof. Most EU countries do not permit Weigh-In-Motion (WIM) for direct enforcement. “It can only be done with certified fixed scales, or, in a few countries (France and Germany), on dedicated low-speed WIM sites, in both cases in the presence of police.”[1]

This ‘legal problem’ leads to a relatively low density and frequency of weight compliance checks. Road transport inspection is focusing more on issues more directly related to safety as speeding, alcohol and drug abuse, vehicle condition, driver fatigue (compliance with the regulations concerning driving and rest periods) and traffic fluidity. Overloading is often not priority as this issue is more related with infrastructure, fair competition and the environment (increase of emissions), and less with road safety (although it still has to do with road safety as overloaded trucks put more challenge to the driving skills of the driver and on the use of brakes and if becoming involved in an accident, the impact will be more serious). Weight compliance checking is also considered to be cumbersome and slow: a suspected vehicle is has to be directed towards the closest available certified weighing scale, which is very time consuming for both the road transport inspector and the driver. If the vehicle turns out to be overloaded, new problems emerge: offenders receive a fine, but many road transport inspectors lack the means to force the driver to solve the problem by taking off the exceeded load. The daily practice in the EU is that the risk of being caught with an overloaded vehicle is rather small, in particular in areas far from fixed weigh scales or with weigh-in-motion installation.

An enforcement strategy should go must beyond than just catching offenders in order to become effective. In 2006 the EU REMOVE project (Rooke, Shipp, de Groet, van Loo and Scorer) proposed that efficient enforcement requires a mix of different enforcement procedures supported by different types of WIM systems. Figure 19 and Figure 20 present various levels of enforcement: manual selection; statistics and planning; pre-selection; problem solving; direct enforcement. One can add even another level, called ‘intelligence’, which also works with other data bases and sensors.

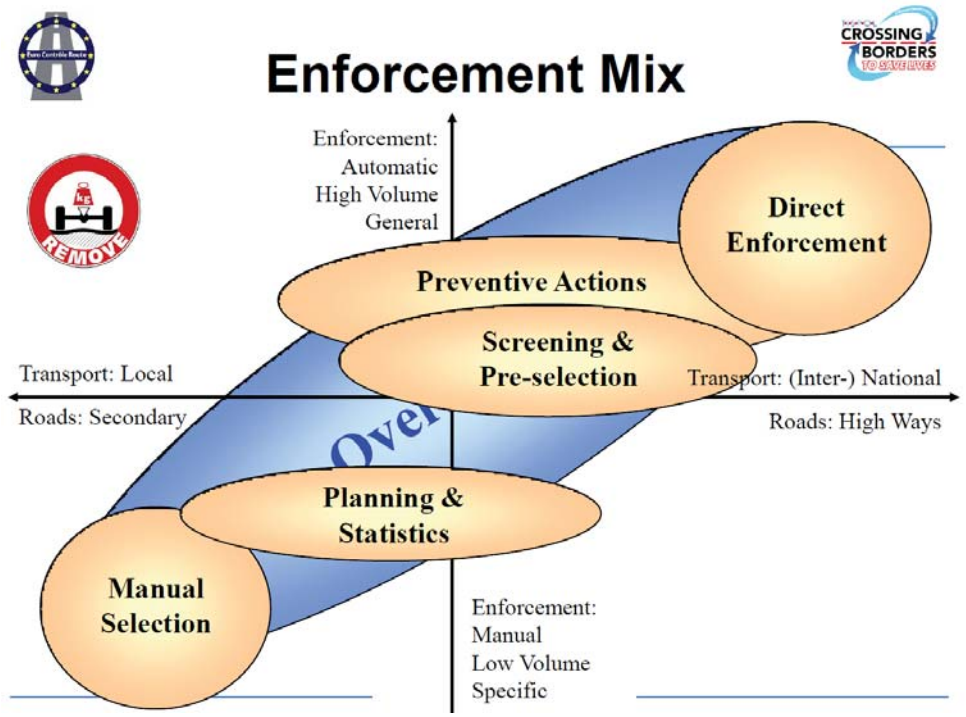
**Figure 19 Lego approach in enforcement strategies**




Source: Van Loo, H., Jacob, B., Applications for WIM for enforcement; presentation; 1st International Symposium on WIM. Florianopolis, Brazil; 2011; p. 19.

[1] Aleš Znidaric, *Heavy-Duty Vehicle Weight Restrictions in the EU; Enforcement and Compliance Technologies*, ACEA Report (Ljubljana, Slovenia, February 2015) <https://www.acea.be/uploads/publications/SAG_23_Heavy-Duty_Vehicle_Weight_Restrictions_in_the_EU.pdf> [accessed 8 August 2019].

Figure 20 Overload enforcement mix




Source: Van Loo, H., Jacob, B., Applications for WIM for enforcement; presentation; 1st International Symposium on WIM. Florianopolis, Brazil; 2011; p. 18.

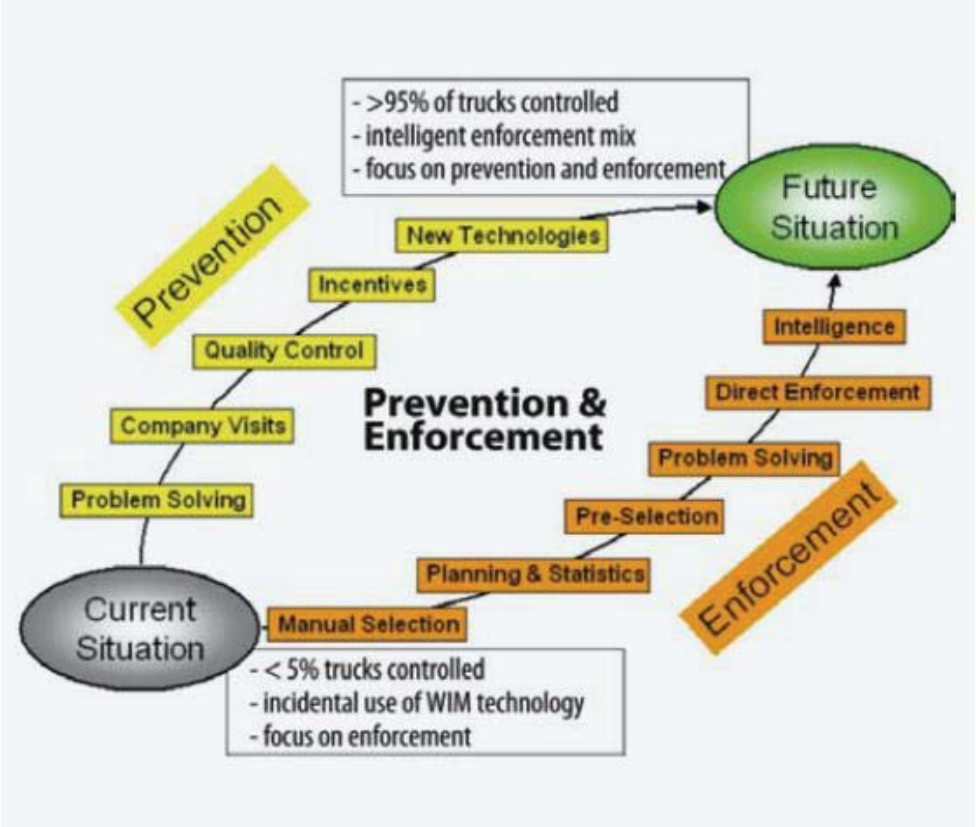
The EU REMOVE project reached the following conclusions regarding overload enforcement, which still are valid in present time:

- Most EU Member states do not consider overloaded vehicles as a high priority although significant benefits could be achieved in terms of road safety with the introduction of effective strategies to reduce overloading.
- Road transport inspectors are reluctant to apply enforcement at foreign trucks because of capacity problems that it could generate.
- Liability is not satisfactorily addressed by existing regulations. Who is responsible for overloading in legal terms: driver, road transport operator, owner of the goods, etc.?
- Road transport industry is in favour of a preventive/problem solving approach to achieve compliance with the legislation.
- Existing methods of enforcement may involve additional cost to legitimate road transport operators in case they are unnecessarily screened by conventional weigh bridges.
- WIM devices still do not have enforcement power in most EU countries.

Overload enforcement in an international network has its particular challenges. An important issue in cross-border enforcement is mutual confidence between countries: records concerning load measurements of heavy-duty vehicles produced by an enforcement system in one country should be recognized by enforcement systems of the neighbouring countries. Also the equipment for enforcing road traffic laws should have type approval as prescribed by EU and national legislation and should be checked and calibrated periodically by national organisations.

Experience in the EU shows that the overloading problem should be solved by a smart combination of enforcement and prevention as Figure 21 shows.

Figure 21 REMOVE dual approach – prevention and enforcement




Source: Znidaric, A., Heavy-duty Vehicle Weight Restrictions in the EU; Enforcement and Compliance Technologies; 23th ACEA Report; February 2015; p. 23

Experiences from the Netherlands and France show that collecting and analysing data from offenders with subsequent company visits to discuss feasible ways to prevent the use of overloaded trucks are more efficient than just fining. Statistics show that more than 90 per cent of the companies presented with overloading records did change their practices of overloading.

## VI.1.3. Case Study: International policy on emission standards for heavy-duty vehicles; the example of the EU

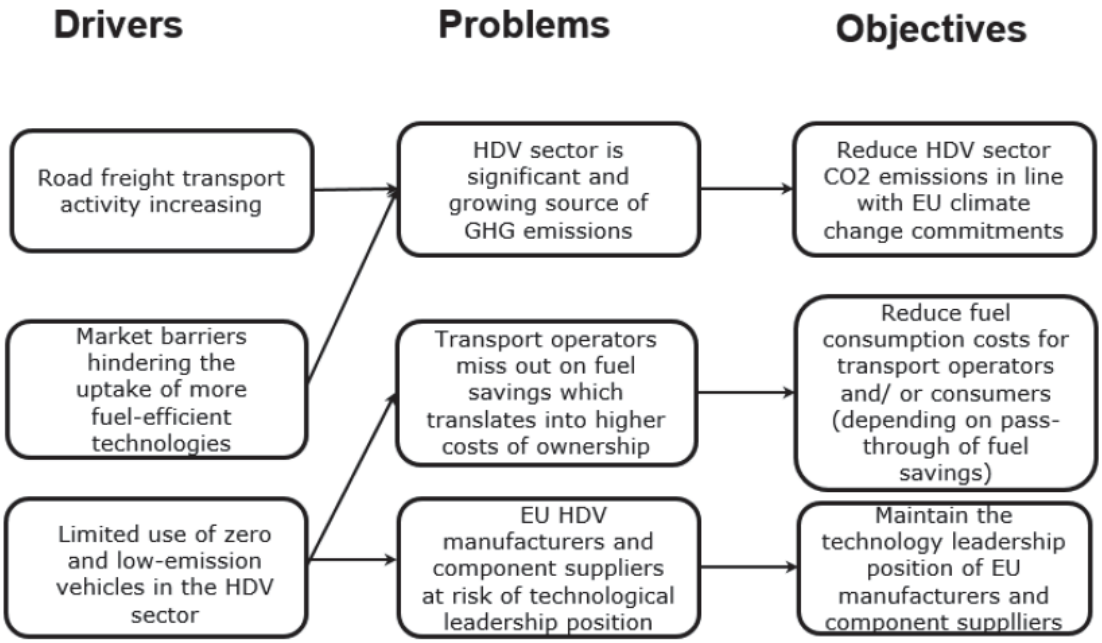
### SETTING $CO_2$ EMISSION PERFORMANCE STANDARDS FOR NEW HEAVY-DUTY VEHICLES IN THE EU

Continuing the efforts to reduce the emissions of pollutants by the vehicles by setting the limits for light-duty and heavy-duties vehicles in standards series Euro 1-6 and Euro I-VI (section IV.1.2, p.51), the EU is preparing a regulation of the European Parliament and of the Council for setting $CO_2$ emission performance standards for new heavy-duty vehicles (COM (2018) 284 final, 2018/0143 (COD), Brussels, 17.5.2018). The rationale for this process is that the European Union has committed under the Paris Agreement to avoiding climate change by limiting global warming to well below 2°C; decreasing greenhouse gas (GHG) emissions is a key perquisite for fulfilling this commitment.

The EU 2030 framework for climate and energy includes a target of at least 40% reduction of domestic EU GHG emissions compared to 1990 levels. The $CO_2$ emissions from heavy-duty vehicles account for about 6% of total EU emissions and is currently not regulated yet at EU level. It is projected hat without further action, the $CO_2$ emissions from heavy-duty vehicles will grow by 9% over the period 2010-2030 due to increasing transport activities. Therefore, further measures are needed to achieve the target of 40% reduction of domestic EU GHG emissions compared to 1990 levels by facilitating a reduction in operating costs and fuel savings for transport operators and incentivising technological and innovative developments of the European automotive industry.

The draft Regulation aims to address the drivers, problems and objectives for reducing $CO_2$ emissions from heavy-duty vehicles identified in Figure 22:

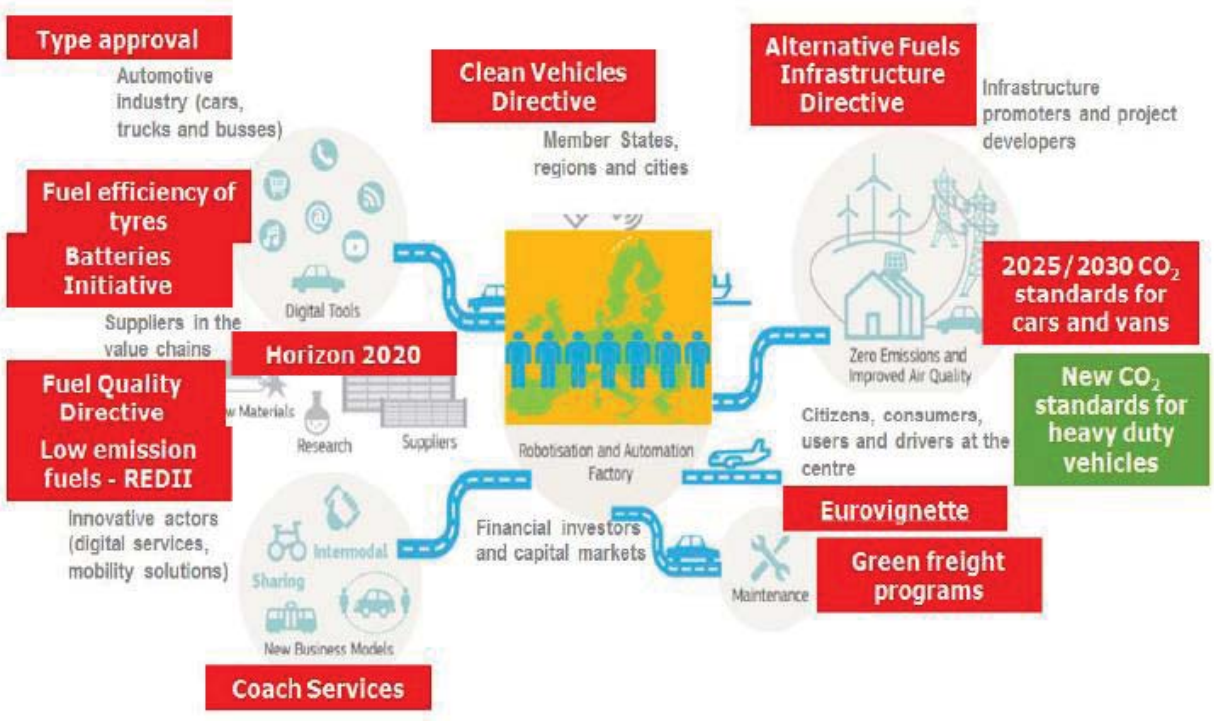
Figure 22 Drivers, problems and objectives




Source: COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT; Accompanying the document; Proposal for a Regulation of the European Parliament and of the Council setting CO2 emission performance standards for new heavy-duty vehicles ; {COM(2018) 284 final} - {SEC(2018) 233 final} - {SWD(2018) 186 final}

The draft Regulation is still under discussion and is part of a larger set of EU mobility related policies as presented in Figure 23:

Figure 23 Overview of main EU mobility related policies




Source: COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT; Accompanying the document; Proposal for a Regulation of the European Parliament and of the Council setting CO2 emission performance standards for new heavy-duty vehicles ; {COM(2018) 284 final} - {SEC(2018) 233 final} - {SWD(2018) 186 final}

## VI.1.4. Case Study: International policy; United Nations ECE and measurement of emissions

The United Nations Economic Commission for Europe (United Nations ECE) was set up in 1947 by the Economic and Social Council (ECOSOC). It is one of five regional commissions of the United Nations of which United Nations ESCAP is one. United Nations ECE's major aim is to promote pan-European economic integration. ECE includes 56 member States in Europe, North America and Asia. However, all interested United Nations member States may participate in the work of ECE. Over 70 international professional organizations and other non-governmental organizations take part in ECE activities.

The Working Party on Pollution and Energy (GRPE) is the subsidiary body of the World Forum for Harmonization of Vehicle Regulations (WP.29) that prepares regulatory proposals on pollution and energy efficiency to WP.29. This group of experts conducts research and analysis to develop emission and energy requirements for vehicles. Details on the regulations managed by the ECE see section IV.1.1, p.49). GRPE convenes officially twice a year and entrusts informal groups with specific problems that need to be solved urgently or that require special expertise. More than 120 experts participate at the sessions of GRPE.

The Working Party is open to the governmental experts from any member country of the United Nations, and to any regional economic integration organization set up by member countries of the United Nations, and to experts of governmental organizations. Experts of non-governmental organizations (NGOs) may participate in a consultative capacity. Final decisions are taken by Government representatives by vote at the World Forum WP.29 level.

The work of GRPE experts is transparent: All agendas, working documents and reports are openly accessible on this Internet website[1].

### Box 7 United Nations ECE works on global methodology to measure on-road car emissions

*Published: 21 June 2018*

Reducing the variations between vehicle emissions measured in laboratory and on-road conditions has become an important dimension of efforts to tackle the environmental and health impact of cars.

This comes as the need to improve air quality is gaining increasing recognition, especially in cities, where tackling harmful nitrogen oxides and particulate matter from transport emissions is a particular challenge.

The accurate measurement of emissions is not only essential in ensuring that vehicles meet air pollution limits, but also underpins informed decision-making by consumers based on advertised emissions test results.

New technologies and approaches aiming to measure real driving emissions in a wide variety of driving scenarios and conditions are rapidly progressing. A number of countries are developing or have already introduced regulatory requirements for real driving emissions tests, based on the work done by the European Union (EU) since 2010. New cars in the EU and Republic of Korea are already approved using this methodology.

At the local level, the C40 network of cities has also developed policies to reduce emissions and provide more realistic consumer information, where harmonized procedures would prove beneficial.

To support the improved coordination of these global efforts, members of United Nations ECE's World Forum for Harmonization of Vehicle Regulations have today decided to develop a harmonized procedure to perform real driving emission testing on open roads.

André Rijnders, Chair of the World Forum's Working Party on Pollution and Energy, welcomed the decision as an important milestone, highlighting that "a harmonized real driving emissions test procedure will centralize expertise and resources for improved emissions measurement. This will also support significant economies of scale across the automotive sector".

The European Union, Japan and Korea are leading the development of the regulatory text that would lead to the establishment of a United Nations Global Technical Regulation on real driving emissions testing, which is expected to be adopted by 2020. The United States of America, Canada, India and China have also showed support to the initiative and are expected to participate in the development of the regulatory provisions, in a process which is transparent, data-driven and open to inputs from all parties involved.

**About the World Forum for Harmonization of Vehicle Regulations**

[1] https://www.unece.org/trans/main/wp29/meeting_docs_grpe.html

The World Forum for Harmonization of Vehicle Regulations, hosted by ECE, is a unique global platform responsible for the regulatory frameworks regarding the safety and environmental performance of vehicles, their subsystems and parts.

The World Forum manages three Global Agreements on vehicles: 1958 Agreement (UN Regulations); 1998 Agreement (UN Global Technical Regulations); and 1997 Agreement (UN Rules on Periodic Technical Inspections). Any country that is member of the United Nations may participate in the activities of the World Forum and accede to the Agreements.

United Nations Global Technical Regulations (UN GTRs) contain globally harmonized performance-related requirements and test procedures. They provide a predictable regulatory framework for the global automotive industry and consumer associations. They do not contain administrative provisions for type approvals and their mutual recognition.

The Working Party on Pollution and Energy (GRPE) is one of the six subsidiary bodies of the World Forum. It concentrates its work on defining exhaust, energy efficiency and power measurement procedures for all modes of inland transport in order to limit environmental damage. GRPE will be in charge of the development of the UN GTR on real driving emissions testing.

**About real driving emissions measurement**

New measurement technologies, such as the Portable Emission Measurement System (PEMS), enable the continuous monitoring of the content of exhaust gases while driving on open roads. Progress achieved during the last decade in terms of reliability, compactness and market competition has made it possible for PEMS to be integrated in emissions measurement procedures for light duty vehicles.

Source: https://www.unece.org/info/media/presscurrent-press-h/transport/2018/unece-works-on-global-methodology-to-measure-on-road-car-emissions/doc.html

## VI.1.5. Case Study: National policy on emission standards for heavy-duty vehicles in Ukraine and Georgia

This case study consists of two parts: 1) recommendations for greening the fleet of heavy-duty vehicles in Ukraine; 2) cost-benefit analysis of replacement of the fleet of older, more polluting trucks by newer trucks with engines causing less emission in Georgia. Both examples show how national policy can contribute to by setting and enforcing emission standards for heavy-duty vehicles.

### IMPLEMENTING NATIONAL POLICY: DEVELOPING A GREEN LOGISTICS STRATEGY IN UKRAINE[1]

This case study shows the recommendations made for Ukraine regarding the formulation of a national policy for greening the fleet of heavy-duty vehicles in Ukraine. It is extracted from a report submitted to the World Bank in 2017 within the framework of the development of a national green logistics strategy.

***Recommendation 1***

*To develop a dedicated policy and strategy for reduction of $CO_2$ emissions and energy consumption by Heavy-Duty Vehicles of the road freight transport sector in Ukraine based on the ClimaEast report "Development of national policy on regulation of road transport of $CO_2$ emissions and energy consumption in Ukraine" (2016) and "The Future of Trucks; Implications for energy and the environment"(2017) published by the International Energy Agency/OECD.*

Ukraine is an Annex I Party to the United Nations Framework Convention on Climate Change (UNFCCC). One of the first tasks set by the UNFCCC was for signatory nations to establish national greenhouse inventories of greenhouse gas GHG) emissions and removals, which were used to create the 1990 benchmark levels for accession of Annex I countries to the Kyoto Protocol and for the commitment of those countries to GHG reductions. Updated inventories had to be submitted annually by Annex I countries.

In 2015, all (then) 196 then parties to the convention came together for the UN Climate Change Conference in Paris and adopted by consensus the Paris Agreement, aimed at limiting global warming to less than two degrees Celsius, and pursue efforts to limit the rise to 1.5 degrees Celsius. The Paris Agreement entered into force on November 4th, 2016. The aim of the convention is described in Article 2, "enhancing the implementation" of the UNFCCC through:

[1] This case study is based on a report written by René Meeuws, "Towards Greener and More Efficient Logistics in Ukraine"; World Bank; 2017; not published; 111 p.

"(a) Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;

(b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production;

(c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development."

The agreement has been described as an incentive for and driver of fossil fuel divestment.

Ukraine signed the Paris Agreement on April 22, 2016 and the Agreement came into force on November 4, 2016. Ukraine's percentage of GHG for ratification was 1.04.

Ukraine is very active in the ClimaEast, a support programme to Climate Change Mitigation and Adaptation in the Eastern Neighbourhood Countries and Russia, largely financed by the EU [1] .

In 2015 and 2016 two projects have been carried out directly related with the transport sector: CEEF2015-041-UA, GHG Inventorization in the Transport Sector and CEEF2015-043-UA, $CO_2$ Emissions and Road Transport Economy of Fuel. The first project supported the Ministry of Ecology and Natural Resources of Ukraine in developing a scientifically sound approach to improve its GHG inventory in general and in the transport field in particular, which would take into account specific national features of fuel use by mobile sources in Ukraine. The support was to underpin improvements in the quality of the next submission of GHG inventories to the UNFCCC Secretariat by Ukraine and to improving its national system. The second project, which was carried out with the State Enterprise State Road Transport Research institute, supported identifications and systematization of Ukrainian current national policies, standards and practices in the field of $CO_2$ emissions regulation and energy consumption by the road transport, existing EU tools for practical implementation of the requirements in this field, methods and procedures for testing wheeled transport vehicles of different categories for the identification of $CO_2$ emissions and energy consumption measures for development of optimal approaches to achieving the objective in GHG emission reduction in road transport sector of Ukraine.

The project "$CO_2$ Emissions and Road Transport Economy of Fuel" proposed many concrete measures and recommendations to 'green' the logistics sector and to make it more sustainable:

**Box 8 Primary prioritisation options for a Green Logistics Strategy in Ukraine**

"The following **Primary Prioritisation Options** were identified that should be taken forward/addressed as a top priority to maximise fuel economy/GHG savings.

1. Measures to improve fleet renewal and enhance fleet structure
   - Vehicle emission and/or fuel consumption standards and MRV (initially for LDVs only).
   - Vehicle labelling (all categories of road vehicles).
   - Vehicle purchase and ownership taxes (to be based on $CO_2$ specific emission and a progressive tax scale, with more shift to ownership (or even operation) tax modes).
   - Tax breaks and subsidies (to stimulate fleet renewal with more efficient vehicles).
   - Green public procurement to stimulate investments in innovation and development.
   - Component efficiency / requirements (including tyre efficiency ratings, etc.).
   - Company car taxation and treatment of business travel (to force a more positive fuel economy policy at a company level).
   - Parking fees
2. Measures to enhance fuel/energy infrastructure for road transport sector
   - Fuel quality/GHG performance standards (to increase the share of low carbon fuels in the total energy consumption of transport).
   - Fuel labelling (for customer information and as the base for differentiated taxes).

[1] The following link provides an overview of donor funded projects support at national level in Ukraine in the areas of: climate change, water and energy, biodiversity and GHG emissions reduction that are relevant to Clima East objectives & activities: http://1067656943.n159491.test.prositehosting.co.uk/wp-content-sec/uploads/2016/03/UA_DonorActivity_Feb2017-Final.pdf

- Fuel Taxes (differentiated according to fuel quality/GHG performance of the fuels).
- Roll-out of alternative fuel infrastructure.

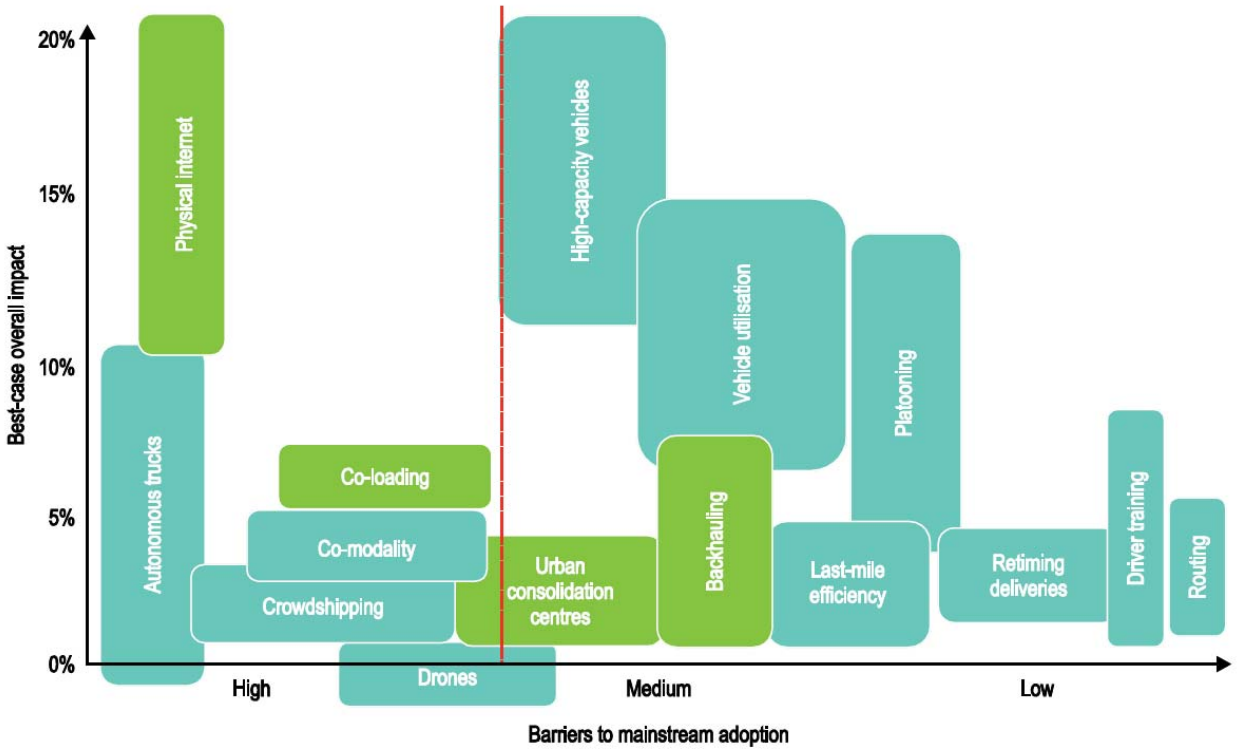
**Secondary options** are a lower priority that should ideally be further developed once progress has been started on the primary options. The following secondary options were identified.

1. Stimulation of innovation and development:
   - Research and development.
   - Fleet tests, demonstrations and pilot programmes.
2. Measures to optimise fleet usage:
   - Driver training (Eco driving).
   - Information for vehicle operators.
   - Potential further development the existing Fuel Rationing system.
   - Information campaigns.
3. Measures to enhance/renew transport infrastructure:
   - Traffic management.
   - Urban planning.
   - Public transport information.
   - Spatial planning outside of urban areas."

Source: ClimaEast (2016), Development of national policy on regulation of road transport $CO_2$ emissions and energy consumption in Ukraine; CEEF2015-043-UA. P.3-4.

In the comprehensive study "The Future of Trucks; Implications for energy and the environment"(2017), published by the International Energy Agency/OECD, measures are identified and analysed to reduce fuel use and $CO_2$ emissions; see Figure 24 Measures to reduce fuel use and $CO_2$ emissions. Many of these measures can be implemented by individual road transport companies, while some of them require external collaboration across companies, either horizontally or vertically across the supply chain. Now is cooperation across firms in Ukraine – and not only in Ukraine - a real challenge as it requires a basis of trust, data privacy and protection, and clear long-term benefits that outweigh the potential costs.

**Figure 24 Measures to reduce fuel use and $CO_2$ emissions**



Source: “The Future of Trucks; Implications for energy and the environment”(2017); International Energy Agency/OECD; p. 56

Table 24 and Table 25 show some measures to improve systems efficiency in road freight with enablers, low and high barriers and potential energy saving.

**Table 24 Measures to improve systems efficiency in road freight with enablers, low implementation barriers and potential energy saving.**

| Category | Enablers | Barriers | Potential energy saving |
|---|---|---|---|
| **Use of high-capacity vehicles (HCVs)** | Performance-based standards<br>Intelligent Access Program as in Australia | Concerns about safety and road infrastructure impacts; potential for ‘reverse’ mode shift (away from freight rail); increased demand for just-in-time delivery | Direct savings may be upwards of 20%, but actual savings may be lower, depending on the extent of activity rebound and of modal shift from rail. |
| **Route optimisation** | Geographic information system real-time routing data<br>Relaxing delivery time constraints | Increased demand for just-in-time delivery | From 5%-10% for intra-city trucking, but closer to only 1% for long-haul missions. |
| **Platooning*** | Vehicle communication and automation technologies | Traffic congestion, and mixed traffic; road capacity limitations.<br>Need to ensure safety | From 5% to 15% for a three-truck platoon traveling at 80 km/h (depending on gap distance).** |
| **Driver training and feedback** | Rewards programmes in mid- to large fleets | Lack of consolidation among carriers (many small owner-operators) | Immediate savings of between 3% and 9% (the latter in long-haul operations). |
| **Improved vehicle utilisation** (including backhauling) | Better data collection (as enabled by ICT)<br>Collaboration and on-line exchanges alliances among carriers and logistics service providers (LSPs) | Legal frameworks that restrict anti-competitive behaviour (and thereby impede co-ordination among carriers, shippers, and LSPs).<br>Lack of industry consolidation among carriers. | Potentially substantial, but difficult to quantify. Savings are enabled by better tracking basic freight operational parameters and adopting industry best practices in logistics. |
| **Last-mile efficiency measures** | Prediction of dynamic demand<br>Increased competition, including market entry of LSPs | Increased demand for just-in-time delivery<br>Urban traffic congestion | Likely in the range of 1-5%. |
| **Re-timing urban deliveries** | Incentives to shipment receivers to accept the insurance and logistical impacts of shifting to early morning and off-hour deliveries | Concerns from local citizens about noise<br>Customer concerns with product quality and condition upon delivery<br>Constraints imposed by just-in-time delivery | Very difficult to estimate and generalise. Across the urban truck fleet as a whole, fuel- and GHG emission reductions are estimated in the range of 10%-15%. |
| **Urban consolidation centres (UCCs)** | City regulatory policies to reduce congestion and promote air quality | Design is highly city-specific, making dissemination of best practices difficult<br>Fiscal sustainability challenges in the absence of a dedicated public funding stream or viable business model | Vehicle activity, fuel use and $CO_2$ emissions within urban centres can be reduced by 20-50%. |

* Platooning refers to the practice of driving heavy-duty trucks (primarily tractor-trailers or rigid trucks) in a single line with small gaps between them to reduce drag and thereby save fuel during highway operations. Vehicle-to-vehicle and vehicle-to-infrastructure (V2V and V2I) communication technologies can enable trucks to drive in very close proximity without sacrificing safety or manoeuvrability.

** According to Tsugawa, Jeschke and Shladovers (2016), the average fuel saving for three trucks driving at 80 km/hr with a 10-m gap is about 8%, and 15% with a 4-m gap. High levels of vehicle autonomy would be needed to safely operate trucks with a 4-m gap.

Based on: Browne, Allen and Leonardi (2011); Wiki4City (2014); Holguín-Veras (2016); McKinnon (2016b); Wallenburg and Raue (2011).

Source: “The Future of Trucks; Implications for energy and the environment”(2017); International Energy Agency/OECD; p. 58.

**Table 25 Measures to improve systems efficiency in road freight with enablers, high implementation barriers and potential energy saving**

| Category | Enablers | Barriers | Potential energy savings |
|---|---|---|---|
| **Physical Internet** | Legal and regulatory frameworks; ICT to collect, process and protect proprietary data | Anti-trust or other non-harmonised national legislative frameworks | Work to date on this concept suggests a potential 20% systems-wide efficiency improvement. |
| **Co-loading*** | Legal and regulatory frameworks to promote energy savings while protecting companies' intellectual property | Just-in-time delivery; lack of industry consolidation among shippers and carriers | Estimated at 5-10%. |
| **Crowdshipping/ Co-modality/Digital freight matching**** | Deregulation of urban delivery markets as well as the protection of citizen-carriers' labour and liability | Legal and regulatory hurdles surrounding liability and insurance<br>Requires a certain scale to realise savings | Difficult to assess; highly dependent on the degree of spatial and temporal matching.<br>Likely 5-10% in urban areas, with the possibility of counterproductive impacts. |
| **Autonomous trucks** | Clear and standardised regulations on technology certification, liability, security and privacy | Truckers' unions; hasty rollout could result in a single accident leading to public backlash | Limited and estimated to be 5% from smoother driving in other conditions. Potential rebound effects might be very substantial. |

* Co-loading is discussed in the previous section as it is among the measures that can be taken to improve vehicle utilisation.

** Crowdshipping is when citizens perform the services of couriers. Co-modality refers to the usage of (often public) passenger transport modes for freight delivery. Digital freight matching is the use of online platforms and apps to match vehicles and cargo in real time. All three are described in more detail below.

Source: "The Future of Trucks; Implications for energy and the environment"(2017); International Energy Agency/OECD; p.67.

***Recommendation 2***

*Introduce and enforce emission standards and limit values for trucks.*

The Government may set emission standards and limit emission values for vehicles, and in particular for trucks. As Ukraine is in the process of the implementation of the Association Agreement EU-Ukraine, the European emission regulations for new heavy-duty diesel engines can be used, commonly referred to as Euro 0, I, II, III, IV, V, VI[1].

The Government of Ukraine could develop a plan to prescribe and handle emission standards from Euro III or Euro IV onwards and phasing-out gradually heavy-duty vehicles with Euro 0, I, II or Euro 0, I, II, III, respectively.

[1] Sometimes a difference is made between Euro in Roman numerals (I…VI) and Euro in Arabic numerals (1…6) to distinguish between heavy-duty vehicles and light-duty vehicles.

***Recommendation 3***

*Carry out a Cost Benefit Analysis of fleet replacement of Euro 0, I, II by second-hand Euro III and of Euro 0, I, II, III by second-hand Euro IV trucks in Ukraine.*

It is highly recommended to carry out a study of the costs and benefits of fleet replacement of Euro 0, I, II by second-hand Euro III and of Euro 0, I, II, III by second-hand Euro IV trucks in Ukraine. It could be an interesting study, which may justify designing a policy to renew the fleet of old trucks with cleaner trucks. The outcome of the study may justify to support such a replacement strategy by financial incentives, for instance, by lowering import duties of second trucks with Euro III or Euro IV engines and, of course, also lowering import duties of the import of trucks with Euro V and Euro VI. The State Enterprise State Road Transport Research Institute should be involved in this study.

***Recommendation 4***

*Establishment of a uniform up-to-date database of Heavy-Duty Vehicles by age and emission standard category shared by the Ministry of Interior, the Ministry of Infrastructure and the State Statistics Office of Ukraine through the introduction of a national single window for the national vehicle fleet in Ukraine. This shared database may contain information about the number plate; the age of the vehicle; the year that it was imported; owner; emission standard (Euro 0, I, II, III, IV, V, VI); type of fuel; date of approved vehicle inspection; etc.*

The challenge is that there is no uniform up-to-date database of Heavy-Duty Vehicles by age and emission standard category. ASMAP has a database of the fleet of their members, but this relates mainly to companies, which also carry out international road transportation. What is lacking is public information about the main characteristics of the domestic fleet of trucks. In order to establish such a database, one would need cooperation between the Ministry of Interior, the Ministry of Infrastructure and the State Statistics Office of Ukraine and the insurance industry. A national single window should be developed for the vehicle fleet in Ukraine. The database would contain information about the number plate and the date of its registration ; the age of the vehicle; the date of import; owner; emission standard (Euro 0, I, II, III, IV, V, VI); type of fuel; date of approved vehicle inspection; vehicle insurance; etc.

***Recommendation 5***

*Define and introduce a scrapping scheme for trucks*

It is recommended to consider the introduction of a scrapping scheme for trucks to stimulate road transport operators to renew their fleet. One would need to establish criteria for the age of the truck and the premium offered. International practice show that the criteria for the truck age vary from more than 10 years old up to more than 20 years old and the premium offered from 700 USD up to 24,600 USD. A Cost Benefit Analysis for a scrapping scheme of trucks is necessary.

***Recommendation 6***

*Consider the various options how differentiation of vehicle taxation according emission standard; import duties for new and second hand heavy-duty vehicles by emission standard, mileage and age; energy taxes; use of alternative fuels; strict enforcement of vehicle inspection; internalisation of external cost in the price of fuel and transport, etc. may contribute to a greener and more sustainable transport and logistics sector.*

There are many other factors related with the fleet and transport performance, which influence the efficiency and the fitness of the transport and logistics system. Continuous study of these factors is key to developing policy that will create a greener and more sustainable transport and logistics sector in Ukraine.

## IMPLEMENTING NATIONAL POLICY: COSTS AND BENEFITS OF REPLACING THE TRUCK FLEET WITH CLEANER VEHICLES IN GEORGIA[1]

Renewal of the fleet of trucks is an effective way of greening the road transport sector and should form an important component of any national green and sustainable logistics strategy. Georgia is also in the process of greening freight transport and the logistics sector. In a study carried out by the World Bank and Panteia an interesting calculation has been made of the costs and benefits of replacing the existing truck fleet with cleaner vehicles.

Georgia has 50,162 registered heavy goods vehicles, of which 82% are Euro II or lower; 8% Euro III; 7% Euro IV; and 2% Euro V (according to 2010 statistics). 40% of the heavy goods vehicles are more than 20 years old; 43% between 10 and 20 years; and the rest up to 10 years. The fleet operating in Georgia is thus relatively old and of low emission standards.

The study identified the following measure that could contribute to the renewal of the truck fleet:

- Introduction of mandatory annual technical inspection of all trucks;
- Gradual phasing out of older vehicles via regulations prohibiting vehicles beyond a certain age of emission class from operating with a transition period followed by a strict enforcement regime;
- Introduction of emission class based bilateral trip permit system, similar to the multinational ECMT system, which discriminates the issuing of permits by emission standard[2].
- Gradual mandatory use of low emission vehicles in certain areas such as ports, inner-cities, etc.
- Introduction of high fuel quality standards in combination with effective control and enforcement.
- Vehicle taxes based on emission standards favouring cleaner vehicles.
- Financial support for investments in greener vehicles, such as lowering import duties and tax reduction.

The study has made an estimation of the number of vehicle kilometres driven on Georgian territory by vehicle emission class in 2013 as shown in Table 26[3].

**Table 26 Attribution of vehicle-kilometres driven on Georgian territory by vehicle emission class, 2013**

| | Euro 0 | Euro I | Euro II | Euro III | Euro IV | Euro V | Total |
|---|---|---|---|---|---|---|---|
| **Total fleet size estimated** | | | | | | | |
| Fleet 2000 | 33,394 | 2,116 | 5,941 | 4,160 | 3,521 | 1,129 | 50,261 |
| Growth factor | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | |
| Fleet 2013, of which | 45,688 | 2,895 | 8,128 | 5,691 | 4,817 | 1,545 | 68,764 |
| Domestic fleet | 45,688 | 2,895 | 4,064 | 0 | 0 | 0 | 52,647 |
| International fleet | 0 | 0 | 4,064 | 5,691 | 4,817 | 1,545 | 16,117 |
| **Vehicle-km (in thousand) driven within Georgian territory** | | | | | | | |
| Domestic transport | 685,314 | 72,374 | 203,203 | 0 | 0 | 0 | 960,891 |
| International transport | 0 | 0 | 52,011 | 72,838 | 61,650 | 19,768 | 206,266 |
| Total | 685,314 | 72,374 | 255,213 | 72,838 | 61,650 | 19,768 | 1,167,156 |

Source: World Bank and Panteia calculation

The study had carried out a survey, which revealed the costs of second-hand vehicles for each Euro class: Euro III vehicles, after driven about 1-1.5 million kilometres, would cost about €7,500; Euro IV trucks, after 0.5-1 million km, would cost about €20,000; and Euro V trucks after driven 0.5 million km or less, would cost about €35,000.

Based on these figures two scenarios were developed: 1) replacement of all Euro 0/I/II trucks with second-hand Euro III trucks; 2) replacement of all trucks below Euro IV with second-hand Euro IV trucks (Table 27).

[1] World Bank Group, Transport & ICT, *Greening Freight Transport and Logistics Sector in Georgia*, 2016, p. 76.

[2] More information about the multinational ECMT system can be found via the following link: https://www.itf-oecd.org/sites/default/files/docs/13mqguide.pdf

[3] The detailed assumptions for this calculation can be found in the study.

**Table 27 Costs of fleet renewal in Georgia**

| Type | Number of vehicles | Total costs | Annualized costs |
|---|---|---|---|
| All Euro 0/I/II replaced by Euro III | 56,711 | €425,329,884 | € 42,532,988 |
| All Euro 0/I/II/III replaced by Euro IV | 62,402 | €1,248,042,032 | €83,202,802 |

The scenario of replacing all Euro 0/I/II trucks with Euro III would cost about € 425 million and the scenario of replacing all trucks below Euro IV with Euro IV about € 1,248 million (Table 27)[1].

The benefits of this measure include a reduction in local air pollution, fuel consumption and GHG emission.

Table 28 presents a calculation of savings in air pollution costs due to fleet renewal using the unit costs of air pollution from the "Update of the Handbook on External Costs of Transport"[2].

**Table 28 Total savings in air pollution costs due to fleet renewal in Georgia, 2013**

| Current situation | Euro 0 | Euro I | Euro II | Euro III | Euro IV | Euro V | Total |
|---|---|---|---|---|---|---|---|
| Total v-km/year (1000) | 685,314 | 72,374 | 255,213 | 72,838 | 61,650 | 19,768 | 1,167,156 |
| Air pollution costs (cent/v-km) | 14.8 | 10.4 | 10.4 | 8.3 | 5.6 | 2.3 | |
| Total costs, in €1000 | 101,426 | 7,527 | 26,542 | 6,046 | 3,452 | 455 | 145,448 |
| **Renewal up to Euro III** | | | | | | | |
| Total v-km/year (1000) | 0 | 0 | 0 | 1,085,739 | 61,650 | 19,768 | 1,167,156 |
| Total costs (in €1000) | 0 | 0 | 0 | 90,116 | 3,452 | 455 | 94,023 |
| Savings, in €1000 | 101,426 | 7,527 | 26,542 | -84,070 | 0 | 0 | 51,425 |
| **Renewal up to Euro IV** | | | | | | | |
| Total v-km/year (1000) | 0 | 0 | 0 | 0 | 1,147,389 | 19,768 | 1,167,156 |
| Total costs (in €1000) | 0 | 0 | 0 | 0 | 64,254 | 455 | 64,708 |
| Savings, in €1000 | 101,426 | 7,527 | 26,542 | 6,046 | -60,802 | 0 | 80,740 |

*Source: Panteia calculation*

The savings in air pollution costs for the renewal of the fleet up to Euro III are € 51 million per year and for the renewal of the fleet up to Euro IV € 81 million.

Table 29 shows the actual emission reductions of various pollutants, which are calculated based on the emission parameters by vehicle emission classes.

**Table 29 Total savings in emissions due to fleet renewal in Georgia, 2013**

| 2013 | Euro 0 | Euro I | Euro II | Euro III | Euro IV | Euro V | Total |
|---|---|---|---|---|---|---|---|
| Total v-km/year (1000) | 685,314 | 72,374 | 255,213 | 72,838 | 61,650 | 19,768 | 1,167,156 |
| $CO_2$ (g/km) | 898 | 898 | 898 | 874 | 834 | 802 | |
| CO (g/km) | 12.3 | 4.9 | 4.0 | 2.1 | 1.5 | 1.5 | |
| NOx (g/km) | 15.80 | 9.00 | 7.00 | 5.00 | 3.50 | 2.00 | |
| HC (g/km) | 2.60 | 1.23 | 1.10 | 0.66 | 0.46 | 0.46 | |
| PM (g/km) | 0.00 | 0.40 | 0.15 | 0.10 | 0.02 | 0.02 | |
| $CO_2$ (million tonnes) | 615,412 | 64,992 | 229,182 | 63,660 | 51,416 | 15,854 | 1,040,515 |
| CO (million tonnes) | 8,429 | 355 | 1,021 | 153 | 92 | 30 | 10,080 |
| NOx (million tonnes) | 10,828 | 651 | 1,786 | 364 | 216 | 40 | 13,885 |
| HC (million tonnes) | 1,782 | 89 | 281 | 48 | 28 | 9 | 2,237 |
| **Renewal up to Euro III** | | | | | | | |
| $CO_2$ (million tonnes) | | | | 948,936 | 51,416 | 15,854 | 1,016,205 |
| CO (million tonnes) | | | | 2,280 | 92 | 30 | 2,402 |
| NOx (million tonnes) | | | | 5,429 | 216 | 40 | 5,684 |
| HC (million tonnes) | | | | 717 | 28 | 9 | 754 |
| **Renewal up to Euro IV** | | | | | | | |
| $CO_2$ (million tonnes) | | | | | 956,922 | 15,854 | 972,776 |
| CO (million tonnes) | | | | | 1,721 | 30 | 1,751 |
| NOx (million tonnes) | | | | | 4,016 | 40 | 4,055 |
| HC (million tonnes) | | | | | 528 | 9 | 537 |

*Source: Panteia calculation*

[1] The annualized cost is based on assuming a 10 years of life for the newly obtained Euro III trucks and 15 years for Euro IV ones, and linear depreciation.

[2] Ricardo-AEA, *Report for the European Commission DG MOVE: Update of the Handbook on External Costs of Transport*, 8 January 2014 <https://ec.europa.eu/transport/sites/transport/files/handbook_on_external_costs_of_transport_2014_0.pdf>.

Table 30 shows that the $CO_2$ savings from the fleet renewal would be relatively small: 24,310 tonnes when renewing up to Euro III (2.3% per year) and 67,739 tonnes when renewing up to Euro IV (6.5% per year). The reduction of other pollutants, however, is significant.

As fuel use is linearly correlated with the level of $CO_2$ emissions, the total savings in fuel costs due to fleet renewal can be calculated. For the calculation an average fuel efficiency of 40 litres per 100 km was applied and an average price of € 0.79 per litres.

**Table 30 Total savings in fuel costs due to fleet renewal in Georgia, 2013**

| Factors | Values |
|---|---|
| Total kilometres on Georgian territory per year | 1,167,156,469 |
| Total fuel consumption per year at fuel economy of 40 litres/100 km | 466,862,588 litres |
| Total fuel costs at € 0.79/litre | € 368,821,444/year |
| Savings 2.3% | € 8,482,893/year |
| Savings 6.5% | € 23,973,394/year |

*Source: Panteia calculation*

Finally, Table 31 presents the annual benefits of fleet renewal measures, which are estimated to exceed the annualized costs.

**Table 31 Costs and benefits of fleet renewal schemes in Georgia**

| Fleet renewal | | 2017 | 2020 | 2025 | 2030 | 2040 |
|---|---|---|---|---|---|---|
| **Up to Euro III** (million €) | | | | | | |
| Costs Benefits | Upfront investment | *425.33* | | | | |
| | Air pollution cost savings (3% v-km increase/year) | 51.42 | 56.19 | 65.14 | 75.52 | 87.55 |
| | Fuel cost savings (price increase 5%/year) | 8.48 | 10.69 | 15.70 | 23.07 | 33.90 |
| | GHG savings, carbon price € 23/ton | 0.56 | 0.56 | 0.56 | 0.56 | 0.56 |
| | Benefit total | *60.47* | *67.44* | *81.40* | *99.15* | *122.00* |
| **Up to Euro IV** (million €) | | | | | | |
| Costs Benefits | Upfront investment | *1,248.04* | | | | |
| | Air pollution cost savings (3% v-km increase/year) | 80.74 | 88.23 | 102.28 | 118.57 | 137.45 |
| | Fuel cost savings (price increase 5%/year) | 23.97 | 30.20 | 44.37 | 65.20 | 95.80 |
| | GHG savings, carbon price € 23/ton | 1.56 | 1.56 | 1.56 | 1.56 | 1.56 |
| | Benefit total | *106.27* | *119.98* | *148.21* | *185.33* | *234.81* |

Source: Panteia and World Bank Group calculations

## VI.2. Roadmap for harmonization and enforcement of standards on weights and dimensions for heavy-duty vehicles along Asian Highway network

It is beneficial if the roadmap to harmonization of the standards on heavy-duty vehicles (freight road vehicles, commercial vehicles) travelling along the Asian Highway and enforcement of such harmonized standards follows the steps bellow and covers the following aspects:

1. Baseline study

   It is useful to start with a *baseline study* to identify the main problems that occur along the Asian Highway network related with weights and dimensions of the heavy-duty vehicles:

   – Attention should be paid to an analysis of the size of the problem caused by different weights and dimensions for heavy-duty vehicles between neighbouring countries, resulting in the fact that entrance is prohibited of the vehicle to drive into the neighbouring country.

   – *Overloading* should be emphasized in the study and analysed in terms of occurrence, scale and impacts.

2. Regional platform for information exchange on standards and enforcement procedures

   Worldwide, Ministries of Transport, Infrastructure and/or Public Works are responsible for the domain of weights and dimensions of heavy-duty vehicles. In many countries ministries of transport are

responsible for the *legislation and regulations* in this respect and sometimes also for the *enforcement*. In most countries the enforcement of this piece of legislation is within the agency responsible for the construction, maintenance and rehabilitation of roads, bridges and tunnels. These governmental institutions and agencies responsible for legislation and enforcement of standards of weight and dimensions of heavy-duty vehicles in the countries along the Asian Highway network should establish a platform to exchange information about standards and procedures for enforcement and to remove any bottleneck preventing harmonization of these standards.

3. Comprehensive regional strategy for harmonization of the weights and dimensions standards for heavy-duty vehicles supplemented by regional and national implementation plans

   This platform could be used to prepare a comprehensive *regional strategy* to address the problems identified in the baseline study. This regional strategy has to be adopted and accompanied by an implementation plans at regional and national level.

   The implementation plan at national level should include the preparation of the proper *legislation and regulatory framework* concerning the common standards of weights and dimensions for heavy-duty vehicles.

4. National institutional frameworks to change the legislation and the regulatory environment

   An institutional framework at national level has to be created with responsibilities concerning the implementation of the changes in legislation and the regulatory environment: surveys, inspections, enforcement, monitoring and evaluation. For all these activities procedures have to be designed.

   In the case of the *management of weighbridges*, special procedures have to be developed about the use of the weighbridges; recognition of weighbridge certificates; calibration of the weighbridges; definition of responsibilities in case of overloading (driver, transport company, shipper, etc.); fining structure; etc.

5. Capacity building

   Capacity building and professional technical training are needed to enable the authorities to enforce the legislation.

6. Public awareness campaign

   Public awareness, dissemination and education are needed to explain the rationale of these standards and create acceptance by the public of the enforcement of the compliance with the legislation and regulations.

7. Investment plan for compliance enforcement system

   Financial resources have to be allocated to implement a compliance enforcement system: purchase and maintain equipment, qualified staff, monitoring and evaluation. A financial appraisal has to be carried out for the investment costs and the operational costs.

8. Monitoring and evaluation

   A monitoring and evaluation structure has to be developed, which should also disclose the impact and effectiveness of this system in order to adjust policy if appropriate.

## VI.3. Roadmap for harmonization and enforcement of emission standards for heavy-duty vehicles along the Asian Highway network

Harmonization the standards on emissions of pollutants by the heavy-duty vehicles (freight road vehicles, commercial vehicles) travelling by the Asian Highway network would pave way for the curbing road transport emissions in Asia. To facilitate the process interested parties to the AH agreement may follow a roadmap covering the following issues:

1. Baseline study

   It is useful to start with a *baseline study* to identify the main problems that occur along the Asian Highway network related with emissions of heavy-duty vehicles. Attention should be paid to an analysis of the size of the problem caused by different emission standards for heavy-duty vehicles between neighbouring countries, resulting in the fact that entrance is prohibited of the vehicle to drive into the neighbouring country. Regional platform for information exchange on standards and enforcement procedures

Worldwide, various ministries are responsible for the domain of emission standards of heavy-duty vehicles: ministry of transport, ministry of environment, ministry of health, etc. These governmental institutions and agencies responsible for legislation and enforcement of emission standards of heavy-duty vehicles in the countries along the Asian Highway network should establish a platform to exchange information about standards and procedures for enforcement and to remove any bottleneck preventing harmonization of these standards.

2. Comprehensive regional strategy for harmonization of the standards on emissions of pollutants by heavy-duty vehicles supplemented by regional and national implementation plans

   This platform could be used to prepare a comprehensive *regional strategy* to address the problems identified in the baseline study. This regional strategy has to be adopted and accompanied by an implementation plan at regional and national level.

   The implementation plan at national level should include the preparation of the proper *legislation and regulatory framework* concerning the common emission standards for heavy-duty vehicles.

3. National institutional frameworks to change the legislation and the regulatory environment

   An institutional framework at national level has to be created with responsibilities concerning the implementation of the changes in legislation and the regulatory environment: surveys, inspections, enforcement, monitoring and evaluation. For all these activities procedures have to be designed.

4. Capacity building

   Capacity building and professional technical training are needed to enable the authorities to enforce the legislation.

5. Public awareness campaign

   Public awareness, dissemination and education are needed to explain the rationale of these standards and create acceptance by the public of the enforcement of the compliance with the legislation and regulations.

6. Investment plan for compliance enforcement system

   Financial resources have to be allocated to implement a compliance enforcement system: purchase and maintain equipment, qualified staff, monitoring and evaluation. A financial appraisal has to be carried out for the investment costs and the operational costs.

7. Monitoring and evaluation

   A monitoring and evaluation structure has to be developed, which should also disclose the impact and effectiveness of the this system in order to adjust policy if appropriate.

In the Box 9 some recommendations are presented to address the highly complicated issue of harmonization and enforcement of emission standards for heavy-duty vehicles.

**Box 9 Harmonization and enforcement of emission standards for heavy-duty vehicles**

- Setting and enforcing emission standards for heavy-duty vehicles is extremely complicated requiring very specialized know-how, equipment, procedures and qualified staff and, last but not least, sufficient funding.
- Emission standards are also complicated in the sense that they address the domain of from various ministries: foreign affairs, transport, environment, health, government authorities at various levels (cities and villages, districts, provinces, country, regional, international); sometimes specific geographic areas introduce other, often tougher, emission standards.
- A very practical way of approaching this issue is to use the type of engine used in heavy-duty vehicles as a standard. The ESCAP Member States could develop a plan to prescribe and handle emission standards from Euro III or Euro IV onwards and phasing-out gradually heavy-duty vehicles with Euro 0, I, II or Euro 0, I, II, III, respectively from the Asian Highway and the major national roads. This is relatively easy to enforce.
- This standard by type of engine could also go one step further by taking into account durability and emission limit values for useful life periods: for heavy-duty vehicles having a maximum mass exceeding 12 tonnes (vehicle category N3) for instance 500,000 km / 7 years for Euro IV-V and 700,000 km /7 years for Euro VI.

– It is highly recommended to Member States of ESCAP to carry out a study of the costs and benefits of fleet replacement of Euro 0, I, II by second-hand Euro III and of Euro 0, I, II, III by second-hand Euro IV trucks (as Georgia had carried out). It could be an interesting study, which may justify designing a policy to renew the fleet of old trucks with cleaner trucks. The outcome of the study may justify to support such a replacement strategy by financial incentives, for instance, by lowering import duties of second trucks with Euro III or Euro IV engines and, of course, also lowering import duties of the import of trucks with Euro V and Euro VI.